Final Environmental Impact Statement

Montanore Project

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Cabinet Mountains *Photo by M. Holdeman*

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Forest Service
Northern Region
Kootenai National Forest

Environmental Impact Statement For The Montanore Project

Kootenai National Forest
Lincoln County, MT

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Abstract: The Kootenai National Forest's (KNF) Montanore Project Final Environmental Impact Statement (Final EIS) describes the land, people, and resources potentially affected by Montanore Minerals Corporation's (MMC) proposed copper and silver mine (Montanore Project). As proposed, the project would consist of eight primary components: the use of an existing evaluation adit, an underground mine, a mill, three additional adits and portals, a tailings impoundment, access roads, a transmission line, and a rail loadout. Three mine alternatives and a No Action Alternative (No Mine) and four transmission line alternatives, plus a No Action Alternative (No Transmission Line), are analyzed in detail.

The KNF will use the analysis in the Final EIS to determine whether to issue approvals necessary for construction and operation of the Montanore Project. The KNF's preferred mine alternative is Alternative 3, Agency Mitigated Poorman Impoundment Alternative, and preferred transmission line alternative is Alternative D-R, Miller Creek Transmission Line Alternative.

Because the KNF will issue a Record of Decision after September 27, 2013, the pre-decisional objection process described in 36 Code of Federal Regulations 218 is in effect. Under these regulations, individuals and entities who have submitted timely, specific written comments regarding the Montanore Project during any designated opportunity for public comment are able to seek pre-decisional review of unresolved concerns before a Record of Decision is signed. 36 Code of Federal Regulations 218 describes the pre-decisional objection process in detail.

After the conclusion of the Forest Service objection process, the KNF and the DEQ will issue a joint Final EIS. The DEQ will use the analysis in that document to determine whether to amend the existing state operating permit for the mine and to authorize construction of the transmission line. The U.S. Army Corps of Engineers (Corps) will use the information to determine whether to issue approvals necessary for construction of the Montanore Project, and the Bonneville Power Administration will use the information to decide whether to build a new substation and loop line, and to provide power to its customer, Flathead Electric Cooperative (Flathead Electric Cooperative would be the retail supplier of power to the mine).

Contents

Volume 1

Tables—Volume 1

Charts—Volume 1

Figures—Volume 1

Volume 2

Tables—Volume 2

Charts—Volume 2

Figures—Volume 2

Volume 3
Appendices A through M

Summary

Purpose and Need for Action

Background

This document presents a summary of the Final Environmental Impact Statement (Final EIS) for the proposed Montanore Project. As a summary, it cannot provide all of the detailed information contained in the Final EIS. If more detailed information is desired, please refer to the Final EIS and the referenced reports. For any remaining questions or concerns, contact the individuals listed in the last section of this summary, *Where to Obtain More Information.*

The U.S. Department of Agriculture (USDA), Kootenai National Forest (KNF), and the Montana Department of Environmental Quality (DEQ) have prepared the Final EIS in compliance with the National Environmental Policy Act (NEPA) and the Montana Environmental Policy Act (MEPA). These laws require that if any action taken by the DEQ or the KNF may "significantly affect the quality of the human environment," an environmental impact statement must be prepared. The Final EIS also has been prepared in compliance with the USDA NEPA regulations (7 Code of Federal Regulations (CFR) 1b), the Forest Service's NEPA compliance regulations (36 CFR 220), the Forest Service's Environmental Policy and Procedures Handbook (Forest Service Handbook 1909.15), DEQ's MEPA regulations (Administrative Rules of Montana (ARM) 17.4.601 *et seq.*), and the U.S. Army Corps of Engineers' (Corps) NEPA implementation procedures for its regulatory program (Appendix B of 33 CFR 325). The Final EIS serves as a report required by the Major Facility Siting Act (MFSA) (75-20-216, Montana Code Annotated (MCA)). Two "lead" agencies are responsible for the analysis of the project: the KNF and the DEQ. Cooperating agencies are the Bonneville Power Administration (BPA), Corps, and Lincoln County, Montana. A single EIS for the Montanore Project is being prepared to provide a coordinated and comprehensive analysis of potential environmental impacts. Before construction and operation of the proposed project could begin, various other permits, licenses, or approvals from the two lead agencies and other agencies would be required.

Mines Management, Inc. (MMI) proposes to construct a copper and silver underground mine and associated facilities, including a new transmission line. Montanore Minerals Corp. (MMC), a wholly-owned subsidiary of MMI, would be the project operator. The proposed project is called the Montanore Project. MMI has requested the KNF to approve a Plan of Operations for the Montanore Project. From the DEQ's perspective, the mining operation is covered by a DEQ Operating Permit first issued by the Montana Department of State Lands (DSL) to Noranda Minerals Corp. (NMC). MMC has applied to the DEQ for a modification of the existing permit to incorporate aspects of the Plan of Operations submitted to the KNF that are different from the DEQ Operating Permit. MMC has also applied to the DEQ for a certificate of compliance to allow for construction of the transmission line.

The KNF and the DEQ issued a Draft EIS for the Montanore Project on February 27, 2009 for public comment. In response to public comment, the agencies revised the agencies' mine alternatives (Alternatives 3 and 4) and transmission line alignments (Alternatives C, D, and E) and issued a Supplemental Draft EIS in 2011. Most of the changes to the mine alternatives in the

Supplemental Draft EIS addressed issues associated with water quality. The agencies' proposed monitoring and mitigation plans (Appendix C) also were revised. The transmission line alignments were modified primarily to avoid effects on private land. To avoid confusion between the transmission line alignments presented in the Draft EIS and those presented in the Supplemental Draft EIS, the agencies designated the revised transmission line alternatives as Alternatives C-R, D-R, and E-R. The alignment of Alternatives C-R, D-R, and E-R was modified between the Supplemental Draft EIS and the Final EIS so a 2-mile segment would cross the Fisher River about 800 feet north of the alignment presented in the Supplemental Draft EIS.

The discovery of mineral deposits for the Montanore Project dates back to the early 1980s. In 1980, Heidelberg Silver Mining Company (Heidelberg) located certain mining claims in Sections 29 and 30 of Township (T) 27 North, Range (R) 31 West, M.M., Sanders County, Montana. Subsequently, in 1983, Pacific Coast Mines, Inc. (Pacific), a subsidiary of U.S. Borax and Chemical Corporation, located other mining claims in Sections 29 and 30 of Township 27N, Range 31 West, M.M., Sanders County, Montana. The mining claims located by Pacific in 1983 included the lode mining claims (HR) Hayes Ridge 133 and HR 134 adjacent to Rock Lake. (These claims are shown on Figure 11 in the EIS.) The outcrop contained stratabound copper-silver mineralization, extending over a 200-foot vertical thickness.

In 1984, Pacific leased Heidelberg's mining claims pursuant to the terms of a 1984 Lease and Option to Purchase Agreement (Lease Agreement). Subsequently, in 1988, Heidelberg was merged into Newhi, Inc. (Newhi), a subsidiary of Mines Management, Inc. (MMI). As a result of that merger, Newhi became the successor in interest to Heidelberg under the Lease Agreement. Also in 1988, Pacific assigned its interest in HR 133 and HR 134 and its interest in the Lease Agreement to Noranda Minerals Corporation, a Delaware based corporation and wholly owned subsidiary of Noranda Finance Inc. (Noranda Finance), part of Noranda, Inc.

In 2002, NMC terminated the Lease Agreement with Newhi. Pursuant to the terms of that agreement, NMC conveyed its interest in HR 133 and HR 134 to Newhi. In 2006, Newhi acquired all of the issued and outstanding shares of NMC. Immediately following the acquisition of NMC, NMC's name was changed to Montanore Minerals Corporation (MMC). MMI has unpatented mining, mill site, and tunnel claims on National Forest System lands that cover the proposed mine development.

The permitting process for the Montanore Project began in 1989 when NMC obtained an exploration license from the Montana Department of State Lands (DSL) and other associated permits for construction of an exploration adit from private land in upper Libby Creek. Soon after obtaining the exploration license, NMC began excavating the Libby Adit. NMC also submitted a "Petition for Change in Quality of Ambient Waters" (Petition) to the Board of Health and Environmental Sciences (BHES) requesting an increase in the concentration of select constituents in surface water and groundwater above ambient water quality, as required by Montana's 1971 nondegradation statute. After constructing about 14,000 feet of the Libby Adit, NMC ceased construction in 1991 in response to elevated nitrate concentration in surface water and low metal prices.

Although construction ceased in 1991, the permitting process continued. Specifically, the KNF, the Montana Department of Health and Environmental Sciences (DHES), the Montana Department of Natural Resources and Conservation (DNRC), and the DSL, DEQ's predecessor agency, prepared a Draft, Supplemental Draft, and Final EIS on the proposed project. The environmental review process culminated in 1992 with BHES's issuance of an Order approving NMC's Petition (BHES 1992) and the DSL's issuance of a Record of Decision (ROD) and Hard Rock Operating Permit #00150 (DSL 1992) to NMC. In 1993, the KNF issued its ROD (KNF 1993a), the DNRC issued a Certificate of Environmental Compatibility and Public Need under MFSA (DNRC 1993), and the U.S. Army Corps of Engineers issued a 404 permit (Corps 1993). These decisions approved mine and transmission line alternatives that allowed for the construction, operation, and reclamation of the project.

The BHES Order, issued to NMC in 1992, authorized degradation and established limits in surface water and groundwater in the Libby, Poorman and Ramsey Creek watersheds adjacent to the Montanore Project for discharges from the project (BHES 1992). The Order established numeric limits for total dissolved solids, chromium, copper, iron, manganese, and zinc (both surface water and groundwater), as well as nitrate (groundwater only), and total inorganic nitrogen (surface water only). Pursuant to BHES's Order, these limits remain in effect during the operational life of the mine and for so long thereafter as necessary (BHES 1992). The Order also adopted the modification developed in Alternative 3, Option C, of the Final EIS, addressing surface water and groundwater monitoring, fish tissue analysis, and in-stream biological monitoring. The Order is presented in Appendix A in the EIS.

In 1997, the DEQ issued a Montana Pollutant Discharge Elimination System (MPDES) permit to NMC (MT-0030279) to allow discharges of water flowing from the Libby Adit to Libby Creek. Three outfalls were included in the permit: Outfall 001 – percolation pond; Outfall 002 – infiltration system of buried pipes; and Outfall 003 – pipeline outlet to Libby Creek. Surface discharge from the adit ceased in 1998 and water in the adit flowed to the underlying groundwater.

Apart from the permitting process, NMC filed an application for patent with the Bureau of Land Management (BLM) in 1991 for lode claims HR 133 and HR 134 (Patent Application MTM 80435). In 1993, the BLM issued a Mining Claim Validity Report recommending that a patent be issued to NMC for HR 133 and HR 134. In 2001, the BLM issued a patent to NMC for the portion of HR 134 that lies outside the Cabinet Mountains Wilderness (CMW) (Patent Number 25-2001-0140). The BLM issued a separate patent to NMC for the mineral deposits for HR 133 and the portion of HR 134 that lies inside the CMW (Patent Number 25-2001-0141).

As discussed above, NMC conveyed its interests in lode claims HR 133 and HR 134 to Newhi in 2002. By that time, many of NMC's permits for the Montanore Project were relinquished, terminated or expired, such as DEQ's air quality permit, the Corps' 404 permit, KNF's approval, and the State's certification of the transmission line. In 2002, NMC notified the KNF it was relinquishing the authorization to operate and construct the Montanore Project. NMC's DEQ Operating Permit #00150 and MPDES permit remain in effect because reclamation of the Libby Adit was not completed.

Proposed Action

In 2004, MMI submitted an application for a hard rock operating permit to the DEQ and a proposed Plan of Operations for the Montanore Project to the KNF. In 2005, MMI also submitted to the DEQ an application for a 230-kV transmission line certificate of compliance, an application for an air quality permit, and an application for a MPDES permit that covered additional discharges not currently permitted under the existing MPDES permit for the Libby Adit.

In 2006, Newhi acquired all of the issued and outstanding shares of NMC pursuant to the terms of a Stock Transfer Agreement between Noranda Finance, Newhi, and MMI. The name of NMC was changed to MMC immediately following Newhi's acquisition of NMC's shares, and MMC (formerly NMC) remains the holder of DEQ Operating Permit #00150 and the MPDES permit for the Montanore Project.

MMI and MMC advised the agencies that MMC will be the owner and operator of the Montanore Project. Consistent with that indication, Newhi has re-conveyed HR 133 and HR 134 to MMC, and MMI and MMC have requested that the DEQ consider MMI's application for a hard rock operating permit as an application by MMC for modification to DEQ Operating Permit #00150. MMC submitted an updated Plan of Operations to the agencies in 2008 that clarified differences between the 2005 Plan of Operations and DEQ Operating Permit #00150. It also incorporated plans required by DEQ Operating Permit #00150 and additional environmental data collected since 2005. With minor exceptions, MMC proposes to construct, operate, and reclaim a new mine in accordance with the terms and conditions of DEQ Operating Permit #00150 and in accordance with the terms and conditions of the other agencies' permits and approvals issued to NMC in 1992 and 1993. MMC's requested changes to DEQ Operating Permit #00150 are:

- Construction of an additional underground ventilation infrastructure that would disturb about 1 acre of private land near Rock Lake
- Relocation of the concentrate loadout facility to the Kootenai Business Park located in Libby (private land) resulting in less than 1 acre of disturbance
- Installation of a buried powerline along the Bear Creek Road (NFS road #278), which would be reconstructed for access
- Construction of a temporary electrical substation adjacent to the Ramsey Creek Road (NFS road #4781), which would be reconstructed for access
- A change in the construction technique proposed for the Little Cherry Creek Impoundment from downstream to centerline
- Installation of a water pipeline from the Libby Adit to the land application and disposal (LAD) Areas
- Changes required to conform Operating Permit #00150 to the mine alternative selected by the KNF in its ROD

MMC and the DEQ agreed to hold the request for modification to the permit in abeyance until completion of the environmental review process.

MMC's Plan of Operations is considered as a new proposed Plan of Operations by the KNF because NMC relinquished the federal authorization to construct and operate the Montanore Project in 2002. Both the KNF and the DEQ consider MMC's proposed 230-kV North Miller Creek transmission line, Sedlak Park Substation (adjacent to BPA's Noxon-Libby transmission line), and a loop line to the Noxon-Libby transmission line to be part of the Proposed Action as the 1993 Certificate of Environmental Compatibility and Public Need for the 230-kV transmission line expired.

Libby Adit Evaluation Program

Following the acquisition of NMC and DEQ Operating Permit #00150, MMC submitted, and the DEQ approved in 2006, two requests for minor revisions to DEQ Operating Permit #00150 (MR

06-001 and MR 06-002). The revisions involved reopening the Libby Adit and re-initiating the evaluation drilling program that NMC began in 1989. The key elements of the revisions include: excavation of the Libby Adit portal; initiation of water treatability analyses; installation of ancillary facilities; dewatering of the Libby Adit decline; extension of the current drift; and underground drilling and sample collection.

The KNF determined the activities associated with the Libby Adit evaluation drilling were a new proposed Plan of Operations under its Locatable Minerals Regulations (36 CFR 228 Subpart A), and MMC needed KNF approval before dewatering and continuing excavation, drilling, and development work at the Libby Adit. Under the authority of Minor Revision 06-002 of the DEQ operating permit, MMC installed a Water Treatment Plant and is treating water from the adit.

In 2006, the KNF initiated an analysis that included public scoping for the proposed road use and evaluation drilling at the Libby Adit Site. In 2008, the KNF decided the best approach for disclosing the environmental effects of the Libby Adit evaluation program was to consider the activity as the initial phase of the overall Montanore Project in this EIS. The Libby Adit evaluation program would be the first phase of the Montanore Project in Alternatives 3 and 4.

Purpose and Need

The Forest Service's and DEQ's overall purpose and need is to process MMC's Plan of Operations, permit applications and application for modification of DEQ Operating Permit #00150, and follow all applicable laws, regulations, and policies pertaining to each pending application. The need, from the perspective of the Forest Service, is to:

- Respond to MMC's proposed Plan of Operations to develop the Montanore copper and silver deposit
- Ensure the selected alternative would comply with other applicable federal and state laws and regulations
- Ensure the selected alternative, where feasible, would minimize adverse environmental impacts on National Forest System surface resources
- Ensure measures would be included, where practicable, that provide for reclamation of the surface disturbance

The Corps is required to consider and express the activity's underlying purpose and need from the applicant's and public's perspectives. From the Corps' perspective, the underlying project purpose is to provide copper and silver from deposits contained in northwestern Montana to meet a portion of current and future public demands.

The MEPA and its implementing rules ARM 17.4.601 *et seq.*, require that EISs prepared by state agencies include a description of the purpose and benefits of the proposed project. MMC's project purpose is described below. Benefits of the proposed project include increased employment in the project area, increased tax payments, and the production of copper and silver to help meet public demand for these metals. The MFSA (75-20-101 *et seq.*, MCA) and an implementing rule, ARM 17.20.920, require that the DEQ determine the basis of the need for a facility and that an application for an electric transmission line contain an explanation of the need for the facility. No electrical distribution system is near the project area. The nearest electrical distribution line parallels US 2 and it is not adequate to carry the required electrical power. A new transmission line is needed to supply electrical power to construct, operate, and reclaim the proposed mine facilities.

BPA's transmission system in northwestern Montana provides reliable power to BPA's customers, including Flathead Electric Cooperative. BPA has a need therefore to improve its transmission system to ensure continued reliable electrical power for all of its customers. BPA's purposes are goals to be achieved while meeting the need for the project; the goals are used to evaluate the alternatives proposed to meet the need.

MMC's project purpose is to develop the Montanore copper and silver deposit by underground mining methods with the expectation of making a profit. MMC's need is to receive all necessary governmental authorizations to construct, operate, and reclaim the proposed Montanore Mine and the associated transmission line, and all other incidental facilities. MMC proposes to construct, operate, and reclaim the Montanore Project in an environmentally sound manner, subject to reasonable mitigation measures designed to avoid or minimize environmental impacts on the extent practicable.

Decisions

The KNF Supervisor will issue a decision on MMC's proposal in a ROD. The decision objective is to select an action that meets the legal rights of MMC, while protecting the environment in compliance with applicable laws, regulations, and policy. The KNF Supervisor will use the EIS process to develop the necessary information to make an informed decision as required by 36 CFR 228, Subpart A. The Corps will decide whether to issue a 404 permit based on MMC's 404 permit application and information in this EIS. MMC submitted a Section 404 permit application to the Corps for the alternatives preferred by the lead agencies (Mine Alternative 3 and Transmission Line Alternative D-R). The Corps will issue a ROD or a Statement of Findings on its permit decision. The BPA will prepare a decision document stating its intent to construct or not construct the new Sedlak Park Substation and loop line from its Noxon- Libby 230-kilovolt (kV) transmission line. The DEQ will issue a ROD or certificate containing its decisions pursuant to each of the project-related permit applications including MMC's MFSA certificate of compliance application, MPDES, air quality, and other permit or renewal applications, and a decision on MMC's application for modification of DEQ Operating Permit #00150.

The KNF submitted two Biological Assessments to the U.S. Fish and Wildlife Service (USFWS) that describes the potential effect on threatened and endangered species that may be present in the area. After review of the Biological Assessments and consultation, the USFWS issued biological opinions for the proposed project. In 2014, the USFWS determined the KNF's proposed action (implementing Mine Alternative 3 and Transmission Line Alternative D-R):

- Is not likely to jeopardize the continued existence of the grizzly bear
- Is not likely to jeopardize the continued existence of the lynx
- Is not likely to jeopardize the continued existence of the bull trout
- Is not likely to destroy or adversely modify bull trout critical habitat

Public Involvement

A Notice of Intent was published in the Federal Register on July 15, 2005. The Notice described KNF and DEQ's intent to prepare an EIS for the proposed Montanore Project, set the dates for public scoping meetings, and solicited public comments. In addition, as part of the public involvement process, the lead agencies issued press releases, mailed scoping announcements, and held three public meetings. Based on the comments received during public scoping, the KNF and the DEQ identified seven key issues that drove alternative development. The key issues that led the lead agencies to develop alternatives to the Proposed Action were:

- Issue 1: Potential for acid rock drainage and metal leaching
- Issue 2: Effects on quality and quantity of surface water and groundwater resources
- Issue 3: Effects on fish and other aquatic life and their habitats
- Issue 4: Changes in the project area's scenic quality
- Issue 5: Effects on threatened and endangered wildlife species
- Issue 6: Effects on wildlife and their habitats
- Issue 7: Effects on wetlands and streams

The KNF and the DEQ issued a Draft EIS for the Montanore Project on February 27, 2009, for public comment. In response to public comment, the agencies revised the agencies' mine alternatives (Alternatives 3 and 4) and transmission line alignments (Alternatives C-R, D-R, and E-R) and issued a Supplemental Draft EIS on October 7, 2011.

Alternatives

Alternatives were developed based on requirements for alternatives under regulations implementing NEPA, MEPA, MFSA, and Section 404 of the Clean Water Act. To develop a reasonable range of alternatives, the agencies separated the proposed Montanore Project into components. Components are discrete activities or facilities (*e.g.*, plant site or tailings impoundment) that, when combined with other components, form an alternative. Options were identified for each component. An option is an alternative way of completing an activity, or an alternative geographic location for a facility (component), such as alternative geographic locations for a tailings impoundment or transmission line, or an alternative method of tailings disposal, such as paste tailings. Options generate the differences among alternatives. An alternative is a complete project that has all the components necessary to fulfill the project purpose and need. The agencies considered options for the following project components:

- Underground mine
- Plant site and adits
- Tailings disposal, including both backfilling and surface disposal
- Land application disposal areas
- Access road
- Transmission line

Besides a No Action and a Proposed Action for both the mine facilities and transmission line, the lead agencies analyzed in detail two mine alternatives and three transmission line alternatives.

Mine Alternatives

Alternative 1—No Action, No Mine

In this alternative, MMC would not develop the Montanore Project, although it is approved under DEQ Operating Permit #00150. The Montanore Project, as proposed, cannot be implemented without a corresponding Forest Service approval of a Plan of Operations. The environmental, social, and economic conditions described in Chapter 3 would continue, unaffected by the construction and operation of the mine or a transmission line. The DEQ's Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002 would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System surface resources. The conditions under which the Forest Service could select the No Action Alternative or the DEQ deny MMC's applications for MPDES and air quality permits, transmission line certificate, and MMC's operating permit modifications are described in section 1.6, *Agencies Roles, Responsibilities, and Decisions* of Chapter 1 of the Final EIS.

Alternative 2—MMC's Proposed Mine

As proposed by MMC, the Montanore Project would consist initially of a 12,500-tons-per-day underground mining operation that would expand to a 20,000-tons-per-day rate. The surface mill (the Ramsey Plant Site) would be on National Forest System lands outside of the CMW in the Ramsey Creek drainage. The proposed project also would require constructing about 16 miles of high-voltage electric transmission line from a new substation adjacent to BPA's Noxon-Libby transmission line to the project site. The 230-kilovolt (kV) transmission line alignment would be from the Sedlak Park Substation in Pleasant Valley along US 2, and then up the Miller Creek drainage to the Ramsey Plant Site. The proposed transmission line is considered as a separate alternative (see Alternative B). The location of the proposed project facilities is shown on Figure S-1.

The ore body would be accessed from two adits adjacent to the mill. Two other adits, an evaluation/ventilation adit and a ventilation adit, both with entrances located on private land, also would be used during the project. The evaluation/ventilation adit would be located in the upper Libby Creek drainage; the ventilation adit would be located on MMC's private land (patented claim HR 134) in the upper East Fork Rock Creek drainage near Rock Lake. The additional 1-acre disturbance for the ventilation adit is part of MMC's requested DEQ Operating Permit #00150 modifications.

The mineralized resource associated with the Montanore subdeposit is about 135 million tons. MMC anticipates mining up to 120 million tons. Ore would be crushed underground and conveyed to the surface plant located near the Ramsey Adits. Copper and silver minerals would be removed from the ore by a flotation process. Tailings from the milling process would be transported through a pipeline to a tailings impoundment located in the Little Cherry Creek drainage, about 4 miles from the Ramsey Plant Site.

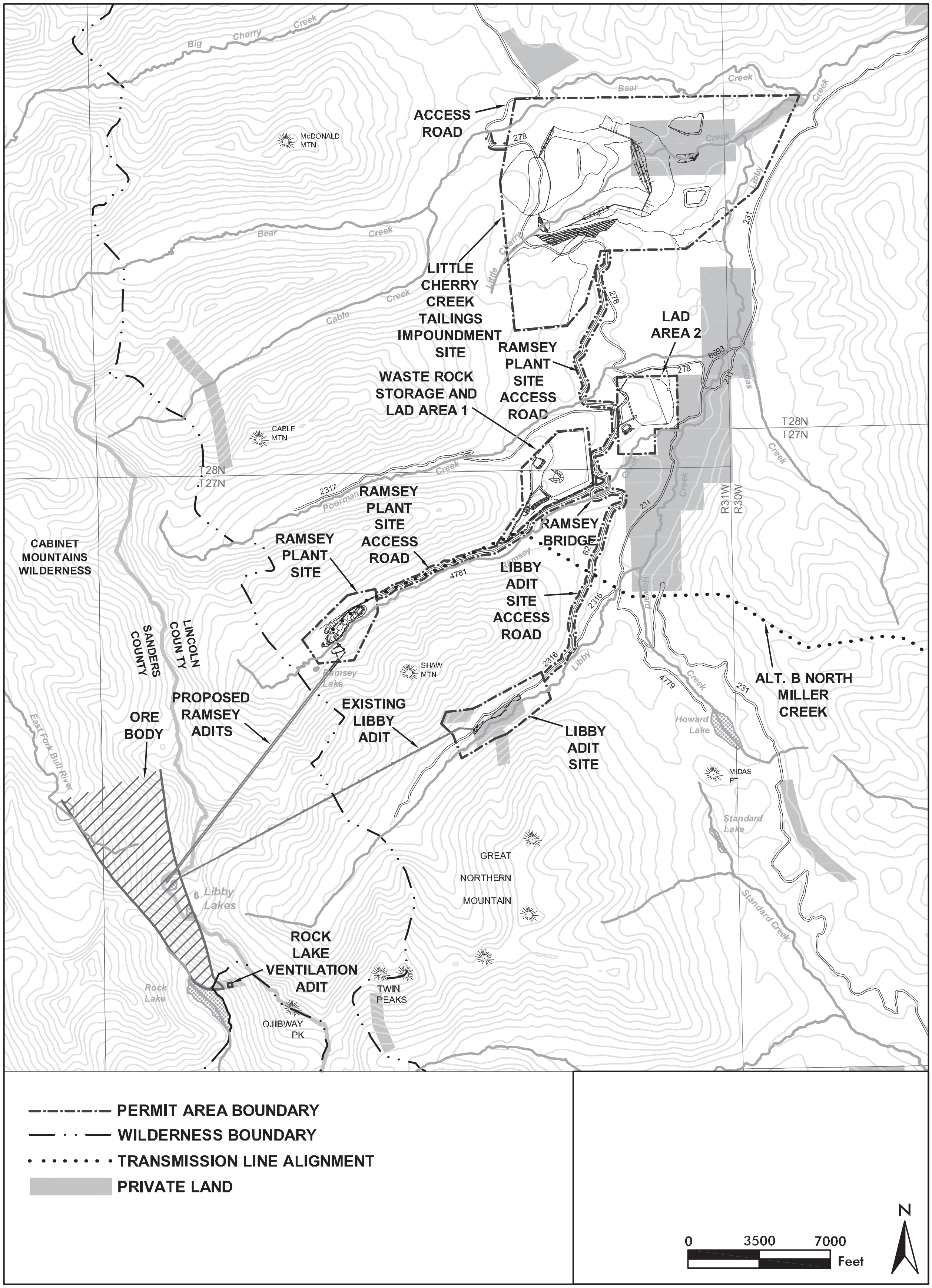


Figure S-1. Mine Facilities and Permit Areas, Alternative 2

Access to the mine and all surface facilities would be via US 2 and the existing National Forest System road #278, the Bear Creek Road. (Road names and numbers are used interchangeably in this EIS; a complete list of all road names and numbers is in Appendix B.) With the exception of the Bear Creek Road, all open roads in the proposed operating permit areas would be gated and limited to mine traffic only. MMC would upgrade 11 miles of the Bear Creek Road and build 1.7 miles of new road between the Little Cherry Creek Tailings Impoundment Site and the Ramsey Plant Site. Silver/copper concentrate from the plant would be transported by truck to a rail siding in Libby, Montana. The rail siding and Libby Loadout facility are near one of the facilities considered in the 1992 Final EIS. The concentrate would then be shipped by rail to an out-of-state smelting facility.

In Alternative 2, MMC's proposed tailings impoundment would be in Little Cherry Creek, a perennial stream, and the impoundment would require the permanent diversion of the upper watershed of Little Cherry Creek. Numerous wetlands and springs are in the Little Cherry Creek Impoundment Site.

MMC would discharge excess mine and adit wastewater at one of two LAD Areas. Additional water treatment would be added as necessary before discharge at the LAD Areas. Water treatment also would continue at the Libby Adit Site, if necessary. MMC would not discharge mine and adit inflows during operations, and would use them in the mill for ore processing.

Mining operations would continue for an estimated 16 to 19 years once facility development was completed and actual mining operations started. Three additional years may be needed to mine 120 million tons. The mill would operate on a three-shifts-per-day, seven-days-per-week, year-long schedule. At full production, an estimated 7 million tons of ore would be produced annually during a 350-day production year. Employment numbers are estimated to be 450 people at full production. An annual payroll of $12 million is projected for full production periods.

The operating permit area would be 3,628 acres and the disturbance area would be 2,582 acres (Table S-1). The operating permit area would encompass 425 acres of private land owned by MMC at the Little Cherry Creek Tailings Impoundment Site, the Libby Adit Site, and the Rock Lake Ventilation Adit Site. All surface disturbances would be outside the CMW. MMC developed a reclamation plan to reclaim disturbed areas.

Alternative 3—Agency Mitigated Poorman Impoundment Alternative

Alternative 3 would incorporate modifications and mitigating measures proposed by the agencies to reduce or eliminate adverse environmental impacts. These measures are in addition to or instead of the mitigations proposed by MMC. The Libby Adit evaluation program would be the initial phase of the project and would be completed before construction of any other project facility. All other aspects of MMC's mine proposal would remain as described in Alternative 2.

In Alternative 3, three major mine facilities would be located in alternative locations (Figure S-2). MMC would develop a Poorman Tailings Impoundment Site north of Poorman Creek for tailings disposal, use the Libby Plant Site between Libby and Ramsey creeks, and construct two additional adits in upper Libby Creek. The Poorman Tailings Impoundment Site was retained for detailed analysis because it would avoid the diversion of a perennial stream (Issue 2) and minimize wetland effects (Issue 7).

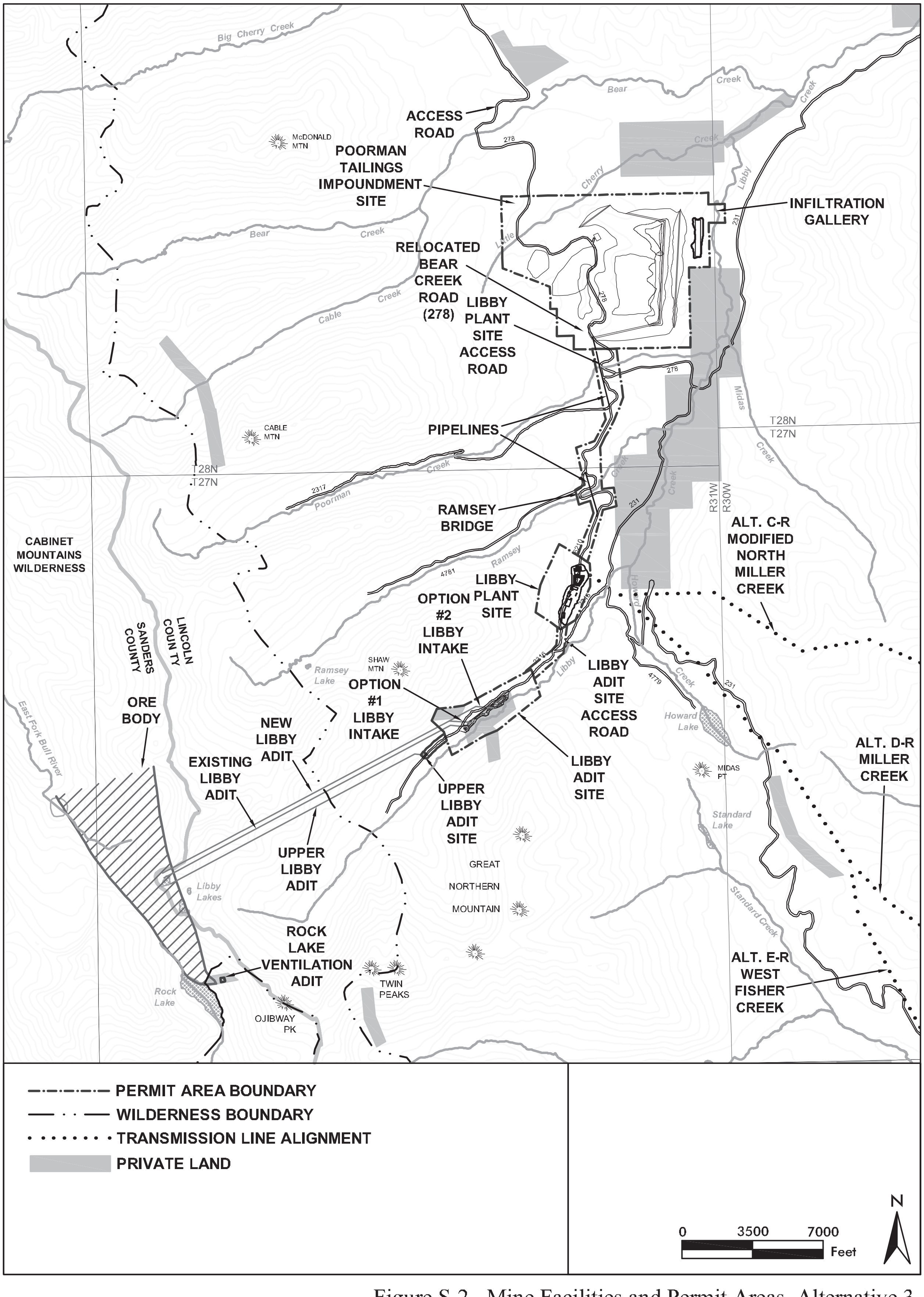


Figure S-2. Mine Facilities and Permit Areas, Alternative 3

Table S-1. Mine Surface Area Disturbance and Operating Permit Areas, Alternatives 2-4.

Facility	Alternative 2		Alternative 3		Alternative 4	
	Disturbance Area† (acres)	Permit Area (acres)	Disturbance Area† (acres)	Permit Area (acres)	Disturbance Area† (acres)	Permit Area (acres)
Existing Libby Adit Site	18	219	18	219	18	219
Upper Libby Adit	0	0	1	1	1	1
Rock Lake Ventilation Adit	1	1	1	1	1	1
Plant Site and Adits	52	185	76	172	76	172
Tailings Impoundment Site and Surrounding Area	1,928	2,458	1,272	1,506	1,619	2,215
LAD Area 1 and Waste Rock Storage Area§	247	261	0	0	0	0
LAD Area 2	183	226	0	0	0	0
Access Roads†	153	278	197	258	208	370
Total	2,582	3,628	1,565	2,157	1,924	2,979

†Disturbance area shown for roads excludes 33 feet of existing disturbance along roads.

§Waste rock would be stored within the disturbance area of the tailings impoundment in Alternatives 3 and 4, and not at LAD Area 1.

MMC's proposed plant site in the upper Ramsey Creek drainage would affect Riparian Habitat Conservation Areas (RHCAs) (Issue 3), core grizzly bear habitat (Issue 5), and Inventoried Roadless Areas (IRAs) (Figure S-3). An alternative site on a ridge separating Libby and Ramsey creeks was retained for detailed analysis to address these issues. Preliminary evaluation indicates the Libby Plant Site could be built of fill material from the large cut on the west side of the plant site. The cut and fill materials would be balanced, and waste rock would not be used in plant site construction. Avoiding the use of waste rock in plant site construction would address acid rock drainage and metal leaching (Issue 1). To avoid disturbance in the upper Ramsey Creek drainage, the adits in Alternative 3 would be in the upper Libby Creek drainage. The modification would address the same issues as the alternate Libby Plant Site (Issues 3 and 5).

In Alternatives 3 and 4, the lead agencies modified the proposed water management plan to address the uncertainties about quality of the mine and adit inflows, the effectiveness of LAD for primary treatment, quantity of water that the LAD Areas would be capable of receiving and the effect on surface water and groundwater quality. In Alternatives 3 and 4, the LAD Areas would not be used and all excess water would be treated at the Water Treatment Plant before discharge. MMC would treat and discharge all mine and adit inflows during all phases in Alternatives 3 and 4. During mill operations, MMC would divert water from Libby Creek near the impoundment site during high flows (April through July) to provide adequate water for mill operations. MMC would cease diversions from Libby Creek and discharge treated water to Libby Creek from the Water Treatment Plant during low flows to avoid adversely affecting senior water rights. Discharges to Ramsey Creek from the Water Treatment Plant at low flows also may be needed for the same reason. Maximum estimated discharge would exceed the current design capacity of the Water Treatment Plant, estimated to be 500 gpm. During final design, MMC would estimate the maximum discharge rate during the estimated wettest year over a 20-year period using best available precipitation data and modify the Water Treatment Plant such that it would have adequate capacity to treat discharges during a 20-year wet year. MMC also would evaluate the size of the percolation pond at the Libby Adit, and enlarged it, if necessary, to accommodate higher flow rates. The plant would be modified to treat nitrogen, and phosphorus, and possibly dissolved metals. The increased capacity and treatment modifications would be in place at mill startup. These modifications would address Issue 2, water quality and quantity.

A comparison of primary mine development and operation features that vary between each mine alternative is shown in Table S-2. The operating permit area would be 2,157 acres and the disturbance area would be 1,565 acres (Table S-1). The operating permit areas would encompass 75 acres of private land owned by MMC at the Libby Adit Site and the Rock Lake Ventilation Adit Site.

MMC would continue to plow the Libby Creek Road (NFS road #231) and the Upper Libby Creek Road (NFS road #2316) year-round during the 2-year Evaluation Phase and the 1-year period during reconstruction of the Bear Creek Road. MMC installed a gate on the Libby Creek Road. MMC would continue to maintain the gate and the KNF would continue to seasonally restrict access on the two roads as long as MMC used and snowplowed the two roads.

In Alternative 3, MMC would use the same roads as Alternative 2 for main access during operations. About 14 miles of Bear Creek Road (National Forest System road #278), from US 2 to the Poorman Tailings Impoundment Site, would be paved and upgraded to a roadway width of 26 feet. South of Little Cherry Creek, MMC would build 0.7 miles of new road west of and parallel to the Bear Creek Road that would connect Bear Creek Road with Ramsey Creek Road (NFS road #4781). The road would have a chip-seal surface and be constructed to a width to accommodate haul traffic. Mine traffic would use the Libby Plant Access Road and the public would use the existing Bear Creek Road.

The agencies extensively revised MMC's proposed mitigation plans in Alternatives 3 and 4, particularly for grizzly bear, lynx, bull trout and other fisheries, and wetlands and streams and completely replaced MMC's plans. The agencies' monitoring plans in Appendix C replace MMC's monitoring plans.

Alternative 4—Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would be similar to Alternative 3, but would have modifications to MMC's proposed Little Cherry Creek Tailings Impoundment as part of the alternative. All other modifications and mitigations described in Alternative 3, other than those associated with the Poorman Tailings Impoundment Site, would be part of Alternative 4. As in Alternative 3, the Libby Adit evaluation program would be the initial phase of the project and would be completed before construction of any other project facility.

In Alternative 4, MMC would use the Libby Plant Site between Libby and Ramsey creeks, construct two additional adits in upper Libby Creek, and modify the proposed Little Cherry Creek Tailings Impoundment Site operating permit and disturbance areas to avoid RHCAs (Issue 3) and old growth (Issue 6) in the Little Cherry Creek drainage (Figure S-4). Borrow areas would be reconfigured to maximize disturbance within the impoundment footprint, and to reduce disturbance of RHCAs (Issue 3), core grizzly bear habitat (Issue 5), and old growth (Issue 6)

(Figure S-3). Waste rock would be stored temporarily within the impoundment footprint to address acid rock drainage and metal leaching (Issue 1) and water quality and quantity (Issue 2). The proposed permanent Little Cherry Creek Diversion Channel below the engineered upper section would be modified to convey anticipated flows adequately. At closure, surface water runoff would be directed toward the Little Cherry Creek Diversion Channel, and not Bear Creek, an important bull trout stream. The operating permit area would be 2,979 acres and the disturbance area would be 1,924 acres (Table S-1). The operating permit area would encompass 276 acres of private land owned by MMC at the Little Cherry Creek Tailings Impoundment Site, the Libby Adit Site, and the Rock Lake Ventilation Adit Site. All other aspects of MMC's mine proposal would remain as described in Alternative 2, as modified by Alternative 3.

Table S-2. Mine Alternative Comparison.

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Operating Permit Areas	3,628 acres	2,157 acres	2,979 acres
Disturbance Areas	2,582 acres	1,565 acres	1,924 acres
Primary Facilities			
Mill site	Ramsey Plant Site in valley bottom in Upper Ramsey Creek	Libby Plant Site between Libby and Ramsey Creek drainages	Same as Alternative 3
Adits and portals	Existing Libby Adit; two Ramsey Adits; Rock Lake Ventilation Adit	Existing Libby Adit; two additional Libby Adits; Rock Lake Ventilation Adit	Same as Alternative 3
Above-ground conveyor	1,200 feet long between Ramsey Adit portal and mill	6,000 and 7,500 feet long (depending on the option) between Libby Adit Site and Libby Plant Site mill	Same as Alternative 3
Tailings impound-ment and seepage collection pond	628 acres in Little Cherry Creek	608 acres between Poorman and Little Cherry creeks	Same as Alternative 2
Perennial stream diversion	Diversion of Little Cherry Creek 10,800 feet long around impoundment to Libby Creek	None	Same as Alternative 2
Land application disposal areas	Two; one along Ramsey Creek and one between Ramsey and Poorman creeks	None; any wastewater treated at Water Treatment Plant	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Water treatment	Land application, Libby Adit Water Treatment Plant, or additional Water Treatment Plant at plant site, as necessary	Libby Adit Water Treatment Plant expanded to accommodate discharges during a 20-year wet year; Modified to treat nitrogen and phosphorus, and possibly dissolved metals	Same as Alternative 3
Primary access road	NFS road #278 (Bear Creek Road) plus new access road; 20 to 29 feet wide	NFS road #278 (Bear Creek Road) plus new access road; 26 feet wide; up to 56 feet wide to accommodate haul traffic and public traffic	Same as Alternative 3
Concentrate loadout location	Kootenai Business Park in Libby	Same as Alternative 2	Same as Alternative 2
Facility Details			
New adits: length, grade, and portal elevation	Ramsey Adits: 16,000 feet long, 8% decline; Elevation: 4,400 feet Rock Lake Ventilation Adit: Elevation: 5,560 feet	Upper Libby Adit: 13,700 feet long, 7% decline; Elevation: 4,100 feet New Libby Adit: 17,000 to 18,500 feet long, depending on option; 5% decline; Elevation: 3,960 feet	Same as Alternative 3
New access roads† To Plant Site:	1.7 miles connecting NFS roads #278 and #4781	0.7 miles of new road parallel to NFS roads #278, connecting existing NFS roads #278 and #2317	Same as Alternative 3
Realigned NFS road #278 at impoundment	1.8 miles	0.2 miles	Same as Alternative 2
To Adit Portal:	0.3 mile to portal	None	Same as Alternative 3
To LAD Area 1	1.0 mile	None	Same as Alternative 3
To LAD Area 2	0.2 mile	None	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Pipelines Tailings	Double-walled, high-density polyethylene adjacent to access road; 6.4 miles to impoundment	Double-walled buried adjacent to access road; 4.2 miles to impoundment	Same as Alternative 3; 6.4 miles to impoundment
Reclaim water	High-density polyethylene adjacent to access road	High-density polyethylene buried adjacent to access road	Same as Alternative 3
Tailings pump stations	At Poorman Creek crossing	At each crossing of Ramsey and Poorman creeks	Same as Alternative 3
Borrow areas	Four; 143 acres within and 419 acres outside of impoundment footprint	Three; 124 acres within and 92 acres outside of impoundment footprint	Five; 185 acres within and 252 acres outside of impoundment footprint
Post-mining impoundment runoff	Riprapped channel to Bear Creek	Natural channel to Little Cherry Creek	Riprapped channel to Little Cherry Creek Diversion Channel

†Temporary roads within the disturbance area of each facility not listed.

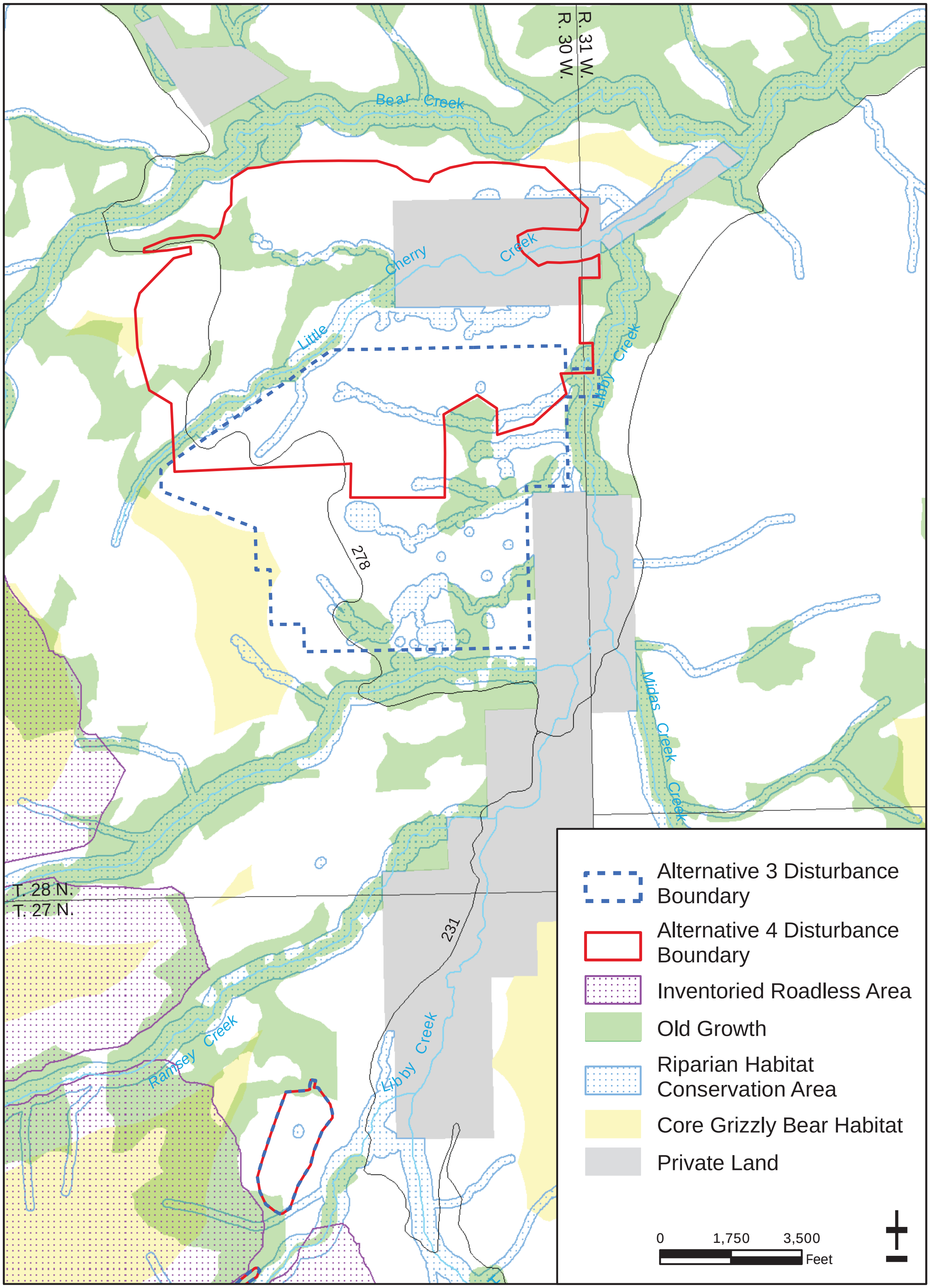


Figure S-3. Key Resources Avoided by Alternatives 3 and 4

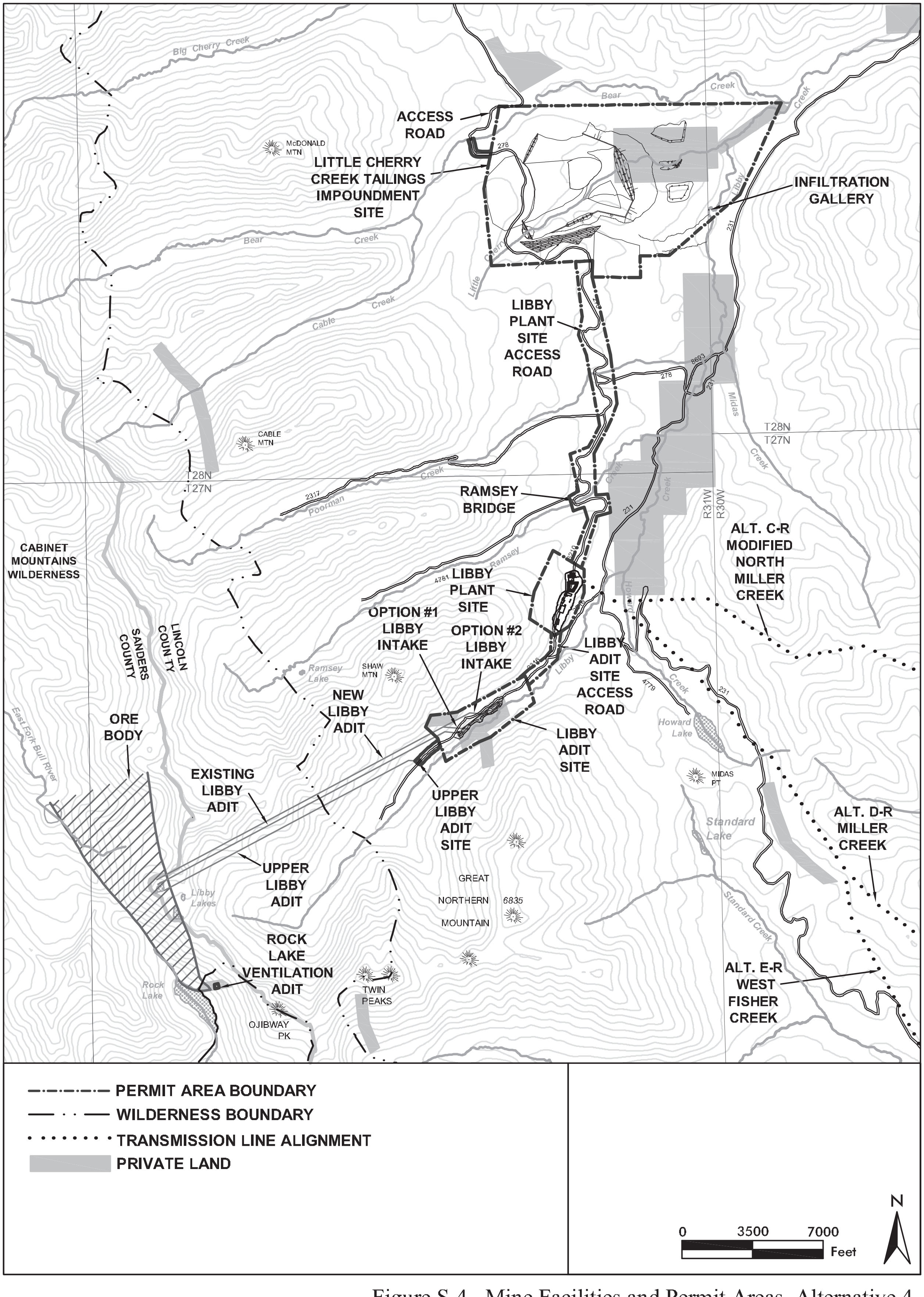


Figure S-4. Mine Facilities and Permit Areas, Alternative 4

Transmission Line Alternatives

Alternative A—No Transmission Line, No Mine

In this alternative, MMC would not build a 230-kV transmission line to provide power to the mine from the Sedlak Park Substation. The BPA would not construct the loop line to the Noxon-Libby 230-kV transmission line nor would it build the Sedlak Park Substation. The environmental, social, and economic conditions described in Chapter 3 would continue, unaffected by the construction and operation of the transmission line. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands.

Alternative B—MMC's Proposed Transmission Line (North Miller Creek Alternative)

The Ramsey Plant Site's electrical service would be 230-kV, 3-phase, and 60-cycle, provided by a new, overhead transmission line. BPA's proposed Sedlak Park Substation Site at the BPA's Noxon-Libby 230-kV transmission line is in an area known locally as Sedlak Park, 30 miles southeast of Libby on US 2 (Table S-3). The proposed Sedlak Park Substation and loop line is the same in all alternatives. MMC would be responsible for funding construction of the transmission line, substation, and loop line that would connect the substation to the Noxon-Libby 230-kV transmission line.

MMC's proposed transmission line alignment would be in the watersheds of the Fisher River, Miller Creek, a tributary to Miller Creek, Midas Creek, Howard Creek, Libby Creek, and Ramsey Creek (Table S-3). The proposed alignment would head northwest from the substation for about 1 mile east and uphill of US 2 and private homes and cabins, and then follow the Fisher River and US 2 north 3.3 miles. The alignment would then turn west and generally follow the Miller Creek drainage for 2.5 miles, and then turn northwest and traverse up a tributary to Miller Creek. The alignment would then cross into the upper Midas Creek drainage, and then down to Howard and Libby Creek drainages. The alignment would cross the low ridge between Libby Creek and Ramsey Creek, and then would generally follow Ramsey Creek to the Ramsey Plant Site. The maximum annual energy consumed by the project is estimated at 406,000 megawatts, using a peak demand of 50 megawatts. Access roads on National Forest System lands would be closed and reseeded after the transmission line was built, and reclaimed after the transmission line was removed at the end of operations.

Characteristics of MMC's proposed North Miller Creek Alternative (Alternative B) and the agencies' three other transmission line alternatives (Alternatives C-R, D-R, and E-R) are summarized in Table S-3. MMC's proposed alignment would end at a substation at the Ramsey Plant Site; the lead agencies' alternatives would end at a substation at the Libby Plant Site, making the lead agencies' alternatives shorter.

Table S-3. Transmission Line Alternative Comparison.

Characteristic	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
Length (miles)[†] Steel monopole Wooden monopole Wooden H-frame Total	 16.4 0.0 0.0 16.4	 0.0 0.0 13.1 13.1	 0.0 0.0 13.7 13.7	 0.0 0.5 14.6 15.1
Number of structures[‡]	108	80	91	104
New access roads (miles)	10.2	3.1	5.1	3.9
Average span length (ft.)	799	862	793	767
Helicopter use				
Structure placement	Contractor's discretion	26 structures, primarily in Miller Creek and Midas Creek drainages	16 structures, primarily in Miller Creek and Howard Creek drainages	31 structures, primarily in West Fisher Creek and Howard Creek drainages
Vegetation clearing	Contractor's discretion	4.8 miles at selected locations; see Figure S-6	2.5 miles at selected locations; see Figure S-6	4.3 miles at selected locations; see Figure S-6
Line stringing	Contractor's discretion	Yes, entire line	Yes, entire line	Yes, entire line
Annual inspection	Yes	Yes	Yes	Yes
Estimated cost in millions $[§]				
Construction	$7.3	$5.4	$5.4	$6.6
Mitigation	$3.9	$10.8	$10.8	$10.8

[†]Length is based on line termination at the Ramsey Plant Site in Alternative B and the Libby Plant Site in the other three alternatives.

[‡]Number and location of structures based on preliminary design, and may change during final design. The lead agencies' analysis of MMC's preliminary design and structure locations indicates additional structures and access may be needed to avoid long spans.

[§]Estimated cost used reasonable assumptions regarding costs of construction materials, clearing, land acquisition, and engineering. Final cost could vary from those shown. Estimated construction cost by HDR Engineering, Inc. 2012; estimated mitigation cost by KNF (2015).

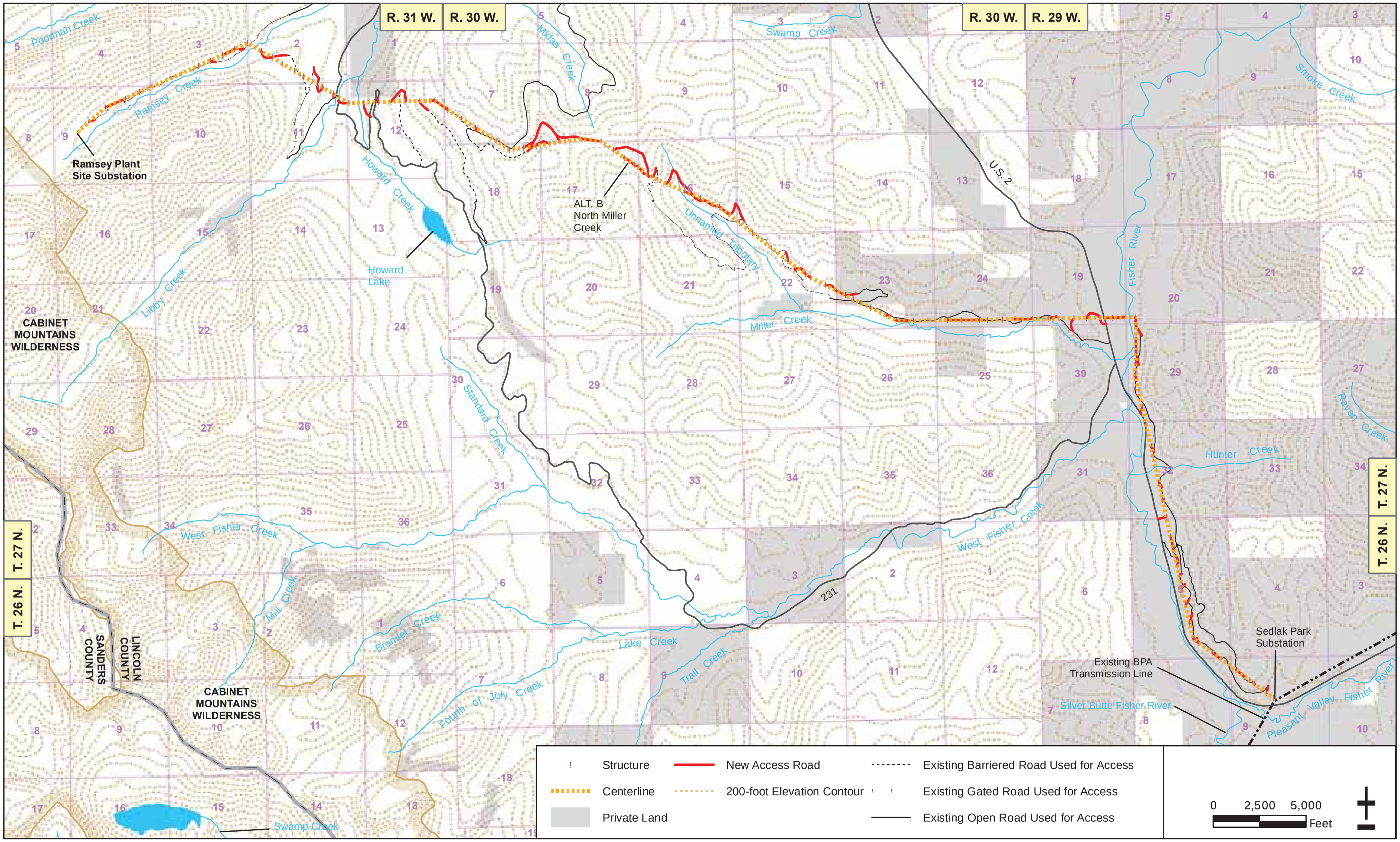


Figure S-5. North Miller Creek Alignment, Structures, and Access Roads, Alternative B

Alternative C-R—Modified North Miller Creek Transmission Line Alternative

This alternative includes modifications to MMC's transmission line proposal described under Alternative B. This alternative could be selected with any of the mine alternatives. For analysis purposes, this alternative would terminate at the Libby Plant Site.

The agencies developed two primary alignment modifications to MMC's proposed North Miller Creek alignment in Alternative B. One modification described in the Draft EIS would route the line on an east-facing ridge immediately north of the Sedlak Park Substation instead of following the Fisher River. The modification would address issues associated with water quality and aquatic life (Issues 2 and 3) by crossing less area with soils that are highly erosive soils and those with potential for high sediment delivery. The modification also addresses the issue of scenic quality (Issue 4) by reducing the visibility of the line from US 2. Fewer residences would be within 0.5 mile of the line. The other alignment modification was developed following comment on the Draft EIS. The modification, which would use an alignment up and over a ridge between West Fisher Creek and Miller Creek, would increase the use of public land and reduce the length of line on private land. During final design, MMC would submit a final Vegetation Removal and Disposition Plan to minimize vegetation clearing, particularly in riparian areas. The alignment was modified between the Supplemental Draft EIS and the Final EIS so a 2-mile segment would cross the Fisher River about 800 feet north of the alignment presented in the Supplemental Draft EIS.

Wooden H-frame structures, which generally allow for longer spans and require fewer structures and access roads, would be used on Alternative C-R. In some locations, a helicopter would be used for vegetation clearing and structure construction (Figure S-6). The lead agencies selected helicopter use so the need to use or construct roads in or adjacent to core grizzly bear habitat would be minimized. Helicopter use also would reduce effects on lynx habitat. Access roads on National Forest System lands would be placed into intermittent stored service after construction and throughout operations, and decommissioned after the transmission line was removed at the end of operations. Unless otherwise specified by a landowner, new roads on private land would be managed in the same manner as on National Forest System lands. These modifications would address issues associated with water quality, aquatic life, threatened and endangered species, and wildlife (Issues 2, 3, 5, and 6) by reducing clearing and wildlife displacement associated with new access roads. Modifications described under Alternative 3 for the mine, such as seed mixtures, revegetation success, and weed control, would be implemented in Alternative C-R.

The agencies developed mitigation measures that would reduce or minimize the effects of the transmission line in Alternatives C-R, D-R, and E-R. Snags and up to 30 tons per acre of coarse woody debris would be left in the clearing area. No transmission line construction in elk, white-tailed deer, or moose winter range would occur between December 1 and April 30 unless approved by the agencies. Grizzly bear mitigations in the agencies' alternatives include restrictions on the timing of transmission line construction and decommissioning. These restrictions would apply to National Forest System and State trust lands. This grizzly bear mitigation would require that MMC be restricted to June 16 to October 14 for conducting these activities. No waiver of winter range timing restrictions would be approved on National Forest System or State trust lands where the grizzly bear mitigations would apply. The KNF would restrict access on five roads to provide big game security habitat. To mitigate effects on the grizzly bear, MMC would secure or protect replacement grizzly bear habitat on 26 acres in the Cabinet-Yaak Ecosystem. Transmission line construction and decommissioning on National

Forest System and State trust lands would be limited to between June 16 and October 14. The KNF would restrict access on 2.8 miles of NFS road #4725 in an unnamed tributary of Miller Creek in Alternative C-R and 4.2 miles in Alternatives D-R and E-R.

Alternative D-R—Miller Creek Transmission Line Alternative

This alternative includes modifications to MMC's transmission line proposal regarding H-frame structures, helicopter use, vegetation clearing, and other modifications described under Alternative C-R. This alternative could be selected with any of the mine alternatives. For analysis purposes, this alternative would terminate at the Libby Plant Site.

As in the Modified North Miller Creek Alternative (Alternative C-R), this alternative modifies MMC's proposed North Miller Creek alignment by routing the line on an east-facing ridge immediately north of the Sedlak Park Substation (Figure S-6). The development of a final Vegetation Removal and Disposition Plan would be the same as Alternative C-R. The modifications would address issues associated with water quality and aquatic life (Issues 2 and 3) by crossing less area with soils that are highly erosive soils and those with potential for high sediment delivery. The issue of scenic quality (Issue 4) was addressed by this modification by reducing the visibility of the line from US 2. Fewer residences would be within 0.5 mile of the line. Another modification, developed following comment on the Draft EIS, was to use the same alignment as Alternative C-R into the Miller Creek drainage, and then along NFS road # 4724 on the south side of Miller Creek. The modification would increase the use of public land and reduce the use of private land. The issue of effects on threatened or endangered wildlife species (Issue 5) was addressed by routing the alignment along Miller Creek and avoiding core grizzly bear and lynx habitat in Miller Creek and the unnamed tributary of Miller Creek. Other alignment modifications, which would use an alignment up and over a ridge between West Fisher Creek and Miller Creek and move the alignment from private land near Howard Lake, would increase the use of public land and reduce the use of private lands. The alignment was modified between the Supplemental Draft EIS and the Final EIS so a 2-mile segment would cross the Fisher River about 800 feet north of the alignment presented in the Supplemental Draft EIS.

This alternative would use an alignment about 0.5 mile east of Howard Lake, a popular recreation facility in the project area. In the 1992 Final EIS, a similar alignment was considered, but was eliminated in part because of visual concerns from Howard Lake. The issue of scenic quality from Howard Lake was addressed by using H-frame structures, which would be shorter than steel monopoles. More detailed engineering was completed and H-frame structures would be used to minimize the visibility of the line from Howard Lake (Issue 4).

As in Alternative C-R, a helicopter would be used for timber clearing and structure construction in some locations (Figure S-6). New access roads would be managed in the same manner as Alternative C-R. These modifications would address issues associated with water quality, aquatic life, threatened and endangered species, and wildlife (Issues 2, 3, 5, and 6) by reducing clearing and wildlife displacement associated with new access roads. Mitigation described for Alternative C-R would be implemented. MMC would secure or protect replacement grizzly bear habitat on 40 acres in the Cabinet-Yaak Ecosystem.

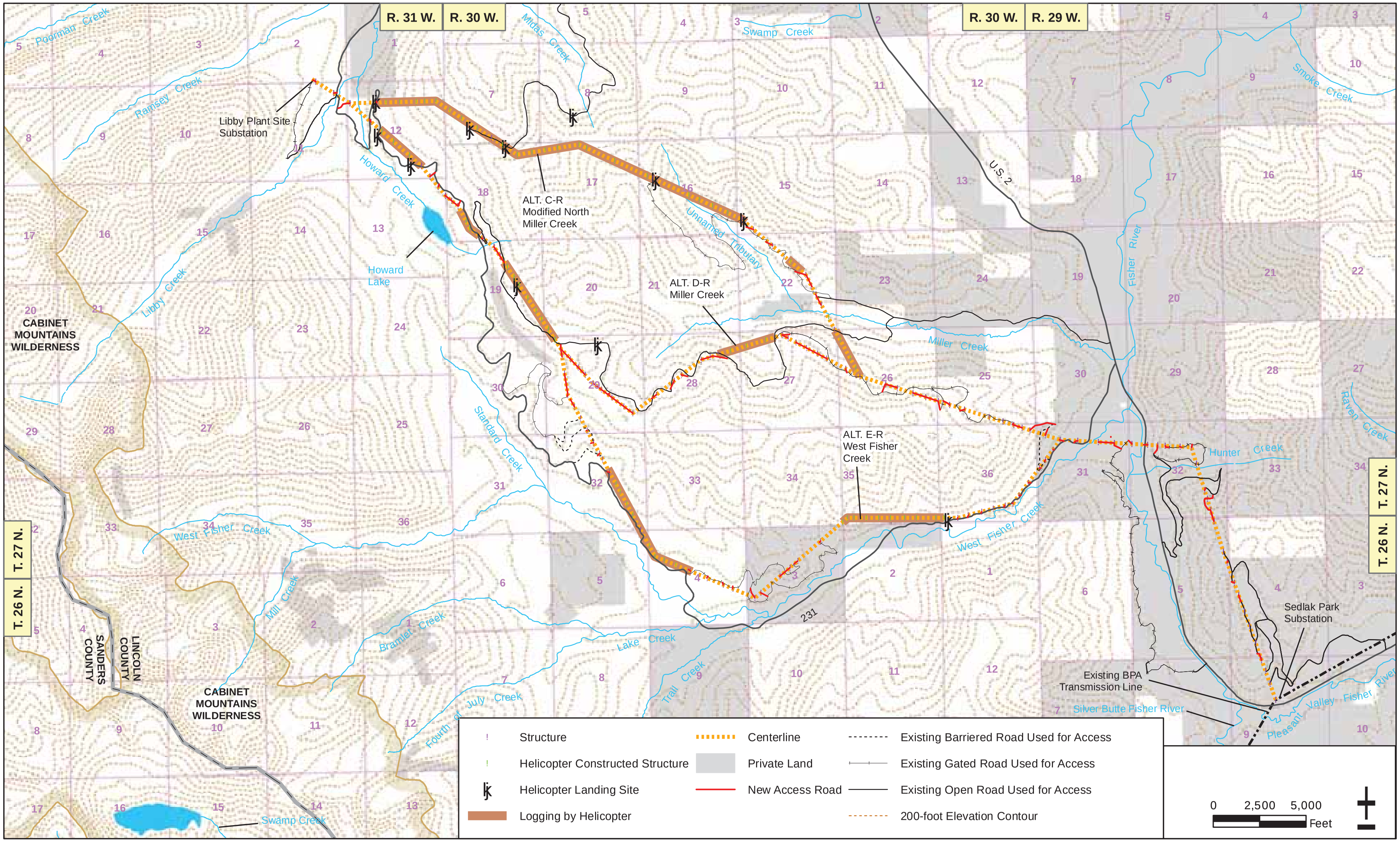


Figure S-6. Transmission Line Alignment, Structures, and Access Roads, Alternatives C-R, D-R, E-R

Alternative E-R—West Fisher Creek Transmission Line Alternative

This alternative includes modifications to MMC's transmission line proposal regarding H-frame structures, helicopter use, vegetation clearing, and other modifications described under Alternative C-R. Some steel monopoles would be used in the steep section 2 miles west of US 2 (Figure S-6). This alternative could be selected with any of the mine alternatives. For analysis purposes, the lead agencies assumed this alternative would terminate at the Libby Plant Site.

As in the Modified North Miller Creek Alternative, this alternative modifies MMC's proposed North Miller Creek Alignment by routing the line on an east-facing ridge immediately north of the Sedlak Park Substation. The modification would address issues associated with water quality (Issue 2) by crossing less area with soils that are highly erosive soils and those with potential for high sediment delivery. The issue of scenic quality (Issue 4) was addressed by this modification by reducing the visibility of the line from US 2. Fewer residences would be within 0.5 mile of the line. The alignment was modified between the Supplemental Draft EIS and the Final EIS so a 2-mile segment would cross the Fisher River about 800 feet north of the alignment presented in the Supplemental Draft EIS.

The primary difference between the West Fisher Creek Alternative (Alternative E-R) and the North Miller Creek Alternative (Alternative B) is routing the line on the north side of West Fisher Creek drainage to Miller Creek to minimize effects on core grizzly bear habitat. As in the Miller Creek Alternative (Alternative D-R), this alternative would use an alignment about 0.5 mile east of Howard Lake, a popular recreation facility in the project area. Wooden H-frame structures, which generally allow for longer spans and require fewer structures and access roads, would be used on this alternative in most locations to minimize the visibility of the line from Howard Lake (Issue 4). In some locations, a helicopter would be used for timber clearing and structure construction (Figure S-6). New access roads on National Forest System lands would be managed in the same manner as Alternative C-R. These modifications would address issues associated with water quality, aquatic life, threatened and endangered species, and wildlife (Issues 2, 3, 5, and 6) by reducing clearing and wildlife displacement associated with new access roads. Mitigation described for Alternative C-R would be implemented. MMC would secure or protect replacement grizzly bear habitat on 30 acres in the Cabinet-Yaak Ecosystem.

Forest Plan Amendment

Each mine and transmission line alternative would require an amendment to the 1987 Kootenai Land and Resource Management Plan, also known as the Kootenai Forest Plan (KFP) in order for the alternative to be consistent with the plan (USDA Forest Service 1987a). The amendment would be completed in accordance with the regulations governing Forest Plan amendments found in 36 CFR 219 and Forest Service Manual 1921.03.

Mine Facilities

In the 1993 ROD approving the lead agencies' preferred alternative for NMC's proposed Montanore Project, the KNF amended the KFP and reallocated an area surrounding the Little Cherry Creek Tailings Impoundment Site and the Ramsey Plant Site to Management Area 31 (MA 31). Maps showing existing MAs are available at the KNF. MA 31 is designed to accommodate the activities associated with mineral development on the KNF. All areas currently proposed for disturbance at the Ramsey Plant Site and the Little Cherry Creek Tailings Impoundment Site were not previously reallocated to MA 31 due to mapping technology and a slight change in the

Little Cherry Creek Tailings Impoundment design from that approved in 1993. In mine Alternatives 2, 3 and 4, the KNF would amend the KFP by reallocating to MA 31 all areas within the operating permit areas of the selected plant site and the tailings impoundment that currently are not MA 31. In addition, a proposed road and facility corridor that would cross MA 13 (Designated Old Growth) would be reallocated to MA 31.

The KFP amendment also would allow for increased open road density (ORD) in MA 12, 15, 16, 17, and 18 in the Crazy Planning Subunit (PSU), where road densities currently exceed the KFP standard of ORD less than or equal to 3.0 miles per square mile (see Section 3.25.3.3, *White-tailed Deer*). For all mine alternatives, the KNF would amend the KFP by allowing the ORD to exceed the KFP standard in the Crazy PSU during and after the project.

The amendment would apply only to National Forest System lands disturbed by any mine alternative, and would not apply to private lands affected by the mine alternatives.

230-kV Transmission Line

In the 1993 ROD approving the lead agencies' preferred alternative for NMC's proposed Montanore Project, the KNF amended the KFP and reallocated areas crossed by the transmission line classified as corridor avoidance areas (224 acres) to Management Area 23 (MA 23). Maps showing existing MAs are available at the KNF. MA 23 is designed to accommodate the activities associated with electric transmission corridors on the KNF (USDA Forest Service 1987a). All areas currently proposed for disturbance by MMC's proposed transmission line alignment classified as corridor avoidance areas were not reallocated to MA 23 due to mapping technology and slight changes in the North Miller Creek transmission line alignment from that approved in 1993. In transmission line Alternatives B, C-R, D-R, and E-R, the KNF would amend the KFP by reallocating certain areas within a 500-foot-wide corridor of the selected 230-kV transmission line on National Forest System lands as MA 23. The amendment would apply only to certain National Forest System lands currently not MA 23 disturbed by any transmission line alternative, and would not apply to private or State lands crossed by the transmission line alternatives. The amendment would apply to the following MAs if crossed by the transmission line under the conditions described:

- MAs 10 and 11 if the proposed corridor is within grizzly bear Management Situation 1 or 2
- MAs 2, 6, 12, 13, and 14

The KFP amendment also would allow for increased open road density (ORD) in MA 12, 15, 16, 17, and 18 in the Crazy Planning Subunit (PSU), and MA 12 in Silverfish PSU where road densities currently exceed the KFP standard of ORD less than or equal to 3.0 miles per square mile (see Section 3.25.3.3, *White-tailed Deer*). In transmission line Alternatives B, C-R, D-R, and E-R, the KNF would amend the KFP by allowing the ORD to exceed the KFP standard in the Crazy PSU during and after the project.

Affected Environment

The project is in the KNF, 18 miles south of Libby, Montana. Elevation of the project area ranges from 2,600 feet along US 2 to nearly 8,000 feet in the Cabinet Mountains. Most of the area is forested. Annual precipitation varies over the area, and is influenced by elevation and topography.

Precipitation is between 30 and 50 inches annually where most project facilities would be located. The ore body is beneath the CMW and all access and surface facilities would be located outside of the CMW boundary. The analysis area is drained by East Fork Rock Creek, a tributary of the Clark Fork River, the East Fork Bull River, Libby Creek and its tributaries, and tributaries to the Fisher River. Two tributaries of the Kootenai River, Libby Creek and the Fisher River provide surface water drainage for most of the area where project facilities are located. Most of the area is National Forest System lands managed in accordance with the KFP. Private land, most of which is owned Plum Creek Timberlands LP, Libby Placer Mining Company, or MMC, is found in the project area. Residential areas are found along US 2, the Libby Creek Road (NFS road #231), and Miller Creek. Recreation, wildlife habitat, and timber harvesting are the predominant land uses. Important grizzly bear and lynx habitat is found in the area. Segments of Fisher River, West Fisher Creek, Libby Creek, Rock Creek, East Fork Rock Creek, and East Fork Bull River are designated bull trout critical habitat. Chapter 3 provides more information about the affected environment.

Environmental Consequences

The following two sections summarize the environmental consequences of the four mine and five transmission line alternatives. The effects of the mine alternatives are summarized for the seven key issues discussed in the previous *Public Involvement* section. For the transmission line, the DEQ requires a certificate of compliance for development of electric transmission lines. The DEQ must find that the selected transmission line alternative meets the set of criteria listed under 75-20-301, MCA to be eligible for transmission line certification. Findings for all criteria under each alternative are summarized in the following *Draft Findings for Transmission Line Certification Approval* section.

Mine Alternatives

Issue 1: Potential for Acid Rock Drainage and Near Neutral pH Metal Leaching

The mineral deposit proposed for mining is part of the Rock Creek-Montanore deposit. The Rock Creek-Montanore deposit has two sub-deposits, the Rock Lake sub-deposit and the Montanore sub-deposit. The Troy Mine, developed within the upper quartzites of the Revett Formation, is a depositional and mineralogical analog for the zone of quartzite to be mined within the upper-most part of the lower Revett Formation at the Montanore sub-deposit. Geological analogs are valuable techniques for predicting acid generation potential and water quality from a proposed mine site. This type of comparison is based on the assumption that mineralization formed under comparable conditions within the same geological formation, and that has undergone similar geological alteration and deformation, will have similar mineralogy and texture and, thus, similar potential for oxidation and leaching under comparable weathering conditions.

The risk of acid generation for rock exposed in underground workings or for tailings would be low, with some potential for release of select metals at a near-neutral pH (around pH 7) and a high potential for release of nitrogen compounds due to blasting. Low acid generation potential exists for a fraction of the total waste rock volume in portions of the Prichard Formation and moderate potential exists within the altered waste zones of the Revett Formation, which MMC proposes to mitigate through selective handling (particularly of the barren lead zone) and additional evaluation by sampling and characterization during mine development and operations.

Portions of the waste rock at Montanore have the potential to release trace elements at a near-neutral pH.

Some additional sampling would be conducted during the Evaluation, Construction and Operations Phases, when a more representative section of waste rock would be available for sampling. Characterization of metal release potential for tailings and waste rock is limited and would be expanded in Alternatives 3 and 4. Descriptions of mineralogy in rocks exposed in the evaluation adit ore zone (for the Revett Formation) and production adits (for the Burke and Prichard Formations) would be used to waste rock characteristics and tonnage to be mined, to guide sampling density. If the Wallace Formation were intercepted, samples of this lithology would be collected and characterized. This information would be used to redefine geochemical units for characterization and evaluate potential selective handling and encapsulation requirements.

Waste rock would be stockpiled for a short period of time near LAD Area 1 in Alternative 2, and in the impoundment area in Alternatives 3 and 4. Runoff from that pile would be contained using stormwater controls, and managed as mine drainage. Waste rock would be used to construct the Plant Site in Alternative 2, and the Tailings Impoundment dam in all alternatives. Because selective handling criteria would be developed using data from the Evaluation Phase, as specified in the geochemistry Sampling and Analysis Plan (Appendix C), it is not known what fraction of the Revett Formation waste rock would be brought to the surface. MMC currently plans to keep the waste rock from the barren lead zone underground, and would consider selective handling and backfill of waste rock when the characterization required in the Sampling and Analysis Plan was complete. Once more detailed information about the Revett and Prichard Formations waste rock was available, along with updated predictions of metal loading for tailings, they would be incorporated into updated water quality mass balance calculations.

Issue 2: Quality and Quantity of Surface Water and Groundwater Resources

Groundwater Level and Baseflow-Mine Area. The No Mine alternative would not change groundwater levels or stream baseflow. Disturbances at the Libby Adit Site would remain until reclaimed in accordance with existing permits and approvals.

A conceptual model and two numerical models of the mine area hydrogeology were developed to understand the characteristics of the groundwater flow system and evaluate potential impacts of the proposed project on groundwater resources. The results of the agencies' 2D model were provided in the Draft EIS. Subsequently, MMC prepared a more complex and comprehensive 3-dimensional (3D) model of the same analysis area. The results of both models were used to evaluate the site hydrogeology and analyze potential impacts due to mining. Although the results of the two models were similar, the 3D groundwater model provides a more detailed analysis by incorporating the influence of known or suspected faults and recent underground hydraulic testing results from the Libby Adit. The 3D groundwater model also uses a more comprehensive calibration process and better simulates vertical hydraulic characteristics of the geologic formations that will be encountered during the mining process. The models required a number of simplifying assumptions described in section 3.10, *Groundwater Hydrology* section of Chapter 3. The 3D model was also used to evaluate the effectiveness of possible mitigation measures, such as grouting during mining, and low permeability barriers post-mining. A different 3D groundwater model was used to assess effects in the Poorman Tailings Impoundment Site (see next section). For the purpose of analyzing the effects of possible mitigations, MMC simulated two options in the modeling: 1) grouting, during Operations Phase, of the sides of the three uppermost mine blocks and corresponding access ramps that would be adjacent to the Rock Lake Fault, and 2) installing two bulkheads in the mine at Closure.

With the data currently available, the model results provide a potential range of dewatering rates and streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. Both 3D groundwater flow models would be refined and rerun after data from the Evaluation Phase were incorporated into the models (see Section C.10.4, *Evaluation Phase* in Appendix C). Following additional data collection and modeling, the predicted impacts on surface water resources in the project area, including simulation of mitigation measures, may change and the model uncertainty would decrease. See section 3.10.4.3.5, *Groundwater Model Uncertainty*, for more discussion of uncertainty.

The effects of Alternatives 2, 3, and 4 due to the inflow of groundwater into the adits and mine void would be the lowering of the regional potentiometric surface and changes in stream baseflow in drainages adjacent to the mine and adits. Baseflow is the contribution of near-channel alluvial groundwater and deeper bedrock groundwater to a stream channel. Baseflow does not include any direct runoff from rainfall or snowmelt into the stream. In general, the effects on the groundwater table and related changes in stream baseflow would gradually increase through the mining phases of Evaluation, Construction, and Operations, as mine inflows increased due to an increasing mine void volume. Because of the low overall permeability of the bedrock, the groundwater system would be somewhat slow to respond to dewatering. Impacts on hydrology, as indicated by groundwater drawdown and related changes in stream baseflow, are predicted to reach a maximum soon after the adits were plugged (in the Closure Phase) in watersheds on the east side of the Cabinet Mountains and reach a maximum in 16 to 30 years after the adits were plugged (in the Post-Closure Phase) in watersheds on the west side of the Cabinet Mountains. Groundwater drawdown is predicted to extend north of St. Paul Lake, south of Rock Lake, and along the trend of the proposed adits. At the end of mining, the largest drawdown is expected to be between 100 and 500 feet north and east of Rock Lake and between 10 and greater than 500 feet along the adits. Alternative 2 would likely result in more drawdown in the Ramsey Creek watershed and less drawdown in the Libby Creek watershed upstream of Ramsey Creek compared to Alternatives 3 and 4.

The effects of groundwater drawdown due to dewatering of the mine are best expressed by estimating changes to baseflow. Streams in the area may reach baseflow for about 1 to 2 months between mid-July to early October; periods of baseflow may also occur during November through March. The 3D model predicted that baseflow would be reduced in East Fork Rock Creek, Rock Creek, East Fork Bull River, Libby Creek, Ramsey Creek and Poorman Creek in all mine alternatives. In addition to baseflow effects, the model predicted the volume of groundwater flowing into Rock Lake would be reduced. Without mitigation, the model predicted water would flow out of the lake toward the mine void, resulting in a reduction in lake storage. The model predicted the reduction would occur for about 130 years after mining ceased. With mitigation, the model predicted that 16 years after mining ceased and the adits were plugged, the volume of the lake would be reduced by an estimated 2 percent, the surface area would be reduced by an estimated 1 percent, and the lake level would decline by 0.5 foot during the 2-month summer/fall period.

As groundwater levels began to recover during the Post-Closure Phase, the model predicted the changes in baseflow would decrease, reaching steady state conditions about 1,200 to 1,300 years after mining ended. The 3D model predicted that the mine void and adits would require about 490 years to fill. Much of the mine void would be substantially filled in less time, but as the mine void filled, the inflow rate would decrease, requiring a total of about 490 years to completely fill the mine void and adits. The 3D model predicted that groundwater levels would not recover to pre-mining levels, and the baseflow in upper East Fork Rock Creek (above Rock Lake) would be permanently reduced. Without mitigation, baseflow in East Fork Rock Creek below the lake, in Rock Creek, and in East Fork Bull River also would be permanently reduced. Leaving barrier pillars with constructed concrete bulkheads at limited access opening in the mine would minimize post-mining effects on the East Fork Bull River and East Fork Rock Creek streamflow. With mitigation, baseflow in East Fork Rock Creek and Rock Creek below the lake would return to pre-mine conditions or increase slightly, and in the East Fork Bull River would be slightly reduced.

The volume of groundwater stored in the flooded mine void and adits would be substantially greater than groundwater stored in fractures in the same area before mining. Assuming 120 million tons of ore and 3.2 million tons of waste rock were mined, the estimated increase in groundwater storage would be about 11.3 billion gallons or 34,600 acre feet of water.

Groundwater Levels-Tailings Impoundment and LAD Areas. The Little Cherry Creek Tailings Impoundment in Alternatives 2 and 4 would be designed with an underdrain system to collect seepage from the tailings impoundment and divert intercepted water to a Seepage Collection Pond below the impoundment. A pumpback well system also would be used, if necessary, in Alternative 2 to collect tailings seepage that reached underlying groundwater. Similar underdrain and pumpback well systems would be required at the impoundment site in Alternatives 3 and 4. The tailings are expected to be placed in the impoundment with a high water content and as they consolidate, water would pool in low areas at the surface and percolate downward. Most of the percolating water would be captured by the underdrain system, but some would seep into the underlying aquifer. Tailings seepage not collected by the underdrains would flow to groundwater at a maximum estimated rate of 25 gpm, slowly decreasing to an estimated 5 gpm after operations ceased. Groundwater drawdown resulting from a pumpback well system would reduce flows in adjacent streams. In Alternative 3, groundwater levels from north of Ramsey Creek to north of Little Cherry Creek are predicted to be reduced. Streamflow in Poorman, Little Cherry and Libby creeks is predicted to be reduced collectively by 0.55 cubic feet per second. The reduction in streamflow would begin in the Operations Phase and continue into the Post-Closure Phase.

A subsurface bedrock ridge occurs between the Little Cherry Creek and Poorman Creek watersheds, which may separate groundwater flow between the watershed of Little Cherry Creek from those of unnamed tributaries in the Poorman Impoundment Site. If a ridge and hydrologic divide separates the two areas, it is likely that groundwater drawdown from pumping in the Poorman Impoundment area would have limited effect on surface resources in the Little Cherry Creek drainage. The pumping rate required to capture all seepage would potentially be lower without recharge from the Little Cherry Creek watershed. Additional subsurface data from this area would be collected during the final design process of the Poorman Impoundment to confirm the geophysical results and the 3D model would be rerun to evaluate the site conditions with the new data.

After flow from the impoundment met BHES Order limits or applicable nondegradation criteria of all receiving waters, operation of the seepage collection system and the pumpback wells would be terminated and the wells plugged and abandoned. Assuming pumpback wells operated at 250 gpm until all pumping ceased, groundwater levels would mostly recover in 13 years after pumping ceased with an estimated residual flow depletion to Libby Creek of 0.1 cfs (50 gpm) and fully recover in about 25 years. Groundwater levels may recover sooner if pumping rates were reduced during the Closure Phase in response to tailings consolidation and impoundment reclamation. As groundwater levels recovered, springs that were buried by the impoundment may again flow, but into the impoundment's gravel underdrain system. Springs outside of the impoundment footprint that were affected by the pumpback wells would likely return to pre-mine conditions and may contribute to baseflow to channels outside of the impoundment.

Seven known springs and seeps in Little Cherry Creek area would be covered by the impoundment or disturbed by other facilities in Alternative 2 and six springs would be similarly affected by Alternative 4. Thirteen springs identified in the vicinity of the Poorman Impoundment Site would be affected by Alternative 3. A pumpback well system in alternatives may potentially affect springs: 10 in Alternative 2, 5 in Alternative 3, and 11 and in Alternative 4. Some of the springs potentially affected by the pumpback well system may be separated by a bedrock ridge that may limit drawdown effects.

In Alternative 2, mine and adit inflows greater than that needed in the mill or that could be stored in the tailings impoundment would be discharged at two LAD Areas between Ramsey and Poorman creeks or treated at the Water Treatment Plant. Groundwater levels in the LAD Areas would rise, and the flow rate from any springs near the two LAD Areas may increase. The increase in groundwater levels would be a function of the application rate used at the LAD Areas. The agencies' analysis indicates the rates proposed by MMC in Alternative 2 would likely cause surface water runoff or increased spring and seep flow on the downhill flanks of the LAD Areas. The maximum application rate would be determined on a performance basis by monitoring both groundwater quality and changes in groundwater levels. It is possible that monitoring would determine that the maximum application rate is higher or lower than estimated by the agencies' analysis. The application rate would be selected to ensure that groundwater did not discharge to the surface as springs between the LAD Areas and downgradient streams. Any water that could not be treated at the LAD Areas would be sent to the Water Treatment Plant.

The LAD Areas would not be used in Alternatives 3 and 4. All mine and adit inflows and any other wastewater in Alternatives 3 and 4 would be sent to the Water Treatment Plant and discharged after treatment to a percolation pond adjacent to Libby Creek.

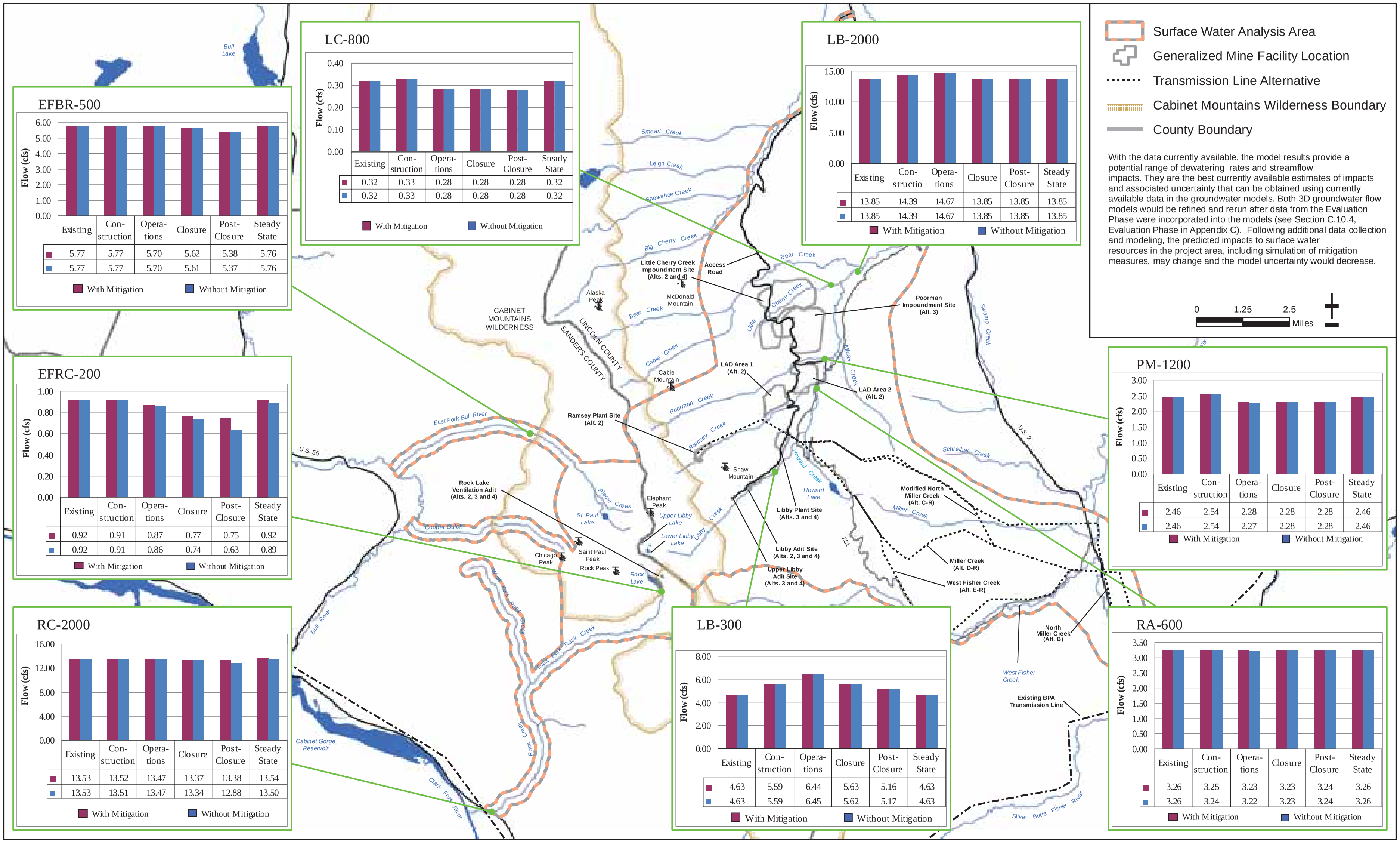
Streamflow. The analysis area is drained on the east by Libby Creek and its tributaries: Ramsey Creek, Poorman Creek, Little Cherry Creek, and Bear Creek. Libby Creek flows north from the analysis area to its confluence with the Kootenai River near Libby. The analysis area is drained on the west by the East Fork Rock Creek and East Fork Bull River. The East Fork Rock Creek flows southwest into Rock Creek and then into the Clark Fork River downstream of Noxon Reservoir. The East Fork Bull River flows northwest into the Bull River. The transmission line corridor area is drained by the Fisher River and its tributaries: Sedlak Creek, Hunter Creek, Miller and North Fork Miller creeks, Standard Creek, and West Fisher Creek; and by Libby Creek and its tributaries: Howard Creek, Midas Creek, and Ramsey Creek, all perennial streams. Numerous unnamed ephemeral streams also drain the area. Snowmelt, rainfall, and groundwater discharge are the sources of supply to streams, lakes, and ponds in the analysis area. High surface water flows occur during snowmelt runoff, typically between April and July, and as a result of runoff-producing storm events, such as during late fall. Low flows typically occur during August and September, as well as sometimes during the winter months. Flow in drainages above an elevation of about 5,000 to 5,600 feet are not perennial because the drainages are above the regional potentiometric surface and receive water only from surface water runoff and from limited perched shallow groundwater in unconsolidated deposits.

Streamflow changes may occur due to mine and adit dewatering, pumpback well system operation around the impoundment, evaporative losses from a tailings impoundment or LAD Areas (in Alternative 2), diversion from Libby Creek during high flows, discharges from a Water Treatment Plant or to the LAD Areas (in Alternative 2), and potable water use. Changes due to mine and adit dewatering and pumpback well system operation around the impoundment were predicted by groundwater models. With the data currently available, the model results provide a potential range of dewatering rates and streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. Both 3D groundwater flow models would be refined and rerun after data from the Evaluation Phase were incorporated into the models (see Section C.10.4, Evaluation Phase in Appendix C). Following additional data collection and modeling, the predicted impacts on surface water resources in the project area, including simulation of mitigation measures, may change and the model uncertainty would decrease. Section 3.10.3.4.3, *Groundwater Model Uncertainty* discusses uncertainty of the model results.

In Alternative 1, reduction of streamflow in Libby Creek above the Libby Adit at LB-300 from the partial dewatering of the Libby Adit would continue until the Libby Adit was plugged and groundwater levels recovered. Streamflow below the Libby Adit at LB-300 would not be affected.

Alternatives 2, 3, and 4 would reduce the flow in some area streams due to diversions, mine inflows and use of the pumpback wells. Discharges of treated water to Libby Creek from the Water Treatment Plant would increase streamflow in Libby Creek below the Libby Adit when discharges occurred. Discharges to Libby Creek would occur in all phases in Alternatives 3 and 4, and in all phases except operations in Alternative 2. In general, the model predicted all mine alternatives would reduce streamflow in East Fork Rock Creek and East Fork Bull River during the Evaluation through early Post-Closure Phases. Predicted effects of Alternative 3 on estimated low flow ($7Q_2$ flow) are shown on Figure S-7. Similarly, predicted effects of Alternative 3 on estimated very low flow ($7Q_{10}$ flow) are shown on Figure S-8. The $7Q_{10}$ flow is defined as the lowest streamflow averaged over 7 consecutive days that occurs, on average, once every 10 years. The $7Q_2$ flow is the lowest streamflow averaged over 7 consecutive days that occurs, on average, once every 2 years. When groundwater levels reached steady state conditions in an estimated 1,200 to 1,300 years, low flows in upper East Fork Rock Creek (above Rock Lake) would be permanently reduced. Without mitigation, the model predicted low flow in East Fork Rock Creek and Rock Creek and in East Fork Bull River would be permanently reduced.

MMC's modeled mitigation would reduce post-mining effects on the East Fork Rock Creek Rock Creek, and slightly reduce flow in the East Fork Bull River. Streamflow in East Fork Rock Creek and Rock Creek below the lake would return to pre-mine conditions or increase slightly (Figure S-7, Figure S-8).



EFBR-500

	Existing	Con-struction	Opera-tions	Closure	Post-Closure	Steady State
With Mitigation	5.77	5.77	5.70	5.62	5.38	5.76
Without Mitigation	5.77	5.77	5.70	5.61	5.37	5.76

LC-800

	Existing	Con-struction	Opera-tions	Closure	Post-Closure	Steady State
With Mitigation	0.32	0.33	0.28	0.28	0.28	0.32
Without Mitigation	0.32	0.33	0.28	0.28	0.28	0.32

LB-2000

	Existing	Con-structio	Opera-tions	Closure	Post-Closure	Steady State
With Mitigation	13.85	14.39	14.67	13.85	13.85	13.85
Without Mitigation	13.85	14.39	14.67	13.85	13.85	13.85

EFRC-200

	Existing	Con-struction	Opera-tions	Closure	Post-Closure	Steady State
With Mitigation	0.92	0.91	0.87	0.77	0.75	0.92
Without Mitigation	0.92	0.91	0.86	0.74	0.63	0.89

PM-1200

	Existing	Con-struction	Opera-tions	Closure	Post-Closure	Steady State
With Mitigation	2.46	2.54	2.28	2.28	2.28	2.46
Without Mitigation	2.46	2.54	2.27	2.28	2.28	2.46

RC-2000

	Existing	Con-struction	Opera-tions	Closure	Post-Closure	Steady State
With Mitigation	13.53	13.52	13.47	13.37	13.38	13.54
Without Mitigation	13.53	13.51	13.47	13.34	12.88	13.50

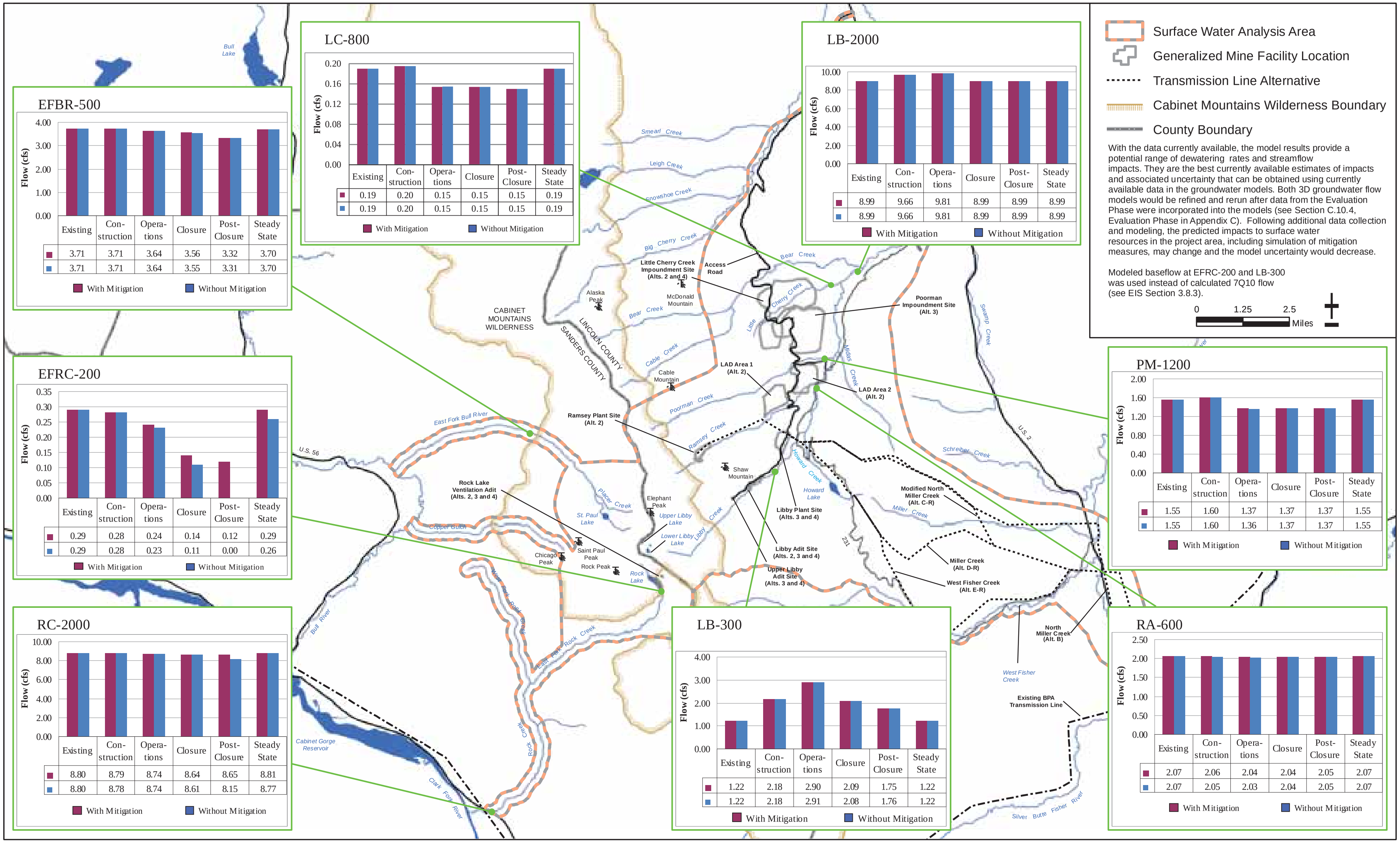
LB-300

	Existing	Con-struction	Opera-tions	Closure	Post-Closure	Steady State
With Mitigation	4.63	5.59	6.44	5.63	5.16	4.63
Without Mitigation	4.63	5.59	6.45	5.62	5.17	4.63

RA-600

	Existing	Con-struction	Opera-tions	Closure	Post-Closure	Steady State
With Mitigation	3.26	3.25	3.23	3.23	3.24	3.26
Without Mitigation	3.26	3.24	3.22	3.23	3.24	3.26

Figure S-7. Estimated Changes in Seven-Day, Two-Year Low Flow, Alternative 3



EFBR-500

	Existing	Con-struction	Opera-tions	Closure	Post-Closure	Steady State
With Mitigation	3.71	3.71	3.64	3.56	3.32	3.70
Without Mitigation	3.71	3.71	3.64	3.55	3.31	3.70

LC-800

	Existing	Con-struction	Opera-tions	Closure	Post-Closure	Steady State
With Mitigation	0.19	0.20	0.15	0.15	0.15	0.19
Without Mitigation	0.19	0.20	0.15	0.15	0.15	0.19

LB-2000

	Existing	Con-struction	Opera-tions	Closure	Post-Closure	Steady State
With Mitigation	8.99	9.66	9.81	8.99	8.99	8.99
Without Mitigation	8.99	9.66	9.81	8.99	8.99	8.99

PM-1200

	Existing	Con-struction	Opera-tions	Closure	Post-Closure	Steady State
With Mitigation	1.55	1.60	1.37	1.37	1.37	1.55
Without Mitigation	1.55	1.60	1.36	1.37	1.37	1.55

EFRC-200

	Existing	Con-struction	Opera-tions	Closure	Post-Closure	Steady State
With Mitigation	0.29	0.28	0.24	0.14	0.12	0.29
Without Mitigation	0.29	0.28	0.23	0.11	0.00	0.26

RC-2000

	Existing	Con-struction	Opera-tions	Closure	Post-Closure	Steady State
With Mitigation	8.80	8.79	8.74	8.64	8.65	8.81
Without Mitigation	8.80	8.78	8.74	8.61	8.15	8.77

LB-300

	Existing	Con-struction	Opera-tions	Closure	Post-Closure	Steady State
With Mitigation	1.22	2.18	2.90	2.09	1.75	1.22
Without Mitigation	1.22	2.18	2.91	2.08	1.76	1.22

RA-600

	Existing	Con-struction	Opera-tions	Closure	Post-Closure	Steady State
With Mitigation	2.07	2.06	2.04	2.04	2.05	2.07
Without Mitigation	2.07	2.05	2.03	2.04	2.05	2.07

Figure S-8. Estimated Changes in Seven-Day, Ten-Year Low Flow, Alternative 3

The model predicted flow in upper Libby Creek above the Libby Adit would decrease during the Evaluation through Closure Phases and would return to pre-mine conditions when groundwater levels reached steady state conditions. Flow in Libby Creek below the Libby Adit would increase during all phases in Alternatives 3 and 4 and during all phases except the Operations Phase in Alternative 2 because of the discharge of treated water from a Water Treatment Plant at the Libby Adit. Flow in Libby Creek below the Libby Adit would return to pre-mine conditions after groundwater levels reached steady state conditions and Water Treatment Plant discharges ceased.

To mitigate effects on senior water rights on Libby Creek and Ramsey Creek, MMC would install plugs near the mine void of each adit soon after mining operations ceased in Alternatives 3 and 4. Streamflow reductions would continue and would cease within an estimated one to two decades after all initial adit plugs were in place. The effect would be reduced to a few years if MMC used water diverted from Libby Creek during high flows to fill the adits during the Closure Phase. The model predicted flow in Ramsey Creek would be slightly reduced during the Construction through early Post-Closure Phases and would return to existing rates after groundwater levels reached steady state conditions. The flow in Libby Creek would also be reduced when the pumpback wells were operating.

The model predicted flow in Poorman Creek would decrease slightly during the Operations through the early Post-Closure Phases in all mine alternatives due to mine inflows. In Alternative 3, flow in Poorman Creek would increase slightly during the Construction Phase from surface water diverted around the impoundment. Flow in lower Poorman Creek in Alternative 3 would be reduced during the Operations through the Post-Closure Phases from a pumpback well system around the Poorman Impoundment. Flow in Poorman Creek would return to existing rates after groundwater levels reached steady state conditions and the pumpback well system ceased operations.

Little Cherry Creek would not be diverted in Alternative 3. Flow in Little Cherry Creek would not be affected during the Evaluation Phase. In Alternative 3, flow in Little Cherry Creek would increase slightly during the Construction Phase from surface water diverted around the impoundment. Flow in lower Little Cherry Creek would be reduced during the Operations through the Post-Closure Phases from a pumpback well system around the Poorman Impoundment. The A low permeability bedrock ridge separates groundwater flow between the watershed of Little Cherry Creek and those of Drainages 5 and 10 in the Poorman Impoundment Site. The bedrock ridge would limit drawdown in the Little Cherry Creek watershed, but drawdown could still extend between watersheds unless the bedrock ridge provided a complete barrier to cross-boundary groundwater flow. Additional subsurface data from this area would be collected during the final design process of the Poorman Impoundment to assess the separation of groundwater flow between the Little Cherry Creek and Poorman Impoundment Site watersheds and the 3D model would be rerun with the new data to evaluate the site conditions.

Post-Closure, the watershed area of Little Cherry Creek would increase by 644 acres, an increase of 44 percent. The Hortness method overestimates low flows in watersheds containing a reclaimed impoundment. The reclaimed impoundment would be in a watershed adjacent to the original watershed, and some of the precipitation that would infiltrate into the reclaimed impoundment would be intercepted by the impoundment's underdrain system and routed toward the original watershed. Both $7Q_2$ and $7Q_{10}$ flow likely occur during late summer or early fall during periods of little or no precipitation. The amount of baseflow that would flow during these periods toward Little Cherry Creek would be negligible. The agencies anticipate little or no increase in $7Q_2$ and $7Q_{10}$ flow in Little Cherry Creek. Any increased flow would be partially offset by flow reduction due to the pumpback well system as long as it operated. As part of the final closure plan, MMC would complete a hydraulic and hydrologic analysis of the impoundment channel during final design, and submit it to the lead agencies and the Corps for approval. The analysis would include a channel stability analysis and a sediment transport assessment. Based on the analysis, modifications to the final channel design would be made and minor modifications to the upper reaches of the tributary of Little Cherry Creek may be needed to minimize effects on channel stability in the tributary of Little Cherry Creek.

After closure in Alternative 4, runoff from the reclaimed tailings impoundment surface would be routed via the permanent Diversion Channel and Drainage 10 to Libby Creek. (Drainage 10 is one of four unnamed drainages in the Poorman Impoundment Site.) After the Seepage Collection Dam was removed, runoff from the South Saddle Dam and the south Main Dam abutment also would flow to the Diversion Channel. Consequently, the watershed of Drainage 10 would increase by about 500 acres post-closure, compared to operational conditions. Average annual flow in the diverted Little Cherry Creek would be about five times the existing flow in Drainage 10, but about 10 percent less than the current flow of Little Cherry Creek. The larger watershed would increase average annual flow and would not affect low flows.

Runoff from the Main Dam would flow to the former Little Cherry Creek channel. Post-closure, the watershed area contributing water to the former Little Cherry Creek channel would decrease by 85 percent directly below the tailings impoundment and by 74 percent at the confluence of Little Cherry and Libby creeks.

Flow in Bear Creek would not be affected by Alternative 3. In Alternatives 2 and 4, flow in Bear Creek would be reduced during the Operations through the Post-Closure Phases from a pumpback well system around the Little Cherry Impoundment. After the pumpback well system ceased operations in the Post-Closure Phase, runoff from the reclaimed tailings impoundment surface would be routed toward Bear Creek and flow would increase. Post-Closure, the watershed area of Bear Creek would increase by 560 acres, an increase of 8 percent.

Groundwater Quality-Mine Area. The No Mine alternative would not change groundwater quality in the mine area. During the Evaluation through Operations Phases, groundwater quality in the mine area would not be affected in Alternatives 2, 3, and 4 because groundwater would move toward the mine void and adits and then be pumped to the surface for use in the ore processing. Any water affected by the mining process would be removed from the mine void, used in mill processing, or treated and discharged. Groundwater would continue to flow toward the mine void and adits in the Closure and early Post-Closure Phases, and groundwater quality in the mine area would not be affected.

The agencies anticipate the quality of the post-closure mine water would be similar to the Troy Mine water quality when it was not operating. The groundwater table would begin to recover, and water would continue to flow toward the mine void for hundreds of years. Eventually, water may begin to flow out of the underground mine workings and may mix with groundwater in saturated fractures, react with iron oxide and clay minerals along an estimated 0.5-mile flow path, undergo changes in chemistry due to sorption of trace elements and mineral precipitation, and, without mitigation, discharge at a low rate (0.07 cfs) as baseflow to the East Fork Bull River. The discharge is unlikely to adversely affect water quality. Using all available hydrologic data collected during mining, low permeability barriers would be designed to minimize post-mining changes in East Fork Bull River and East Fork Rock Creek streamflow.

Water Quality Standards and Limits. The DEQ developed and the Montana Board of Environmental Review adopted numeric and narrative water quality standards for the protection of beneficial uses of analysis area water bodies. In response to a petition from NMC (MMC's predecessor), the BHES issued an 1992 Order to that authorized degradation and established numeric limits for total dissolved solids, chromium, copper, iron, manganese, and zinc (both surface water and groundwater), as well as nitrate (groundwater only), and total inorganic nitrogen (surface water only). For these parameters, the limits contained in the authorization to degrade apply. For the parameters not covered by the authorization to degrade, the applicable nonsignificance criteria established by the 1994 nondegradation rules apply, unless MMC obtained an authorization to degrade under current statute. The limits apply to all surface water and groundwater in the Libby Creek, Poorman Creek and Ramsey Creek watersheds adjacent to the Montanore Project and remain in effect during the operational life of the mine and for as long thereafter as necessary.

Groundwater Quality-Tailings Impoundment, LAD Areas, and Libby Adit Area. Groundwater in the tailings impoundment, LAD Areas, and Libby Adit Area is a calcium-bicarbonate or calcium-magnesium bicarbonate type with low total dissolved solids concentrations, low nutrient concentrations, and dissolved metal concentrations that are typically below detection limits. No groundwater users have been identified in the analysis area. Private land immediately downgradient of the Little Cherry Creek Tailings Impoundment Site in Alternatives 2 and 4 is owned by MMC. Private land immediately downgradient of LAD Area 2 in Alternative 2 and downgradient of the Poorman Impoundment Site in Alternative 3 is not owned by MMC.

In all alternatives, seepage not captured by the seepage collection system at the tailings impoundment would mix with the underlying groundwater. The existing groundwater quality would be altered because the seepage water quality would have higher concentrations of nitrate, several metals, and total dissolved solids than existing water quality. Manganese and antimony concentrations in all alternatives are predicted to be higher than nondegradation and BHES Order limits. Concentrations of other metals, after mixing, are predicted to be below nondegradation and BHES Order limits. MMC requested a groundwater mixing zone beneath and downgradient of the Poorman Impoundment for changes in water quality. The DEQ would determine if a mixing zone beneath and downgradient of the impoundment would be granted in accordance with ARM 17.30.518 and, if so, would determine its size, configuration, and location. If DEQ granted a mixing zone, water quality changes might occur, but BHES Order limits could not be exceeded outside the mixing zone, and for other water quality parameters, nondegradation criteria could not occur outside the mixing zone unless authorized by DEQ. A mixing zone is a limited area of a surface water body or a portion of an aquifer, where initial dilution of a discharge takes place and water quality changes may occur, and where certain water quality standards may be exceeded (ARM 17.30.502(6)).

Seepage not captured by the seepage collection system at the tailings impoundment would be intercepted by the pumpback well system and pumped to the mill for reuse during operations. Pumpback wells would be installed if required to comply with applicable standards in Alternative 2. In Alternatives 3 and 4, a pumpback well system would be required and a system design would be finalized after site investigations gathered sufficient information to refine a 3D groundwater model. The goal of a pumpback system would be to establish and maintain complete hydraulic capture of all groundwater moving downgradient from the impoundment, as confirmed by measuring water levels at adjacent monitoring wells. At closure, intercepted seepage would be sent to the LAD Areas or Water Treatment Plant in Alternative 2, the Water Treatment Plant in Alternatives 3 and 4, or pumped back to the impoundment in all alternatives. MMC would continue to operate the seepage collection and pumpback well systems, and the Water Treatment Plant until water quality standards, BHES Order limits, and MPDES permitted effluent limits were met without treatment.

In Alternative 2, concentrations of total dissolved solids, nitrate, antimony, arsenic, cadmium, mercury, and manganese beneath the LAD Areas are predicted to exceed groundwater quality standards, BHES Order limits or nondegradation criteria in one or more phases of mining. (Ambient manganese concentrations at the LAD Areas exceed the BHES Order limit.) MMC requested a source-specific groundwater mixing zone for the LAD Areas. During the MPDES permitting process, the DEQ would determine if a mixing zone beneath and downgradient of the LAD Areas should be granted in accordance with ARM 17.30.518 and, if so, would determine its size, configuration, and location. If DEQ granted a mixing zone, water quality changes might occur and certain water quality standards could be exceeded within the mixing zone. The DEQ typically does not grant mixing zones for LAD Areas. The DEQ also would determine where compliance with applicable standards would be measured.

In all mine alternatives, mine and adit water treated at the Water Treatment Plant at the Libby Adit Site may be discharged to groundwater via a percolation pond located in the alluvial adjacent to Libby Creek. The expected quality of the treated water would be below BHES Order limits for groundwater or nondegradation criteria. During the MPDES permitting process, the DEQ would determine if the groundwater mixing zone in the current permit would be renewed.

Surface Water Quality. Surface waters in the analysis area are a calcium bicarbonate-type water. Total suspended solids, total dissolved solids, turbidity, major ions, and nutrient concentrations are low, frequently at or below analytical detection limits. Metal concentrations are generally low with a high percentage of below detection limit values. Some elevated metal concentrations may be attributable to local mineralization. Analysis area streams are poorly buffered due to low alkalinities, and consequently tend to be slightly acidic. Water hardness is typically less than 35 mg/L. Lakes in and near the CMW have high water quality. The water quality of streams, springs and lakes varies based on the relative contribution of surface water runoff, shallow groundwater and deeper bedrock groundwater.

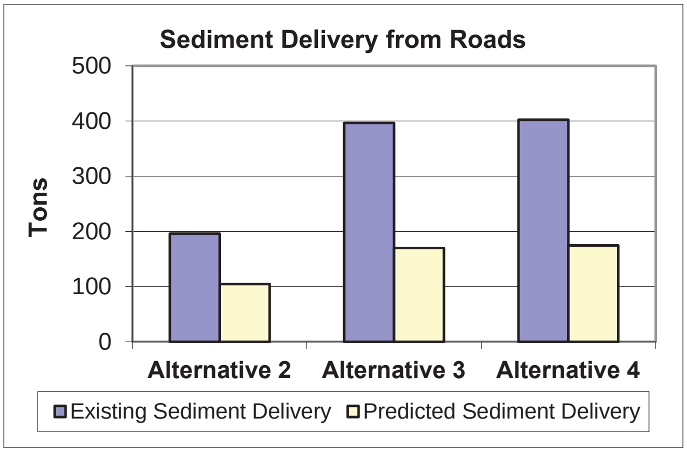
In the analysis area, four stream segments are listed on Montana's list of impaired streams. Libby Creek is separated into two segments. The upper segment is from 1 mile above Howard Creek to the US 2 bridge. This segment is listed as not supporting drinking water and partially supporting its fishery and aquatic life. Probable causes of impairment listed are alteration in stream-side or littoral vegetative covers, mercury, and physical substrate habitat alterations. Probable sources of impairment are impacts from abandoned mine lands and historic placer mining. The lower segment, which is downstream of the analysis area, begins at the US 2 bridge and is impaired for sediment and siltation. The Fisher River from the confluence of the Silver Butte Fisher River and the Pleasant Valley Fisher River to the confluence with the Kootenai River also is impaired, with aquatic life support and cold-water fishery uses only partially supported. Probable causes for the Fisher River impairment are a high flow regime and high lead concentrations (source unknown), with probable sources of these impairments listed as channelization, grazing, road runoff, road construction, silvicultural activities, and stream bank modification and destabilization. Rock

Creek from the headwaters (including Rock Lake and East Fork Rock Creek) to the mouth below Noxon Dam is impaired, with aquatic life support and cold-water fishery uses only partially supported. Probable causes for the Rock Creek impairment are other anthropogenic substrate alterations, with probable sources of these impairments listed as silvicultural activities. Total Maximum Daily Loads are not required on Rock Creek because no pollutant-related use impairment has been identified.

Alternative 1 would not affect surface water quality. Alternatives 2, 3, and 4 would affect stream quality by increasing dissolved solids, nitrogen, and metal concentrations. In Alternative 2, wastewater discharges at the LAD Areas are predicted to exceed BHES Order limits or nondegradation criteria for one or more parameters in Libby, Ramsey, and Poorman creeks. If land application of excess water resulted in water quality exceedances, MMC would treat the water at the Water Treatment Plant before land application. If needed, an additional water treatment facility may be required. Water discharged from the Water Treatment Plant in all alternatives would not cause an exceedance in a BHES Order limits or water quality standards for any parameter downstream of the mixing zone.

In Alternatives 3 and 4, all wastewater would be treated at the Water Treatment Plant. The treatment plant would be expanded to accommodate discharges during the estimated wettest year in a 20-year period and modified to treat nitrogen compounds (primarily nitrates and ammonia) and possibly dissolved metals. To monitor protection of beneficial uses, MMC would implement the water quality and aquatic biology monitoring described in Appendix C, such as monitoring for periphyton and chlorophyll-a monthly between July and September. Changes also would occur in part due to reductions in streamflow contributions from deeper groundwater, which contributes more dissolved solids to streams than shallower sources of water.

Surface Water Quality-Sediment. In Alternatives 2, the Ramsey Plant Site would be built within a Riparian Habitat Conservation Area. Non-channelized sediment flow rarely travels more than 300 feet and 200- to 300-foot riparian buffers are generally effective at protecting streams from sediment from non-channelized overland flow. The Ramsey Plant Site would increase the potential for non-channelized sediment flow to reach Ramsey Creek. Stormwater runoff from other facilities in Alternative 2, and from all facilities in Alternatives 3 and 4, would be collected in ditches and directed to one or more sediment ponds. In Alternative 2, ponds would be designed to contain runoff from a 10-year, 24-hour storm. Ditches and sediment ponds containing process water or mine drainage would be designed for the 100-year/24-hour storm to minimize potential overflow to nearby streams, which would be more effective in minimizing erosion and sedimentation.



With Best Management Practices and mitigation, Alternatives 2, 3, and 4 would decrease sediment delivery from roads to streams. In Alternatives 3 and 4, MMC would implement Best Management Practices and road closure mitigation, some of which would be completed before the Evaluation Phase and some before the Construction Phase. Other roads would be closed at the end of operations. Existing sediment delivery would vary by alternative because roads proposed for use in each alternative would be different. Alternative 2 would reduce sediment delivery from roads by 92 tons; reduction in sediment delivery from roads in Alternatives 3 and 4 would be about 225 tons. Road removal would have direct and long lasting beneficial effects on water quality. The Best Management Practices to minimize sediment delivery from affected forest roads are predicted to be between 88 and 99 percent effective.

In Alternative 2, a Diversion Dam in Little Cherry Creek would be constructed to divert flow above the dam around the tailings impoundment. The Diversion Channel would consist of an upper channel, and two existing natural drainage channels tributary to Libby Creek. Two natural drainages would be used to convey water from the upper channel to Libby Creek. The drainages are not large enough to handle the expected flow volumes and downcutting and increased sediment delivery to Libby Creek would occur as the channels stabilized. In the event of heavy precipitation during construction of the channel, substantial erosion and short-term increases in sedimentation to the lower channel and Libby Creek would occur. Where possible, MMC would construct bioengineered and structural features in the two tributary channels to reduce flow velocities, stabilize the channels, and create fish habitat.

Alternative 4 would have similar effects as Alternative 2. The Diversion Channel in Alternative 4 would flow into a constructed channel that would be designed to be geomorphologically stable and to handle the 2-year flow event. A floodplain would be constructed along the channel to allow passage of the 100-year flow. Following reclamation of the impoundment, the constructed channel would undergo an additional period of channel adjustment when runoff from the impoundment surface was directed to the Diversion Channel. The increase in flow would be about 50 percent higher than during operations, and would lead to new channel adjustments. This would likely cause short-term increases in sedimentation in the lower channel and Libby Creek. Alternative 3 would not require the diversion of a perennial stream.

Issue 3: Fish and Other Aquatic Life and Their Habitats

Aquatic habitat in most analysis area streams is good to excellent. The riparian habitat condition in Libby Creek between Poorman Creek and Little Cherry Creek is fair, reflecting the physical effects of abandoned placer mining operations. Overall, the analysis area streams score high on measures such as bank cover and stability, while measures of pool quality and quantity are typically lower, resulting in an overall reduction in stream reach scores for habitat condition. Most streams have a moderate susceptibility to habitat degradation.

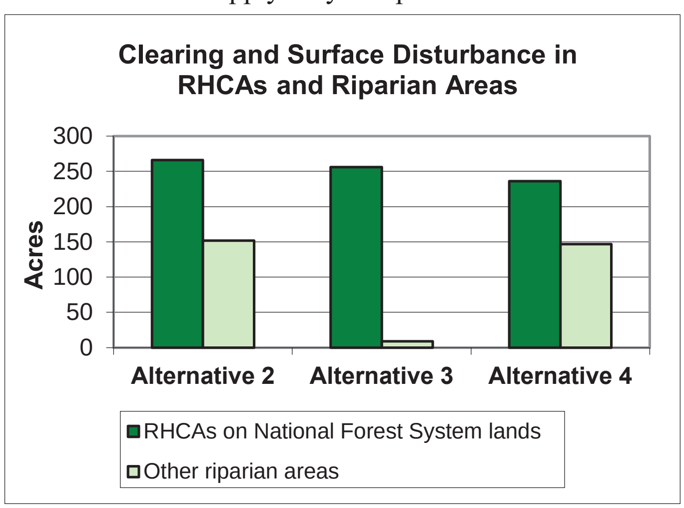
Analysis area streams provide habitat for the federally listed bull trout, and Forest Service sensitive species westslope cutthroat trout and interior redband trout. Mixed redband rainbow, coastal rainbow, and westslope cutthroat/rainbow hybrids, Yellowstone cutthroat, brook trout, torrent and slimy sculpin, mountain whitefish, longnose dace, and largescale suckers are also in the drainages. In the mine analysis area, designated critical bull trout habitat is found in segments of Libby Creek, Bear Creek, Rock Creek, East Fork Rock Creek, and East Fork Bull River. Bull trout are found in most streams, except where barriers have prevented their passage, such as Little Cherry Creek and Miller Creek. No pure westslope cutthroat trout populations have been found to inhabit stream reaches within the Libby Creek watershed. The hybrid trout populations in Ramsey Creek, Bear Creek, Little Cherry Creek, and segments of Libby Creek downstream of the mine area include coastal rainbow/westslope cutthroat and redband/westslope cutthroat trout hybrids. The East Fork Bull River has a pure westslope cutthroat trout population, and both pure and hybrid populations are found in East Fork Rock Creek. Miller Creek has a pure westslope cutthroat trout population. Pure populations of interior redband trout are found in Libby, Bear, Little Cherry Creek, Poorman, and Ramsey creeks and in the Fisher River.

In Alternative 1, No Mine, the Montanore Project would not be developed and existing disturbances would continue to affect aquatic habitats. Past activities, particularly timber harvest and road construction, and ongoing current activities have occurred in RHCAs, and would continue to decrease the quality of aquatic habitats. Productivity of fish and other aquatic life in analysis area streams would continue to be limited by past natural and human-caused adverse habitat changes, by naturally low nutrient concentrations, and by natural habitat limitations from periodic floods and other climate and geology influences.

Bull trout populations would continue to be marginal and their habitat would continue to be in need of restoration work. Bull trout populations would be susceptible to decline or disappearance due to hybridization with the introduced brook trout, competition with brook trout and other trout present in the analysis area, or from other land use disturbances. Redband trout and westslope cutthroat trout also would continue to be subject to population declines, mainly due to the threat of hybridization from past introductions of non-native salmonids.

Sediment. Any increased sediment loads to streams would most likely occur during the Construction Phase of the mine, when trees, vegetation, or soils were removed from many locations for mine facilities, and roads. Road construction and reconstruction is often considered the largest source of sediment in mining and timber harvest areas due to the removal of vegetation and construction of cut and fill slopes that expose large areas subject to erosion. Any increased sediment in streams would alter stream habitat by decreasing pool depth, alter substrate composition by filling in interstitial spaces used by juvenile fish and invertebrates, and increase substrate embeddedness, or the degree in which fine substrates surround coarse substrates. Best Management Practices in all action alternatives and road closures in Alternatives 3 and 4 would minimize any sedimentation to streams, substantially decrease sediment delivery from roads to streams, and benefit aquatic life.

Riparian Habitat Conservation Areas. RHCAs are protection zones adjacent to streams, wetlands, and landslide-prone areas. The KFP has standards and guidelines for managing activities that potentially affect conditions within the RHCAs, and for activities in areas outside RHCAs that potentially degrade RHCAs. These standards apply only to riparian areas on National Forest System lands. Similar riparian areas are found on private land. All riparian areas are covered by Montana's Streamside Management Zone law.



Alternatives 2, 3, and 4 would require construction of roads, waste disposal facilities, and other facilities in RHCAs. Protection of RHCAs was a key criterion in the alternatives analysis and development of alternatives. The lead agencies did not identify an alternative that would avoid locating all mine facilities in RHCAs. Alternative 2 would affect 266 acres of RHCAs and 152 acres of other riparian areas on private lands, primarily in the Little Cherry Creek Impoundment Site and the Ramsey Plant Site. Little Cherry Creek and Ramsey Creek are both fish-bearing streams, which affects the width of RHCAs. Effects of Alternatives 3 and 4 would be less than Alternative 2. Alternative 3 would affect 256 acres of RHCAs and 9 acres of other riparian areas on private lands. The RHCAs in the Poorman Tailings Impoundment Site in Alternative 3 are not adjacent to fish-bearing streams. The Libby Plant Site in Alternatives 3 and 4 would not affect RHCAs. The disturbance area at the Little Cherry Creek Impoundment Site would be changed in Alternative 4 to avoid RHCAs. Alternative 4 would affect 236 acres of RHCAs and 147 acres of other riparian areas on private lands, primarily in the Little Cherry Creek Impoundment Site. In Alternatives 3 and 4, MMC would develop and implement a final Road Management Plan to reduce effects on RHCAs. The plan would describe for all new and reconstructed roads criteria that govern road operation, maintenance, and management; requirements of pre-, during-, and post-storm inspection and maintenance; regulation of traffic during wet periods to minimize erosion and sediment delivery and accomplish other objectives; implementation and effectiveness monitoring plans for road stability, drainage, and erosion control; and mitigation plans for road failures.

Water Quantity. Alternatives 2, 3, and 4 would alter flow in Libby Creek and its tributaries through appropriations and discharges. Changes in flow would not affect aquatic habitat during high flow periods between April and July. In all alternatives, reduced streamflow would reduce habitat availability at low flow in Ramsey, Poorman, Libby Creek above the Libby Adit, East Fork Rock Creek, Rock Creek, and East Fork Bull River, particularly during Closure and Post-Closure Phases. Reduction in habitat availability would range up to 20 percent. The agencies' bull trout mitigation plan would mitigate for the reduction in habitat availability in Alternatives 3 and 4. Reduced streamflow and habitat availability below the Libby Adit also would occur in Alternative 2. In Alternatives 3 and 4, higher low flow from discharges to Libby Creek would improve habitat in Libby Creek below the Libby Adit during all mine phases. Streamflow changes when groundwater levels reached steady state conditions would not affect aquatic habitat in any analysis area stream.

In Alternatives 2 and 4, Little Cherry Creek would be diverted permanently around the tailings impoundment, resulting in a loss of 15,600 feet of fish habitat in the existing Little Cherry Creek. The agencies' analysis assumed the engineered diversion channel would not provide any fish habitat, while the two channels would eventually provide marginal fish habitat. Reductions in flow in the Diversion Channel during Operations, Closure, and early Post-Closure phases would not support the current redband trout population in Little Cherry Creek. The effect of Alternative 3 on Little Cherry Creek would be minimal.

Water Quality. Alternative 2 would increase concentrations of nutrients, such as nitrates, and some metals in Ramsey, Poorman, and Libby creeks. Similar increases would occur in Libby Creek in Alternatives 3 and 4. Low nutrient concentrations currently contribute to limited aquatic productivity. A total nitrogen concentration greater than 0.275 mg/L may cause an increase in algal growth in Libby Creek, but algal growth may be limited by factors other than nitrogen, such as phosphorus, temperature, or streambed scouring. Increased algal growth associated with total nitrogen concentrations less than 0.275 mg/L would stimulate productivity rates for aquatic insects and, consequently, stimulate populations of trout and other fish populations. Whether total inorganic nitrogen concentrations greater than 0.275 mg/L and less than 1 mg/L would actually increase algal growth to the extent that it would be considered "nuisance" algae is unknown. To address the uncertainty regarding the response of area streams to increased total inorganic nitrogen concentrations, MMC would implement water quality and aquatic biology monitoring, including monitoring for periphyton and chlorophyll-a monthly between July and September.

The low concentrations of dissolved minerals in surface waters of the Libby Creek drainage cause these waters to tend toward acidic pH levels, and to have extreme sensitivities to fluctuations in acidity. For most heavy metals, the percentage of the metal occurring in the dissolved form increases with increasing acidity. Generally, dissolved metals are the most bioavailable fraction and have the greatest potential toxicities and effects on fish and other aquatic organisms. Any increase in metal concentrations could increase the potential risk for future impacts on fish and other aquatic life in some reaches. Metal concentrations near the aquatic life could result in physiological stress, such as respiratory and ion-regulatory stress, and mortality.

Issue 4: Scenic Quality

The existing scenery from Key Observation Points (KOPs) would not change in the No Mine Alternative. The existing Libby Adit Site would remain, and would be visible only from one KOP in a montane forest at a National Forest System road #231 pullout. Disturbances on private land at the Libby Adit Site would remain until reclaimed in accordance with existing permits and approvals.

Construction of all proposed mine facilities would alter the scenic integrity from KOPs. The relatively large size of the tailings impoundment in Alternatives 2, 3, and 4 in all views would create noticeable contrasts in landscape character and substantial alterations in scenic integrity. The tailings impoundment in Alternatives 2 and 4 would cover Little Cherry Creek, altering the area’s scenic integrity. The impoundment in Alternative 3 would have similar effect. In addition, there would be the short-term effects from the presence of fugitive dust from construction activities, night lighting for construction operations, and vehicle traffic. The agencies’ mitigations in Alternatives 3 and 4 would reduce the visual contrasts at most facility locations. Long-term effects on scenery would be loss of vegetation and landform changes at all mine facilities. Following mine closure, landscape reclamation at all mine facilities, except the tailings impoundment, would create areas similar in appearance to abandoned roads and timber harvest areas. The tailings impoundment would have physical characteristics in substantial contrast to the surrounding landscape. The scenic integrity and landscape character changes at the impoundment site would be noticeable indefinitely.

In Alternatives 2, 3, and 4, the KNF would amend the KFP by reallocating to MA 31 all areas within the operating permit areas of LAD Areas 1 and 2, and portions of the plant site and tailings impoundment currently not in MA 31. In addition, a proposed road and facility corridor that would cross MA 13 would be reallocated to MA 31. MA 31 has a Visual Quality Objective (VQO) of Maximum Modification. All mine facilities would comply with a VQO of Maximum Modification.

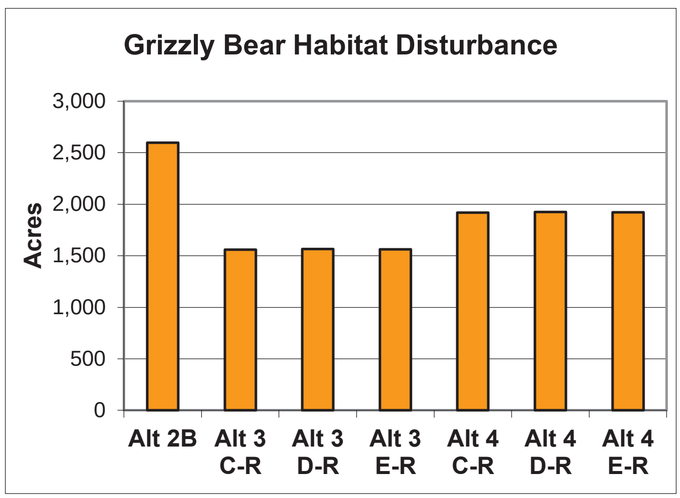
Issue 5: Threatened and Endangered Wildlife Species

The mine area provides habitat for two threatened and endangered wildlife species: the grizzly bear and the Canada lynx. Bull trout, which is also a threatened and endangered species, was discussed previously under Issue 3, *Effects on Fish and Other Aquatic Life and Their Habitats*.

Grizzly Bear. All alternatives may affect, and are likely to adversely affect the grizzly bear. In its Biological Opinion, the USFWS indicated that it was the USFWS' biological opinion that the Montanore Project as proposed in the KNF's preferred Mine Alternative 3 and the agencies' preferred Transmission Line Alternative D-R is not likely to jeopardize the continued existence of the grizzly bear. No critical habitat has been designated for this species, and therefore none would be affected.

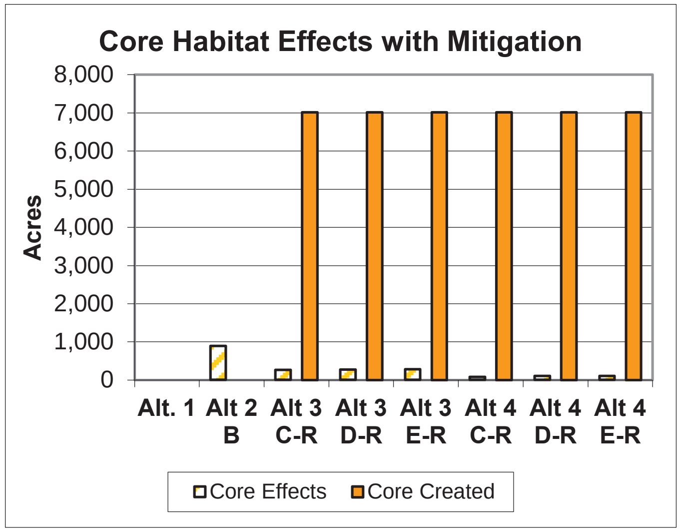
The agencies used five measurable criteria to assess effects on the grizzly bear: physical habitat disturbance, percent core habitat, percent open motorized route density, percent total motorized route density, and displacement effects. These criteria are evaluated within a planning area called a Bear Management Unit, or BMU. A BMU is an area of land containing sufficient quantity and quality of all seasonal habitat components to support a female grizzly. The project would affect habitat in three BMUs: BMU 2, Snowshoe, BMU 5, St. Paul, and BMU 6, Wanless.

Because of the complexity of the analysis, the agencies did not complete separate analyses for criteria dependent on open roads for the mine alternatives and transmission line alternatives. Instead, the agencies analyzed combinations of mine and transmission line alternatives, which would compose a complete project. Alternative 2B is MMC's proposed mine (Alternative 2) and its proposed North Miller Creek transmission line alternative (Alternative B). Six other mine and transmission line alternative combinations were analyzed: mine Alternative 3 with the three agencies' transmission line alternatives (Alternatives C-R, D-R, and E-R); and mine Alternative 4 with the three agencies' transmission line alternatives (Alternatives C-R, D-R, and E-R). These combinations are discussed in the following sections on effects on grizzly bear.



Physical Habitat Disturbance. All action alternatives would remove grizzly bear habitat due to the construction of mine facilities and new or upgraded roads. Alternative 2B would remove the most grizzly bear habitat (2,598 acres), while Alternatives 3C-R, 3D-R, and 3E-R would remove the least (1,560 to 1,567 acres). For all combined action alternatives, construction and improvement of access roads during transmission line construction would temporarily remove habitat. The impacts of physical habitat loss would be reduced through MMC and agencies' land acquisition requirements. In Alternative 2B, MMC would acquire 2,826 acres (an approximate 1:1 ratio of habitat lost to replacement) and transfer the lands or a conservation easement to the KNF. In the agencies' alternatives, MMC would acquire 2 acres of habitat for every acre of grizzly bear habitat physically lost (between 3,120 and 3,852 acres, depending on the alternative). Acquired parcels that might otherwise be developed in a manner inconsistent with bear needs would be managed for grizzly bear use in perpetuity.

Percent Core Habitat. A core area or core habitat is an area of high quality grizzly bear habitat within a BMU that is greater than or equal to 0.31 mile from any road (open or gated), motorized trail, or high use non-motorized trail open during the active bear season. Core habitat may contain



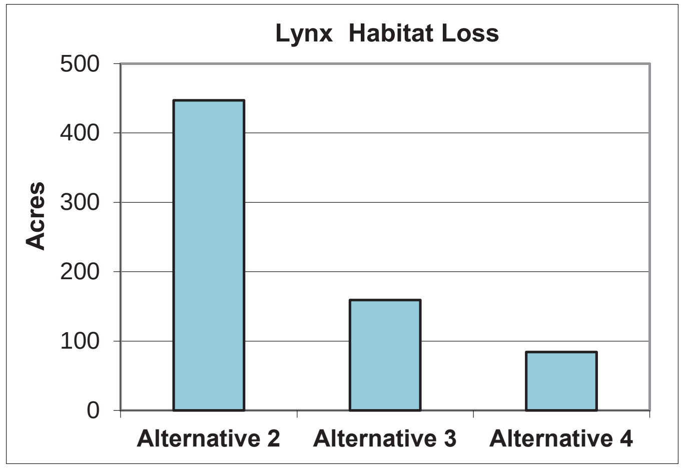
restricted roads, but such roads must be effectively closed with devices such as earthen berms or vegetation growth.

Alternative 2B would reduce core habitat by 566 acres in BMU 5 and 314 acres in BMU 6, for a total reduction of 880 acres. Access changes proposed in MMC's mitigation plan would have no effect on core. Alternatives 3C-R, D-R, and E-R would have similar effects, reducing core by 253 to 271 acres. Alternative 4C-R would have the least effect on core habitat, reducing 73 acres in BMU 5. Access changes proposed by the KNF would create core habitat in the agencies' alternatives, and core habitat in BMU 5 in the other six alternative combinations would increase by 6,732 acres. The agencies' proposed land acquisition requirement for wildlife mitigation would have the potential to increase core habitat through access changes on acquired land.

Total and Open Motorized Route Density. These criteria measure of the density of roads or trails in a BMU that exist or are open for motorized access. In Alternative 2B, road density would increase in one or more phases of the project in BMU 5 and 6. In Alternatives 3C-R, 3D-R, 4C-R, and 4D-R with mitigation, only total motorized route density during the Construction Phase would increase above standards. Route density would be better than the standards during the other phases and would be better than the standards in all phases in Alternatives 3E-R and 4E-R.

Displacement Effects. Disturbance from human activities may displace grizzly bears from suitable habitat to other areas with fewer disturbances, changing normal behavior or disrupting normal movement patterns. The analysis of habitat displacement estimates the extent of the displacement, or zone of influence, and the degree to which suitable grizzly bear habitat is used. Long-term displacement effects in the Cabinet-Yaak Recovery Zone from activities associated with mine construction and operations would occur on a total of 6,901 acres in Alternative 2, 5,087 acres in Alternative 3, and 5,362 acres in Alternative 4. Displacement in Alternatives 3 and 4 would be primarily during the grizzly bear summer season of April 16 to October 31. Long-term displacement effects would be mitigated by the agencies' proposed land acquisition requirements and other measures. The land acquisition requirement for mitigation of long-term displacement would be 2,293 acres in Alternative 3 and 2,339 acres in Alternative 4.

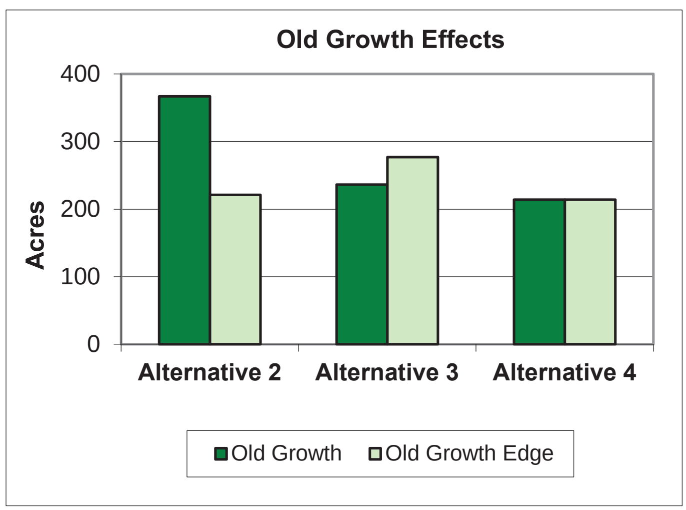
Canada Lynx. Alternative 2 would not meet all Northern Rockies Lynx Management Direction objectives, standards, or guidelines and would remove 2 percent of lynx habitat in either the Crazy or West Fisher Lynx Analysis Units for the life of the mine (about 30 plus years) from the Crazy Lynx Analysis Unit. The agencies combined action alternatives would remove less than 1 percent of lynx habitat in either the Crazy or West Fisher Lynx Analysis Units and would meet all applicable Northern Rockies Lynx Management Direction objectives, standards, and guidelines. The USFWS concurred with the Forest Service's determination that the KNF's preferred Mine Alternative 3 and the agencies' preferred Transmission Line Alternative D-R may affect, but is not likely to adversely affect the Canada lynx. The USFWS does not review or provide concurrence on no effect determinations but acknowledged the Forest Service's analysis that the project would have no effect on lynx critical habitat.



Effects on lynx habitat would range from 447 acres in Alternative 2 to 84 acres in Alternative 4. In the agencies' alternatives, impacts on currently suitable lynx habitat would be offset through enhancement of between 168 and 308 acres of lynx stem exclusion habitat.

Issue 6: Other Wildlife and Key Habitats

Old Growth. Alternative 1 would have no direct effect on designated old growth or associated plant and wildlife. All old growth areas would maintain their existing conditions and continue to provide habitat for those species that use the area over a long term. Alternatives 2, 3, and 4 would reduce the amount of old growth in the Crazy Planning Subunit. Old growth removed for mine facilities would range from 214 acres in Alternative 4 to 367 acres in Alternative 2. Alternatives 2, 3, and 4 would reduce the quality of old growth by creating openings in old growth, or creating an "edge effect." Edge effects would range from 214 acres in Alternative 4 to 277 acres in Alternative 3.



Mine Alternatives 2, 3, and 4 would require a project-specific amendment to allow harvest within designated old growth stands (MA 13). The project-specific amendment would change the current MA 13 (Designated Old Growth) designation of all harvested stands to MA 31 (Mineral Development). The KNF would designate 797 acres in Alternative 3 and 828 acres in Alternative 4 of additional old growth on National Forest System lands. Designation of additional areas of old growth would not create new old growth, but would ensure that these areas are managed to retain or develop old growth characteristics. Losses and degradation of old growth habitat may be offset by land acquisition associated with grizzly bear habitat mitigation if old growth habitat characteristics were present on the acquired parcels. Sufficient designated old growth would be present below 5,500 feet in all alternatives to be consistent with the KFP direction regarding old growth.

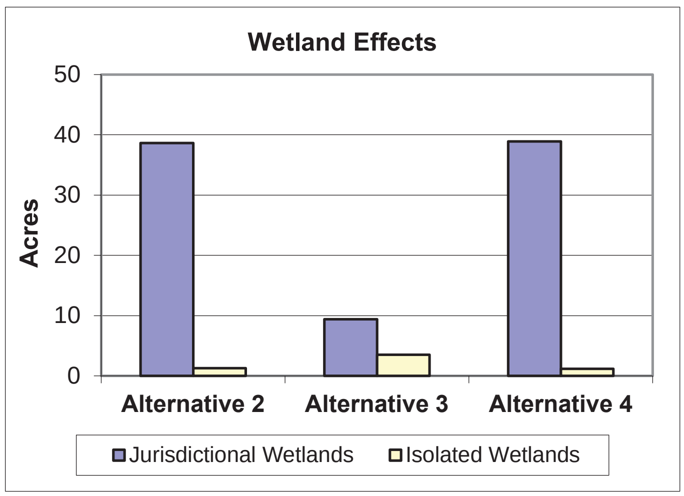
Pileated Woodpecker. In Alternative 1, natural successional processes would continue to occur throughout old growth stands and habitat would continue to be provided for pileated woodpecker nesting pairs where feeding and breeding conditions are suitable. Alternative 1 would not have direct or indirect impacts on pileated woodpecker (old growth habitat) and would not change potential population index. The effects on old growth in Alternatives 2, 3, and 4 would reduce nesting and foraging habitat and habitat quality for the pileated woodpecker. Alternatives 2, 3, and 4 would result in the loss of snags and downed logs greater than 10 inches diameter at breast height that provide potential nesting and foraging habitat for pileated woodpeckers. Snag densities and quantities of down wood would remain above KNF-recommended levels and would continue to be sufficient to sustain viable populations of cavity-dependent species in the KNF.

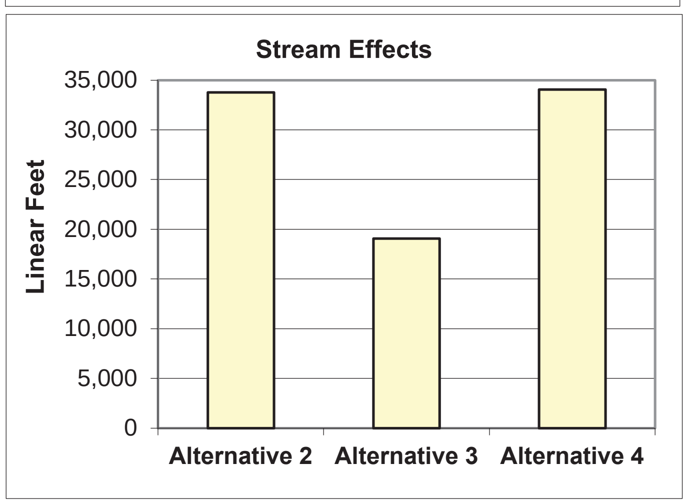
Issue 7: Wetlands and Streams

The No Mine Alternative would not disturb or affect any wetlands or streams. Any existing wetland disturbances would be mitigated in accordance with existing permits and approvals.

Alternatives 2, 3, and 4 would require the unavoidable filling of jurisdictional wetlands, isolated wetlands, and streams. Wetlands that are isolated from other waters of the U.S., and whose only connection to interstate commerce is use by migratory birds, do not fall under Corps of Engineers' jurisdiction. The terms "isolated" and "non-jurisdictional" wetlands are used synonymously. The jurisdictional status of the wetlands and other waters of the U.S. is preliminary and impacts may change during the 404 permitting process.

Effects of Alternatives 2 and 4 would be similar, with Alternative 2 directly or indirectly affecting 38.6 acres and Alternative 4 affecting 38.9 acres of jurisdictional wetlands; both alternatives would affect about 1 acre of isolated wetlands. Both alternatives would have similar effects on streams, directly and indirectly affecting about 34,000 linear feet. Alternative 3 would have less effect than Alternatives 2 and 4. Alternative 3 would directly or indirectly affect 9.4 acres of jurisdictional wetlands, 3.5 acres of isolated wetlands, and about 19,000 linear feet of streams.





The effect on wetland, spring, and seep habitat overlying the mine would be the same in Alternatives 2, 3, and 4. The effects on springs and seeps at the tailings impoundment site in each alternative was discussed previously under groundwater (see p. S-33). The indirect effect on wetlands, springs, and seeps overlying the mine and downstream of the tailings impoundment is difficult to predict.

The effect on plant species, functions, and values associated with the affected wetlands, springs, or seeps by a change in water level would be best determined by relating plant species with water abundance and quality for monitoring and evaluation. Alternative 2 does not include a survey and monitoring of groundwater-dependent ecosystems overlying the mine. Without this type of monitoring, mining-induced changes in water level or quality may result in a loss of species, functions, and values associated with the affected wetlands, springs, or seeps. Monitoring of wetlands, springs, and seeps overlying the mine area and tailings impoundment sites would be conducted in Alternatives 3 and 4.

In Alternative 2, MMC proposes to replace forested and herbaceous wetlands at a 2:1 ratio and herbaceous/shrub wetlands at a 1:1 ratio. The feasibility of MMC’s proposed Wetland Mitigation Plan to replace the lost functions of all potentially affected wetlands is uncertain. MMC’s plan is conceptual and would be refined during the 404 permitting process. MMC did not update its mitigation plan for Alternative 2 to reflect new wetland and stream mitigation regulations and procedures.

In Alternatives 3 and 4, the proposed Swamp Creek off-site wetland mitigation area has about 15 acres of a degraded wetland that would be rehabilitated for mitigation of effects on jurisdictional wetlands. Mitigation for streams would consist of constructing about 6,500 linear feet of new meandering channels and other improvements at the Swamp Creek property; removing a bridge and replacing culverts, stabilizing 400 feet of eroding roadcut, and removing 21 culverts and restoring adjacent riparian habitat on lands acquired for grizzly bear mitigation. MMC would follow the Corps’ compensatory wetland mitigation regulations (33 CFR 332) regarding compensatory mitigation requirements for losses of aquatic resources and Montana Stream Mitigation Procedure in finalizing the mitigation plan. The mitigation would replace the functions of the channels that would be directly or indirectly affected by the tailings impoundment. The Corps would be responsible for developing final mitigation requirements for jurisdictional wetlands and waters of the U.S. during 404 permitting process.

Federal agencies have responsibilities to avoid, minimize, and mitigate unavoidable impacts on wetlands under Executive Order 11990. Federal agencies must find that there is no practicable alternative to new construction located in wetlands, and that the proposed action includes all practicable measures to minimize harm to wetlands. During final design, the agencies would require MMC to avoid or minimize, to the extent practicable, filling wetlands and other streams, such as described in Glasgow Engineering Group, Inc. (2010). This mitigation would ensure adverse effects would be minimized before considering compensatory mitigation. The Corps’ wetland mitigation requirements would fulfill the Executive Order’s requirements to minimize harm to jurisdictional wetlands. To minimize harm to isolated wetlands, the KNF would require MMC to create 4.5 acres of wetlands and 2.5 acres of upland buffers at three sites in Little Cherry Creek and 3 acres of wetlands and 2 acres of upland buffers at an unreclaimed gravel pit. After the 3D model has been rerun, MMC would reevaluate the feasibility of the three Little Cherry Creek sites and the Gravel Pit site as mitigation for isolated wetlands. Should one or more of the sites be determined to infeasible, MMC could develop similar sites north of Little Cherry Creek where groundwater drawdown would not occur. MMC also would convey the title or a perpetual conservation easement to the Forest Service for the following lands: lands contiguous with existing wetlands, the isolated wetland mitigation sites and National Forest System lands owned by MMC along Little Cherry Creek.

Draft Findings for Transmission Line Certification Approval

This section summarizes the effects of the transmission line and serves as the draft findings for transmission line certification approval. The DEQ will approve a transmission line facility as proposed or as modified, or an alternative to the proposed facility if it finds and determines:

- The need for the facility
- The nature of probable environmental impacts
- That the facility minimizes adverse environmental impact, considering the state of available technology and the nature and economics of the various alternatives
- What part, if any, would be located underground
- That the facility is consistent with regional plans for expansion of the appropriate grid of the utility systems serving the state and interconnected utility systems
- That the facility will serve the interests of utility system economy and reliability
- The location of the facility as proposed conforms to applicable state and local laws and regulations, except that the department may refuse to apply any local law or regulation if it finds that, as applied to the proposed facility, the law or regulation is unreasonably restrictive in view of the existing technology, of factors of cost or economics, or of the needs of consumers, whether located inside or outside the directly affected government subdivisions;
- That the facility will serve the public interest, convenience, and necessity
- That DEQ has issued all necessary decisions, opinions, orders, certifications, and permits
- That the use of public lands for the location of the facility was evaluated, and public lands were selected whenever their use is as economically practicable as the use of private lands (75-20-301(1), MCA)

Need

In order to determine that there is a need for the proposed electric transmission line, the DEQ must make one of the findings enumerated in ARM 17.20.1606. No electrical distribution system is near the project area. The nearest electrical distribution line parallels US 2 and it is not adequate to carry the required electrical power. The lead agencies considered, but eliminated from detailed analysis, alternatives other than a new transmission line. A new transmission line is needed to supply electrical power to construct, operate, and reclaim the proposed mine facilities.

Probable Environmental Impacts

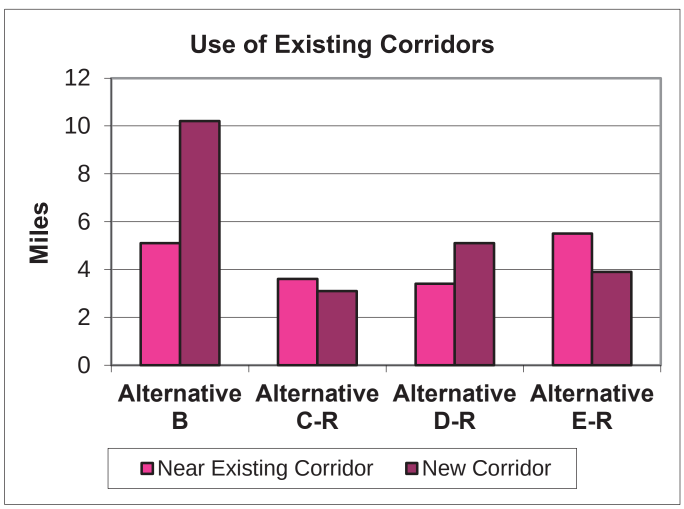
The probable environmental impacts of the construction and maintenance of the proposed transmission line, Sedlak Park Substation, and loop line are described in Chapter 3. The DEQ does not regulate the Sedlak Park Substation or loop line under MFSA, and the probable environmental impacts of the substation and loop line are not discussed in this section. The following sections summarize selected effects of the North Miller Creek Alternative (Alternative B) as proposed by MMC, along with the agencies' alternatives: Modified North Miller Creek Alternative (Alternative C-R), Miller Creek Alternative (Alternative D-R), and West Fisher Creek Alternative (Alternative E-R) using the preferred location criteria listed in DEQ Circular MFSA-2, section 3.1. These criteria are:

- Locations with the greatest potential for general local acceptance of the facility
- Locations that use or parallel existing utility and/or transportation corridors
- Locations in nonresidential areas
- Locations on rangeland rather than cropland and on nonirrigated or flood irrigated land rather than mechanically irrigated land
- Locations in logged areas rather than undisturbed forest
- Locations in geologically stable areas with nonerosive soils in flat or gently rolling terrain
- Locations in roaded areas where existing roads can be used for access to the facility during construction and maintenance
- Locations where structures are not on a floodplain
- Locations where the facility will create the least visual impact
- Locations a safe distance from residences and other areas of human concentration
- Locations that are in accordance with applicable local, state, or federal management plans when public lands are crossed

None of the transmission line alternatives would cross rangeland or cropland. This preferred criterion is not discussed further. Alternative A, No Transmission Line, would not require the construction and operation of a transmission line. Electrical power would be provided by generators. The No Transmission Line Alternative would not provide a safe and reliable source of electrical power for the mine. Alternative A is not discussed in the following sections on the preferred location criteria.

General Local Acceptance. Issues and concerns about the proposed transmission line were identified during the public involvement process, discussed in Chapter 1. A public meeting on the proposed 230-kV transmission line was held in May 2005 to identify resources potentially affected by the proposed transmission line, suggested locations for the proposed line, alternatives to the proposed line, and mitigation measures for the proposed line. At the meeting, MMC presented information on the need for the proposed facility. The agencies issued a Draft EIS for public comment in 2009 and a Supplemental Draft EIS in 2011. Based on public and agency comments, the transmission line alternatives were revised to reduce effects on private lands.

Use of Existing Corridors. No existing transmission line corridors are found in the analysis area. Existing transportation corridors consist of US 2 and roads on National Forest System lands, such as NFS road #231 or #278, and roads on Plum Creek lands. Alternatives B through E-R would use or parallel existing road corridors, including open, gated, barriered, or impassable roads. Alternative B would have 5 miles of centerline within 100 feet of an existing open road. Alternative E-R

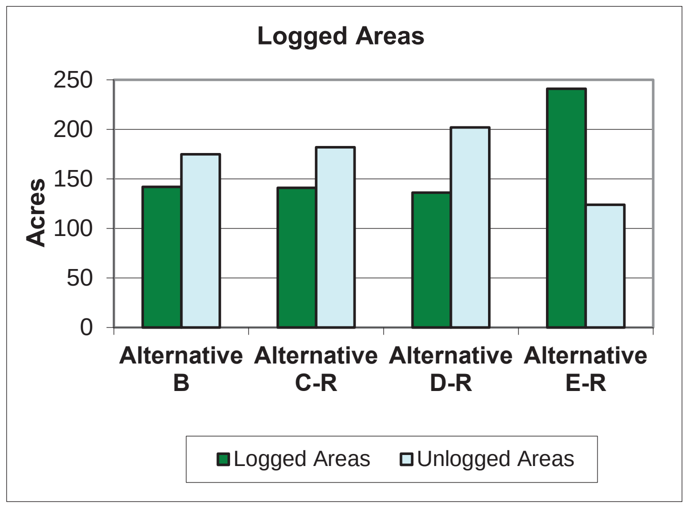


would make greater use of existing corridors, with 5.5 miles of centerline within 100 feet of these roads. Alternative D-R would make the least use of existing corridors.

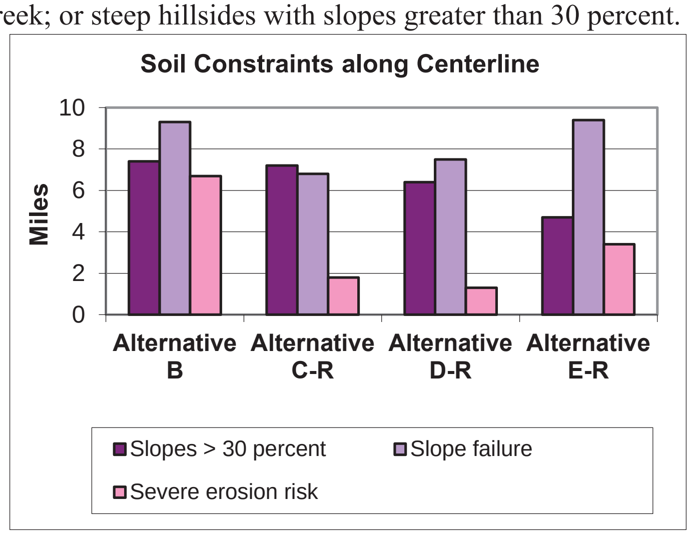
Location in Nonresidential Areas. Most of the transmission line corridors are National Forest System lands or private lands owned by Plum Creek Timberlands LP. Residential areas are not found on either type of land. Twenty residences are within 1 mile of one of the four transmission line alternatives. Most of these properties are within 0.5 mile of US 2. Alternative B would be closer to more residences than the other three alternatives. Fourteen residences are within 0.5 mile of Alternative B, of which 11 are greater than 450 feet from the centerline of the right-of-way, and the remaining three are within 450 feet of the centerline.

All residences in Alternatives C-R, D-R, and E-R would be more than 450 feet from the centerline. Montana regulations allow the final centerline to vary up to 250 feet from the centerline analyzed in this EIS (ARM 17.20.301 (21)), unless there is a compelling reason to increase or decrease this distance. The centerline during the final design of these alternatives would be no closer than 200 feet from the centerline.

Logged Areas rather than Undisturbed Forest. Alternatives B through E-R would cross both logged areas, and undisturbed forest, riparian, and other areas. Slightly less than half of the area crossed by Alternatives B and C-R has been logged. Alternative E-R would cross the most logged areas (241 acres) and least undisturbed areas (124 acres). Alternative D-R would cross the least logged areas (136 acres) and most undisturbed areas (202 acres).

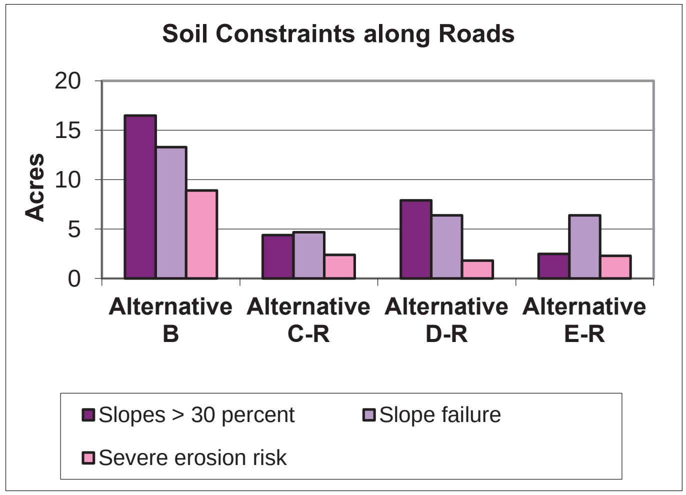


Geologically Stable Areas with Nonerosive Soils in Flat or Gently Rolling Terrain. The terrain in the transmission line analysis area consists of relatively flat alluvial valleys along major creeks and rivers, such as the Fisher River, Miller Creek, and West Fisher Creek; or steep hillsides with slopes greater than 30 percent. Soils subject to slope failure are found throughout the analysis area, primarily on lower hillslopes. Erosive soils are found along the Fisher River, Miller Creek, and West Fisher Creek.



Of the four alternatives, the centerline of the transmission line of Alternative B would cross more steep areas (7.4 miles) and more soils with a severe erosion hazard (6.7 miles) than the other three alternatives. The centerline of Alternative E-R would cross the least amount of steep slopes, (4.7

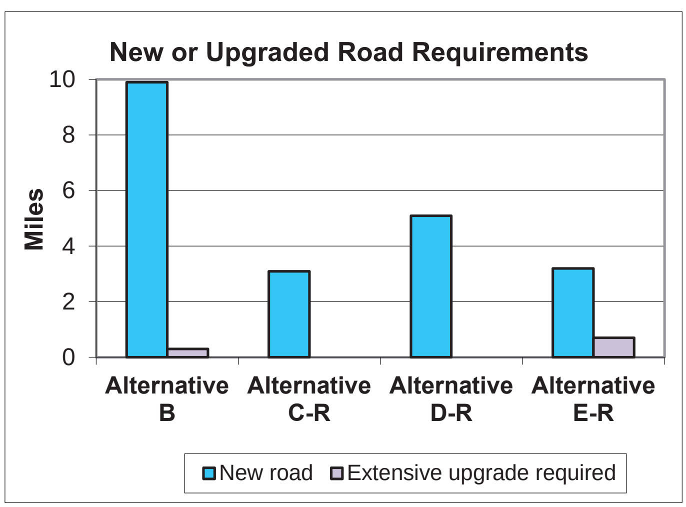
miles). Alternatives B and E-R would have a similar length of line subject to slope failure. The centerline of Alternative C-R would cross the least amount of soils subject to slope failure.



New or reconstructed access roads also would be needed on all transmission line alternatives. Alternative B would have more access roads than the other alternatives. In Alternatives C-R through E-R, the need for access roads would be reduced by using a helicopter to set structures in areas of poor accessibility. The access roads in Alternative B would disturb 17 acres of slopes greater than 30 percent, 13 acres of soil having potential for slope failure, and 9 acres of soil having severe erosion risk. Because of the fewer roads in the other alternatives, roads would disturb 2 and 8 acres of soils with these constraints in Alternatives C-R, D-R, and E-R.

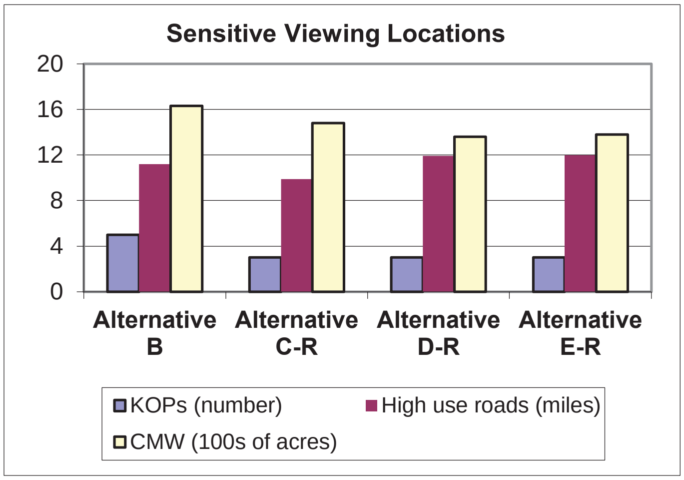
Within the transmission line analysis area, a segment of Libby Creek and the Fisher River are on Montana's list of impaired streams. Alternative B would have 4.7 miles of line paralleling the Fisher River, where soils with severe erosion risk and high sediment delivery are found. Clearing for the transmission line and new or upgraded roads would disturb 84 acres in the watershed. Alternative B also would disturb 17 acres in the Libby Creek drainage. The soils at the Libby Creek crossing have severe erosion risk and high sediment delivery. Alternatives C-R, D-R, and E-R would have fewer disturbances in the watersheds of impaired streams, disturbing 21 acres in the Fisher River watershed and 13 acres in the Libby Creek watershed. Through the use of Best Management Practices, Environmental Specifications, and other design criteria, these potential sediment increases would have minimal effects on analysis area streams under most conditions.

Roaded Areas. Existing roads are found throughout the transmission line analysis area. Most of the roads on the KNF were used for timber harvest and are currently closed. Roads on Plum Creek land would be used for all alignments. Four open roads would be used as primary access by one or more of the transmission line alternatives: US 2, NFS road #231 (Libby Creek Road), NFS road #385 (Miller Creek Road), and NFS road #4724 (South Fork Miller Creek Road).

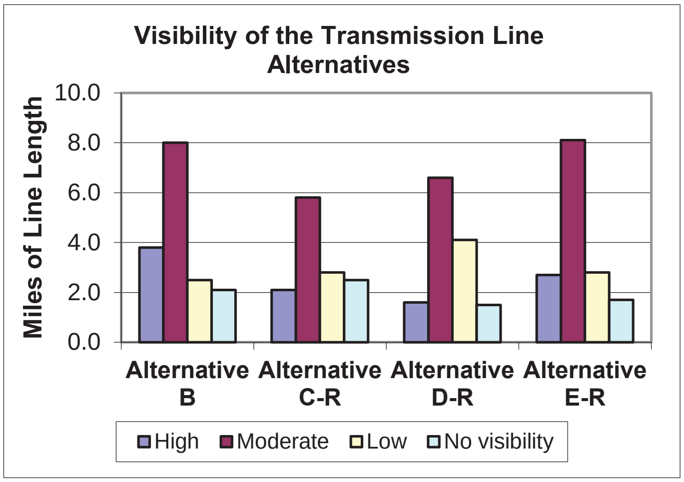


Alternative B would require about 10 miles of new roads or roads with extensive upgrade requirements. In Alternatives C-R through E-R, the need for access roads would be reduced by using a helicopter to set structures in areas of poor accessibility. Alternatives C-R and E-R would require about 3 miles of new or extensively upgraded roads and Alternative D-R would need 5 miles. Alternatives B and E-R would also require extensively upgrading of less than a mile of existing road.

Structures in a Floodplain. One hundred-year floodplains have been designated along the Fisher River, Miller Creek, an unnamed tributary to Miller Creek, Ramsey Creek, and Libby Creek. Eight structures in Alternative B would be located in a designated 100-year floodplain, primarily along the Fisher River. Two structures would be located in a designated 100-year floodplain in the other three alternatives.



Visual Impact. The transmission line analysis area is characterized visually by the summit peaks of the Cabinet Mountains surrounded by the adjacent densely forested mountains and valleys, with some flat, open stream valleys of dense low-growing herbaceous vegetation interspersed with the forest. The four transmission line alternatives would be located in montane forest and valley characteristic landscapes within the KNF. All alternatives would be visible from KOPs, high use roads, and the CMW. Alternative B would be visible from five KOPs, with the other alternatives visible from three KOPs. Alternative C-R would be visible from 10 miles of high use roads, with the other three alternatives visible from 11 miles of high use roads. The effects of views from the CMW would be the greatest in Alternative B, with 1,600 acres in the CMW having views of the corridor, and the least in Alternative E-R. A short segment of Alternatives D-R and E-R would be visible from Howard Lake, a popular recreation area.



About 3.8 miles of Alternative B would have high visibility and 8 miles would be moderately visible. Alternatives C-R, D-R, and E-R would have similar lengths of high visibility (about 2 to 3 miles). Alternatives C-R, D-R and E-R would have increasing lengths of moderate visibility, with 5.8, 6.6, and 8.1 miles each. Alternative C-R would have the greatest length of transmission line without any visibility at 2.5 miles. Visually sensitive and high visibility areas are considered sensitive areas and under the Environmental Specifications (see Appendix D), MMC would take all necessary actions to avoid adverse impacts on them.

Safe Distance from Residences and Other Areas of Human Concentration. Fourteen residences are within 0.5 mile of Alternative B, of which 11 are greater than 450 feet from the centerline and the remaining three are within 450 feet of the centerline. Because the final alignment could vary by up to 250 feet from the centerline analyzed in this EIS (ARM 17.20.301 (21)), three residences may be within 200 feet of the centerline, depending on the final transmission line alignment. At lateral distances from the edge of the right-of-way (50 feet from the centerline) to 200 feet away, the electric field strength would range from about 0.75 kV/m (kilovolt/meter) at 50 feet to about 0.05 kV/m (or 50 V/m) at 200 feet. The magnetic field strength would be about 4 milligauss (mG) at 50 feet and less than 1 mG at 200 feet. This maximum electric field strength at 50 feet would be below the level set by Montana regulation for subdivided and residential areas for electric field strength, and both the electric and magnetic field strengths at 50 feet would be below the exposure levels for the public recommended as reference levels or maximum permissible levels.

All four residences in Alternative C-R and all six residences within 0.5 mile of Alternatives D-R and E-R are more than 450 feet from the centerline. As part of these alternatives, the centerline would be no closer than 200 feet from any residence during final design. The electric field strength would be less than 0.05 kV/m (or 50 V/m), and the magnetic field strength would be less than 1.0 mG at 200 foot from the center line. Based on the electric and magnetic field strengths recommended in guidelines as reference levels or maximum permissible levels for the public, and the current state of scientific research on electric and magnetic fields, these alternatives would be a safe distance from residences and other areas of human concentration.

If approved, the DEQ would require that the project meet minimum standards set forth in the National Electrical Safety Code and Federal Aviation Administration requirements for marking the line.

Compliance with Local, State, or Federal Management Plans. The KFP guides all natural resource management activities and establishes management direction for the KNF in the form of prescriptions consisting of goals, objectives, standards, and guidelines. This direction may be established to apply throughout the forest plan area (forest-wide direction), or it may be established for only a part of the forest plan area, a MA. The Montanore Project is being evaluated under the 1987 KFP. Unincorporated Lincoln County has no comprehensive or general plan, zoning regulations, or growth policies.

The Montana Fish, Wildlife and Parks (FWP) holds a conservation easement on some lands owned by Plum Creek Timberlands LP where the transmission line may be located. Under the terms of the conservation easement, the FWP has reserved the right to prevent any inconsistent activity on or use of the land by Plum Creek Timberlands LP or other owners, and to require the restoration of any areas or features of the land damaged by such activity or use. Activities and uses prohibited or restricted include installing any natural gas or other pipelines or power transmission lines greater than 25-kV unless prior written approval is given by the FWP. If the selected transmission line were approved by the FWP, it would comply with the FWP-Plum Creek conservation easement. Before the agencies authorize the start of the transmission line construction, MMC would convey title or a conservation easement to FWP to up to 91 acres of private land adjacent to the FWP conservation easement in Alternatives C-R and D-R, and 94 acres in Alternative E-R. MMC would follow any FWP requirements for conveyance. Acquired lands or easements would be added to the existing conservation easement.

Alternative B would not be in compliance with all goals, objectives, standards, and guidelines of the KFP. For example, Inland Native Fish Strategy Standard Minerals Management (MM-2) requires all structures, support facilities, and roads to be located outside RHCAs. Where no alternative to siting facilities in RHCAs exists, operators are to locate and construct the facilities in ways that avoid impacts on RHCAs and streams, and adverse effects on inland native fish. MMC's Alternative B would locate roads and transmission line structures in RHCAs. The lead agencies' alternatives incorporate modifications and mitigations to MMC's proposals that are alternatives to siting facilities in RHCAs and would minimize effects on RHCAs and inland native fish. No alternatives exist that eliminate the need to site facilities in RHCAs. Compliance with the KFP is discussed in each resource section of Chapter 3.

Minimized Adverse Environmental Impact

The MFSA requires a finding that the facility as proposed or modified, or an alternative to the facility, must minimize adverse environmental impacts, considering the state of available technology and the nature and economics of the various alternatives (75-20-301(1)(c), MCA). ARM 17.20.1607 outlines additional requirements before this finding can be made. In addition, the final location for the facility must achieve the best balance among the preferred site criteria discussed in the previous section.

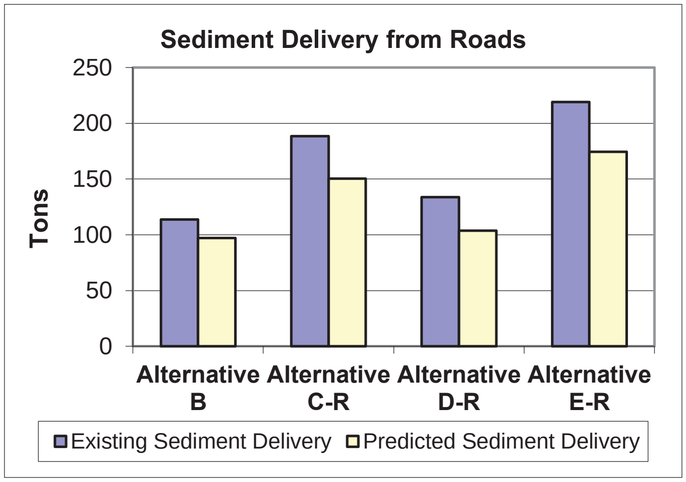
In addition to the DEQ's preferred location criteria listed in DEQ Circular MFSA-2, section 3.1, transmission line impacts were evaluated based on criteria listed in DEQ Circular MFSA-2, sections 3.2(1)(d)(iii) through (xi) and 3.4(1)(b) through (w) (see Appendix J), and other criteria established to meet Forest Service and NEPA requirements. Alternative A, No Transmission Line, would not have additional effects beyond that described for the mine, and is not discussed further. Impacts of transmission line alternatives are summarized below, based on the criteria listed in Appendix J. Other key issues as required by the Forest Service or NEPA are discussed where they relate to DEQ Circular MFSA-2 criteria. Additional Forest Service or NEPA issues that do not fit in the context of MFSA criteria are discussed at the end of this section. Of the key issues identified by the KNF and the DEQ, the transmission line alternatives would have no effect on acid rock drainage, metal leaching, groundwater quality or quantity, or surface water quantity, and these issues are not discussed further. The proposed transmission line would have no effect for the following resources listed in DEQ Circular MFSA-2 criteria: national primitive areas; national wildlife refuges and ranges; state wildlife management areas and wildlife habitat protection areas; national parks and monuments; state parks; national recreation areas; designated or eligible wild and scenic river systems; specifically managed buffer areas; state or federal waterfowl production areas; designated natural areas; national historic landmarks, districts, or sites; municipal watersheds; sage and sharp-tailed grouse breeding areas and winter range; high waterfowl population areas; areas of unusual scientific, educational, or recreational significance; areas of high probability of including significant paleontological resources; water bodies; potable surface water supplies, or active faults.

National Wilderness Areas. None of the transmission line alternatives would directly affect the wilderness attributes of the CMW. Indirect effects of the transmission line alternatives on the CMW are discussed below under Scenic Quality.

Roadless Areas over 5,000 acres. Alternative B would physically disturb 2 acres of the Cabinet Face East IRA in the Ramsey Creek drainage. Timber harvest for line clearing would occur in the IRA, and 0.1 mile of new roads would be constructed in the IRA under Alternative B.

Alternatives C-R, D-R, and E-R would avoid physical disturbance in the Cabinet Face East IRA. No road construction or timber harvest would occur in the IRA for these alternatives.

Rugged Topography, Soil Erosion, and Sediment Delivery. The centerline of Alternative B would cross more areas with slopes greater than 30 percent (7.4 miles), more soils with a severe erosion hazard (6.7 miles), and more soils with high sediment delivery (5.1 miles) than the other three alternatives. The total disturbance for access roads, which would be either new roads or closed roads requiring upgrades, would be greater in Alternative B (16 acres) than the other alternatives, followed by Alternative D-R and E-R (4 acres). Of the agencies' alternatives, Alternative D-R would cross the most areas with slopes greater than 30 percent (7.9 miles), and Alternative C-R would cross the most soils with a severe erosion hazard (2.4 miles). Alternatives C-R, D-R, and E-R would cross the same amount of soils with high sediment delivery (0.5 miles). Slopes greater than 30 percent, areas with severe erosion hazard, and areas with high sediment delivery are shown for all transmission line alternatives in Appendix J.



Sediment delivery from roads used during transmission line construction would be less than existing sediment delivery in all action alternatives. In Alternatives C-R, D-R, and E-R, MMC would implement Best Management Practices and road closure mitigation, some of which would be completed before the Evaluation Phase and some before the Construction Phase. Existing sediment delivery would vary by alternative because roads proposed for use in each alternative would be different. Alternative B would reduce sediment delivery from roads by 17 tons; reduction in sediment delivery from roads in the agencies' alternatives would be between 30 and 45 tons. To minimize erosion risk and sediment delivery, Alternative B would include implementing erosion and sediment control Best Management Practices; interim reclamation (replacing soil where it was removed and reseeding) access roads; immediately stabilizing cut-and-fill slopes; seeding, applying fertilizer, and stabilizing road cut-and-fill slopes and other disturbances along roads as soon as final post-construction grades were achieved; at the end of operations, decommissioning new roads and reclaiming most other currently existing roads to pre-operational conditions; ripping compacted soils before soil placement; and disking and harrowing seedbeds. In addition to measures listed for Alternative B, Alternatives C-R, D-R, and E-R would minimize erosion risk and reduce sediment delivery through: rerouting to avoid highly erosive soils; using H-frame poles, allowing longer spans, and fewer structures and access roads; using helicopter construction in grizzly bear core habitat to decrease the number of access roads; and implementing a Road Management Plan. For all transmission line alternatives, with implementation of mitigation measures there would be no substantial adverse impacts on the soil resources, and the soil losses along access roads would likely be minor until vegetation was re-established in most areas after 3 to 5 years. Vegetation re-establishment on steep areas, particularly on south- and west-facing slopes, could take longer.

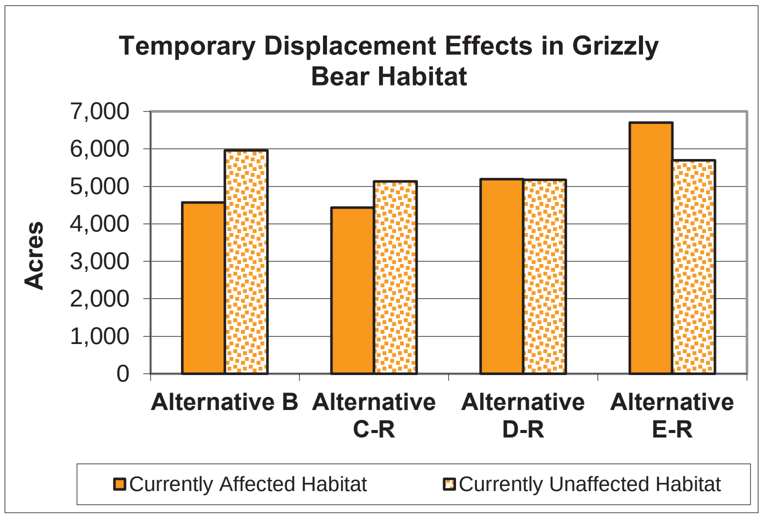
Bull Trout Critical Habitat and Occupied Habitat and Other Fisheries. The Forest Services' effect determination and the USFWS' Biological Opinion on the bull trout and bull trout critical habitat were discussed under the mine alternatives. The Fisher River, West Fisher Creek, Libby Creek, and Ramsey Creek in the transmission line analysis area provide habitat for bull trout, listed as threatened. Because of natural barriers, bull trout are not found in Miller Creek or its tributaries. The USFWS designated bull trout critical habitat in the transmission line analysis area in the Fisher River, West Fisher Creek, and Libby Creek.

Bull trout could be affected by increased sedimentation caused by clearing, road construction, and other disturbance associated with the transmission line. All alternatives may affect bull trout and designated critical habitat. All alternatives would cross critical habitat in Libby Creek. Alternative B also would cross essential excluded habitat in the Fisher River; and Alternatives C-R, D-R, and E-R would cross critical habitat in West Fisher Creek. Alternative E-R would parallel critical habitat and essential excluded habitat in West Fisher Creek. For most of its length adjacent to West Fisher Creek, the existing Libby Creek Road (NFS road #231) would be between the transmission line and any new roads in Alternative E-R, and West Fisher Creek. As shown in Appendix J, Alternative E-R would have the most structures within 1 mile of bull trout critical habitat (67), and Alternative B would disturb the most habitat for road construction and upgrades within 1 mile of bull trout critical habitat (9.6 acres). Alternative D-R would have the fewest structures within 1 mile of bull trout critical habitat (25), and would disturb the least habitat for road construction and upgrades within 1 mile of bull trout critical habitat (4 acres). Alternative B would have the most disturbance from clearing and road construction or upgrades in watersheds of occupied bull trout streams (182 acres), followed by Alternative E-R (177 acres). Alternative D-R would have the least disturbance in watersheds of occupied bull trout streams (70 acres). Bull trout critical habitat is considered a sensitive area and, under the agencies' Environmental Specifications (see Appendix D), MMC would take all necessary actions to avoid adverse impacts on it.

Three Montana fish species of concern are found in the transmission line analysis area streams: interior redband trout, torrent sculpin, and westslope cutthroat trout. Pure populations of interior redband trout are found in the Fisher River, West Fisher Creek, Ramsey Creek, a short segment of Libby Creek below Ramsey Creek, and Midas Creek. Torrent sculpin are found in Libby Creek and Miller Creek. Both torrent and slimy sculpin are found in analysis area streams. Westslope cutthroat trout are found in Howard Creek and Miller Creek. The transmission line alternatives would have only minor disturbance in these watersheds, which is unlikely to affect aquatic life. None of the transmission line alternatives would likely contribute to a trend toward federal listing of interior redband trout or westslope cutthroat trout.

In addition to mitigation measures described above to minimize erosion and sediment delivery, Alternative B would include implementation of a Stormwater Pollution Prevention Plan and structural and nonstructural Best Management Practices, construction of stream crossings per KNF and DEQ requirements, minimization of disturbance on active floodplains, and curtailment of construction activities during heavy rains. Alternatives C-R, D-R, and E-R also would include the following measures: where feasible, location of structures outside of riparian areas, installation of new culverts to allow fish passage, design of stream crossing structures to withstand a 100-year flow event, and the completion of a habitat inventory and development of instream structures in Libby Creek. Based on the use of Best Management Practices, Environmental Specifications, and other design criteria, sediment increases would have minimal effects on analysis area streams under most conditions.

Grizzly Bear. As discussed in the previous summary of the mine alternatives, an analysis of the independent effects of the transmission line alternatives on the grizzly bear was not completed because of the analysis' complexity. The effects of the combined mine and transmission line alternatives have been discussed previously. The following is an estimate of the effects of the transmission line alternatives. The physical loss of grizzly bear habitat would be low, primarily from construction of roads and the Sedlak Park Substation. About 34 acres of grizzly bear habitat would be lost in Alternative B, while the agencies' alternatives would affect between 13 and 20 acres. The impacts of physical habitat loss would be reduced through MMC and agencies' land acquisition requirements. In the agencies' alternatives, 2 acres of habitat would be acquired for every acre of grizzly bear habitat physically lost. Most impacts on grizzly bear habitat in the clearing area would be temporary because disturbed habitat would be reclaimed and revegetated after the transmission line was built. Some of the coniferous forest in the clearing area would be converted to grassland or shrubland in the long term.



In all alternatives, project activities would temporarily increase displacement effects on bears both inside and outside the Recovery Zone. Some areas in the zone of influence of transmission line activities are currently being affected by other activities, such as road use or activities on private land. Total additional displacement effects within and outside of the Grizzly Bear Recovery Zone in currently affected habitat would range from 4,432 acres in Alternative C-R to 6.706 acres for Alternative E-R, while new displacement effects in currently undisturbed habitat would range from 5.136 acres in Alternative C-R to 5,962 acres in Alternative B. In all alternatives, increased displacement would be primarily due to helicopter activity. Displacement effects in the agencies' alternatives would be mitigated by restricting transmission line construction and decommissioning on National Forest System and State trust lands to between June 16 and October 14.

In all alternatives, helicopters would be used for line stringing, which would last about 10 days. In Alternatives C-R, D-R, and E-R, helicopters also would be used in some segments for vegetation clearing and structure construction, prolonging disturbance for up to 2 months. New roads would not be needed where a helicopter was used for vegetation clearing and structure construction. For all alternatives, disturbance also would occur for about 2 months during other transmission line construction activities in areas where helicopters were not used, and would be more extensive for Alternative B than Alternatives C-R, D-R, or E-R. For all transmission line alternatives, except for annual inspection and infrequent maintenance operations, helicopter use and other transmission line construction activity would cease after the transmission line was built until decommissioning. Helicopter use and other transmission line construction activities would cause similar disturbances with similar durations during line decommissioning. The effects on the grizzly bear would be mitigated through habitat acquisition, access changes, and habitat enhancement.

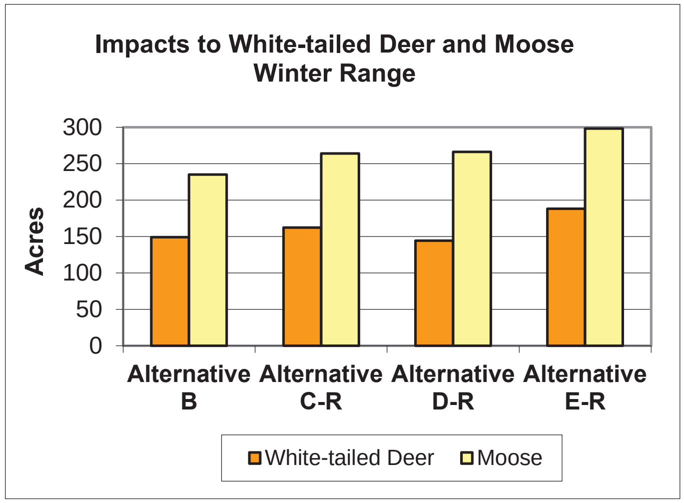
Canada Lynx. Impact evaluation criteria for the Canada lynx have been discussed in the previous summary of the mine alternatives. All transmission line alternatives would comply with Northern Rockies Lynx Management Direction objectives, standards, and guidelines. Overall lynx habitat disturbed in the transmission line clearing area or for road construction or improvement would range from 63 acres for Alternative C-R to 107 acres for Alternative D-R. All transmission line alternatives may affect the Canada lynx. In the agencies' alternatives, impacts on currently suitable lynx habitat would be offset through enhancement of between 126 and 214 acres of lynx stem exclusion habitat. Land acquired for grizzly bear mitigation for the transmission line alternatives would likely improve habitat conditions for lynx and their prey.

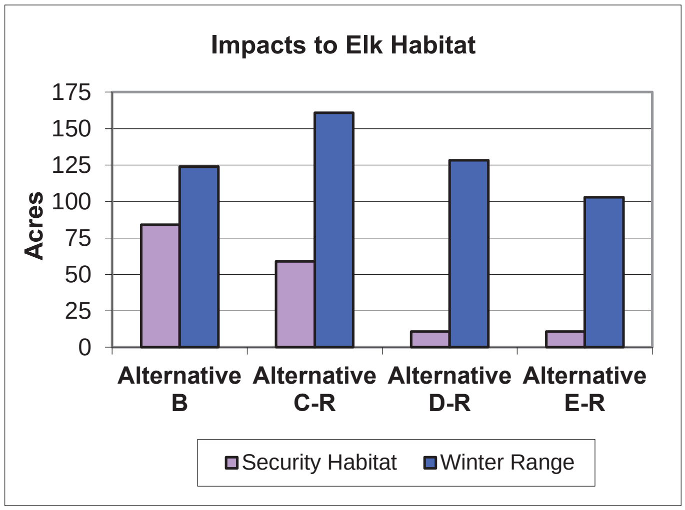
Cultural Resources. Five cultural sites eligible or recommended eligible for the National Register of Historic Places are in the Alternative B 500-foot corridor. The corridor for Alternatives C-R, D-R, and E-R would cross three, four, and seven, respectively, eligible or recommended eligible cultural sites. These sites are discussed in Chapter 3. All sites would either be avoided or mitigated in consultation with the Montana State Historic Preservation Office (SHPO). One site is a portion of US 2 that crosses Alternatives B, C-R, D-R, and E-R; it has not been evaluated for the National Register of Historic Places. For all transmission line alternatives, consultation with the SHPO would be conducted to receive consensus determinations and to develop a plan of action for this portion of US 2. Sites identified on State land would be coordinated with the Montana Department of Natural Resources and Conservation. Additional fieldwork in all alternatives would be necessary before SHPO consultation. Cultural resources are considered sensitive areas and under the Environmental Specifications (see Appendix D), MMC would take all necessary actions to avoid adverse impacts on them.

Surface Water Quality. Libby Creek, Ramsey Creek, Poorman Creek, Little Cherry Creek, Bear Creek, Howard Creek, and Midas Creek are rated as outstanding (Class 1) for fisheries habitat by the FWP. No Class II streams are found in the analysis area. Clearing for the transmission line within watersheds of Class I streams would range from 47 acres for Alternatives D-R and E-R to 72 acres for Alternative C-R, to 107 acres for Alternative B. Road construction and improvement would disturb less than 1 acre in watersheds of Class I streams for Alternatives C-R, D-R, and E-R; and 7 acres for Alternative B (see Appendix J).

Stream segments on Montana's list of impaired streams in the analysis area are described in the previous summary of the mine alternatives. Vegetation clearing and road construction within watersheds of impaired streams would be 34 acres for Alternatives C-R, D-R, and E-R to 101 acres for Alternative B (see Appendix J).

Scenic Quality. In transmission line Alternatives B, C-R, D-R, and E-R, the KNF would amend the KFP by reallocating certain areas disturbed by the 230-kV transmission line on National Forest System lands as MA 23. MA 23 has a Visual Quality Objective (VQO) of Maximum Modification. The MAs that would not be reallocated to MA 23 currently have a VQO of Modification. All transmission line facilities would comply with a VQO of Modification or Maximum Modification. Some segments of all transmission line alternatives would be visible from some locations within the CMW, as shown in Appendix J.





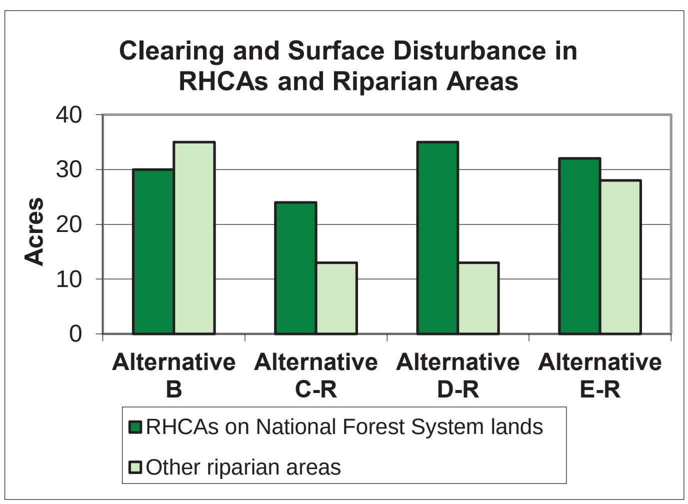
Big Game Winter and Security Habitat. All transmission line alternatives would disturb winter habitat for moose, elk, and white-tailed deer; and security habitat for elk. Security habitat offers elk refuge and reduces their vulnerability during the hunting season. For this analysis, elk security habitat is defined as areas that are larger than 250 contiguous acres and more than 0.5 mile from an open road. Alternatives B, C-R, and D-R would affect elk security habitat, ranging from 11 acres in Alternatives D-R and E-R to 84 acres in Alternative B. Alternative C-R would disturb the most elk winter range (161 acres), and Alternative E-R would disturb the least (103 acres) (see Appendix J). Disturbance impacts on white-tailed deer winter range would range from 144 acres for Alternative D-R to 188 acres for Alternative E-R. The most moose winter range would be disturbed by Alternative E-R (298 acres) and the least by Alternative B (235acres). Nearly 7 miles of Alternative E-R is within 0.25 mile of NFS road #231, an existing high-use road. The quality of big game winter range and overall habitat affected by Alternative E-R in the NFS road #231 corridor is currently reduced by existing road disturbance. About 1 mile of Alternatives C-R and D-R would bisect an area of relatively undisturbed elk, deer, and moose winter range greater than 0.25 mile from an existing high-use road between the Miller and West Fisher creek drainages.

Big game winter range is considered a sensitive area and, under the Environmental Specifications (see Appendix D), MMC would take all necessary actions to avoid adverse impacts on it. For all transmission line alternatives, effects on big game winter habitat from transmission line construction and decommissioning would be minimized through timing restrictions in elk, white-tailed deer, or moose winter range. Land acquisition programs proposed by MMC and the agencies, especially where roads could be closed, also would mitigate impacts on big game. Additional mitigation measures included in Alternatives C-R, D-R, and E-R would be creating security habitat through road access changes and monitoring road-killed animals to determine if improved access results in increased wildlife mortality.

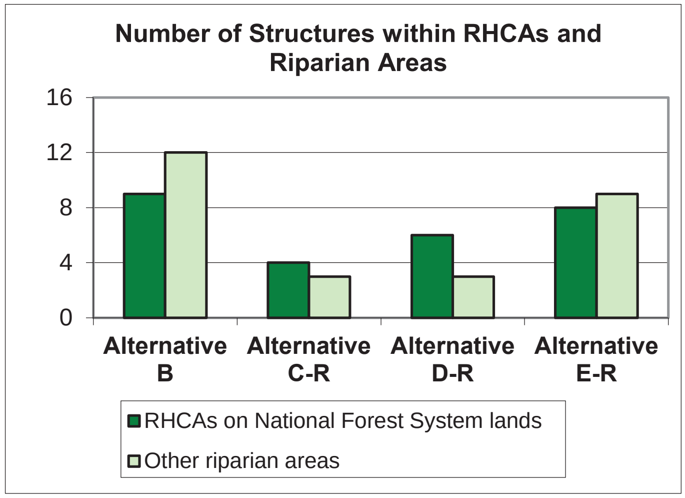
Mountain Goat. Only Alternative B would physically disturb mountain goat habitat, affecting 47 acres. Helicopter use and other transmission line construction activities associated with the transmission line alternatives are described above for the grizzly bear. Helicopter and other transmission line construction activities could temporarily displace goats from suitable habitat or reduce their ability to effectively use the available habitat in the short term. Individual goats could suffer increased stress levels from helicopter and construction disturbance. During the Construction Phase, additional displacement effects in Alternative B would occur on 3,362 acres of goat summer habitat, primarily due to helicopter line stringing in the Ramsey Creek area. Additional disturbance effects would be less for Alternatives C-R, D-R, and E-R, ranging from 743 acres for Alternative C-R to 766 acres for Alternatives D-R and E-R. Impacts on mountain goats would be reduced through land acquisition programs proposed by MMC and the agencies, if the acquired land provided suitable goat habitat.

Bald Eagle. Alternative B would be within 0.07 mile of an active bald eagle nest along the Fisher River west of US 2, while the Alternatives C-R, D-R, and E-R would be within 0.58 mile. Montana's Bald Eagle Management Plan recommends no additional human activity, including low-intensity activity, during the breeding season (February 1 to August 15) for activities within 0.25 mile of a nest site (Zone 1). The plan also recommends no high intensity activities during the breeding season, construction of permanent developments, or structures that pose a hazard within 0.5 mile (primary use areas or Zone 2) and minimization of disturbance, habitat alteration, and hazards for activities within 2.5 miles (home range or Zone 3).

Alternative B would have direct impacts on about 9 acres of habitat in Zone 1, and 10 acres of habitat in Zone 2. None of the agencies' alternatives would cross Zones 1 or 2. Direct impacts on Zone 3 habitat would be comparable for all alternatives. Compared to other alternatives, Alternative B would create greater risks of bald eagle collisions with the transmission line due to its proximity to nesting bald eagles and their foraging habitat along the Fisher River. For all alternatives, potential collisions of bald eagles with the transmission line would be reduced by constructing the transmission line according to recommendations for minimizing avian collisions with power lines and compliance with the Environmental Specifications, including restrictions on the location of overhead utility lines. Bald eagle primary use areas are considered sensitive areas and under the Environmental Specifications (see Appendix D), MMC would take all necessary actions to avoid adverse impacts on them.



Riparian Habitat Conservation Areas. Alternatives B through E-R would require construction of roads and other facilities in RHCAs and other riparian areas. Protection of RHCAs was a key criterion in the alternatives analysis and development of alternatives. The lead agencies did not identify an alternative that would avoid locating transmission line facilities or timber harvest in RHCAs. Effects from clearing and road construction and improvement on RHCAs would range from 24 acres in Alternative C-R to 35 acres in Alternative D-R; effects on other riparian areas on state and private land would range from 13 acres in Alternatives C-R and D-R to 35 acres in Alternative B. In Alternatives C-R, D-R, and E-



R, MMC would develop and implement a final Road Management Plan to reduce the effects on RHCAs. The plan would describe criteria for all new and reconstructed roads that govern road operation, maintenance, and management; requirements of maintenance and inspection before, during, and after storms; and regulation of traffic during wet periods to minimize erosion and sediment delivery, among other traffic-related objectives. The plan would also describe criteria related to implementation and effectiveness of monitoring plans for road stability, drainage, and erosion control and mitigation plans for road failures.

A KFP standard is to locate structures and support facilities, such as the transmission line, outside of RHCAs, unless no alternative exists. Based on preliminary design, the agencies did not identify an alternative that would avoid locating structures in RHCAs. Alternative B would have more structures in RHCAs and other riparian areas, with nine structures on RHCAs and 12 structures on riparian areas on state and private land. Structures in RHCAs in the other alternatives would be fewer, ranging from four in Alternative C-R to eight in Alternative E-R. Similarly, fewer structures would be located in other riparian areas in the other alternatives, ranging from three in Alternatives C-R and D-R, to nine in Alternative E-R. RHCAs are considered sensitive areas and under the Environmental Specifications (see Appendix D), MMC would take all necessary actions to avoid adverse impacts on them. Effects on RHCAs in Alternatives C-R, D-R, and E-R would be minimized by include developing and implementing a Vegetation Removal and Disposition Plan. Heavy equipment use in RHCAs would be minimized. Shrubs in RHCAs would be left in place unless they had to be removed for safety reasons.

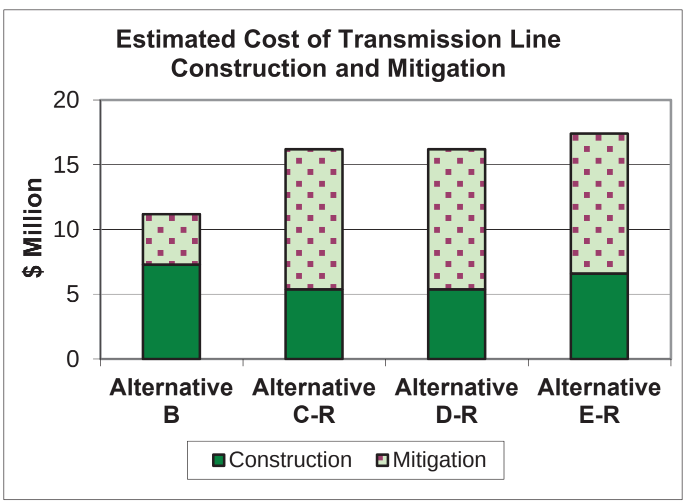
Old Growth Habitat. Old growth in the transmission line corridors is found in small blocks along the Fisher River, Miller Creek, West Fisher Creek, and Libby Creek. Alternatives B through E-R would remove old growth and reduce the effectiveness of old growth adjacent to new disturbances. Loss of old growth on both private and National Forest System lands would be 27 acres in Alternative B. The other alternatives would not directly affect old growth. Edge effects would include 121 acres in Alternative B, 17 acres in Alternative C-R, 4 acres in Alternative D-R, and 6 acres in Alternative E-R. Increased new road construction would contribute to the greater edge effect of Alternative B. The reduction of old growth on National Forest System lands would be mitigated in Alternatives C-R, D-R, and E-R by designating undesignated old growth as designated old growth (MA 13). In addition, old growth habitat is considered sensitive areas and under the Environmental Specifications see Appendix D), MMC would take all necessary actions to avoid adverse impacts on it.

Transmission line Alternatives B through E-R would require a project-specific amendment to allow harvest within designated old growth stands (MA 13). The project-specific amendment would change the current MA 13 designation of all harvested stands to MA 23. Designation of additional areas of old growth would not create new old growth, but would ensure that these areas are managed to retain or develop old growth characteristics. Losses and degradation of old growth habitat may be offset by private land acquisition associated with grizzly bear habitat mitigation, if old growth habitat characteristics were present on the acquired parcels. All alternatives would be consistent with KFP direction to maintain a minimum of 10 percent old growth below 5,500 feet in elevation in each 3rd-order drainage or compartment, or a combination of compartments.

Pileated Woodpecker. The pileated woodpecker is a Management Indicator Species for old growth and snag habitat in the KNF. The effects on old growth in the transmission line alternatives, especially edge effects, would reduce nesting and foraging habitat, and habitat quality for the pileated woodpecker. The potential population index in the transmission line alternatives would not be affected. All transmission line alternatives would eliminate some snags and downed logs greater than 10 inches diameter at breast height that provide potential nesting and foraging habitat for pileated woodpeckers. Snag densities and quantities of down wood would remain above KNF-recommended levels and would continue to be sufficient to sustain viable populations of cavity-dependent species in the KNF. Loss of old growth providing potential pileated woodpecker habitat may be offset by private land acquisition associated with grizzly bear habitat mitigation, if old growth habitat characteristics were present on the acquired parcels.

Wetlands. Direct effects on wetlands and streams are expected to be avoided by the placement and location of transmission structures outside of wetlands and streams. The BPA would avoid all wetlands at the Sedlak Park Substation Site. Unavoidable wetland direct effects would be determined during final design. Indirect effects on wetlands from road construction, such as sediment or pollutant delivery, would be minimized through implementation of Best Management Practices and appropriate stream crossings. In addition, wetlands are considered sensitive areas and under the Environmental Specifications (see Appendix D), MMC would take all necessary actions to avoid adverse impacts on them.

Transmission Line Construction Costs. Resource-specific impacts and cumulative impacts are described in the previous section and discussed in Chapter 3. The monetary values of these impacts cannot reasonably be quantified. Many potential adverse environmental impacts would be minimized through measures proposed by MMC and the application of the agencies' proposed measures that would be included in Environmental Specifications. Agency-proposed mitigation measures would be included as conditions in the certificate should the DEQ approve the transmission line. Proposed Environmental Specifications for the transmission line, including environmental protection and monitoring measures, are described in Appendix D and are further detailed in ARM 17.20.1901.



Estimated transmission line construction costs range from $7.3 million for Alternative B to $5.4 million for Alternatives C-R and D-R. Cost estimates are based on preliminary design and material costs in 2012. High steel costs would make the steel monopoles proposed in Alternative B more expensive than the wooden H-frame structures proposed in the other alternatives. The lower cost of wooden H-frame structures in Alternatives C-R, D-R, and E-R would offset the cost of helicopters to set structures and clear timber in these alternatives. The estimated mitigation cost of $10.8 million are the same for the agencies' alternatives. Alternative B mitigation would cost an estimated $3.9 million, but would not adequately mitigate effects. Overall cost is lowest for Alternative B and highest for Alternative E-R.

Locating Transmission Lines Underground

The lead agencies considered locating the transmission line underground. Underground transmission lines typically have less clearing and do not have the visual impact of the transmission lines and structures. Underground transmission lines typically have significantly fewer faults, fewer voltage sags, and fewer short- and long-duration interruptions. Traditional overhead circuits typically fault about 90 times per 100 miles per year; underground circuits fail less than 10 or 20 times per 100 miles per year. Because overhead circuits have more faults, they cause more voltage sags, more momentary interruptions, and more long-duration interruptions.

Locating the line underground would require proximity to an access road for the entire length of the line. Consequently, the option chosen for analysis is generally the route of Alternative E-R, West Fisher Creek. The line would not follow the overhead line route exactly, but would be adjacent to US 2 and NFS road #231. This alignment would allow easy access for construction and maintenance. The line would start at the Sedlak Park Substation. Two voltages would be feasible for an underground line, 230 kV and 115 kV. Both voltages would be solid dielectric, cross-linked polyethylene, insulated cable in duct banks encased in concrete. Multiple underground cable splicing vaults with access manholes would be required along the route. Generally, the vaults would be required every 1,000 feet. Aboveground to overhead line termination points would be necessary at the Sedlak Park Substation and at the Plant Site Substation. The duct bank would have four, 5-inch to 8-inch conduits with a cable in each conduit. One conduit would be a spare conduit and cable for reliability of service in case of a cable failure.

Considerable disturbance would be necessary for construction due to the size of the cable trench and the cable splicing vaults. Trenches are 5 feet deep and vaults are 8 feet high, 10 feet wide, and 20 to 30 feet long. The line length would be about 20 miles.

For the 230-kV option, the proposed BPA Sedlak Substation would stay essentially the same except for the addition of a cable termination system. This could increase the substation cost by 15 percent. The construction cost for the installation would be $3 million per mile or $60 million total. For the 115-kV option, the proposed BPA Sedlak Substation would require a voltage step-down transformer, which would increase the substation construction area and require additional facilities and equipment. It also would require a termination system. The substation costs would increase by about 60 percent for the 115-kV cable option. The construction cost for the cable installation would be $2 million per mile or $40 million total. The agencies eliminated underground installation as an alternative because of the cost.

Consistency with Regional Plans for Expansion

The transmission line would allow the mine to connect to the regional electrical transmission grid. While there is no single formal published plan for expansion of the regional grid, the line would be consistent with plans for expansion of the BPA grid in the area. The line would not significantly add to the ability of the grid as a whole to deliver electricity because the purpose of the line would be to serve only the mine loads. The BPA completed the studies necessary to interconnect the proposed line to BPA's Libby-Noxon 230-kV line. BPA's study indicated the proposed line would not have a significant effect on the interconnected system.

Utility System Economy and Reliability

The BPA completed a study indicating that the proposed interconnection would not adversely affect BPA's system. Operating the proposed line at 230 kV would help ensure low line losses.

Conformance with Applicable State and Local Laws

The location of the facility would conform to applicable state and local laws and regulations either as a permitting or certification condition, or in compliance with project-specific Environmental Specifications (see Chapter 1).

Public Interest, Convenience, and Necessity

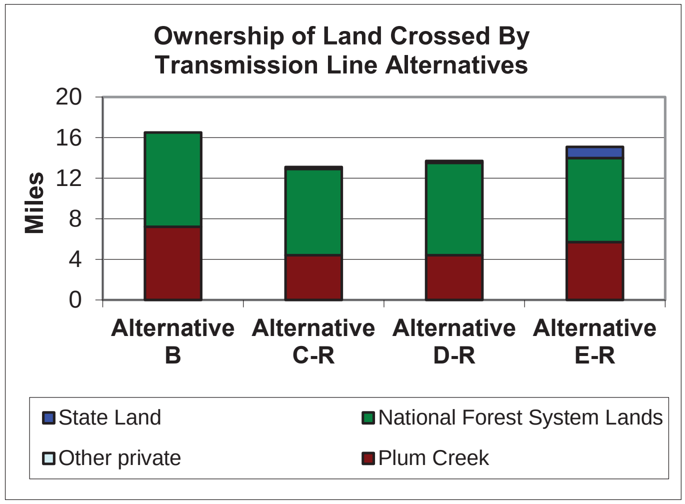
The proposed transmission line would be built to meet the need for additional transfer capacity to the mine. Benefits to MMC would be the monetary profit from operating the mine and transmission line. Benefits to the state include local tax revenues to counties in which the line and mine are located, state tax revenues from the line and mine, a short-term beneficial effect on local economies from construction of the line and mine, and a long-term beneficial effect on local economies from maintenance of the line.

Economic impacts due to the proposed transmission line would be minimal at a state level. Construction benefits due to the line would be short-term. Line maintenance employment benefits and tax benefits would be long-term but small at both a county and state level. The total costs include mine and transmission line construction, and operation costs and other costs due to environmental impacts described in Chapter 3. The costs of these environmental impacts cannot be reasonably quantified in monetary terms.

The proposed transmission line is unlikely to have adverse effects on public health, welfare, and safety because the line would conform to the requirements of the National Electrical Safety Code and DEQ standards for electric field strength in residential or subdivided areas, and at road crossings. Sensitive receptors such as residences would be located at distances sufficient that even the most restrictive suggested standards for magnetic fields would be met under normal operating conditions. Alternatives C-R, D-R, and E-R would be constructed in a manner that minimizes adverse impacts on soil, water, and aquatic resources.

The DEQ will make a final determination on public interest, convenience, and necessity after a Final EIS is issued.

Public and Private Lands



The use of public lands for location of the facility was evaluated, and public lands were incorporated into alternatives whenever their use was as economically practicable as the use of private lands (75-20-301(1)(h), MCA). All of the transmission line alternatives would be primarily on National Forest System lands and private land owned by Plum Creek. Alternative B would cross 7.2 miles of private and Plum Creek land. The other alternatives would cross less land, with Alternatives C-R and D-R crossing 4.4 miles and Alternative E-R crossing 5.7 miles. The agencies did not identify an alternative that would avoid the use of private land.

DEQ Issuance of Necessary Decisions, Opinions, Orders, Certifications, and Permits

As appropriate, the DEQ would issue all necessary environmental permits for the transmission line at the time the decision is made on whether to grant a certificate for the facility.

Where to Obtain More Information

More information on the proposed Montanore Project can be found on the KNF's website: http://www.fs.usda.gov/projects/kootenai/landmanagement/projects. If you have any additional questions or concerns, please contact the individuals listed below.

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Chapter 1. Purpose of and Need for Action

1.1 Document Structure

Mines Management, Inc. (MMI) proposes to construct a copper and silver underground mine and associated facilities, including a new transmission line. Montanore Minerals Corp. (MMC), a wholly owned subsidiary of MMI, would be the project operator. The proposed project is called the Montanore Project. MMI has requested the U.S. Department of Agriculture (USDA), Kootenai National Forest (KNF) to approve a Plan of Operations for the Montanore Project. From the perspective of the Montana Department of Environmental Quality (DEQ), the mining operation is covered by a DEQ Operating Permit first issued by the Montana Department of State Lands (DSL) to Noranda Minerals Corp. (NMC). MMC has applied to the DEQ for a modification of the existing permit to incorporate aspects of the Plan of Operations submitted to the KNF that are different from the DEQ Operating Permit. MMC has also applied to the DEQ for a certificate of compliance to allow for construction of the transmission line.

The KNF and the DEQ are the lead agencies and have prepared this final environmental impact statement (Final EIS) with the assistance of the cooperating agencies in compliance with the National Environmental Policy Act (NEPA) and the Montana Environmental Policy Act (MEPA). These laws require that if any action taken by the DEQ or the KNF may "significantly affect the quality of the human environment," an Environmental Impact Statement (EIS) must be prepared. This Final EIS also has been prepared in compliance with the USDA NEPA regulations (7 Code of Federal Regulations (CFR) 1b), the Forest Service's NEPA regulations (36 CFR 220), the Forest Service's Environmental Policy and Procedures Handbook (Forest Service Handbook 1909.15), DEQ's MEPA regulations (ARM 17.4.601 *et seq.*) and the U.S. Army Corps of Engineers' (Corps) NEPA implementation procedures for its regulatory program (Appendix B of 33 CFR 325). This Final EIS discloses the potential direct, indirect, and cumulative environmental impacts that would result from the proposed mine and alternatives and serves as a report required under the Major Facility Siting Act (MFSA). The document is organized into four chapters:

- Chapter 1. Purpose of and Need for Action: Chapter 1 includes information on the history of the proposed project, the purpose of and need for the proposed project, and the lead agencies' proposal for achieving that purpose and need.
- Chapter 2. Alternatives, Including the Proposed Action: This chapter summarizes how the KNF and the DEQ informed the public of the proposal and how the public responded. This chapter provides a more detailed description of MMC's Proposed Action as well as the lead agencies' alternative methods for achieving the project's purpose. These alternatives were developed based on key issues raised by the public and other agencies and include mitigation measures to reduce impacts.
- Chapter 3. Affected Environment and Environmental Consequences: This chapter describes the affected environment and environmental effects of implementing the Proposed Action or other alternatives. This analysis is organized alphabetically by resource.
- Chapter 4. Consultation and Coordination: Chapter 4 provides a list of preparers and agencies consulted during the development of the Final EIS.

The following appendices provide more detailed information to support the analyses presented in the Final EIS:

- Appendix A—1992 Board of Health and Environmental Sciences Order
- Appendix B—Names, Numbers, and Current Status of Roads Proposed for Use in Mine or Transmission Line Alternatives
- Appendix C—Agencies' Conceptual Monitoring Plans, Alternative 3
- Appendix D—Proposed Environmental Specifications for the 230-kV Transmission Line
- Appendix E—Past and Current Actions Catalog for the Montanore Project
- Appendix F—Supplemental Macroinvertebrate Data
- Appendix G—Water Quality Mass Balance Calculations
- Appendix H—Various Streamflow Analyses
- Appendix I—Visual Simulations
- Appendix J—Transmission Line Minimum Impact Standard Assessment
- Appendix K—Water Quality Data
- Appendix L—404(b)(1) Analysis
- Appendix M—Response to Comment on the Draft and Supplemental Draft EISs

Additional documentation, including more detailed analyses of project-area resources, may be found in the project record located at the KNF Supervisor's Office in Libby, Montana, and in the project record at DEQ's Environmental Management Bureau in Helena, Montana.

This disclaimer pertains to all geographic information system (GIS) maps within this document:

These products are reproduced from geospatial information prepared, in part, by the USDA KNF and other sources. GIS data and product accuracy may vary. They have been developed from sources of differing accuracy and resolution, accurate only at certain scales, based on modeling or interpretation, and some sources may have been incomplete while being created or revised. Using GIS products for purposes other than those for which they were created may yield inaccurate or misleading results. The KNF reserves the right to correct, update, modify, or replace its GIS products without notification.

1.2 Project Area Description

The Montanore Project is located 18 miles south of Libby near the Cabinet Mountains of northwestern Montana (Figure 1; all figures are bound separately in Volume 2 of this document). The ore body is beneath the Cabinet Mountains Wilderness (CMW). All access and surface facilities including the 230-kV transmission line would be located outside of the CMW boundary (Figure 2). The proposed operating permit areas for the mine facilities would be within Sections 13, 14, 15, 22, 23, 24, 26, 27, 35, and 36, Township 28 North, Range 31 West, Sections 2, 3, 9, 10, 11, 14, 15, and 29, Township 27 North, Range 31 West, and Sections 18 and 19, Township 28 North, Range 30 West, all Principal Meridian, in Lincoln and Sanders counties, Montana.

1.3 Background

1.3.1 Mineral Rights

On January 1, 1984, the CMW was withdrawn from mineral entry under provisions of the Wilderness Act, subject to valid existing rights. The Wilderness Act requires federal agencies, such as the KNF, to ensure that valid rights exist before approving mineral activities inside a congressionally designated wilderness. To establish valid existing rights, mining claimants must show they have made a discovery of a valuable mineral deposit on the claim(s) before the withdrawal date, and have maintained that discovery.

The discovery of mineral deposits for the Montanore Project dates back to the early 1980s. In 1980, Heidelberg Silver Mining Company (Heidelberg) located certain mining claims in Sections 29 and 30 of Township 27N, Range 31 West, P.M., Sanders County, Montana. Subsequently, in 1983, Pacific Coast Mines, Inc. (Pacific), a subsidiary of U.S. Borax and Chemical Corporation, located other mining claims in Sections 29 and 30, Township 27N, Range 31 West, P.M., Sanders County, Montana. The mining claims located by Pacific in 1983 included the lode mining claims HR (Hayes Ridge) 133 and HR 134 adjacent to Rock Lake. (These claims are shown on Figure 11.) This outcrop contained stratabound copper-silver mineralization, extending over a 200-foot vertical thickness.

The deposit is part of the Rock Creek-Montanore deposit, as described by Boleneus *et al*. (2005). The Rock Creek-Montanore deposit has two sub-deposits, the Rock Lake sub-deposit, which was discovered by Pacific, and the Rock Creek sub-deposit, which is proposed to be mined by RC Resources, Inc., a wholly owned subsidiary of Revett Silver Company. The Rock Creek portion of the deposit is separated from the Montanore (Rock Lake) portion by the Rock Lake Fault. Exploration drilling was conducted across the deposit in 1983 and 1984.

In 1984, Pacific leased Heidelberg's mining claims pursuant to the terms of a 1984 Lease and Option to Purchase Agreement (Lease Agreement). Subsequently, in 1988, Heidelberg was merged into Newhi, Inc. (Newhi), a subsidiary of Mines Management, Inc. (MMI). As a result of that merger, Newhi became the successor in interest to Heidelberg under the Lease Agreement. Also in 1988, Pacific assigned its interest in HR 133 and HR 134 and its interest in the Lease Agreement to Noranda Minerals Corporation (NMC), a Delaware based corporation and wholly owned subsidiary of Noranda Finance Inc. (Noranda Finance), part of Noranda, Inc.

In 1991, NMC filed an application with the Bureau of Land Management (BLM) for patent of the HR 133 and HR 134 mining claims (Patent Application MTM 80435). In 1993, the Forest Service issued a Mining Claim Validity Report recommending to BLM that a patent be issued to NMC for HR 133 and HR 134. In 2001, the BLM issued a patent to NMC for the portion of HR 134 that lies outside the CMW (Patent Number 25-2001-0140). The BLM issued a separate patent to NMC for the mineral deposits for HR 133 and the portion of HR 134 that lies inside the CMW (Patent Number 25-2001-0141). These two claims straddle the CMW boundary, and cover 22 acres inside the CMW, for which NMC received only the rights to the mineral estate with the federal government retaining the surface rights, and 14.5 acres outside the CMW, for which NMC received fee title (surface and mineral rights). These patented mining claims contain the surface exposure of the ore body proposed for mining by the Montanore Project. The ore body extends north of the patented claims.

In 2002, NMC terminated the Lease Agreement with Newhi. Pursuant to the terms of that agreement, NMC conveyed its interest in HR 133 and HR 134 to Newhi. In 2006, Newhi acquired all of the issued and outstanding shares of NMC. Immediately following the acquisition of NMC, NMC's name was changed to Montanore Minerals Corporation (MMC). MMI has unpatented lode mining claims, mill site claims, and tunnel claims on National Forest System lands that cover the proposed mine development east of the CMW in the Libby Creek drainage.

1.3.2 Previous Permitting and Approvals

1.3.2.1 General Mine and Transmission Line Approvals

The permitting process for the Montanore Project began in 1989 when NMC obtained an exploration license from the Montana Department of State Lands (DSL) and other associated permits for construction of an exploration adit from private land in upper Libby Creek. Soon after obtaining the exploration license, NMC began excavating the Libby Adit. NMC also submitted a "Petition for Change in Quality of Ambient Waters" (Petition) to the Board of Health and Environmental Sciences (BHES) requesting an increase in the concentration of select constituents in surface water and groundwater above ambient water quality, as required by Montana's 1971 nondegradation statute. After constructing 14,000 feet of the Libby Adit, NMC ceased construction in 1991 in response to elevated nitrate concentration in surface water and low metal prices.

Although construction ceased in 1991, the permitting process continued. Specifically, the KNF, the Montana Department of Health and Environmental Sciences (DHES), the Montana Department of Natural Resources and Conservation (DNRC), and the DSL, DEQ's predecessor agency, prepared a Draft, Supplemental Draft, and Final EIS on the proposed project. The environmental review process culminated in 1992 with BHES's issuance of an Order approving NMC's Petition (BHES 1992) and the DSL's issuance of a Record of Decision (ROD) and DEQ Operating Permit #00150 (DSL 1992) to NMC. In 1993, the KNF issued its ROD (USDA Forest Service 1993a), the DNRC issued a Certificate of Environmental Compatibility and Public Need under the Major Facility Siting Act (MFSA) (DNRC 1993), and the Corps issued a 404 permit (Corps 1993). These decisions approved mine and transmission line alternatives that allowed for the construction, operation, and reclamation of the project.

1.3.2.2 Water Quality-Related Approvals

The BHES Order, issued to NMC in 1992, authorized degradation and established limits in surface water and groundwater adjacent to the Montanore Project for discharges from the project (BHES 1992). The Order established numeric limits for total dissolved solids, chromium, copper, iron, manganese, and zinc in both surface water and groundwater, nitrate+nitrite in groundwater only, and total inorganic nitrogen (nitrate+nitrite+ammonia) in surface water only. For these parameters, the limits contained in the authorization to degrade apply. For the parameters not covered by the authorization to degrade, the applicable nonsignificance criteria established by the 1994 nondegradation rules apply, unless MMC obtains an authorization to degrade under current statute. Pursuant to BHES's Order, these limits apply to all surface water and groundwater affected by the Montanore Project and remain in effect during the operational life of the mine and for so long thereafter as necessary (BHES 1992). The Order also adopted the modification developed in Alternative 3, Option C, of the Final EIS, addressing surface water and groundwater monitoring, fish tissue analysis, and in-stream biological monitoring. The Order is presented in Appendix A.

The Order also indicates that land application and disposal (LAD) treatment, as then proposed, would satisfy the requirement in Administrative Rules of Montana (ARM) 16.20.631(3) (now ARM 17.30.635(3)) to treat industrial wastes using technology that is the best practicable control technology available, or, if such technology has not been determined by the Environmental Protection Agency (EPA), then the equivalent of secondary treatment as determined by the DEQ. In 1992, the DHES (now DEQ) determined that LAD treatment, with at least 80 percent removal of nitrogen, would satisfy the requirements of ARM 16.20.631(3). The Order requires the DEQ to review design criteria and final engineering plans to determine that at least 80 percent removal of nitrogen would be achieved.

In 1997, the DEQ issued a Montana Pollutant Discharge Elimination System (MPDES) permit to NMC (MT-0030279) to allow discharges of water flowing from the Libby Adit to Libby Creek. Three outfalls were included in the permit: Outfall 001 – percolation pond; Outfall 002 – infiltration system of buried pipes; and Outfall 003 – pipeline outlet to Libby Creek. Surface discharge from the adit ceased in 1998 and water in the adit flowed to the underlying groundwater.

1.3.2.3 Current Status of Existing Permits

As discussed above, NMC conveyed its interests in lode claims HR 133 and HR 134 to Newhi in 2002. By that time, many of NMC's permits for the Montanore Project were relinquished, terminated or expired, such as DEQ's air quality permit, the Corps' 404 permit, KNF's approval, and the State's certification of the transmission line. In 2002, NMC notified the KNF it was relinquishing the authorization to operate and construct the Montanore Project. NMC's DEQ Operating Permit #00150 and MPDES permit remain in effect because reclamation of the Libby Adit was not completed.

In 2004, MMI submitted an application for a hard rock operating permit to the DEQ and a proposed Plan of Operations for the Montanore Project to the KNF. In 2005, MMI also submitted to the DEQ an application for a 230-kV transmission line certificate of compliance and an application for an air quality permit. In 2011, MMC applied to the DEQ to renew the existing MPDES permit and requested the inclusion of five new stormwater outfalls under the permit. In 2011, the DEQ determined the renewal application was complete and administratively extended the permit (ARM 17.30.1313(1)) until MMC receives the renewed permit.

In 2006, Newhi acquired all of the issued and outstanding shares of NMC pursuant to the terms of a Stock Transfer Agreement between Noranda Finance, Newhi, and MMI. Although the name of Noranda Minerals Corporation was changed to Montanore Minerals Corporation (MMC) immediately following Newhi's acquisition of NMC's shares, MMC (formerly NMC) remains the holder of DEQ Operating Permit #00150 and the existing MPDES permit for the Montanore Project. Following the acquisition of NMC, MMI and MMC advised the agencies that MMC will be the owner and operator of the Montanore Project. Consistent with that indication, Newhi has re-conveyed HR 133 and HR 134 to MMC, and MMI and MMC have requested that the DEQ consider MMI's application for a hard rock operating permit as an application by MMC to modify the DEQ Operating Permit #00150 (Klepfer Mining Services 2008a). MMC submitted an updated Plan of Operations to the agencies in 2008 that clarified differences between the 2005 Plan of

Operations and DEQ Operating Permit #00150. It also incorporated plans required by DEQ Operating Permit #00150 and additional environmental data collected since 2005 (MMC 2008).

The DEQ renewed the MPDES permit in 2006. A minor modification of the MPDES permit in 2008 reflected an owner/operator name change from NMC to MMC. In 2011, MMC applied to the DEQ to renew the existing MPDES permit and requested the inclusion under the permit of five new stormwater outfalls needed in Alternative 3 for the next 5 years. In 2011, the DEQ determined the renewal application was complete and administratively extended the permit (ARM 17.30.1313(1)) until MMC receives the renewed permit. Other outfalls may be identified during the MPDES permitting process.

1.3.2.4 Libby Adit Evaluation Drilling Program

In 2006, MMC submitted, and the DEQ approved, two requests for minor revisions to DEQ Operating Permit #00150 (MR 06-001 and MR 06-002). The revisions involved reopening the Libby Adit and re-initiating the evaluation drilling program that NMC began in 1989. The key elements of the revisions include: excavation of the Libby Adit portal; initiation of water treatability analyses; installation of ancillary facilities; dewatering of the Libby Adit decline; extension of the current drift; and underground drilling and sample collection.

Under the revisions, the Libby Adit would be dewatered and water would be treated before discharging to one of three MPDES permitted outfalls. The Libby Adit would be rehabilitated and the drift extended 3,300 feet. An additional 7,100 feet including 16 drill stations would be developed under the currently defined ore zones. An estimated 545,300 tons (246,000 cubic yards) of waste rock would be generated and stored at the Libby Adit site.

The evaluation drilling program (MR 06-002) is designed to delineate the first 5 years of planned production. An estimated 35,000 feet of primary drilling and 12,800 feet of infill drilling are planned. The drill core would be used to support resource modeling, mine planning, metallurgical testing, preliminary hydrology assessment, and rock mechanic studies for the full Montanore Project. If adit closure and site reclamation were necessary after completion of the evaluation drilling program, MMC would install a concrete-reinforced hydraulic plug in bedrock, reconstruct the original adit plug, remove all surface facilities, and regrade and revegetate the disturbed areas. Additional information about the evaluation drilling program and site operations and reclamation can be found in MMC’s submittal, Notification to Resume Suspended Exploration and Drilling Activities for the Montanore Project (MMC 2006), on file with the lead agencies.

In 2008, the KNF decided the best approach for disclosing the environmental effects of the Libby Adit evaluation program was to consider this activity as the initial phase of the overall Montanore Project in this EIS. The Libby Adit evaluation program would be the first phase of the Montanore Project in Alternatives 3 and 4.

1.4 Proposed Action

The 2005 Plan of Operations is considered as a new proposed Plan of Operations by the KNF because NMC relinquished the federal authorization to construct and operate the Montanore Project in 2002. Both the KNF and the DEQ consider MMC’s proposed 230-kV North Miller Creek transmission line to be part of the Proposed Action as the 1993 Certificate of Environmental Compatibility and Public Need for the 230-kV transmission line expired.

As proposed by MMC, the Montanore Project would consist initially of a 12,500-tons-per-day underground mining operation that would expand to a 20,000-tons-per-day rate. The surface mill would be located on National Forest System lands outside of the CMW in the Ramsey Creek drainage. The proposed project also would require constructing about 16 miles of high-voltage electric transmission line from a new substation adjacent to Bonneville Power Administration's (BPA) Noxon-Libby 230-kV Transmission Line to the project site. The Noxon-Libby 230-kV Transmission Line would be looped into the new ring bus substation named the Sedlak Park Substation at the tap point. BPA would design, construct, own, operate, and maintain the substation and loop line, and BPA's customer, Flathead Electric Cooperative, would provide power to MMC at that location. MMC would own and operate the 16-mile-long, 230-kV transmission line from the tap point to the project site. MMC's proposed 230-kV transmission line would be routed from the Sedlak Park Substation along US 2, and then up the Miller Creek drainage to the project site. The location of the proposed project facilities is shown on Figure 2.

The ore body would be accessed from two adits adjacent to the mill. Two other adits, an evaluation/ventilation adit and a ventilation adit, both with entrances located on private land, also would be used during the project. The evaluation/ventilation adit would be located in the upper Libby Creek drainage; the ventilation adit would be located on MMC's private land (patented claim HR 134) in the upper East Fork Rock Creek drainage near Rock Lake.

The mineralized resource associated with the Montanore subdeposit is about 135 million tons. MMC anticipates mining up to 120 million tons. Ore would be crushed underground and conveyed to the surface mill located near the Ramsey Adits. Copper and silver minerals would be removed from the ore by a flotation process. Tailings from the milling process would be transported through a pipeline to a tailings impoundment located in the Little Cherry Creek drainage, about 4 miles from the proposed plant site.

Access to the mine and all surface facilities would be via US 2 and the existing National Forest System road #278, the Bear Creek Road. (Road names and numbers are used interchangeably in this EIS; a complete list of all road names and numbers is in Appendix B) MMC would upgrade 11 miles of the Bear Creek Road, and build 1.7 miles of new road between the Little Cherry Creek Impoundment Site and the Ramsey Plant Site. Silver/copper concentrate from the mill would be transported by truck to a rail siding in Libby, Montana. The concentrate would then be shipped by rail to an out-of-state smelting facility.

Mining operations would continue for an estimated 16 years once facility development was completed and actual mining operations started. Three additional years may be needed to mine 120 million tons. The mill would operate on a three-shifts-per-day, seven-days-per-week, year-long schedule. At full production, an estimated 7 million tons of ore would be produced annually during a 350-day production year. Employment numbers are estimated to be 450 people at full production. An annual payroll of $12 million is projected for full production periods.

As proposed, the mine operating permit area would be 3,628 acres and the disturbance area would be 2,582 acres. The operating permit area would include 443 acres of private land owned by MMC for the proposed mine and associated facilities. All surface disturbances would be outside the CMW. MMC has developed a reclamation plan to reclaim the disturbed areas following the phases associated with evaluation, construction, operations, and mine closure. MMC's proposal is described in section 2.4, *Alternative 2—MMC's Proposed Mine*.

With minor exceptions, MMC proposes to construct, operate, and reclaim a new mine and transmission line in accordance with the terms and conditions of DEQ Operating Permit #00150 and in accordance with the terms and conditions of the other agencies' permits and approvals issued to NMC in 1992 and 1993. As indicated earlier, MMC and MMI have requested that the DEQ consider MMI's application for a hard rock operating permit as an application by MMC for modification to DEQ Operating Permit #00150, pursuant to ARM 17.24.119(3) (Klepfer Mining Service 2008a). MMC's requested changes to DEQ Operating Permit #00150 are:

- Construction of an additional underground ventilation infrastructure that would result in an acre of disturbance on private land near Rock Lake
- Relocation of the concentrate loadout facility to the Kootenai Business Park located in Libby (private land) resulting in less than 1 acre of disturbance
- Installation of a buried powerline along the Bear Creek Road (NFS road #278), which would be reconstructed for access
- Construction of a temporary electrical substation adjacent to the Ramsey Creek Road (NFS road #4781), which would be reconstructed for access
- A change in the construction technique proposed for the Little Cherry Creek Impoundment from downstream to centerline construction
- Installation of a water pipeline from the Libby Adit to the LAD Areas
- Changes required to conform DEQ Operating Permit #00150 to the alternative selected by the KNF in its ROD.

MMC and the DEQ agreed to hold the request for modification to the permit in abeyance until completion of the environmental review process.

Each mine and transmission line alternative would require an amendment to the Kootenai Forest Plan (KFP) for the alternative to be consistent with the KFP. The amendment would be completed in accordance with the regulations governing Forest Plan amendments found in 36 CFR 219 and FSM 1921.03. The analysis disclosed in this EIS satisfies the requirements for an evaluation for the amendment. The proposed KFP amendments are described in section 2.12*, Forest Plan Amendment*.

1.5 Purpose and Need

The following sections briefly describe the underlying purpose and need to which each major permitting agency (KNF, DEQ, BPA, and Corps) is responding in proposing the alternatives, including the Proposed Action (40 CFR 1502.13). MMC's project purpose and need also is discussed. Purpose(s) and need(s) are used to define the range of alternatives analyzed in the EIS. Each agency's statutory authorities and policies determine its underlying purpose and need. The KNF's and DEQ's overall purpose and need is to process MMC's proposed Plan of Operations to develop the Montanore copper and silver deposit, application for a modification to DEQ Operating Permit #00150, application for a transmission line certificate of compliance, and other permit applications, and to follow all applicable laws, regulations, and policies pertaining to each pending application. The BPA's need is to improve its transmission system to ensure continued reliable electric power to its customer, Flathead Electric Cooperative, and its purposes are to minimize costs while meeting BPA's long-term system planning objectives for the area, and to minimize impacts on the human environment through site selection and design.

1.5.1 Kootenai National Forest

As discussed previously, the Forest Service verified in 1985 and 1993 that valid rights to the minerals patented on HR 133 and HR 134 claims have been established within the CMW. Those rights are currently held by MMC. The role of the KNF under its primary authorities in the Organic Administration Act, Locatable Regulations 36 CFR 228 Subpart A, and the Multiple Use Mining Act is to ensure that mining activities minimize adverse environmental effects on National Forest System lands and comply with all applicable laws. The KNF has no authority to unreasonably circumscribe or prohibit reasonably necessary activities under the General Mining Law that are otherwise lawful. Through the Mining and Mineral Policy Act, Congress has stated it is the continuing policy of the federal government, in the national interest, to foster and encourage private enterprise in:

- The development of economically sound and stable domestic mining, minerals, and metal and mineral reclamation industries
- The orderly and economic development of domestic mineral resources, reserves, and reclamation of metals and minerals to help assure satisfaction of industrial, security, and environmental needs

MMC is asserting its right under the General Mining Law to mine the mineral deposit and remove the copper and silver, subject to regulatory laws. From the perspective of the Forest Service, the need is to:

- Respond to MMC's proposed Plan of Operations to develop the Montanore copper and silver deposit
- Ensure the alternative selected in the ROD would comply with other applicable federal and state laws and regulations
- Ensure the alternative selected in the ROD, where feasible, would minimize adverse environmental impacts on National Forest System surface resources
- Ensure measures would be included, where practicable, that provide for reclamation of the surface disturbance

1.5.2 U.S. Army Corps of Engineers

1.5.2.1 Basic Project Purpose

In accordance with the Clean Water Act, the Corps is required to consider and express the activity's underlying purpose and need from the applicant's and public's perspectives (33 CFR 325). From the Corps' perspective, the basic project purpose is to provide copper and silver to meet a portion of current and future public demands. Under the Guidelines, the Corps uses the basic project purpose to determine if a project is "water dependent." A project is water dependent if it must be located in, or in close proximity to, a water of the U.S. to fulfill its basic purpose. Providing copper and silver is not a water dependent activity. For projects that are not water dependent, practicable alternatives that do not involve special aquatic sites, such as wetlands, are presumed to be available. The 404(b)(1) Guidelines are discussed in more detail in section 2.13, *Alternatives Analysis and Rationale for Alternatives Considered but Eliminated.*

1.5.2.2 Overall Project Purpose

The overall project purpose is more specific to the applicant's proposed project than the basic project purpose. The overall project purpose is used for evaluating practicable alternatives under the 404(b)(1) Guidelines. The overall project purpose must be specific enough to define the applicant's needs, but not so restrictive as to preclude discussion of a range of alternatives. Defining the overall project purpose is the Corps' responsibility; the applicant's needs are considered in the context of the desired geographic area of the development and the type of project being proposed. From the Corps' perspective, the overall project purpose is to extract copper and silver from ore in northwestern Montana in order to meet demand.

1.5.2.3 Project Need

Over the past decade, global demand for copper and silver generally has been on an upward trend. The proposed project would partially fulfill society's demand for these commodities. The following sections discuss the demand and supply for copper and silver.

Because of its properties of thermal and electrical conductivity, malleability, and resistance to corrosion, copper has become a major industrial metal, ranking third after iron and aluminum in terms of quantities consumed. In 2012, building construction was the single largest market for copper, followed by electric and electronic products, transportation equipment, consumer and general products, and industrial machinery and equipment. Domestic (U.S.) consumption of copper in 2012 (1.7 million metric tons) exceeded domestic production (1.2 metric tons), a pattern that has existed for over 10 years. In 2012, the principal domestic mining states, in descending order of production—Arizona, Utah, New Mexico, Nevada, and Montana—accounted for 99 percent of domestic copper production; copper also was recovered at mines in three other states. Copper in all recycled scrap contributed about 33 percent of the U.S. copper supply (USGS 2013). China remained the largest worldwide copper user. Copper byproducts from manufacturing and obsolete copper products are readily recycled and contribute significantly to copper supply (USGS 2013). Average U.S. imports of copper over the past 5 years were 31 percent of apparent consumption. Chile and Canada provided 75 percent of copper imported into the U.S. between 2008 and 2011 (USGS 2013).

Of all the metals, pure silver has the whitest color, the highest optical reflectivity, and the highest thermal and electrical conductivity. Demand for silver is generated by four primary uses: electrical and electronics, coins and metals, photography, and jewelry and silverware. Together, these four categories represented 78 percent of annual silver consumption in 2012. Domestic (U.S.) consumption of silver in 2012 (190 million Troy ounces) exceeded domestic mine production (34 million Troy ounces), a pattern that has existed for over 10 years (USGS 2013). In 2012, new mine production provided about 75 percent of the world silver demand, with old scrap providing 20 percent (The Silver Institute 2013).

Mine production of silver in the U.S. over the past 20 years peaked in 2000 at 64 million troy ounces (USGS 2001), decreasing to 34 million troy ounces in 2012 (USGS 2013). In 2012, Alaska and Nevada were the leading U.S. silver producers. Average U.S. imports of silver over the past 5 years were 61 percent of apparent consumption. Mexico and Canada provided 74 percent of silver imported into the U.S. between 2008 and 2011 (USGS 2013).

1.5.3 Bonneville Power Administration

The BPA is a federal power marketing agency that owns and operates more than 15,000 circuit miles of transmission lines in the Pacific Northwest. The transmission lines carry most of the high voltage electricity (230-kV and above) from the resources of the federal Columbia River Power system and other interconnected private and federal projects. BPA's customers include publicly owned power marketers (public utility districts), municipalities, investor-owned utilities, and large direct service industries. The utility customers, in turn provide electricity to industry, homes, businesses, and farms.

BPA's transmission system in northwestern Montana provides reliable power to BPA's customers, including Flathead Electric Cooperative. BPA has a need therefore to improve its transmission system to ensure continued reliable electrical power for all of its customers. BPA's purposes are goals to be achieved while meeting the need for the project; the goals are used to evaluate the alternatives proposed to meet the need. Therefore, BPA will use the following purposes to choose among the alternatives:

- Increase BPA system capacity while maintaining BPA transmission system reliability
- Maintain environmental quality
- Minimize impacts on the human environment through site selection and design
- Minimize costs while meeting BPA's long-term transmission system planning objectives for the area

1.5.4 Montana Department of Environmental Quality

The Montana Environmental Policy Act (MEPA) and its implementing rules, ARM 17.4.201 *et seq*., require that EISs prepared by state agencies include a description of the purpose and benefits of the proposed project. MMC's project purpose is described in section 1.5.5, *Montanore Minerals Corporation*. Benefits of the proposed project include the production of copper and silver to help meet public demand for these minerals. The project would increase employment and tax payments in the project area. Employment and taxes are addressed in section 3.18, *Social/Economics*. Although the proposed project would help meet public demand for copper and silver, that topic is outside the scope of this EIS and is not addressed in Chapter 3.

The MFSA and an implementing rule, ARM 17.20.920, require that an application for an electric transmission line contain an explanation of the need for the facility. No electrical distribution system is near the project area. The nearest electrical distribution line parallels US 2 and it is not adequate to carry the electrical power required by the project. As discussed in Chapter 2, the lead agencies considered, but eliminated from detailed analysis, alternatives other than a new transmission line. A new transmission line is needed to supply electrical power to construct, operate, and reclaim the proposed mine facilities.

1.5.5 Montanore Minerals Corporation

MMC's project purpose is to develop the Rock Lake copper and silver deposit by underground mining methods with the expectation of making a profit. MMC's need is to receive all necessary governmental authorizations to construct, operate, and reclaim the proposed Montanore Mine, the associated transmission line, and other incidental facilities. MMC proposes to construct, operate, and reclaim the Montanore Project in an environmentally sound manner, subject to reasonable mitigation measures designed to avoid or minimize environmental impacts on the extent practicable.

1.6 Agency Roles, Responsibilities, and Decisions

Two "lead" agencies are responsible for the analysis of this project: the KNF and the DEQ. The cooperating agencies, the Corps, BPA, and Lincoln County, provided technical assistance as needed. A single EIS for the Montanore Project is being prepared to provide a coordinated and comprehensive analysis of potential environmental impacts. Before construction and operation of the proposed project could begin, various other permits, certificates, licenses, or approvals will be required from the two lead agencies and other agencies (see Table 5 at the end of this chapter). Table 5 is not a comprehensive list of all permits, certificates, or approvals needed, but lists the primary federal, state, and local agencies with permitting responsibilities. The roles and responsibilities of the agencies with primary environmental permitting and regulatory responsibilities are discussed in the following sections.

The major decisions to be made by the lead agencies and by other agencies are discussed briefly in this section. Federal and state agency decision-making is governed by regulations. Each agency's regulations provide the conditions that the project must meet to obtain the necessary permits, approvals, or licenses and provide the conditions under which the agency could deny MMC the necessary permits or approvals.

1.6.1 Federal Agencies

1.6.1.1 Kootenai National Forest

1.6.1.1.1 Applicable Laws and Regulations

Most of the proposed permit areas would be on National Forest System lands managed by the KNF. The KNF is obligated under certain laws, regulations, and 1987 KFP direction to evaluate and take action on MMC's request to operate a mine, mill, and auxiliary facilities on National Forest System lands and associated private lands. The applicable major laws are summarized below:

- **1872 General Mining Law**—This law gives U.S. citizens the right to explore, locate mining claims, make discoveries, patent claims, and develop mines on National Forest System lands open to mineral entry.
- **1897 Organic Administration Act**—This act authorizes the Forest Service to regulate use and occupancy, such as mineral operations, on National Forest System lands. The Forest Service's locatable minerals regulations are promulgated at 36 CFR 228, Subpart A. These regulations require that a proposed Plan of Operations be submitted for activities that could result in significant disturbance to National Forest System surface resources.
- **1955 Multiple-Use Mining Act**—This act affirms that unpatented mining claims may be used for prospecting, mine processing, and uses reasonably incident thereto and reinforces Forest Service authority to ensure mining activities are restricted to these uses.

- **1964 Wilderness Act**—This act allows mineral exploration and development under the General Mining Law to occur in wilderness to the same extent as before the Wilderness Act until December 31, 1983, when the Wilderness Act withdrew the CMW from mineral entry, subject to valid and existing rights. Holders of mining claims with valid existing rights within National Forest Wilderness are accorded the rights provided by the United States mining laws. Mining operations and access are subject to the 36 CFR 228 Subpart A regulations.
- **1970 National Mining and Minerals Policy Act**—This act states that the continuing policy of the Federal Government to foster and encourage private enterprise in the development of economically sound and stable domestic mining and mineral industries and the orderly and economic development of domestic mineral resources.
- **1972 Federal Water Pollution Control Act (Clean Water Act)**—This act as amended, is to protect and improve the quality of water resources and maintain their beneficial uses. Proposed mining activities on National Forest System lands are subject to compliance with Clean Water Act Sections 401, 402, and 404 as applicable.

  The DEQ, EPA, and the Corps all have regulatory, compliance and enforcement responsibilities under the Clean Water Act. If the proposed mining activity may result in any discharge into the navigable waters, the mining operator must obtain a 401 certification from the designated Clean Water Act entity. Pursuant to the Clean Water Act, MMC must obtain a 401 certification from the DEQ for proposed discharges into the navigable waters unless the DEQ waives its issuance (see section 1.6.2.1, *Montana Department of Environmental Quality*).The 401 certification from the Montana DEQ certifies that the operator's proposed discharges of fill permitted under a Section 404 permit are in compliance with all applicable water quality requirements of the Clear Water Act. Unless the 401 certification is waived, the mining operator must give a copy of the 401 certification to the Forest Service before the KNF can authorize the operator to commence any activity that requires a 404 permit.
- The EPA has delegated responsibility for Section 402 of the Clean Water Act, which covers surface water discharges, to the DEQ (see section 1.6.2.1, *Montana Department of Environmental Quality*).
- **1973 Endangered Species Act (ESA)**—The KNF is required by this act to ensure that any actions it approves will not jeopardize the continued existence of a threatened or endangered (T&E) species or result in the destruction or adverse modification of critical habitat. The Forest Service prepared biological assessments (BAs) that evaluates the potential effect of the proposed project on T&E species, including measures the Forest Service would require to minimize or compensate for effects. The KNF submitted the BAs to the U.S. Fish and Wildlife Service (USFWS) for review and consultation in 2011. The BAs were revised in 2013 to provide additional information about the project and to make them consistent with current regulatory requirements (USDA Forest Service 2013a, 2013b).

- **1976 National Forest Management Act**—This act requires the KNF to provide for the diversity of plant and animal communities. KFP standards for wildlife state that the maintenance of viable populations of existing native and desirable non-native vertebrate species, as monitored through indicator species, will be attained through the maintenance of a diversity of plant communities and habitats. It is Forest Service policy (FSM 2670) that biological evaluations (BE) be conducted to determine potential effects on Forest Service sensitive species designated by the Regional Forester. If the BE identifies any effects that would likely create a trend toward federal listing or cause a loss of viability to the population or species, the KNF Supervisor could not approve the Plan of Operations.
- **1980 Alaska National Interest Lands Conservation Act—**This act directed the KNF to provide access to non-federally-owned land (which includes patented claims and private mineral estates) within the boundaries of National Forest System lands, allowing landowners reasonable use and enjoyment of their property.
- **1987 Kootenai Forest Plan and EIS**—This plan includes management direction to encourage responsible development of mineral resources in a manner that recognizes national and local needs and provides for economically and environmentally sound exploration, extraction, and reclamation (KFP Vol. 1, II-2, # 11). The objective of the KFP for mining activities is to encourage mineral development under the appropriate laws and regulations and according to the direction established by the plan (KFP Vol. 1, II-8, Locatables). The Montanore Project analysis tiers to the 1987 Forest Plan Final Environmental Impact Statement (USDA Forest Service 1987b) and all amendments, including the 2013 Final EIS for the Revised Land Management Plan (USDA Forest Service 2013c).
- **Title 36, Code of Federal Regulations, Part 228, Subpart A**—These regulations (36 CFR 228, Subpart A) provide rules and procedures for conducting locatable mineral operations on National Forest System lands. The regulations apply to operations conducted under the U.S. mining laws as they affect surface resources on National Forest System lands under the jurisdiction of the Secretary of Agriculture. Operations are defined as all functions, work, and activities in conjunction with prospecting, exploration, development, mining or processing of mineral resources, and all uses reasonably incident thereto, including roads and other means of access on lands subject to the regulation in this part, regardless of whether said operations take place on or off mining claims (36 CFR 228.3(a)). Special use permits may be needed if proposed facilities would not be owned or operated by the operator (MMC) or if facilities would remain in place after mining operations are completed, such as a transmission line or radio facilities. Regulations for special uses on National Forest System lands are contained in 36 CFR 251.

  The Forest Service's locatable minerals regulations require that mining activity be conducted, where feasible, to minimize adverse environmental impacts on National Forest surface resources. The KNF and the DEQ would share the responsibility to monitor and inspect the Montanore Project, and would require MMC to post joint reclamation bond to ensure that both federal and state reclamation requirements were met. As stipulated in a 1989 Memorandum of Understanding (MOU) between the Forest Service-Northern Region and the DSL, a joint reclamation bond can be held by the DEQ to ensure compliance with the reclamation plan associated with the operating permit and an approved Plan of Operations. If MMC defaulted on its obligations, the agencies may jointly collect or access the bond or one of the agencies may collect the bond with the concurrence of the other agency. Even if the reclamation bond is collected by one of the agencies, the bond must be expended in a manner that satisfies both federal and state reclamation requirements. The DEQ and the KNF would also require a reclamation bond to be posted for National Forest System lands affected by the transmission line. The DEQ also would require the posting of reclamation bond for private lands affected by the transmission line. Financial assurance is discussed in more detailed in section 1.6.3, *Financial Assurance*.

Kootenai National Forest Responsibilities to Federally Recognized Tribes. Federal agencies have government-to-government responsibilities to consult with federally-recognized American Indian Tribes. Among those tribes are the Confederated Salish and Kootenai Tribes and the Kootenai Tribe of Idaho who have retained off-reservation treaty rights in the project area through the Hellgate Treaty of 1855. The responsibilities of the KNF regarding tribal consultation are found in the following laws and treaties:

- Hellgate Treaty of 1855
- National Historic Preservation Act
- National Environmental Policy Act
- National Forest Management Act
- American Indian Religious Freedom Act
- Archaeological Resources Protection Act
- Native American Graves Protection and Repatriation Act
- Religious Freedom Restoration Act
- Food, Conservation, and Energy Act
- Interior Secretarial Order 3175

As a federal agency, the KNF is subject to Presidential Executive Orders. Applicable Executive Orders are discussed by resource in Chapter 3.

1.6.1.1.2 Decision

The KNF Supervisor will issue a decision on MMC's proposal in a ROD. The decision objective is to select an action that meets the legal rights of MMC, while protecting the environment in compliance with applicable laws, regulations, and policy. The KNF Supervisor will use the EIS process to develop the necessary information to make an informed decision as required by 36 CFR 228, Subpart A. Based on the alternatives developed in the EIS, the KNF will issue a ROD in which one of the following decisions will be made:

- Approval of the Plan of Operations as submitted
- Approval of a Plan of Operations with changes, and the incorporation of mitigations and stipulations that meet the mandates of applicable laws, regulations, and policy
- Notification to MMC that the KNF Supervisor will not approve a Plan of Operations until a revision to the proposed Plan of Operations that meets the mandates of applicable laws and regulations is submitted

The alternative selected by the KNF must meet the purpose of the Forest Service locatable mineral surface management regulations as described in 36 CFR 228, Subpart A and the Mining and Minerals Policy Act.

1.6.1.2 U.S. Fish and Wildlife Service

1.6.1.2.1 Applicable Laws and Regulations

The USFWS has responsibilities under the Endangered Species Act, Migratory Bird Treaty Act, and Bald Eagle Protection Act.

1.6.1.2.2 Decision

In its 2014 Biological Opinion on the grizzly bear, the USFWS indicated that it was the USFWS' biological opinion that the Montanore Project as proposed in the KNF's preferred Mine Alternative 3 and the agencies' preferred Transmission Line Alternative D-R is not likely to jeopardize the continued existence of the grizzly bear (USFWS 2014a). No critical habitat has been designated for this species, and therefore none would be affected. The USFWS concurred with the Forest Service's determination that the project may affect, but is not likely to adversely affect the Canada lynx (USFWS 2014b). The USFWS does not review or provide concurrence on no effect determinations but acknowledged the Forest Service's analysis that the project would have no effect on lynx critical habitat (USFWS 2014b).

In its 2014 Biological Opinion on the bull trout, the USFWS indicated that it was the USFWS' biological opinion that the project as proposed in the Forest Service's preferred Mine Alternative 3 and the agencies' preferred Transmission Line Alternative D-R is not likely to jeopardize the continued existence of the bull trout, and is not likely to destroy or adversely modify bull trout critical habitat (USFWS 2014c). The USFWS does not review or provide concurrence on no effect determinations but acknowledged the Forest Service's analysis that the project would have no effect on the Kootenai River white sturgeon (USFWS 2014b).

Both Biological Opinions concluded that the project would result in "take" as defined under the ESA and included reasonable and prudent measures to reduce the likelihood of incidental take and minimize adverse effects to both bull trout and designated critical habitat. Both Biological Opinions contained terms and conditions that implement the reasonable and prudent measures. The take of one grizzly bear deemed attributable to the mine would trigger re-evaluation of the situation by the USFWS to determine whether additional measures are needed to reduce the potential for future mortality (USFWS 2014a). The USFWS determined that the actual amount or extent of the anticipated incidental take of bull trout due to changes in habitat conditions in the affected streams is unquantifiable (USFWS 2014c).

1.6.1.3 U.S. Army Corps of Engineers

1.6.1.3.1 Applicable Laws and Regulations

MMC's construction of certain project facilities in waters of the U.S., including wetlands and other special aquatic sites, would constitute the disposal of dredged or fill materials. Such activities require a permit from the Corps under Section 404 of the Clean Water Act. MMC submitted a Section 404 permit application to the Corps for the agencies' preferred alternatives (Mine Alternative 3 and Transmission Line Alternative D-R) in 2011 (MMC 2011a). The application described the amount and types of wetlands and other waters of the U.S. that would be affected by proposed facilities. The permit application also included a draft conceptual mitigation plan to mitigate impacts on wetlands and other waters of the U.S. The Corps and the DEQ jointly issued a 60-day public notice on the permit application in 2011. In 2013, MMC submitted a Preliminary Mitigation Design Report for Impacts on Waters of the U.S. for Alternative 3 to Corps (NewFields Companies and Kline Environmental Research 2013). MMC submitted a revised Preliminary Mitigation Design Report in 2014 (MMC 2014a) and a Supplemental Report on the existing conditions of affected streams and wetlands (NewFields Companies and Kline Environmental Research 2014). The Corps will request 401 certification from the DEQ for the proposed discharge (see section 1.6.2.1, *Montana Department of Environmental Quality*). The Corps has the authority to take reasonable measures to inspect Section 404-permitted activities (33 CFR 326.4).

The Corps and the EPA have developed guidelines to evaluate impacts from the disposal of dredged or fill material on waters of the U.S. and to determine compliance with Section 404 of the Clean Water Act (40 CFR 230). The guidelines require analysis of "practicable" alternatives that would not require disposal of dredged or fill material in waters of the U.S., or that would result in less environmental damage. In the guidelines, the term "practicable" is defined as "available or capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes." The Corps can only permit the least environmentally damaging practicable alternative.

1.6.1.3.2 Decision

The Corps will decide whether to issue a 404 permit based on MMC's 404 permit application. The Corps can deny a Section 404 permit if the project would not comply with the 404(b)(1) Guidelines (40 CFR 230.10), or if the permit issuance would be contrary to the public interest (33 CFR 320.4). If the Corps decides to issue a Section 404 permit, it will issue a ROD or a Statement of Findings concurrently with the permit.

1.6.1.4 Bonneville Power Administration

1.6.1.4.1 Applicable Laws and Regulations

A number of federal laws and regulations address open access to BPA's transmission system, including (i) the Bonneville Project Act, which gives preference and priority in power sales to public bodies and cooperatives; (ii) the Flood Control Act, which specifies that the Secretary of the Interior (now the Secretary of the Energy) must transmit and dispose of power/energy in a way that encourages widespread use of the power/energy and is sold at the lowest possible rates consistent with sound business principles; (iii) the Pacific Northwest Power Act, which requires BPA "whenever requested" to meet the net requirements of Northwest utilities; and (iv) the Columbia River Transmission System Act, which requires the BPA administrator to make available to all utilities on a fair and nondiscriminatory basis transmission system capacity not needed to transmit federal power. The BPA would provide a 230-kV power source from its Noxon-Libby 230-kV transmission line to its customer Flathead Electric Cooperative at the proposed Sedlak Park Substation. Under the new large single load provisions of the Northwest Power Planning and Conservation Act, the BPA is prohibited from providing power directly to the project. Flathead Electric Cooperative could serve the proposed mine under its existing power sales contract with BPA. The BPA would design construct, own, operate, and maintain the substation and the loop line, which would be paid for by MMC. The substation would be located at Sedlak Park.

1.6.1.4.2 Decision

Before deciding to provide electrical power to Flathead Electric Cooperative for MMC's project, the BPA will prepare a decision document for its part of the project. The BPA can deny approval for the electrical transmission line connection if significant environmental impacts at the connection location would occur, or if the interconnected electrical system would not allow adequate service to the mine and existing electrical customers if the mine were approved.

1.6.1.5 Environmental Protection Agency

The EPA has responsibilities under the Clean Air Act to review Draft EISs and federal actions potentially affecting the quality of the environment. The EPA evaluates the adequacy of information in Draft EISs, and the overall environmental impact of the Proposed Action and alternatives. The EPA also reviews 404 permit applications and provides comments to the Corps, and has veto authority under the Clean Water Act for decisions made by the Corps on 404 permit applications. The EPA has oversight responsibility for Clean Water Act programs delegated to and administered by the DEQ. The EPA may also intervene to resolve interstate disputes if discharges of pollutants in an upstream state may affect water quality in a downstream state.

1.6.2 State and County Agencies

1.6.2.1 Montana Department of Environmental Quality

1.6.2.1.1 Applicable Laws and Rules

The Montana legislature has passed statutes and the Board of Environmental Review has adopted administrative rules defining the requirements for construction, operations, and reclamation of a mine and transmission line, discharge of mining waters, discharge of emissions, storage of hazardous and solid wastes, and development and operation of public water supply and sewer systems. The DEQ is required to evaluate the operating permit modification, certificate, and license applications submitted by MMC under the following major laws and regulations:

- MEPA requires the state to conduct an environmental review when making decisions or planning activities that may have a significant impact on the environment. The MEPA and its rules define the process to be followed when preparing an EIS.
- The Montana Metal Mine Reclamation Act (MMRA) requires an approved operating permit for all mining activities that have more than 5 acres of land disturbed and unreclaimed at any one time. The MMRA sets forth reclamation standards for lands disturbed by mining, generally requiring that they be reclaimed to comparable stability and utility as that of adjacent areas. The MMRA describes the process by which a minor revision or a major amendment to an approved operating permit is reviewed and processed. MMC must also obtain the necessary or modify any existing air and water quality permits. Mines that would have more than 75 employees must also have a valid approved Hard Rock Mining Impact Plan before operations.
- MFSA requires the DEQ to issue a certificate of compliance before construction of certain major facilities, such as the proposed transmission line. Before certification of the proposed transmission line, MMC must also obtain the necessary air and water quality permits.

- The Montana Water Quality Act, through MPDES permits, regulates discharges of pollutants into state surface waters through a permit application process and the adoption of water quality standards. Water quality standards, including the Montana nondegradation policy, specify the changes in surface water or groundwater quality that are allowed from a waste water discharge. A MPDES permit may also include limits for discharges of stormwater and will require the development of a stormwater pollution prevention plan. Montana Ground Water Pollution Control System permits are required for discharges of wastes to state groundwaters. Discharges to groundwater from mining operations subject to operating permits under the Metal Mine Reclamation Act are not subject to groundwater permit requirements (75-5-401(5), MCA).
- The Clean Air Act of Montana requires a permit for the construction, installation, and operation of equipment or facilities that may cause or contribute to air pollution.
- The federal Clean Water Act requires that applicants for federal permits or licenses for activities that may result in a discharge to state waters obtain certification from the state, certifying the discharge complies with state water quality standards. Section 404 permits issued by the Corps require 401 certification. The DEQ provides Section 401 certification pursuant to state regulations (ARM 17.30.101 *et seq.*).
- The Montana Public Water Supply Act regulates public water supply and sewer systems that regularly serve at least 25 persons daily for a period of at least 60 calendar days a year. The DEQ must approve plans and specifications for water supply wells in addition to water systems or treatment systems and sewer systems. Operators for community public water supply, waste water treatment, or sewer systems must be certified by the DEQ.
- The Montana Hazardous Waste Act and the Solid Waste Management Act regulate the storage and disposal of solid and hazardous wastes.

1.6.2.1.2 Decision

DEQ's authority to impose modifications or mitigations without the consent of MMC is limited to modifications necessary for compliance with the MMRA, Montana Water Quality Act, Clean Air Act of Montana, or other state environmental regulatory statutes or rules adopted pursuant to those statutes. The DEQ can impose modifications to the proposed transmission line without MMC's consent under MFSA in accordance with 75-20-301, MCA. Grounds for DEQ denial of the application to modify DEQ Operating Permit #00150 would be a finding that the modification does not provide an acceptable method for accomplishing the reclamation required by the MMRA, or that it conflicts with Montana water and air quality laws. The DEQ must deny the application for a transmission line certificate of compliance if the findings required under 75-20-301 cannot be made.

Compliance with MEPA

The DEQ and the KNF have entered into an agreement describing how each agency will cooperate to fulfill the requirements of MEPA and NEPA. No decision is made under MEPA. The EIS is a disclosure document. All DEQ decisions are made pursuant to specific regulatory requirements. The DEQ is participating in the environmental review of the Montanore Project and may issue a modification to MMC's operating permit to make the federal and state approvals consistent. The DEQ also may issue a certificate of compliance for the proposed transmission line. The DEQ will issue a ROD or certificate containing its decisions pursuant to each project-related permit application. In general, for an application for an operating permit amendment or modification and a transmission line certificate of compliance, three decisions are possible:

- Approval of the application as submitted
- Approval of the application, and the incorporation of mitigations and stipulations that meet the mandates of applicable laws, regulations, and policy
- Denial of the application

Hard Rock Operating Permit

The DEQ Director may make a decision on MMC's application for a modification to DEQ Operating Permit #00150 no sooner than 15 days following publication of the Final EIS. The DEQ may deny the application pursuant to 82-4-351, MCA, if the proposed mine or reclamation plan modification conflicted with the Clean Air Act of Montana, the Montana Water Quality Act, or reclamation standards set forth in the MMRA. The DEQ may also deny the modification based on the compliance standard of an applicant under 82-4-336 and 360, MCA. These sections of the MMRA require permittees to be in compliance at other sites they may have permitted under MMRA, require submittal of ownership and control information, and submittal of an adequate bond.

Transmission Line Certificate of Compliance

For MMC's proposed transmission line, MFSA requires the DEQ Director to determine:

- The basis of the need for the facility
- The nature of the probable environmental impact
- That the facility minimizes adverse environmental impact, considering the state of available technology and the nature and economics of the various alternatives
- In the case of an electric, gas, or liquid transmission line or aqueduct:
- What part, if any, of the line or aqueduct will be located underground
- That the facility is consistent with regional plans for expansion of the appropriate grid of the utility systems serving the state and interconnected utility systems
- That the facility will serve the interests of utility system economy and reliability
- That the location of the facility as proposed conforms to applicable state and local laws and regulations, except that the DEQ may refuse to apply any local law or regulation if it finds that, as applied to the proposed facility, the law or regulation is unreasonably restrictive in view of the existing technology, of factors of cost or economics, or of the needs of consumers, whether located inside or outside the directly affected government subdivisions
- That the facility will serve the public interest, convenience, and necessity
- That the DEQ or board has issued any necessary air or water quality decision, opinion, order, certification, or permit as required by 75-20-216(3)
- That the use of public lands for location of the facility was evaluated and public lands were selected whenever their use is as economically practicable as the use of private lands

This EIS serves as a report required by the MFSA (75-20-216, MCA). DEQ's decision on the transmission line must be made within 30 days after the final report (Final EIS) is released or may be timed to correspond to the ROD issued by a participating federal agency.

Permit Denial

The DEQ must deny certification for a project if the findings in 75-20-301, MCA, or implementing regulations cannot be made or if the transmission line would violate Montana air or water quality standards, based on the DEQ analysis. Without the approval of the mine by the KNF, MMC would likely withdraw the transmission line certificate application because a demonstrated showing of need for the transmission line could not be made. The DEQ may disapprove the transmission line, regardless of actions by other agencies. After issuance of the certificate, any other state or regional agency or municipality or other local government may not require any approval, consent, permit, certificate, or other condition for the construction, operation, or maintenance of a facility except that the DEQ and board retain the authority that they have to determine compliance of the proposed facility with state and federal standards and implementation plans for air and water quality.

Water Quality Permits

MPDES Permit. The status of MMC's existing MPDES permit is described in section 1.3.2.3, *Current Status of Existing Permits*. MPDES permits are required for discharges of wastewater to state surface water or to groundwater hydrologically connected to state surface water. MPDES permits regulate discharges of wastewater by imposing, when applicable, technology-based effluent limits and state surface water quality standards, which include numeric and narrative requirements, nondegradation criteria, and Total Maximum Daily Loads. Montana Ground Water Pollution Control System permits are required for discharges of wastes to state groundwaters. Discharges to groundwater from mining operations subject to operating permits under the MMRA are not subject to groundwater permit requirements (75-5-401(5), MCA).

All Montanore facilities must be designed, constructed, and operated to prevent degradation of surface water or groundwater quality beyond that allowed by and specified in the BHES Order (Appendix A). The DEQ will follow EPA Region 8 guidance when determining types of wastewater as "process," "mine drainage," or "stormwater." The DEQ will use both Technology-Based Effluent Limits (TBEL) and Water Quality-Based Effluent Limits (WQBEL) in MPDES permit development or modification. The more stringent of the two, TBEL or WQBEL, would be applied for each specific parameter and would be the final effluent limit for parameters of concern in the discharge. The DEQ must also consider mixing zone applicability and Total Maximum Daily Loads (TMDL) when applicable.

401 Certification. MMC will submit an application for a 401 certification to the DEQ. The DEQ has 30 days to review MMC's application and supplemental materials, and determine if the application is complete. At a minimum, "completeness" will require the 401 application fee and a complete description of the activity for which certification is sought, including information listed in ARM 17.30.103(2). The DEQ may request other technical information to complete the 401 decision.

Within 30 days of receipt of a complete application, MMC will be notified of the tentative decision to issue a 401 certification (with or without DEQ conditions) or deny the certification. The DEQ will provide public notice of the tentative determination and within 30 days of the close of the comment period make a final 401 certification decision. The DEQ and the Corps jointly issued a 60-day public notice on MMC's Section 404 permit application in 2011. Because MMC had not submitted an application for 401 certification to the DEQ, this public notice is no longer valid for the 401 certification process. The DEQ may deny the 401certification if the discharge would result in a violation of Montana water quality standards. The DEQ may also waive certification if the activity would cause minimal or no effect on state water quality or if the activity would require a MPDES permit.

318 Authorization (formerly 3A Waiver). The DEQ may authorize short-term surface water quality standards for total suspended sediments and turbidity for construction of the powerline, access roads, the tailings impoundment, and other stream crossings (75-5-318, MCA). Any exemption would include conditions that minimize, to the extent practicable, the magnitude of any change in water quality and the length of time during which any change may occur. The authorization also would include site-specific conditions that ensure that the activity is not harmful, detrimental, or injurious to public health and the uses of state waters and that ensure that existing and designated beneficial uses of state water are protected and maintained upon completion of the activity. The DEQ may not authorize short-term narrative standards for activities requiring a discharge permit.

Air Quality Permit

The DEQ will decide whether to issue an Air Quality Permit to control particulate emissions of more than 25 tons per year. In 2006, the DEQ issued a Preliminary Determination on MMC's air quality permit application, which remained as preliminary pending a Final EIS. The DEQ issued a Supplemental Preliminary Determination in 2011 on MMC's updated air quality permit application that primarily addressed the new National Ambient Air Quality Standards (NAAQS) for oxides of nitrogen (NO_x) and sulfur dioxide (SO_2). When an environmental review is completed on the permit application, the final permit or determination may be included in the Final EIS, the ROD, or issued within 180 days after the application is ruled complete.

Public Water Supply and/or Public Sewer System Authorization

The DEQ will decide on issuance of a public water supply and/or public sewer system authorization. This program is responsible for assuring that the public health is maintained through a safe and adequate supply of drinking water. If the public water supply and/or sewer systems are not constructed within 3 years of authorization, a new application must be submitted.

Hazardous Waste Generator/Transporter Permit

The DEQ has adopted hazardous waste regulations that are equivalent to those promulgated by EPA. The DEQ will decide on issuing a permit for generators and transporters of hazardous waste for the Montanore Project. The permit review considers the applicant's record of complaints and convictions for the violation of environmental protection laws for 5 years before the date of the application. The DEQ would consider the number and severity of the violations, the culpability and cooperation of the application, and other factors. Annual registration is required.

1.6.2.2 State Historic Preservation Office

The State Historic Preservation Office (SHPO) advises federal and state agencies when a proposed project could affect eligible or potentially eligible historic properties (historic and prehistoric sites). The SHPO provides federal and state agencies with opinions on all historic properties' eligibility for listing in the National Register of Historic Places. SHPO also provides comments on the determination of effect on eligible historic properties. The KNF, the DEQ, and the SHPO will concur that the alternative selected in the ROD will have: 1) no effect; 2) no adverse effect; or 3) adverse effect on eligible historic properties. The lead agencies would require MMC to implement any protection, mitigation, and monitoring in plans reviewed and approved by the SHPO and possibly the Advisory Council on Historic Preservation. In 2010, the KNF and the SHPO entered into a Programmatic Agreement regarding the protection of historic properties within the Area of Potential Effect (APE) of the Montanore Project.

1.6.2.3 Montana Hard Rock Mining Impact Board

The Hard Rock Mining Impact Act (90-6-301 *et seq*., MCA) is designed to assist local governments in handling financial impacts caused by large-scale mineral development projects. A new mineral development may result in the need for local governments to provide additional services and facilities before mine-related revenues become available. The resulting costs can create a fiscal burden for local taxpayers. The Hard Rock Mining Impact Board (HRMIB), part of the Montana Department of Commerce (DOC), oversees an established process for identifying and mitigating fiscal impacts on local governments through the development of a Hard Rock Mining Impact Plan. Under the Impact Act, each new hard rock mineral development in Montana that would have more than 75 employees is required to prepare a local government fiscal Impact Plan. In the plan, the developer is to identify and commit to pay all increased capital and net operating costs to local government units that will result from the mineral development. A Hard Rock Mining Impact Plan developed for the original Montanore Project was approved in the early 1990s, and that approval was acquired by MMC when it acquired NMC. Because the Montanore Project as currently proposed would change employment projections, MMC submitted an amendment for consideration by the HRMIB. The HRMIB approved the amendment in 2008.

1.6.2.4 Montana Department of Natural Resources and Conservation

1.6.2.4.1 Applicable Laws and Regulations

The DNRC administers the following statutes and regulations that pertain to MMC's proposed mine and transmission line:

- The Montana Water Use Act requires a water rights permit before commencing to construct new or additional diversion, withdrawal, impoundment, or distribution works for appropriations of groundwater or surface water.
- Except for the transmission line, the Montana Flood Plain and Floodway Management Act requires a permit for new construction within a designated 100-year floodplain.
- A Montana land-use license or easement on navigable waters is required for any project on lands below the low water mark of navigable waters.
- The Streamside Management Zone requirements apply to any landowner or operator conducting a series of forest practices that will access, harvest, or regenerate trees on a defined land area for commercial purposes on private, state, or federal lands. Timber harvest is prohibited within 50 feet of any stream, lake, or other body of water.
- Except for the transmission line, a burning permit must be obtained from the DNRC to burn any slash or other material outside the open burning season of October 10 to November 31 and April 1 to May 31.

- The Conservation Districts Bureau of the DNRC administers the Montana Natural Streambed and Land Preservation Act. Any non-governmental entity that proposes to work in or near a stream on public or private land requires a 310 permit for any activity that physically alters or modifies the bed or banks of a perennially flowing stream.
- The Montana Dam Safety Act applies to the construction, repair, operation, and removal of any dam that impounds 50 acre-feet or more at normal operating pool level. This permit will not apply during mine operation, but may apply after mine closure if other safety criteria are not met.

1.6.2.4.2 Decision

Beneficial Water Use Permit

The DNRC will decide on issuance of a beneficial water use permit based on criteria set forth in 85-2-311, MCA. Denial of the permit must follow 85-2-310, MCA. A person having standing to file an objection may do so pursuant to 85-2-309, MCA. Valid objections received by the DNRC pursuant to 85-2-308, MCA, may require that the DNRC hold a contested case hearing pursuant to 2-4-601 *et al*., MCA, on the objection within 90 days from a date set by the DNRC. A person who has exhausted all administrative remedies available within the DNRC and who is aggrieved by a final written decision in a contested case is entitled to judicial review pursuant to 2-4-702, MCA.

Floodplain and Floodway Management Permit

The local floodplain administrator or the DNRC would make a decision on the permit application. The application process may take up to 60 days. DNRC's permit issuance is based on the danger to life and property downstream, availability of alternate locations, possible mitigation to reduce the danger, and the permanence of the obstruction or use (76-5-405, MCA).

DNRC Land Use License or Easement

The DNRC will review the application, conduct a field investigation if necessary, and file an environmental action checklist. A written report and recommendation is then submitted to the Special Use Management Bureau, which makes the final determination and recommends stipulations as necessary. A Land Use License can normally be reviewed, approved, and issued within 60 days upon the payment of the application fee and a minimum annual rental fee set by the DNRC. The license may be held for a maximum period of 10 years, with the ability to request renewal for an additional 10 years. An easement requires approval from the Board of Land Commissioners, which typically takes up to 90 days.

Streamside Management Zone

MMC must comply with the streamside management practices found in 77-5-303, MCA, or submit a request to conduct an alternative practice to the DNRC. Within 10 working days of receipt of the application for approval of alternative practices, the DNRC will determine if the application is approved, approved with modification, disapproved, incomplete, requires additional information or environmental analysis, or requires a field review. If a field review is required, the DNRC will make a decision on the application within 10 days of completing the field review.

Burning Permit

The DNRC Burning Permit outside the open burning season depends on air quality standards set by the DEQ. Review and issuance of the permit is done in coordination with the DEQ and depends on the air quality at the time of the request.

310 Permit

Except for streams affected by the transmission line, the Lincoln County Conservation District must receive a 310 permit application from MMC before activity in or near a perennial-flowing stream. Once an application is accepted, a team that consists of a conservation district representative, a biologist with the Montana Fish, Wildlife and Parks (FWP), and the applicant may conduct an onsite inspection. The team makes recommendations to the Conservation District Board, which has 60 days from the time the application is accepted to approve, modify, or deny the permit.

High Hazard Dam Permit

A high-hazard dam is any dam or reservoir with an impounding capacity of 50 acre-feet or more at the maximum normal operating pool, the failure of which would be likely to cause loss of life. If a mining operation proposes construction of a dam that has an impoundment capacity of 50 acre-feet or more, such as a tailings impoundment dam, the owner must apply to the DNRC's Dam Safety Bureau for hazard classification. The DNRC classifies the hazard of that dam by the potential loss of life downstream if the dam failed. If permitted by the DEQ under a hard-rock operating permit, construction and operation of such a dam would be regulated under MMRA, rather than a DNRC dam safety permit, during mine operation and closure until reclamation bond release. After the agencies released the reclamation bond, the impoundment would be subject to DNRC oversight and regulation if the impoundment met the definition of a high-hazard dam. The reclamation bond would not be released until the impoundment was reclaimed successfully. The DEQ intends that MMC's proposed impoundment meet high hazard dam safety requirements including the preparation of an Operations and Maintenance Plan and Emergency Preparedness Plan that met DNRC requirements, so the transition to regulation under a DNRC permit, if applicable, would be facilitated at mine closure.

1.6.2.5 Montana Fish, Wildlife and Parks

The FWP is responsible for the use, enjoyment, and scientific study of the fish in all state waters. FWP's approval, and designation of a licensed collector as field supervisor, would be required for monitoring, mitigation, and any transplanting of the fish within the project area. The FWP also administers applicable portions of the Stream Protection Act and cooperates with the DEQ in water quality protection.

The FWP also holds a conservation easement on some lands owned by Plum Creek Timberlands LP (Plum Creek) where the transmission line may be sited. The conservation easement was partially funded by the Forest Legacy Program for the purpose of preventing the land from being converted to non-forest uses. One of the stated purposes of the conservation easement is to "preserve and protect in perpetuity the right to practice commercial forest and resource management." Under the terms of the conservation easement, the FWP has reserved the right to prevent any inconsistent activity on or use of the land by Plum Creek or other owner and to require the restoration of any areas or features of the land damaged by such activity or use. Activities and uses prohibited or restricted include installing any natural gas or other pipelines or power transmission lines greater than 25-kV unless the FWP gives prior written approval.

1.6.2.6 Montana Department of Transportation

The Montana Department of Transportation (MDT) is responsible for the safe operation of the state-owned highways and transportation facilities, such as US 2. The MDT is responsible for approving approach roads onto state-owned highways and for approving utilities occupancy within MDT rights-of-way. The MDT reserves the right to modify or deny applications if the design puts the traveling public, the state highway system, or transportation facilities at risk.

1.6.2.7 Lincoln County Weed Board

The Lincoln County Weed Board administers the County Noxious Weed Control Act for any land-disturbing activities within its jurisdiction. MMC is required to submit a weed management plan to the Lincoln County Weed Board for approval.

1.6.3 Financial Assurance

1.6.3.1 Authorities

Pursuant to the Organic Administration Act and regulations adopted thereunder, a mine operator is required to submit a reclamation bond to the Forest Service before the Forest Service may approve a Plan of Operations for the mining activity. Similarly, pursuant to the MMRA and administrative rules adopted thereunder, a mine operator is required to submit a reclamation bond to the DEQ before DEQ may issue an operating permit, an amendment, or modification for the mining activity. The DEQ can also require a bond for the reclamation of transmission line construction disturbances pursuant to the MFSA and administrative rules adopted thereunder. The reclamation bond may not be less than the estimated cost to the Forest Service or the DEQ to ensure compliance with the respective federal and state reclamation requirements. The federal reclamation requirements include compliance with 36 CFR 228, Subpart A. The state reclamation requirements include compliance with the Clean Air Act of Montana, Montana Water Quality Act, the MMRA, the administrative rules adopted under the MMRA, the operating permit, the MFSA, the administrative rules adopted under the MFSA, and the transmission line certificate. Thus, a reclamation bond represents the public's "insurance policy" that reclamation will be performed.

The reclamation bond may be in the form of a surety bond, an irrevocable letter of credit, a certificate of deposit, or cash. The bond for larger mining operations is usually in the form of a surety or irrevocable letter of credit because of the significant financial obligation that reclamation typically represents.

Agency engineers calculate the reclamation bond amount after an alternative has been selected for implementation and a ROD or decision is issued by each agency. In addition, the Forest Service requires that all bonds pertaining to Plans of Operations on National Forest System lands be developed or reviewed by a Certified Locatable Minerals Administrator. The training abilities and required knowledge of the administrator are outlined in FSM, Chapter 2890.

Pursuant to ARM 17.24.140, the total amount of the bond calculated by the DEQ must be in place before the issuance of an operating permit, an amendment, or modification unless the applicable plan identifies phases or increments of disturbance which may be individually identified and for which individual, incremental bonds may be calculated. 36 CFR 228.13 requires submittal of a bond for reclaiming disturbances on National Forest System lands before approval of a Plan of Operations. The bond for the transmission line will be determined after a decision is made and an alternative is selected.

Pursuant to 33 CFR 332.3(n), the Corps requires sufficient financial assurances to ensure a high level of confidence that any compensatory mitigation project permitted under a 404 permit will be successfully completed in accordance with applicable performance standards. In some circumstances, the Corps may determine that financial assurances are not necessary for a compensatory mitigation project. In consultation with the project sponsor, the Corps determines the amount of the required financial assurances, which is based on the size and complexity of the compensatory mitigation project, the degree of completion of the project at the time of project approval, the likelihood of success, the past performance of the project sponsor, and any other factors the Corps deems appropriate. Financial assurances may be in the form of performance bonds, escrow accounts, casualty insurance, letters of credit, legislative appropriations for government sponsored projects, or other appropriate instruments, subject to the Corp's approval. If financial assurances are required, the 404 permit will include a special condition requiring the financial assurances to be in place before commencing the permitted activity. The Corps' financial assurance for 404-permitted mitigation is phased out once the Corps determines mitigation is successful in accordance with the plan's performance standards.

The Forest Service is required to review reclamation bonds annually for adequacy (FSM 2817.24b). Similarly, the DEQ is required to conduct an overview of the amount of each bond annually and a comprehensive bond review at least every 5 years (82-4-338(3), MCA). The DEQ may conduct additional comprehensive bond reviews if, after modification of a reclamation or operating plan, an annual overview, or an inspection of the permit area, the DEQ determines that an increase in the bond level may be necessary. When the existing bonding level of an operating permit or an amendment does not represent the costs of compliance with federal and state reclamation requirements, the DEQ is required to modify the bonding requirements. A complete description of DEQ's bond-review procedure is set forth in section 82-4-338(3), MCA.

A mine operator may propose modifications to its Plan of Operations and operating permit. The proposed modification is reviewed by the agencies and the appropriate level of environmental analysis is performed. If the modification is approved, the agencies then determine whether the modification affects the estimated cost to the Forest Service and the DEQ to ensure compliance with federal and state reclamation requirements. If an increase in bond is required, the operator must submit the additional bond amount before the approved modification can be executed.

There is no specific timeframe for bond release once reclamation activities have been completed. Bond release is performance based, and is granted or denied based on the agencies' evaluation. The Forest Service may not release a bond until the reclamation requirements of 36 CFR 228.8(g) are met. Pursuant to section 82-4-338(4), the DEQ may not release bond until the provisions of the MMRA, its associated administrative rules, and the operating permit have been fulfilled. In addition, pursuant to section 82-4-338(4), MCA, the DEQ is required to provide reasonable statewide and local notice of a proposed bond release or decrease. The DEQ may not release or decrease a reclamation bond unless the public has been provided an opportunity for a hearing and a hearing has been held if requested. All information regarding bond releases and decreases is available to the public upon request.

To avoid requiring a mine operator to submit duplicative bonds, the Forest Service and the DEQ have executed a MOU allowing the agencies to accept a joint bond that satisfies both federal and state reclamation requirements. The reclamation bond may be collected jointly by the agencies or by one of the agencies acting with the concurrence of the other agency. Even if the reclamation bond is collected by one of the agencies, the bond must be expended in a manner that satisfies both federal and state reclamation requirements. To ensure administrative continuity and to conform to the intent of the MOU, the Forest Service as a co-permitting agency has adopted a 5-year schedule for reviewing the sufficiency of the reclamation bond. Guidance for Forest Service bonding can be found in Training Guide for Reclamation Bond Estimation and Administration (USDA Forest Service 2004a).

1.6.3.2 Reclamation Costs

The bond amount is the agencies' estimated cost to complete site reclamation in the event the operator cannot or will not perform the required reclamation. The Plan of Operations submitted by MMC to the Forest Service for approval describes the proposed operation, the types of disturbances which may be expected under the proposed operation, and the reclamation proposed by MMC. During the course of this environmental review, the Forest Service analyzed, in addition to the proposed action alternative, a reasonable range of other alternatives. Additional modifications may be made in the course of developing stipulations to minimize environmental impacts. The Forest Service will identify a selected alternative and stipulations when its ROD for the mine is issued. The DEQ is participating in the environmental review and may issue a modification to MMC's operating permit to make the federal and state approvals consistent and may issue a certificate of compliance for the proposed transmission line. Assuming mining is ultimately approved, the agencies do not have all of the information required to complete a bond calculation until the federal Record of Decision and the state operating permit modification for the mine and the state certificate of compliance for the transmission line have been issued. Therefore, the bond amount will be determined after the Record of Decision, operating permit modification and certificate of compliance have been issued, and will be based on the information and requirements contained in the Record of Decision, operating permit modification and certificate of compliance. Until these decisions are issued, bond amounts based on alternatives presented in the EIS would be based on incomplete information and may be misleading.

Reclamation at the Montanore Project would not be limited to near-term reclamation activities such as facilities removal, site regrading, and revegetation. The reclamation may include requirements to collect and treat mine-impacted waters, and site maintenance and monitoring for as long as necessary to ensure the protection of environmental resources.

The bond calculation can be divided into two parts. The first part of the calculation addresses reclamation tasks that can be completed soon after cessation of mining operations. Table 1 (all tables are at the end of this chapter) represents a typical bond summary sheet, which outlines both direct costs and indirect costs. Table 2 depicts a representative list of direct cost reclamation items specific to the Montanore Project, which would be reclaimed soon after mine closure. These reclamation items are referenced in the Plan of Operations and operating permit. A complete list of reclamation items would be developed once the Record of Decision is signed and the Plan of Operation is updated.

The indirect costs in Table 1 are calculated as a percentage of the direct costs, and they represent costs common to any mine closure project where the agencies assume responsibility for reclamation. Bonds are typically recalculated every 5 years (see Section 1.6.3.1, *Authorities*), and an inflation factor is applied to the direct costs to account for cost increases over this intervening 5-year period.

The second part of the calculation addresses water treatment and long-term monitoring, which may continue for many years after mine closure (Table 3 and Table 4). Separating the cost estimates into two calculations allows the agencies to use a discounted cash flow approach for the long-term activities.

The bond amount also reflects the estimated cost for the agencies to contract, manage, and direct construction at the site during reclamation. For large projects such as Montanore, this often means the agencies will include the cost to retain a third-party to prepare the contract documents, to serve as the construction manager overseeing on-site reclamation, and to act as the liaison between the agencies and the various contractors performing the work.

1.6.3.2.1 Direct Costs

A reclamation cost calculation includes direct and indirect costs. Direct costs are assigned to reclamation tasks that are specific in scope and to which a cost can be assigned based on requirements outlined in the Records of Decision, certificate of compliance, and the approved Plan of Operations and operating permit. Examples of direct costs would include removal of surface facilities and roads, wetland mitigation, adit closure using concrete plugs, dewatering and capping of the tailings impoundment, installing permanent surface water diversions, revegetating disturbed areas, and removing the transmission line. Table 1 summarizes typical direct costs associated with the reclamation of a large mining project, such as Montanore. Table 2 provides representative line items of a mine reclamation cost estimate based on descriptions contained in the updated Plan of Operations. These line items would be updated after MMC submits an amended Plan of Operation and operating permit application.

The final slope angle of waste dumps, depth of topsoil cover, location and design of surface diversions, and seed mix are typical information contained in a reclamation plan and used by the agencies to estimate reclamation costs. Because the reclamation information in the Records of Decision and the approved Plan of Operations and operating permit are projections of future site conditions, often well in advance of closure, the actual disturbance area, quantity of salvaged reclamation materials, and quantity and quality of water being managed are estimates and final quantities may vary.

For most of the reclamation items, the agencies have enough information to estimate reclamation costs. Direct costs are estimated by the agencies using data from a number of sources. These include bids from past mine reclamation contracts awarded by the DEQ or the Forest Service, industry accepted references such as the Caterpillar Performance Handbook, (2010), RS Means cost data service (2009), Dataquest©, quotes from local contractors and vendors, and the Forest Service's Training Guide for Reclamation Bond Estimation and Administration (USDA Forest Service 2004a).

Water treatment costs are estimated using real time costs from existing mine water treatment plants at either operating mines or from abandoned mine sites under the jurisdiction of government agencies. Because water treatment costs can vary widely based on water quality and flow, there are frequently no comparable treatment plants which are suitable for direct comparison. In these instances, the agencies use EPA's Treatability Manual (Environmental Protection Agency 1983), a publication for estimating costs for treating industrial waste streams, and EPA's Technical Report Construction Costs for Municipal Wastewater Treatment Plants: 1973-1978 (Environmental Protection Agency 1980) as cross references to assist in calculating the bond. The agencies recognize uncertainties associated with long-term water treatment and the agencies make various assumptions to account for these uncertainties (see section 1.6.3.2.3, *Long-term Reclamation Bond Considerations*). In every instance, the bond estimate is annotated to identify the source of information used in the calculations and the assumptions made to account for missing or incomplete data.

1.6.3.2.2 Indirect Costs

The other cost component of the reclamation estimate is indirect costs, which are those costs that cannot be attributed to any one specific activity. Rather, indirect costs represent expenses necessary to the overall successful implementation and execution of the reclamation. Examples of indirect costs include contractor mobilization and demobilization, bid and scope contingency, engineering redesign, and project administration.

The agencies estimate indirect costs based on a percentage of the total direct cost. This approach is used in part due to the uncertainty associated with many of the indirect cost line items and the inherent difficulty in assigning costs to these uncertainties. For example, engineering redesign is considered an indirect cost because it is not known what design modifications, if any, may be necessary to take the mine site at the cessation of operations to final reclamation. Usually, some additional engineering design is required during final reclamation to account for incomplete data and changed site conditions from the time when the reclamation plan was initially developed during permitting to the moment of actual on-the-ground reclamation. The scope of possible modifications to the final reclamation plan is difficult to project during permitting, and consequently, this uncertainty is addressed through a percent multiplier of the direct cost. Cost data providers, such as RS Means, and various government agencies have suggested indirect cost percentages based on data they have compiled, and which both the DEQ and Forest Service have referenced and modified for their own use (DEQ 2001, USDA Forest Service 2004a). Typically, the guidance suggests a range for indirect costs based on the dollar amount of the calculated direct costs and the level of certainty associated with the accuracy of the cost estimate. These ranges are intended as guidelines for the agencies, and there is latitude in their application depending on site-specific conditions, complexity of reclamation, potential environmental risk, and professional judgment.

1.6.3.2.3 Other Reclamation Costs

Third-Party Oversight

Should site reclamation become the agencies' responsibility, other activities and costs aside from those identified in previous sections can have an effect on a final reclamation cost. If an operator fails to reclaim a site adequately and forfeits the bond, the agencies frequently will retain the services of a third-party contractor, such as an engineering or construction management firm, to assume management of the mine site and oversee reclamation. They assist the agencies during closure of the mine site, and often assume the role of project manager. Their duties may include technical advisor, on-going site maintenance, environmental compliance, preparation of construction and environmental documents associated with site closure, and construction management during reclamation, with the agencies retaining overall responsibility for the site.

Interim Site Care and Maintenance

Frequently, a mine site will need to be maintained for some period of time before reclamation can begin in earnest. This is often due to legal processes and other restrictions, lead time to contract for the actual on-site reclamation work, and weather. During this interim period, mine-related activities, such as water treatment, may need to continue to ensure environmental protection. In the bond estimate, the agencies assume that they will have to manage a fully operational mine for some period of time before site reclamation commences. In the case of the Montanore Project, access to the site would be maintained, water management at the tailings impoundment and in underground workings would continue, ventilation and power to underground workings would be required, and any and all attendant care and maintenance activities would continue. The responsibility to maintain the mine systems requires the agencies to establish a physical presence at site, most likely by a third-party contractor. Thus, the agencies include a “Care and Maintenance” line item in the direct cost calculation. This site maintenance requirement may last from 6 months to 1 year and can be a significant expense.

Long-Term Site Monitoring and Maintenance

Other reclamation costs include site monitoring and maintenance for a period of time after initial site reclamation has been completed. This typically lasts from 5 to 20 years, but in some instances may be extended depending on the complexity and longevity of the risk of environmental impact. Activities associated with site monitoring and maintenance may include water sampling, diversion ditch maintenance, repair of recent erosion events, and revegetation. For large sites like Montanore that would have areas of extensive surface reconfiguration, some redesign and reconstruction of reclaimed areas may be required to address episodic reclamation failure. It may take several years before disturbed areas reach equilibrium and are self-sustaining. The agencies account for this maintenance need by assuming labor and material requirements and applying them over a specified maintenance period. Monitoring and maintenance is assumed to be needed annually for an initial period, usually projected at 5 to 10 years while reclamation becomes established, and then may be needed intermittently after that. The agencies’ bond calculation captures this initial annual phase as well as the future intermittent requirements.

Inflation

The agencies assume reclamation costs will rise from year to year and account for the cost increase by assigning an inflation factor to the reclamation estimate. The agencies use data provided by the Office of Management and Budget when determining an appropriate inflation factor (Office of Management and Budget 1992). The agencies have used 2 percent per annum as the increase in costs from one year to the next in recent bond calculations. A similar inflation rate would be used for the Montanore Project bond calculation. Annual inflation is applied to the direct costs over a 5-year period to account for the time between mandated bond reviews.

Long-term Reclamation Bond Considerations

Water Treatment

The agencies account for reclamation activities that may extend into the future, well after completion of site reclamation, by making assumptions about the frequency and level of effort required to ensure site reclamation is being maintained and is accomplishing its intended objectives. These obligations have been discussed previously in the Site Monitoring and Maintenance section. Other reclamation requirements may continue for a much longer time. One of these is water management, where maintaining protection of water quantity and quality can be a significant financial liability long after a mine has ceased operations.

MMC may be required to manage water during operations and closure, possibly requiring capture, storage, treatment and water discharge systems that would be operated for a significant period of time after closure. In this event, the agencies would include costs associated with long-term water treatment in the reclamation bond calculation. Table 3 summarizes the entire calculation for long-term water treatment; Table 4 provides representative line items of such treatment.

Discounted Cash Flow Analysis and Net Present Value

The agencies calculate a long-term water treatment cost using a discounted cash flow (DCF) analysis, where the annual treatment costs are converted to a net present value (NPV). For purposes of a reclamation cost estimate, a NPV is the amount of money that must be put in an interest bearing account (trust account) on Day 1 of the mining operation so that it will provide sufficient revenue to pay for all future water treatment capital and operating costs. The time frame for water management and treatment at Montanore currently is unknown, but the agencies estimate it may be decades or more. For the Montanore Project, the agencies will likely project the DCF over 100 years. This time frame is in line with federal guidelines contained in the USDA's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (USDA 1983). The net present value is sensitive to the discount rate used in the calculation, and going out beyond 100 years often makes little difference in the bond amount because those outlying years are heavily discounted. The agencies use four variables when calculating a bond for a water management and treatment system: 1) the annual cost of the system, 2) the rate of inflation, 3) the rate of return on money in the trust fund, and 4) capital replacement costs. In a DCF analysis, the first three variables are held constant from one year to the next over the projected 100-year time frame. If any of the variables deviate from their initial estimates over a 100-year period, the result may be either a shortfall in the amount of money in the trust fund needed to operate the water management system for a 100-year period or conversely, there may be a surplus of monies available to run the system. These variables are evaluated during each 5-year bond review.

The agencies refer to the Office of Management and Budget's Circular No. A-94, Appendix C, for guidance on nominal (market) and real (inflation-adjusted) interest rates to be used as the discount rate in the DCF analysis (Office of Management and Budget 1992). This publication provides Federal Government forecasts and recommendations on select discount rates for up to 30 years into the future. These rates are updated annually. For analyses beyond 30 years, the Office of Management and Budget recommends using rates for the 30-year time frame. The longer the forecast is projected, the more uncertainty there is in the accuracy of the forecast. The agencies use Federal guidelines and circulars as one source of information in developing their financial projections, but owing to the significant forward-looking time frames involved in this type of forecasting, they consult other sources of information and use professional judgment in arriving at the final bond estimate.

The agencies invest monies for long-term water treatment in government-backed securities that typically earn a lower interest rate than other type of investments but have less financial risk. Treasury bills, notes and bonds, are typical investment options. The longest term for government-auctioned treasury securities is also 30 years.

Table 1. Typical Mine Reclamation Bond Summary Sheet.

Direct Costs	**Tasks**		**Cost**
Task 1:	Reclaim Surface Facilities and Associated Surface Disturbance		$$$
Task 2:	Reclaim Tailings Impoundment and Associated Disturbance		$$$
Task 3:	Reclaim Underground Workings and Associated Disturbance		$$$
Task 4:	Regrading and Revegetation		$$$
Inflation	Inflation Cost @2% Per Year for 5 Years	10.4%	
Sub-Total Direct Costs:	Sub-Total of Direct Costs (Inflation Adjusted)		$$$
Indirect Costs	**Type**	**% of Direct Cost**	**Cost**
	Mobilization/Demobilization	%	$$$
	Contingency		
	Bid	%	$$$
	Scope	%	$$$
	Project Administration		
	Trustee Fees	%	$$$
	Legal Fees	%	$$$
	Contract Administration	%	$$$
	Engineering and Redesign	%	$$$
Subtotal Indirect Costs:			$$$
Subtotal:	(Subtotal Direct Costs + Subtotal Indirect Costs)		$$$$
Task 5	Long-Term Care and Maintenance		
Total Bond Amount:	(Subtotal + Inflation)		$$$$

Table 2. Representative Line Items for Montanore Project Reclamation.

Task 1: Reclaim Facilities and Associated Disturbance	
A. Libby Plant Site	
Bonded Item	Costs Calculated For:
Mill and Admin Building	Gutting, Demolition, and Disposal
Tailings Thickener Tank	Demolition and Disposal
Warehouse	Gutting, Demolition, and Disposal
	Disposal of Petroleum Products and Other Waste Materials
Substation	Hauling Off-Site
Chemical Storage	Gutting, Demolition, and Disposal
	Disposing Hazardous Waste and Other Chemicals
Propane Tank	Hauling Off-Site
Explosives Storage	Demolition and Disposal
	Removal and Disposal of Explosives
Fuel Tanks	Hauling Off-Site
Assay Lab	Gutting, Demolition, and Disposal
	Disposing Hazardous Waste and Other Chemicals
Septic System	Pumping, Excavation, Hauling Off-Site
Fresh Water Tank	Hauling Off-Site
Coarse Ore Stockpile Building	Demolition and Disposal
	Removing Any Remaining Material
Lined Sediment Pond	Pumping, Sediment Removal, Liner Removal
Security Gate House	Demolition and Disposal
Above Ground Conveyors	Demolition and Disposal
Concrete Foundations	Broken and Buried On-Site
Well	Plugging
Miscellaneous Surface Piping	Removal and Disposal
B. Libby Adit Site	
Bonded Item	Costs Calculated For:
Shop	Gutting, Demolition, and Disposal
	Disposal of Petroleum Products and Other Waste Materials
Generators	Hauling Off-Site
Lined Stormwater Pond	Pumping, Liner Removal
Water Treatment Plant	Gutting, Demolition, and Disposal
	Disposal of Hazardous Waste and Any Other Waste Materials
Leach Fields	Disconnect Surface Pipelines and Leave in Place
Percolation Pond	Dewater
Waste Rock Areas	Cap in place
Pumpback Sumps	Dewater
Fuel Tanks	Haul Off-Site
C. Other Surface Disturbance	
Bonded Item	Costs Calculated For:
Transmission Line	Removing and Reclaiming Corridor
Access Roads	Reclaim to Blend with Surrounding Topography
Libby Concentrate Loadout	Disposal of Concentrate and Cleaning Facility
Waste Rock Stockpile	Move Any Remaining Material

Task 2: Reclaim Tailings Impoundment and Associated Disturbance	
Bonded Item	Costs Calculated For:
Seepage Pumpback System	Pond Dewatering and Liner Removal
	Demolition and Disposal of Pumphouse; Haul Pumps Off-Site
Wells	Plugging
Piping Infrastructure	Removal of Any Surface Piping; Buried Piping Left in Place
Thickener Facility	Gutting, Demolition and Disposal
Cyclones and Piping Network	Removal and Disposal
Tailings Pipelines	Flushing Pipelines into Tailings Impoundment
	Removal of Pipelines from All Stream Crossings
	Removal of Pipelines if Less Than 3 Feet Below Surface
	Cut Pipelines at 0.5-Mile Intervals, Cap, Leave in Place
Tailings Pipeline Pump Stations	Haul Off-Site
Power Poles and Electrical Lines	Removal and Disposal
Tailings Impoundment Surface	Dewatering, Water Treatment, Capping as Needed
Tailings Embankment	Rip-Rap for Erosion Control
	Channel Excavation
Borrow Areas	Reclaim as Necessary
Task 3: Reclaim Underground Workings and Associated Disturbance	
A. Underground Workings	
Bonded Item	Costs Calculated For:
Explosives Magazines	Removal and Disposal
Underground Facilities	Disposing Hazardous Waste and Other Chemicals
	Disposal of Petroleum Products and Other Waste Materials
	Removal of Fuel Storage Tanks
Transformers	Haul Off-Site
Mobile Equipment	Remove Working Equipment
	Drain Fluids and Abandon Non-Functional Equipment
Other Large Equipment	Abandon Underground
B. Portal Areas	
Bonded Item	Costs Calculated For:
Libby Adit Site	Constructing Two Portal Plugs
Upper Libby Adit	Constructing Portal Plug
Rock Lake Ventilation Raise	Constructing Portal Plug
Task 4: Regrading and Revegetation	
Bonded Item	Costs Calculated For:
Dirt Moving	Regrading to Post-Mine Topography
Soil	Cover Regraded Areas with Soil or Suitable Material
Seeding	Seeding According to Proposed Reclamation Plan
Task 5: Long-Term Site Care and Maintenance (may be included in Discounted Cash Flow Calculation)	
Bonded Item	Costs Calculated For:
Surface Water Monitoring	Monitoring for Quality and Quantity
Groundwater Monitoring	Monitoring Wells; Possibly Springs
Surface Disturbances	Erosion Control and Weed Control

Table 3. Typical Summary Table for Long-Term Water Treatment Calculation.

Direct Costs	**Tasks**		**Cost**
Task 1:	Annual Capital Costs		$ Task 1
Task 2:	Annual Operating and Maintenance Costs		$ Task 2
Task 3:	Annual Water Quality Monitoring and Reporting		$ Task 3
Total Annual Direct Costs:			$ Direct Cost Sum
Indirect Costs	**Type**	**% of Direct Cost**	**Cost**
	Mobilization/Demobilization	%	$$$
	Contingency		
	Bid	%	$$$
	Scope	%	$$$
	Project Administration		
	Legal Fees	%	$$$
	Contract Administration	%	$$$
Subtotal Annual Indirect Costs:			$$$$
Total Annual Cost:	(Total Annual Direct Costs + Total Annual Indirect Costs)		$$$$
	Total Water Treatment Cost =		NPV of Total Annual Costs
Assumptions:	Long-term Water Treatment Liability Based on Discounted Cash Flow Analysis Assumed Rate of Inflation Over Water Treatment Period Assumed Rate of Return on Trust Fund Over Water Treatment Period Net Present Value (NPV) = Amount of Money Needed on Day 1		

Table 4. Representative Line Items for Long-term Water Treatment Costs.

Direct Costs to be Included in Water Treatment Bond Calculation (more line items may be included)	
Task 1: Capital Costs	
Bonded Item	Costs Calculated For:
Engineering and Design	Determining Appropriate Treatment Method; Designing Plant
Construction	Construction Based on the Chosen Treatment Method
	Assumed Replacement Period for Capital Infrastructure
Task 2: Operating and Maintenance Costs	
Bonded Item	Costs Calculated For:
Engineering	Troubleshooting and Redesign
Labor	Wages and Benefits
Materials	Equipment, Chemicals, Parts, etc.
Power	Electrical Requirements for Operating the Plant
Miscellaneous	Waste Disposal, Site Access, System Repairs, etc.
Task 3: Water Quality Monitoring and Reporting	
This will depend on the treatment method and required frequency	
Task 4: Reclaim Water Treatment Plant	
Bonded Item	Costs Calculated For:
Structure	Gutting, Demolition, and Disposal
Cleanup	Disposal of Hazardous Waste and Any Other Waste Materials
Dirt Moving	Regrading to Post-Mine Topography
Soil	Cover Regraded Areas with Soil or Suitable Material
Seeding	Seeding According to Proposed Reclamation Plan

Table 5. Permits, Licenses, and Approvals Required for the Montanore Project.

Permit, License, or Approval	Purpose
Kootenai National Forest	
Approval of Plan of Operations (36 CFR 228, Subpart A)	To allow MMC to explore, construct and operate a mine and related facilities on National Forest System lands. Approval incorporates management requirements to minimize or eliminate effects on other surface resources that include final design of facilities, and mitigation and monitoring plans as described in the ROD. Review of the proposed plans is coordinated with the DEQ and other appropriate agencies. Approval of the Plan of Operations is contingent on MMC accepting and incorporating the stipulations and mitigations (as listed in the ROD) into the Plan of Operations.
Special Use Permit(s) (36 CFR 251)	To allow utility companies to construct and operate electric transmission/distribution and telephone lines and to allow MMC to construct and maintain associated facilities such as a weather station that may remain on National Forest System lands after completion of the mining operation.
Road Use Permit	To specify operation and maintenance responsibilities on National Forest Service roads not covered by an approved Plan of Operations.
Mineral Material Permit	To allow MMC to take borrow material from National Forest System lands not covered by an approved Plan of Operations.
Timber Sale Contract	To allow MMC to harvest commercial timber from the project area on National Forest System lands. Harvesting would be conducted to clear the area for project facilities.
U.S. Fish and Wildlife Service	
Biological Opinion	To protect T&E species and any designated critical habitat. Consultation with the KNF.
404 Permit Review	To comment on the 404 permit to prevent loss of, or damage to, fish or wildlife resources. Consultation with the Corps.
U.S. Army Corps of Engineers	
404 Permit (Clean Water Act)	To allow discharge of dredged or fill material into wetlands and other waters of the U.S. Subject to review by the EPA, the USFWS, the KNF, and the DEQ. Coordinate with the SHPO.

Table 5. Permits, Licenses, and Approvals Required for the Montanore Project (cont'd).

Permit, License or Approval	Purpose
Montana Department of Environmental Quality	
Hard Rock Operating Permit Modification (MMRA)	To allow a change in an approved operating plan. Proposed activities must comply with state environmental standards and criteria. Approval may include stipulations for final design of facilities and monitoring plans. A sufficient reclamation bond must be posted with the DEQ before implementing an operating permit amendment or modification. Coordinate with the KNF.
Transmission Line Certificate (MFSA)	To allow the construction and operation of a 230-kV transmission line more than 10 miles long. Reclamation plans and bond can be required. Coordinate with the KNF, the FWP, the Montana Department of Transportation, the DNRC, the DOC, the Montana Department of Revenue, and the Montana Public Service Commission.
Air Quality Permit (Clean Air Act of Montana)	To control particulate emissions of more than 25 tons per year.
MPDES Permit (Montana Water Quality Act)	To establish effluent limits, treatment standards, and other requirements for point source discharges, including stormwater discharges to state waters including groundwater. Coordinate with the EPA.
Public Water Supply and Sewer Permit	To allow construction of public water supply and sewer system and to protect public health.
Water Quality Waiver of Turbidity (318 Permit) (Montana Water Quality Act)	To allow for short-term increases in surface water turbidity during construction. Request may be forwarded from the FWP.
401 Certification (Clean Water Act)	To ensure that any activity that requires a federal license or permit (such as the Section 404 permit from the Corps) complies with Montana water quality standards.
Hazardous Waste and Solid Waste Registration (various laws)	To ensure safe storage and transport of hazardous materials to and from the site and proper storage and transport and disposal of solid wastes. Some classes of solid waste disposal is covered under the MMRA. Solid wastes may be addressed under an operating permit.

Table 5. Permits, Licenses, and Approvals Required for the Montanore Project (cont'd).

Permit, License or Approval	Purpose
Montana Department of Natural Resources and Conservation	
Beneficial Water Use Permit (Montana Water Use Act)	To allow the beneficial use of groundwater or surface water.
Floodplain Development Permit (Montana Floodplain and Floodway Management Act)	To allow construction of mine facilities within a 100-year floodplain.
310 Permit (Montana Natural Streambed and Land Preservation Act)	To allow mine-related activities that physically alter or modify the bed or banks of a perennially flowing stream.
Streamside Management Zone Law	To control timber harvest activities within at least 50 feet of any stream, lake, or other body of water.
Burning Permit	To control slash or open burning outside the open burning season.
Montana State Historic Preservation Office	
Cultural Resource Clearance (Section 106 Review)	To review and comment on federal compliance with the National Historic Preservation Act.
Montana Fish, Wildlife and Parks	
310 Permit (Natural Streambed and Land Preservation Act)	To allow mine-related construction activities by non-government entities within the mean high water line of a perennial stream or river. Coordinated with DNRC and the Lincoln County Conservation District. The FWP works with conservation districts to review permit and determine if a Water Quality Waiver of Turbidity (318 Permit) from the DEQ is needed.
Transmission Line Approval	To allow construction of the 230-kV transmission line across the Thompson Fisher conservation easement.
Montana Department of Transportation	
Approach Permit	To allow safe connection of mine-related roads to state highways.
Utility Occupancy and Location Agreement or Encroachment Permit	To allow mine-related utility or construction access roads within MDT rights-of-way.
Montana Department of Commerce, Hard Rock Impact Board/Lincoln County	
Fiscal Impact Plan (Hard Rock Mining Impact Act)	To mitigate fiscal impacts on local government services.
Lincoln County Weed District	
Noxious Weed Management Plan	To minimize propagation of noxious weeds.

Chapter 2. Alternatives, Including the Proposed Action

This chapter describes and compares the alternatives considered for the Montanore Project. It includes a detailed description and map of each alternative considered. This chapter presents the alternatives in comparative form, defines the differences between each alternative, and provides a clear basis for choice among options by the decision makers and the public. Because alternative development was in response to issues and concerns identified during scoping, public involvement and the significant issues identified for the project are discussed first. Following a discussion of the key issues, each alternative analyzed in detail is described. MMC's Proposed Action (Mine Alternative 2 and Transmission Line Alternative B) is described in detail. The other action alternatives incorporate many aspects of MMC's proposal and contain less detail. The last section of this chapter discusses the alternatives considered by the lead agencies in developing the alternatives, but that were eliminated from detailed analysis.

2.1 Public Involvement

2.1.1 Scoping Activities

A Notice of Intent (NOI) was published in the Federal Register on July 15, 2005. The NOI described KNF's and DEQ's intent to prepare an EIS for the proposed Montanore Project, set the dates for public scoping meetings, and solicited public comments. The NOI asked for public comment on the proposal until September 15, 2005. In addition, as part of the public involvement process, the lead agencies issued press releases, mailed scoping announcements, and held three public meetings. The public scoping meetings were held in Libby and Trout Creek, Montana and Bonners Ferry, Idaho in August 2005. Scoping activities are discussed in the Scoping Report (ERO Resources Corp. 2005). A public meeting on the proposed 230-kV transmission line was held in May 2005 to identify resources potentially affected by the proposed transmission line, suggested locations for the proposed line, alternatives to the proposed line, and mitigation measures for the proposed line. At the meeting, MMC presented information on the need for the proposed facility. Consultation and coordination is discussed in Chapter 4.

2.1.2 Issues

Based on the comments received during public scoping, the KNF and the DEQ prepared a Scoping Content Analysis Report that includes a summary of all comments received, organized by resource or issue (KNF and DEQ 2006). The KNF and the DEQ separated the issues into three groups: "key" issues that drove alternative development; "analysis" issues that were used in impact analysis; and non-significant issues. The KNF and the DEQ identified seven key issues; each issue is briefly discussed in the following sections. The indicators, baseline data, and analysis approach used to assess effects on these issues are described in *Issue Statements and Analysis Guidance* (ERO Resources Corp. 2006a), on file in the project record. Each resource section in Chapter 3 describes how the effects on each resource were evaluated.

2.1.2.1 Key Issues

2.1.2.1.1 Issue 1: Potential for acid rock drainage and metal leaching

Drainage from waste rock, tailings, and stormwater runoff may adversely affect water resources in the project area. Effects will be assessed through predicted changes in water quality due to acid generation and near-neutral pH metal leaching and release of elevated concentrations of trace elements as a result of weathering of mined materials, based on geochemical characterization data.

2.1.2.1.2 Issue 2: Effects on quality and quantity of surface water and groundwater resources

Groundwater Flow and Quality

Underground mining activities may affect groundwater in the mine area, which may indirectly affect Rock Lake and other waters in the CMW located above the mine. Appropriations from or discharges to groundwater, such as from the proposed LAD Areas and the tailings impoundment, may affect groundwater flows and quality. Under Montana law, the definition of appropriate includes to divert, impound, or withdraw, including by stock for stock water, a quantity of water for a beneficial use. Appropriations by the FWP and USDA Forest Service have slightly different meaning. Effects will be assessed through two-dimensional and three-dimensional models, which will evaluate potential quantity impacts on mine area groundwater and overlying and surrounding surface water during construction, operations, and post-mining periods. Effects on groundwater at other facility locations will be assessed through estimating changes in flow path, quantity, and quality from discharges.

Surface Water Flow

Changes in groundwater from underground mining operations, discharges, and altered topography may change surface water flow and lake levels. Effects will be predicted by evaluating changes in surface water flow in area springs, lakes, and streams. For lower-altitude spring and streamflows, changes will be estimated for appropriations from or discharges to streams.

Surface Water Quality

Discharges or flow from mined areas containing metals, nutrients, or sediments may affect surface water quality in project area lakes, streams, and rivers. Effects were predicted by estimating changes in selected water quality parameters.

2.1.2.1.3 Issue 3: Effects on fish and other aquatic life and their habitats

Discharges and changes in surface water flows may affect fish and other aquatic life; the threatened bull trout and designated critical habitat in the analysis area are particularly of concern. Riparian habitat alteration from construction and operation of mine and transmission line facilities may affect KFP's Inland Native Fish Strategy (INFS) riparian management objectives (RMOs) for facilities located within riparian habitat conservation areas (RHCAs). The effects will be predicted by estimating changes in surface water and groundwater parameters, changes in habitat quality, and changes in abundance and composition of aquatic life.

2.1.2.1.4 Issue 4: Changes in the project area's scenic quality

The proposed mine and transmission line may change existing the visual character of the project area. Effects will be predicted by estimating change in line, color, texture, form and character of the landscape, and evaluating compliance with the KFP's visual quality objectives (VQOs).

Effects will also be assessed quantitatively by determining mine facilities and miles of transmission line visible from key observation points, important travel corridors, and the CMW.

2.1.2.1.5 Issue 5: Effects on threatened or endangered wildlife species

Grizzly Bear

Construction and operation of mine and transmission line facilities may impact grizzly bear habitat and increase grizzly bear mortality and displacement. Effects will be evaluated by estimating changes in percent of core habitat, percent open motorized route density (OMRD) greater than 1 mile per mile squared (mi/mi^2), percent total motorized route density (TMRD) greater than 2 mi/mi^2, and displacement effects in affected Bear Management Units (BMU) in the Cabinet-Yaak Recovery Zone (CYRZ). The effects in the Cabinet Face Bears Outside of the Recovery Zone (BORZ) will be estimated in the Final EIS by estimating changes in the baseline total linear miles of road and total linear miles of open road on National Forest System land. Effects within the Cabinet-Yaak Ecosystem Recovery Zone and Cabinet Face BORZ will also be assessed qualitatively by evaluating potential changes in effectiveness of grizzly bear movement corridors, human activity, and attractant availability.

Lynx

Construction and operation of mine and transmission line facilities may disturb or degrade lynx habitat. Effects will be evaluated by assessing the proposed activities compliance with the applicable objectives, standards, and guidelines of the Northern Rocky Lynx Management Direction in each affected Lynx Analysis Unit (LAU). Effects on lynx habitat components within the affected LAUs was also assessed. Effects also will be assessed qualitatively by evaluating connectivity between habitat blocks in affected and adjacent LAUs, linkage areas between LAUs, habitat for alternative prey, and traffic-related mortality risks in affected LAUs or adjacent LAUs.

2.1.2.1.6 Issue 6: Effects on wildlife and their habitats

Key Wildlife Habitats

Construction and operation of mine and transmission line facilities may impact the quality or quantity of old growth, snags, and down wood habitat. Effects will be predicted by determining the following:

- Acres of vertical structure removed in designated and undesignated effective and replacement old growth
- Percent of designated old growth in the Planning Subunit (PSU)
- Acres of edge habitat
- Acres of interior old growth
- Estimated percent of potential cavity-nester population by PSU
- Coarse woody debris removed

Forest Service Management Indicator Species – Pileated Woodpecker

Construction and operation of mine and transmission line facilities may directly or indirectly cavity-nesting species, such as the pileated woodpecker. Effects will be predicted by determining changes in the estimated number of pileated woodpeckers potentially supported in the analysis area, based on acres of old growth habitat. Availability of other stands having one or more attributes of old growth or values for connectivity or interior habitat, down wood and snag habitat and indirect disturbance to pileated woodpeckers will also be evaluated.

2.1.2.1.7 Issue 7: Effects on wetlands and streams

Construction and operation of mine and transmission line facilities may affect, directly or indirectly, wetlands and other streams, altering wetland function and services. Effects will be predicted by estimating the number of wetland acres and feet of streams filled, dewatered, or otherwise affected. Changes in wetland function and values will be evaluated qualitatively.

2.1.2.2 Analysis Issues

Issues identified by the public and the lead agencies during project scoping not considered as key issues, but important enough to be considered in the effects analysis are listed in Table 6. The lead agencies developed measures to address these issues, where needed to mitigate effects. The indicators, baseline data, and analysis approach used to assess effects on these issues are described in *Issue Statements and Analysis Guidance* (ERO Resources Corp. 2006a), on file in the project record.

Table 6. Other Issues Evaluated in the EIS.

Air Quality	Monitoring	Vegetation
American Indian Consultation	Recreation	Wilderness and Roadless Areas
Cultural Resources	Social/Economics	Migratory Birds
Electro-magnetic Fields and Radio/TV Interference	Soils	Forest Service Indicator Species – Elk and White-tailed Deer
Geology: Subsidence	Sound	Forest Service Indicator Species – Mountain Goat
Geotechnical	Threatened and Endangered Wildlife Species – Gray Wolf	Forest Service Sensitive Species
Land Use	Transportation	Other Species of Interest – Moose and Montana Sensitive Species

2.1.2.3 Non-Significant Issues

Non-significant issues were identified by the lead agencies as those 1) outside the scope of the Proposed Action; 2) already decided by law, regulation, the KFP, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The U.S. Council on Environmental Quality NEPA regulations in 40 CFR 1501.7 requires lead agencies to "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review…"

One issue identified by the public during project scoping, an alternative combining Rock Creek and Montanore Projects, was beyond the scope of this environmental analysis. During scoping, commenters indicated the NEPA process should explore the possibility of an alternative that combines both the Rock Creek and Montanore Projects into one. The Rock Creek Project on the western side of the Cabinet Mountains underwent 14 years of analysis involving agency, tribal, and public participation. The DEQ issued a ROD in 2001 and the KNF issued a ROD in 2003, selecting Alternative V for implementation. The KNF's ROD was remanded in 2010 and the KNF is preparing a Supplemental EIS (see section 3.3.1.1, *Rock Creek Project*). The DEQ's ROD remains in effect. The alternative of combining Rock Creek and Montanore Projects is discussed in section 2.13*, Alternatives Analysis and Rationale for Alternatives Considered but Eliminated*.

2.2 Development of Alternatives

Alternatives were developed based on requirements for alternatives under regulations and rules implementing NEPA, MEPA, MFSA, and Section 404 of the Clean Water Act. Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not analyzed in detail (40 CFR 1502.14). NEPA regulations do not specify the number of alternatives that need to be considered in the EIS, but indicate that a reasonable range of alternatives should be evaluated (40 CFR 1502.14). NEPA regulations require analysis of a No Action Alternative in an EIS. Likewise under MEPA, the DEQ is required to consider alternatives that are realistic, technologically available, and that represent a course of action that bears a logical relationship to the proposal being evaluated (ARM 17.4.603(2)(b)). Alternative alignments for the transmission line were developed based on requirements of MFSA (ARM 17.20.1607).

In addition to satisfying NEPA requirements for the selection of alternatives, projects subject to permitting for discharge of dredged and fill material into wetlands and waters of the U.S. also must comply with the 404(b)(1) Guidelines (40 CFR 230). It is anticipated that one or more Montanore Project facilities would need a 404 permit from the Corps. The 404(b)(1) Guidelines specify "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences." An alternative is considered practicable "if it is available and it is capable of being done after taking into consideration cost, existing technology, and logistics in the light of overall project purposes." Practicable alternatives under the Guidelines assume that "alternatives that do not involve special aquatic sites are available, unless clearly demonstrated otherwise." The Guidelines also assume that "all practicable alternatives to the proposed discharge which do not involve a discharge into a special aquatic site are presumed to have less adverse impact on the aquatic ecosystem, unless clearly demonstrated otherwise" (40 CFR 230.10(a)(3)).

To develop a reasonable range of alternatives, the lead agencies separated the proposed Montanore Project into components. *Components* are discrete activities or facilities (*e.g.*, plant site or tailings impoundment) that, when combined with other components, form an alternative. Options were identified for each component. An *option* is an alternative way of completing an activity, or an alternative geographic location for a facility (component), such as alternative geographic locations for a tailings impoundment or transmission line, or an alternative method of tailings disposal, such as thickened tailings. Options generate the differences among alternatives. An alternative is a complete project that has all the components necessary to fulfill the project purpose and need. Options with more favorable environmental characteristics were retained and other options were eliminated from further analysis. Section 2.13*, Alternatives Analysis and Rationale for Alternatives Considered but Eliminated*, describes the lead agencies' analysis of alternatives considered but eliminated from detailed analysis. Options comprising the Proposed Action were retained regardless of their environmental characteristics. Next, options for each component were combined into potentially viable alternatives. The transmission line was analyzed as a separate component from the mine facilities because any transmission line alternative could be combined with any mine alternative. Each component or alternative was developed to a level that allowed for comparison of significant environmental issues. If an action alternative were selected in the ROD, final design would be completed after the NEPA process was finished.

The KFP guides all natural resource management activities and establishes management standards for the KNF (USDA Forest Service 1987a). The KFP establishes management direction in the form of prescriptions consisting of goals, objectives, standards, and guidelines. This direction may be established to apply throughout the forest plan area (forest-wide direction) or they may be established for only a part of the forest plan area, a management area (MA). The Montanore Project is being evaluated under the 1987 KFP. In developing alternatives to the Proposed Action, the lead agencies considered the management direction of the KFP. For example, the KFP, which incorporates INFS standards, establishes stream, wetland, and landslide-prone area protection zones called RHCAs and sets standards and guidelines for managing activities that potentially affect conditions within the RHCAs. An INFS standard for minerals management is to locate structures, support facilities, and roads outside of RHCAs. Where no alternative exists to siting facilities in RHCAs, the standard is to locate and construct facilities in ways that avoid impacts on RHCAs and streams, and adverse effects on inland native fish. Section 2.1.2.1*, Key Issues*, discusses that RHCAs were a key resource during the lead agencies' alternatives analysis. The lead agencies did not identify an alternative that would comply with all KFP standards (see section 2.13.13*, Forest Plan Consistency*).

The MFSA requires that the proposed transmission line be approved if the findings listed in 75-20-301, MCA and related administrative rules can be made. Under this statute, the DEQ can approve a modified transmission facility or a transmission line alternative different from that proposed by MMC. Under 75-20-301(1)(c), MCA, the DEQ must find and determine that the facility minimizes adverse environmental impact, considering the state of available technology and the nature and economics of the various alternatives.

Besides the No Action and Proposed Action alternatives for both the mine facilities and transmission line, the lead agencies analyzed in detail two mine alternatives and three transmission line alternatives. The following sections describe these alternatives. In the two mine alternatives and three transmission line alternatives to the Proposed Action, the issues addressed by the modification and mitigations that comprise the alternatives are discussed. The mine alternatives are discussed in the first sections, followed by the transmission line alternatives. The most significant modifications in the alternatives are relocating project facilities, such as the tailings impoundment. These alternative locations are summarized in Table 7. Other mitigations or changes to MMC's proposed mine alternative are listed in Table 8. (A similar table of mitigation proposed for the transmission line is found in Table 37.) Unless modified by the lead agencies, MMC's Mine Proposal as described in Alternative 2 would carry over into the two other mine alternatives. Similarly, aspects of MMC's proposed transmission line alternative, the North Miller Creek Alignment, as described in Alternative B, would carry over into the three other transmission line alternatives, unless modified by the lead agencies. The agencies could select segments from portions of transmission Alternatives B, C-R, D-R, or E-R.

Table 7. Mine Alternative Comparison.

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Operating Permit Areas	3,628 acres	2,157 acres	2,979 acres
Disturbance Areas	2,582 acres	1,565 acres	1,924 acres
Primary Facilities			
Mill site	Ramsey Plant Site in valley bottom in Upper Ramsey Creek	Libby Plant Site between Libby and Ramsey Creek drainages	Same as Alternative 3
Adits and portals	Existing Libby Adit; two Ramsey Adits; Rock Lake Ventilation Adit	Existing Libby Adit; two additional Libby Adits; Rock Lake Ventilation Adit	Same as Alternative 3
Concentrate loadout location	Kootenai Business Park in Libby	Same as Alternative 2	Same as Alternative 2
Above-ground conveyor	1,200 feet long between Ramsey Adit portal and mill	6,000 and 7,500 feet long (depending on the option) between Libby Adit Site and Libby Plant Site mill	Same as Alternative 3
Tailings impound-ment and seepage collection pond	628 acres in Little Cherry Creek	608 acres between Poorman and Little Cherry creeks	Same as Alternative 2
Perennial stream diversion	Diversion of Little Cherry Creek 10,800 feet long around impoundment to Libby Creek	None	Same as Alternative 2
Land application disposal areas	Two; one along Ramsey Creek and one between Ramsey and Poorman creeks	None; any wastewater treated at Water Treatment Plant	Same as Alternative 3
Primary access road	NFS road #278 (Bear Creek Road) plus new access road; 20 to 29 feet wide	NFS road #278 (Bear Creek Road) plus new access road; 26 feet wide; up to 56 feet wide to accommodate haul traffic and public traffic	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Water treatment	Land application, Libby Adit Water Treatment Plant, or additional Water Treatment Plant, as necessary	Libby Adit Water Treatment Plant expanded to accommodate discharges during the estimated wettest year in a 20-year period; modified to treat nitrogen and phosphorus, and possibly dissolved metals	Same as Alternative 3
Facility Details			
New adits: length, grade, and portal elevation	Ramsey Adits: 16,000 feet long, 8% decline; Elevation: 4,400 feet Rock Lake Ventilation Adit: Elevation: 5,560 feet	Upper Libby Adit: 13,700 feet long, 7% decline; Elevation: 4,100 feet New Libby Adit: 17,000 to 18,500 feet long, depending on option; 5% decline; Elevation: 3,960 feet Rock Lake Ventilation Adit	Same as Alternative 3
New access roads[†] To Plant Site:	1.7 miles connecting NFS roads #278 and #4781	0.7 miles of new road parallel to NFS road #278, connecting existing NFS roads #278 and #2317	Same as Alternative 3
Realigned NFS road #278 at impoundment	1.8 miles	0.2 miles	Same as Alternative 2
To Adit Portal:	0.3 mile to portal	None	Same as Alternative 3
To LAD Area 1	1.0 mile	None	Same as Alternative 3
To LAD Area 2	0.2 mile	None	Same as Alternative 3
Pipelines Tailings	Double-walled high-density polyethylene on surface adjacent to access road; 6.4 miles to impoundment	Double-walled buried adjacent to access road; 4.2 miles to impoundment	Same as Alternative 3; 6.4 miles to impoundment

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Reclaim water	Double-walled high - density polyethylene on surface adjacent to access road	Double-walled high - density polyethylene buried adjacent to access road	Same as Alternative 3
Tailings pump stations	At Poorman Creek crossing	At each crossing of Ramsey and Poorman creeks	Same as Alternative 3
Borrow areas	Four; 143 acres within impoundment footprint and 419 acres outside of impoundment footprint	Three; 124 acres within impoundment footprint and 92 acres outside of impoundment footprint	Five; 185 acres within impoundment footprint and 252 acres outside of impoundment footprint
Post-mining impoundment runoff	Riprapped channel to Bear Creek	Natural channel to Little Cherry Creek	Riprapped channel to Little Cherry Creek Diversion Channel

[†]Temporary roads within the disturbance area of each facility not listed.

Table 8. Comparison of Mitigation for Mine Alternatives.

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
		Mine Plan	
Final Mine Plan	Submit final plan to the lead agencies for approval	Same as Alternative 2 Fund an independent technical advisor to assist the agencies in review of MMC's subsidence monitoring plan, underground rock mechanics data collection, and MMC's mine plan Submit an Operations, Maintenance and Surveillance Manual for the Libby Plant and tailings impoundment and a comprehensive Environmental Health and Safety Plan.	Same as Alternative 3
Barrier Zone	500 feet from Rock Lake and 100 feet from Rock Lake Fault	1,000 feet from Rock Lake and 300 feet from Rock Lake Fault until additional data collection and analysis completed and closer mining approved by the agencies	Same as Alternative 3
Underground Mine Barriers	Not proposed	Identify location of one or more barrier pillars before Construction Phase Leave one or more barrier pillar within mine, if needed to minimize post-mining changes in East Fork Rock Creek and East Fork Bull River streamflow and water quality during Operations Phase Construct concrete bulkheads at limited access openings in barrier pillars, if left in place, during Closure Phase	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Geotechnical Testing to Reduce Subsidence Risk	Underground geotechnical investigations conducted as the Libby Adit was completed; ongoing subsidence monitoring	Libby Adit evaluation program part of Alternative 3. Testing same as Alternative 2 with the following additions: Back-analyze the pillar failure at the Troy Mine using publicly available data to compare the Troy Mine design in effect at the time of the failure with the Montanore design; undertake numerical modeling to further evaluate expected design performance, to assess potential for shear failure at the pillar/roof or pillar/floor interface, and pillar columnization and sill stability between the two ore zones Conduct lineament analysis, mapping and statistical analysis of joint frequency and attitude, strain-relief overcoring, and further exploratory drilling Fund and facilitate biannual surveys of the underground workings by an independent qualified mine surveyor	Same as Alternative 3.
Final Closure Plan	Submit a revised reclamation plan to the lead agencies for approval	Update the closure plan, including a long-term monitoring plan, during the Construction Phase in sufficient detail to allow development of a reclamation bond Submit final closure and post-closure plan, including a long-term monitoring plan, 3 to 4 years before mine closure	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
		Water Management	
Long-term Maintenance of Little Cherry Creek Diversion Channel	Not specified	None needed	Fund a long-term maintenance account
Sanitary Wastes			
Evaluation and Construction Phases	Self-contained systems at Ramsey Plant Site and Libby Adit Site	On-site treatment and disposal at Libby Adit Site	Same as Alternative 3
Operations Phase	Closed sanitary system with waste stored in buried sewage tanks at Ramsey Plant Site; tanks pumped and disposed off-site during Operations Phase	On-site treatment and then pumped to tailings impoundment during Operations Phase	Same as Alternative 3
Closure Phase	Not specified	On-site treatment and disposal at Libby Adit	Same as Alternative 3
Sediment Ponds and Ditches	Designed for 10-year/24-hour storm	Ponds and ditches containing process water or mine drainage sized for 100-year/24-hour storm	Same as Alternative 3
Well Abandonment	Wells at tailings impoundment plugged and abandoned according to ARM 36.21.810 Other monitoring wells and water supply wells not specified	Any monitoring well used by MMC for monitoring during any project phase plugged and abandoned according to ARM 36.21.810 Any potable water supply well on National Forest System lands plugged and abandoned according to ARM 36.21.810.	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Water Rights			
Construction and Operations Phases	Not Proposed	Monitor Libby Creek flow at LB-2000, cease appropriating Libby Creek water whenever flow was less than 40 cfs at LB-2000, and treat and discharge water from the Water Treatment Plant at a rate equal to its Libby Creek appropriations during such times Monitor Ramsey Creek flow at RA-300; if baseflow changes in Ramsey Creek may adversely affect any senior right on Ramsey Creek during any mining phase, develop a plan during final design to convey treated water from the Water Treatment Plant to a location upstream of the point of diversion (RA-300)	Same as Alternative 3
Closure and Post-Closure Phases	Plug Ramsey and Libby adits at closure with single plug	Place two or more plugs in each adit to isolate the adits hydraulically from the mine void and to ensure any diversion of groundwater from Libby and Ramsey creeks would flow into the adits Treat and discharge water from the adits at the Water Treatment Plant at a rate equal to its Libby Creek appropriations and diversions under the conditions described for the Construction and Operations Phases	Same as Alternative 3
Swamp Creek Water Right	Swamp Creek mitigation site not proposed	Water right not needed for rehabilitation of Swamp Creek site; Change of use of existing water right to instream flow right requested	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Tailings Impoundment Design			
Impoundment Design		Use the most recent attenuation relationships that are based on instrumental records of attenuation collected in the United States and internationally Complete circular failure plane assessments through the near-dam tailings and dam section and through the dam crest and slope Update the pumpback well design and analysis using geologic and hydrologic data collected as part of geotechnical field studies, with a focus on minimizing drawdown north of impoundment Minimize and avoid, to the extent practicable, filling wetlands and streams Minimize and avoid, to the extent practicable, locating structures, such as the Seepage Collection Pond, in a floodplain Fund an independent technical review of the final design as determined by the lead agencies	Complete a pumpback well design and analysis using available geologic and hydrologic data, with a focus on minimizing drawdown south of impoundment Other mitigations same as Alternative 3
Other Facilities			
Waste Rock Management Stockpile and Storage	Stored temporarily at unlined stockpile at LAD Area 1, Libby Adit Site, and/or Ramsey Adit portal, or hauled to the tailings impoundment area then used in impoundment dam.	Stored temporarily at stockpiles, lined if necessary, and then hauled to a lined, if necessary, location within impoundment footprint; then used in impoundment dam	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Characterization	Collect representative rock samples from the adits; ore zones; above, below and between the ore zones; and tailings for static and kinetic testing	Same as Alternative 2; in addition, collect samples of the lead waste zone, altered waste zones within the lower Revett, and the portions of the Burke and Wallace Formations for static and kinetic testing; assess potential for trace metal release from waste rock; conduct operational verification sampling within the Prichard Formation during development of the new adits	Same as Alternative 3
Handling	Segregate potentially acid-generating materials and materials that could create near-neutral pH metal leaching as they were mined and placed under sufficient cover to minimize direct exposure to the atmosphere and precipitation	Same as Alternative 2; in addition, segregate potentially acid-generating materials and materials that could create near-neutral pH metal leaching from portions of the lower Revett and Prichard Formations for additional kinetic and metal mobility testing and provide for selective handling as indicated by test results	Same as Alternative 3
Waste Management Solid Wastes	Bury certain wastes underground in mined-out areas	No solid wastes other than waste rock buried underground in mined-out areas; reinforced concrete foundation material may be buried on National Forest System lands under certain conditions; all other building materials would be removed and disposed of at an approved off-site waste disposal facility	Same as Alternative 3
		Air Quality	
Tier 4 Engines	Not specified	Use Tier 4 engines on underground mobile equipment and emergency generators, if available, beginning in Construction Phase and continuing during the Operations Phase	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Ultra-low sulfur fuel	Not specified	Use ultra-low sulfur diesel fuel in engines on underground mobile equipment and emergency generators beginning in Construction Phase and continuing during the Operations Phase	Same as Alternative 3
		Recreation and Scenery	
New Recreational Facilities	Not specified	Design and construct a scenic overlook with interpretive signs south of the switchback on NFS road #231 (Libby Creek Road) downstream of the Midas Creek confluence with views of the tailings impoundment Develop a small (4 to 5 vehicle) graveled recreational parking area at the gate on the Poorman Creek Road (NFS road #2317) Develop a new hiking trail between Poorman and Ramsey creeks to provide non-motorized access to upper Ramsey Creek	Same as Alternative 3
Howard Lake campground host	Not specified	Pay the reimbursement funding for a volunteer campground host from Memorial Day through Labor Day at Howard Lake campground using an Volunteer Services Agreement for Natural Resources Agencies (Optional Form 301a) throughout the life of the project	Same as Alternative 3
Road Closure Inspection	Not specified	Inspect and maintain gates or barriers for access changes used in wildlife mitigation	Same as Alternative 3
Night Lighting	Not specified	Shield or baffle night lighting at the Libby Adit Site and Libby Plant Site	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Final Regrading Plans	Not specified	Develop final regrading plans for each facility to reduce visual impacts of reclaimed mine facilities	Same as Alternative 3
	Not specified	At the end of operations, place any waste rock not used in construction either back underground or use it in regrading the tailings impoundment	Same as Alternative 3
Clearing Operations	Not specified	Complete vegetation clearing operations under the supervision of an agency representative with experience in landscape architecture and revegetation Create clearing edges with shapes directly related to topography, existing vegetation community densities and ages, surface drainage patterns, existing forest species diversity, and view characteristics from Key Observation Points Avoid straight line or right-angle clearing area edges Avoid creation of symmetrically-shaped clearing areas Transition forested clearing area edges into existing treeless areas by varying the density of the cleared edge under the supervision of an agency representative	

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Clearing Operations (continued)	Not specified	Transition forested clearing area edges into existing treeless areas by varying the density of the cleared edge under the supervision of an agency representative Mark only trees to be removed with water-based paint, and not mark any trees to remain Cut all tree trunks at 6 inches or less above the existing grade in clearing areas located in sensitive foreground areas such as within 1,000 feet of residences, roads, and recreation areas determined and identified by an agency representative before clearing operations	Same as Alternative 3
General Facility Location	Not specified	Locate above-ground facilities, to the greatest extent practicable, without the facilities being visible above the skyline as viewed from the Key Observation Points	Same as Alternative 3
Sound			
Mill Equipment	Not specified	Operate all surface and mill equipment so that sound levels do not exceed 55 dBA, measured 250 feet from the mill for continuous periods exceeding an hour	Same as Alternative 3
Intake and Exhaust Ventilation Fans	Adjust intake and exhaust ventilation fans in the Libby Adits so that they generate sounds less than 82 dBA measured 3 feet downwind of the Ramsey Adit portals	Same as Alternative 2 applied to the three Libby Adits	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Transportation			
Bear Creek Road Reconstructed Width	20 to 29 feet	26 feet	26 feet; up to 56 feet wide to accommodate haul traffic and public traffic
Other roads	Single lane	Same as Alternative 2, except up to 56 feet wide to accommodate mixed haul traffic and public traffic	Same as Alternative 3
Bear Creek Road south of impoundment	Left in current condition	Selected segments graveled with 6 inches of gravel at least 16 feet wide	Selected segments graveled with 6 inches of gravel at least 16 feet wide
Culverts	Install and/or extend culverts	Replace as necessary to comply with INFS standards and Forest Service guidance, such as fish passage or conveyance of adequate flows	Same as Alternative 3
Bear Creek Bridge	Not replaced	Replace and widened to a width compatible with a 26-foot wide Bear Creek Road	Same as Alternative 3
Gated roads	Not specified	Install and maintain each closure; gates would have dual-locking devices to allow the KNF fire or administrative access	Same as Alternative 3
Development of Plans	Not specified	Develop and implement a final Road Management Plan, Transportation Plan, and Traffic Impact Study	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
		Noxious Weed Management	
Noxious Weed Management	Implement Weed Control Plan approved by Lincoln County Weed Control District	Same as Alternative 2 with the Weed Control Plan incorporating the following changes: Following KNF's and DEQ's approval of the final Weed Control Plan, submit it to the Lincoln County Weed Control District for approval Submit an annual report to the lead agencies describing weed control efforts Implement all weed BMPs identified in Appendix A of the KNF Invasive Plant Management Final EIS for all weed-control measures Include integrated noxious weed management in the environmental training To the extent possible, survey all proposed ground disturbance areas for noxious weeds before initiating disturbance; describe in final design plans the extent of which surveys and pretreatment would not be feasible; where noxious weeds were found, treat infestation the season before the activity was planned Pressure wash all off-road equipment including equipment for mining, vegetation clearing, road construction and maintenance, and reclamation before entering the project area	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Noxious Weed Management (continued)	Implement Weed Control Plan approved by Lincoln County Weed Control District	Develop and implement site-specific guidelines to be followed for weed treatments within or adjacent to known sensitive plant populations; evaluate all future treatment sites for sensitive plant habitat suitability; survey suitable habitats as necessary before treatment Consider winter vegetation clearing to reduce mineral soil exposure and the chance of spreading existing noxious weeds Continue to monitor/survey the project area for existing and new invader weed species and populations annually Treat noxious weeds along all haul and access roads yearly with the appropriate herbicide mix for the target species; broadcast treat every other year and spot treat the alternate years Prevent road maintenance machinery from blading or brushing through known populations of new invading noxious weed species; in areas where noxious weeds were established and activities require blading, brush and blade areas with uninfested segments of road systems to areas with noxious-weed infested areas; limit brushing and mowing to the minimum distance and height necessary to meet safety objectives in areas of heavy weed infestations	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
		Reclamation Plans	
Soil Salvage and Handling	Double-lift salvage at Little Cherry Creek Tailings Impoundment, Seepage Collection Pond, Borrow Areas, other potential disturbances within impoundment area. Single-lift salvage at Little Cherry Creek Diversion Channel, Ramsey Plant Site, Upper Libby Adit Site, LAD Areas, and road disturbances	Double-lift salvage at all disturbances where soil is to be salvaged except road disturbances. These disturbances include Poorman Tailings Impoundment, Seepage Collection Pond, Borrow Areas, other disturbances within impoundment area, Libby Plant Site, and Upper Libby Adit Site	Similar to Alternative 3, except double-lift salvage at Little Cherry Creek Tailings Impoundment and Little Cherry Creek Diversion Channel
	Not specified	Map soils not mapped at an intensive level before salvage to assure maximum amount of suitable soil was salvaged	Same as Alternative 3
	Not specified	Salvage soils at low moisture content to minimize compaction	Same as Alternative 3
Vegetation Removal and Disposition	As proposed in Plan of Operations	Prepare a Vegetation Removal and Disposition Plan for lead agencies' approval	Same as Alternative 3
	Not specified	Where possible, salvage, chip, and use limited amounts of slash as mulch	Same as Alternative 3
Soil Stockpiles	Stabilize soil stockpiles when they reach their design capacity and seed during the first appropriate season following stockpiling	Incrementally stabilize soil stockpiles (rather than waiting until the design capacity was reached) to reduce erosion and maintain soil biological activity	Same as Alternative 3
	First-lift soils stockpiled together at tailings impoundment	Segregate first-lift soils based on rock content and stockpiled separately at tailings impoundment	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
	Second-lift soils stockpiled together at tailings impoundment	Second-lift clay-rich glaciolacustrine soils stockpiled separately from other second-lift subsoils at tailings impoundment	Same as Alternative 3
	For road disturbances, salvaged soils stockpiled along entire road corridors	For road disturbances, salvaged soils stockpiled in clearings or in areas of recent timber harvest immediately adjacent to new roads	Same as Alternative 3
Soil Replacement	Embankment of Little Cherry Creek Tailings Impoundment would be covered with 24 inches of replaced soil using two lifts; rest of impoundment would be covered with 18 inches of replaced soil using two lifts	Entire tailings impoundment would be covered with 24 inches of replaced soil using two lifts	Same as Alternative 3
	Rocky and non-rocky topsoil would be used as upper 9 inches of respread soil on embankment of tailings impoundment	Rocky topsoil would be used as upper 9 inches of respread soil on embankment of tailings impoundment to minimize erosion	Same as Alternative 3
	Soil would be replaced using single lift at Ramsey Plant Site, Little Cherry Creek Diversion Channel, Libby Adit Site, road disturbances, and other potential disturbances	Soil would be replaced using two lifts at all disturbances requiring soil replacement except road disturbances	Same as Alternative 3, except soil would be replaced in the Little Cherry Creek Diversion Channel
Revegetation Seedbed preparation	Before soil replacement, embankment of tailings impoundment would be ripped; top of impoundment would not be ripped	Before soil replacement, entire tailings impoundment would be ripped to minimize compaction, break up surface crust and enhance rooting depth	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
	Apply organic amendments as needed or when soil tests demonstrate deficiencies	Agency-approved wood-based organic amendment would be incorporated into upper 4 inches of respread soil to improve nutrient content and the organic matter level to 1 percent by volume	Same as Alternative 3
	Use mycorrhizae-inoculated trees and shrubs if readily available	Mycorrhizae would be added to soil in areas where trees are to be planted	Same as Alternative 3
Seed Mixtures	Interim and permanent seed mixtures	Permanent seed mixture only	Same as Alternative 3
	Native and introduced species	Native species only, to the extent they were commercially available; seed sources for native plant species would be from northwestern Montana, if available at the time of revegetation	Same as Alternative 3
Tree and Shrub Density After 15 Years	283 trees/acre (assumes a 65 percent survival rate of 435 trees/acre planted) Unspecified (200 shrubs/acre planted)	400 trees/acre 200 shrubs/acre	Same as Alternative 3
Noxious Weeds	No more than 10 percent noxious weeds	Less than 10 percent cover of Category 1 weeds and 0 percent of Category 2 and 3 weeds; would not dominate an area greater than 400 square feet	Same as Alternative 3
Total Cover	60 percent live vegetation cover or 80 percent of control site total cover	80 percent of control site total cover	Same as Alternative 3
Monitoring Plan	3 consecutive years of success	20 years unless criteria achieved sooner	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Mitigation Plans			
Wildlife (see Table 37 for additional mitigation for transmission line)			
Old Growth	Not specified	Designate 797 acres of effective or replacement old growth on National Forest System lands	Designate 828 acres of effective or replacement old growth on National Forest System lands
Snags (Cavity Habitat)	Not specified	Leave snags in disturbance areas, unless required to be removed for safety reasons	Same as Alternative 3
Mountain Goat	Not specified	Fund aerial surveys three times annually for 2 consecutive years before construction, and every year during construction activities	Same as Alternative 3
	Not specified	No blasting at adit portals from May 15 to June 15	Same as Alternative 3
Migratory Birds	Not specified	Fund and initiate annual monitoring of up to 12 Integrated Monitoring in Bird Conservation Regions transects	Same as Alternative 3
Gray Wolf	None proposed	Fund FWP personnel to implement adverse conditioning techniques before wolves concentrate their activity around the den site if a wolf den or rendezvous site was located in or near the project facilities	Same as Alternative 3
Lynx	None proposed	Fund habitat enhancement of lynx stem exclusion habitat on between 436 and 526 acres (depending on the transmission line alternative)	Fund habitat enhancement of lynx stem exclusion habitat on between 290 and 380 acres (depending on the transmission line alternative)

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Grizzly Bear Road and Trail Access Changes Before Libby Adit evaluation program	None proposed	Seasonally change access (install gates) on 6 roads totaling 14.5 miles. Decommission or place into intermittent stored service 13 roads totaling 20.3 miles	Same as Alternative 3
Before Construction	NFS road #4784 (upper Bear Creek Road) year-long for the life of the project NFS road #4724 (South Fork Miller Creek) on a seasonal basis (April 1 to June 30) for the life of the project	Decommission or place into intermittent stored service seven roads totaling 13.2 miles within the CYRZ. Place barriers on five roads year-round totaling 10.2 miles within the BORZ Decommission or place into intermittent stored service NFS road #4784 (upper Bear Creek Road) if the Rock Creek Mine mitigation restricting the road with a barrier had not been implemented before Forest Service authorization to initiate the Evaluation Phase Convert trail #935 in upper East Fork Rock Creek to non-motorized access	Same as Alternative 3
Land Acquisition for Physical Disturbance see Table 37 for additional mitigation of transmission line effects	Purchase, secure or protect replacement grizzly bear habitat (through conservation or acquisition) of 2,758 acres in the Cabinet-Yaak Ecosystem	Secure or protect replacement grizzly bear habitat (through conservation or acquisition) of 3,094 acres in the Cabinet portion of the Cabinet-Yaak Ecosystem and a 5-acre parcel near Rock Creek Meadows below Rock Lake	Same as Alternative 3 except protected habitat would be 3,812 acres in the Cabinet portion of the Cabinet-Yaak Ecosystem and the 5-acre Rock Creek Meadows parcel

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Land Acquisition for Long-term Displacement Effects	Not proposed	Secure or protect replacement grizzly bear habitat (through conservation easement or acquisition) of 2,293 acres in the Cabinet portion of the Cabinet-Yaak Ecosystem.	Same as Alternative 3 except protected habitat would be 2,339 acres in the Cabinet portion of the Cabinet-Yaak Ecosystem
Personnel Funding	Fund two new full-time wildlife positions, a law enforcement officer, and an information and education specialist	Fund three new full-time wildlife positions, a law enforcement officer before Evaluation Phase, an information and education specialist, and a bear specialist during Construction and Operations Phases	Same as Alternative 3
Other Measures	Report road-killed animals to the FWP as soon as road-killed animals were observed. The FWP would either remove road-killed animals or direct MMC how to dispose of them Not specified	Remove big game animals killed by any vehicles daily from road rights-of-way within the permit area and along roadways used for access or hauling ore Fund and maintain up to 35 bear-resistant refuse containers for employees and mine facilities Fund and maintain 100 bear-resistant garbage containers plus an additional 20 per year, after the first year of Construction Phase, for distribution to the community Fund fencing, electrification, and maintenance of garbage transfer stations in grizzly habitat in and adjacent to the Cabinet-Yaak Ecosystem Fund an initial 10 electric fencing kits for use at bear problem sites that can be installed by FWP bear specialists, and then 2 replacements per year Not use salt when sanding during winter plowing operations	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Fisheries and Other Aquatic Organisms Reduced habitat availability in Little Cherry Creek	Collect all fish in Little Cherry Creek and move the fish to the newly constructed Diversion Channel Implement various mitigation projects to mitigate fisheries loss	None needed for Little Cherry Creek; streams affected by Poorman Impoundment Site are non-fish-bearing streams	Diversion channel unlikely to provide adequate habitat; additional mitigation for fish and recreational fishing losses from Little Cherry Creek diversion
Reduced Habitat Availability (bull trout)	None proposed	In Copper Gulch, West Fork Rock Creek, Rock Creek, Flower Creek, or Poorman Creek, mitigation may include: Create genetic reserves through bull trout transplanting to protect existing bull trout populations from catastrophic events Rectify unnatural blockages to bull trout passage that are prohibiting access to spawning and rearing habitat Rectify other factors that are limiting the potential of streams to support increased production of bull trout Eradicate non-native fish species, especially brook trout, that are a hybridization threat to bull trout Develop final mitigation plans in cooperation with the KNF, USFWS, and FWP	Same as Alternative 3
Reduced Habitat Availability In Impoundment Site	Options for fisheries and stream improvements in Ramsey, Libby, Standard, and Snowshoe creeks and Howard and Kilbrennan lakes	Poorman Impoundment Site drainages not fish bearing Create 6,500 linear feet of stream on main Swamp Creek channel and two tributary channels	Same as Alternative 3

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Sediment	Optional inventory and implementation of sediment abatement projects	Fund maintenance of access changes described for grizzly bear mitigation Implement road improvements, such as installing culverts, on NFS roads #231 and #2316	Same as Alternative 3
Wetlands			
Wetland Mitigation of Jurisdictional Wetlands	Create or expand existing wetlands totaling 44.6 acres; final mitigation requirements determined by Corps during 404 permitting process; Feasibility of plan to replace the lost functions of all potentially affected wetlands uncertain	Rehabilitate 15 acres of degraded water along Swamp Creek; final mitigation requirements determined by Corps during 404 permitting process	Create or expand existing wetlands totaling 48.8 acres; final mitigation requirements determined by Corps during the 404 permitting process; Feasibility of plan to replace the lost functions of all potentially affected wetlands uncertain
Mitigation of Non-jurisdic-tional Wetlands	Not specifically proposed; included in jurisdictional wetland mitigation plan	Create or expand existing wetlands at four sites totaling 7.5 acres outside of the impoundment area	Same as Alternative 3
Mitigation for streams	Options for stream improvements in Ramsey, Libby, Standard, and Snowshoe creeks	Construct 6,500 linear feet of new meandering channel at Swamp Creek property. Replace a culvert on Little Cherry Creek with a bottomless, arched culvert Replace a culvert on Poorman Creek with a bottomless arched culvert Remove a bridge across Poorman Creek and re-establish floodplain Stabilize 400 feet of eroding area on NFS road #6212 Remove 21 culverts and restore riparian habitat on land acquired for grizzly bear mitigation	Construct 6,500 linear feet of new meandering channel at Swamp Creek property. Replace a culvert on Poorman Creek with a bottomless arched culvert Stabilize 400 feet of eroding area on NFS road #6212 Remove 21 culverts and restore riparian habitat on land acquired for grizzly bear mitigation

Project Facility or Feature	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Pre-construction Hydrologic Monitoring of Mitigation Sites	Not specified	Adequate hydrologic data previously collected	Six months (April–September) of monthly monitoring prior to development of sites without hydrologic data
Wetland Soil Management	Not specified	Wetland soils and sod salvaged and used at isolated wetland mitigation sites	Same as Alternative 3
Beneficial Water Use Permit Acquisition for Mitigation Sites	Not proposed	Obtain beneficial water use permit for isolated wetland mitigation sites if required by DNRC for water use	Same as Alternative 3
Mitigation Site Management	Mitigation sites on private land retained by MMC	Convey the title to or a perpetual conservation easement on the Swamp Creek mitigation site to the Forest Service after the Corps determined the sites' performance standards had been met Convey isolated mitigation sites, vegetated upland buffers, and adjacent existing wetlands contiguous to National Forest System lands to Forest Service Convey any water right used or obtained for wetland mitigation to Forest Service	Same as Alternative 3 Same as Alternative 3 Same as Alternative 3

2.3 Alternative 1—No Action, No Mine

In this alternative, MMC would not develop the Montanore Project, although the project as proposed NMC is approved under DEQ Operating Permit #00150. The Montanore Project, as proposed, cannot be implemented without a corresponding Forest Service approval of a Plan of Operations or DEQ's issuance of a transmission line certificate. The environmental, social, and economic conditions described in Chapter 3 would continue, unaffected by the construction and operation of the mine or a transmission line. The DEQ's Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002 would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands. The conditions under which the Forest Service could select the No Action Alternative or the DEQ deny MMC's application for an air quality permit, transmission line certificate, and MMC's operating permit modifications are described in section 1.6, *Agency Roles, Responsibilities, and Decisions*.

2.4 Alternative 2—MMC's Proposed Mine

2.4.1 Construction Phase

2.4.1.1 Permit and Disturbance Areas

Development of the Montanore Project would require construction of an underground mine and adits (underground access), and surface facilities, such as a mill, tailings impoundment, and access roads (Figure 1, Figure 2). In MMC's proposal, the mill and mine production adits would be located in the upper Ramsey Creek drainage, about 0.5 mile from the CMW boundary. An additional adit on private land owned by MMC in the Libby Creek drainage and a ventilation adit on private land owned by MMC east of Rock Lake would be used for ventilation. A tailings impoundment is proposed to be constructed in the Little Cherry Creek drainage, and would require the permanent diversion of Little Cherry Creek. Two LAD Areas between Poorman Creek and Ramsey Creek are proposed to allow for discharge of water to the surface. A portion of the waste rock may be stored temporarily at LAD Area 1 and at the Libby Adit Site. Permit area boundaries would be established around each of these facilities (Figure 3). The total operating permit area, a required description for the DEQ operating permit, would total 3,628 acres and the total permitted disturbance area would be 2,582 acres (Figure 3, Table 9). For analysis purposes, the lead agencies used a disturbance area to assess effects on surface resources. For maximum flexibility, MMC would bond to cover the full disturbance area even if no activities were currently proposed. This would allow MMC to construct temporary and seasonal roads and other facilities within these disturbance area boundaries as needed.

The underground mine would produce up to 20,000 tons of ore daily, or 7 million tons per year at full production. Currently delineated mineral resources, estimated at about 135 million tons, extend from Rock Lake to St. Paul Lake beneath the CMW (Figure 4). These estimates are based on a limited number of drill holes. The deposit has not been fully delineated and likely extends farther north than the available drilling information. Considering an expected ore extraction of 65 to 75 percent, waste rock dilution, and initial production rates, the mine is anticipated to have a production life of about 16 years. Three additional years may be needed to mine 120 million tons. MMC's proposed construction, operations, mitigation, and reclamation plans for the mine are described in the following sections.

A 230-kV transmission line to supply electrical power would be built from the Sedlak Park Substation to the Ramsey Plant Site. Facilities associated with MMC's proposed transmission line are discussed in section 2.8, *Alternative B—MMC's Proposed Transmission Line (North Miller Creek Alignment Alternative)*.

Table 9. Mine Surface Area Disturbance and Operating Permit Areas, Alternative 2.

Facility	Disturbance Area (acres)	Permit Area (acres)
Existing Libby Adit Site	18	219
Rock Lake Ventilation Adit	1	1
Ramsey Plant Site and Adits	52	185
Little Cherry Creek Tailings Impoundment Site and Surrounding Area	1,928	2,458
Little Cherry Creek Tailings Impoundment and Seepage Collection Pond	628	
Borrow areas outside impoundment footprint	419	
Soil stockpiles	53	
Other potential disturbance (Diversion Channel, roads, storage areas)	828	
LAD Area 1 and Waste Rock Stockpile	247	261
LAD Area 2	183	226
Access Roads†		
Bear Creek Road (NFS road #278 from US 2 to Tailings Impoundment)§	79	10
Tailings Impoundment permit area to Ramsey Plant Site (NFS road #278 to new haul road to NFS road #4781)	48	172
Libby Adit Site (NFS road #2316 and #6210) to Ramsey Creek Road (NFS road #4781)	26	96
Total	2,582	3,628

†Disturbance area shown for roads excludes 33 feet of existing disturbance along roads.
§A small area of the Bear Creek Road would be within a permit area outside of the Little Cherry Creek Tailings Impoundment permit area (Figure 3).

In the first 2 years of the Construction Phase, MMC would upgrade NFS roads #278 (Bear Creek Road) and #4781 (Ramsey Creek Road); short segments of these roads would be realigned. About 10 miles of the Bear Creek Road (NFS road #278), from US 2 to the Bear Creek bridge, would be reconstructed to applicable road standards set by the either the KNF or Lincoln County. The road would be widened on its existing alignment to 20 to 29 feet wide and chip-and-seal paved. While NFS road #278 was upgraded, the Libby Creek Road (NFS road #231) would be used for access. Additional information about access is provided in section 2.4.1.6, *Transportation and Access*.

During the Construction Phase, MMC would construct the Ramsey Plant Site (Figure 5), two Ramsey Adits, and a Ventilation Adit near Rock Lake (Figure 4), tailings impoundment dams, transmission line, and other ancillary infrastructure necessary to initiate mining activities. Construction of a ventilation adit near Rock Lake, which would predominantly be a horizontal shaft (Figure 4), may be deferred until initial mine production commenced, depending on ventilation requirements. MMC also would undertake underground delineation drilling in the ore body. MMC also would develop the Libby Loadout Facility at the Kootenai Business Park in Libby for concentration storage and shipping. The Libby Loadout Facility is discussed in section 2.4.2.2.2*, Concentrate Shipment*.

US 2 south of Libby to the Bear Creek Road and the Bear Creek Road (NFS road #278) would be the primary access to the mine site. During the Construction Phase, the Bear Creek Road would be widened and surfaced with chip-seal. MMC would use the Libby Creek Road (NFS road #231) during reconstruction of the Bear Creek Road. MMC's road use for the project is discussed in section 2.4.1.6*, Transportation and Access*.

2.4.1.2 Vegetation Clearing and Soils Salvage and Handling

Before any construction, vegetation would be cleared and suitable soils salvaged. Merchantable timber would be measured, purchased from the KNF, and then cleared before soil removal. Non-merchantable trees, shrubs, and slash would be removed using a brush blade to minimize soil accumulation, piled into windrows, and burned. All requirements of the Montana Slash Disposal Law would be observed.

MMC would salvage and replace soils on most disturbed areas, except where slopes were too steep or where the water table was high. Proposed salvaged depths would vary between 9 and 65 inches, based on physical and chemical data collected during the baseline soils survey. Certain soils on a portion of the tailings impoundment would be salvaged in two lifts. The surface layer would be salvaged in other disturbances.

Soil stockpiles would be located in areas to minimize impacts from wind and water erosion, impacts from ongoing operations, and away from sensitive areas (*i.e.*, wetlands and streams) (Figure 6, Figure 7, and Figure 8). If necessary, stockpile locations would be modified to meet field conditions and accommodate quantities of soils actually salvaged. Soils with more than 50 percent rock fragments generally would not be salvaged. Soils with rock fragment contents up to 60 percent by volume would be salvaged in some areas to provide erosion protection on the tailings impoundment dam and portal patio slopes. Reclamation soil thicknesses would be adjusted, if necessary, according to results of interim reclamation and site-specific conditions, as determined by the lead agencies.

Soil would be salvaged and replaced without stockpiling when feasible, primarily at the tailings impoundment, or stockpiled as close as possible to redistribution sites. Active soil stockpiles would be protected to minimize wind and water erosion. Soil stockpiles would be constructed with 40 percent side slopes and 33 percent sloping ramps where possible. As stockpiles reached their design capacity, they would be stabilized and seeded during the first appropriate season following stockpiling. Fertilizer, mulch, and tackifier would be applied as necessary to promote soil stabilization and successful revegetation. Weed control would be an important aspect of the soil storage and protection. MMC's Weed Control Plan describes the measures that would be employed to minimize noxious weeds.

2.4.1.3 Ramsey Plant Site and Adits

MMC would build a plant adjacent to Ramsey Creek (Figure 5), consisting of the following facilities:

- Mill and administration building and associated parking
- Tailings thickener tank
- Mine/yard pond
- Coarse ore stockpile building
- Warehouse
- Explosives storage
- Electrical substation
- Other miscellaneous facilities

Two parallel, 16,000-foot-long production adits would be excavated directly southwest of the Ramsey Plant Site (Figure 4). One adit would serve as the main conveyor adit for ore extraction and an exhaust airway. The other adit would provide an intake for fresh air underground and access for personnel and materials during operations. The adit portals would be outside the CMW boundary. Portal patios, which are flat working surfaces outside the adits, would be constructed by cutting into the sideslope, creating a vertical face for adit construction and an area for staging of supplies. Each adit would be about 30 feet wide by 30 feet high. During construction, four ventilation fans would be located outside of the adit portals, and include inlet and discharge attenuators to meet a total noise level of 85 dBA at 3 feet (Big Sky Acoustics 2006). During operations, all fans would be located within the mine a minimum of 10,000 feet from the portals.

During adit construction, a lined retention pond would be constructed at the Ramsey Plant Site to handle water during construction of the Ramsey Adits. Water would report to this pond from the adits. A pipeline would be installed to convey water to LAD Areas. The pond would provide storage of 62 acre-feet of water (1 week's storage of temporary inflows of 2,000 gallons per minute (gpm)). After the Starter Dam was built at the impoundment site (see section 2.4.1.5, *Tailings Impoundment*), water would be diverted to the impoundment area for storage and mill startup. The pond would then be enlarged and relined, once storage at the tailings impoundment were available, to the final size required for operations (shown as the mine/yard pond on Figure 5). The pond would be available for use during construction and would provide additional storage capacity/surge storage during mill start-up and other periods.

Underground development would include excavation of a crusher station and related ore and waste rock bins, and development of main mining benches, haulage drifts, and ore and waste passes. At the terminal end of the Ramsey Adits, MMC would build an underground primary rock crusher. MMC anticipates construction of the Ramsey Adits that would connect with the Libby Adit to the crusher station would begin about 6 months after project inception and take about 12 months. The Ramsey Adits would decline to the ore body at an 8 percent slope. MMC would construct the Ramsey Adits from both the surface at the Ramsey Creek portal and underground from the Libby Adit Site.

MMC would excavate a ventilation raise, the Rock Lake Ventilation Adit, beginning vertically from the center of the ore body and then horizontally to private land 800 feet east and 600 feet higher than Rock Lake (Figure 4). Air would be drawn into the ventilation raise to supply fresh air for underground workers. No fans or other facilities are proposed on the surface. The Rock Lake Ventilation Adit would be a combination of a drift from the ore body, a vertical raise, and a short adit to the surface. The portal opening would be about 15 feet wide by 15 feet high and gated with a steel grate or similar structure. The short adit from the vertical raise to the portal would be sloped back into the mine, collecting any water inflow back into the mine. Grouting and other water management techniques would be used to minimize inflow of subsurface water into the raise. The ventilation raise would be constructed from inside the mine and would not require any surface activities, with the exception of creating the surface opening. Total surface disturbance associated with the Rock Lake Ventilation Adit would be about 1 acre. The ventilation adit is not anticipated to be required to support mine construction activities but would be installed during the initial mine production period.

In 2006, MMC received DEQ approval for Minor Revision (MR 06-002) to extend the Libby Adit 3,300 feet to the ore body and to conduct underground evaluation drilling and geotechnical and hydrogeologic studies. MMC would use the Libby Adit Site for ventilation and a secondary escape route for underground workers (Figure 6). Additional drilling beyond the evaluation drilling would be completed during the pre-production phase of the project to provide information required for mine planning beyond the first 5 years of production.

2.4.1.4 Waste Rock Management

All waste rock produced during construction and operations would be stored in waste rock stockpiles in the Ramsey Plant Site or LAD Area 1, and then used for tailings embankment construction, Ramsey Plant Site and portal construction, or placed in mined out sections of the mine (Table 10) for ongoing tailings dam construction. During pre-production and possibly during operations, waste rock would be temporarily stored at an unlined area in the LAD Area 1 for future use in dam construction material. Waste rock stored in the LAD Area 1 waste rock stockpile would be no higher than 50 feet above the original ground contours. All waste rock would be removed from the stockpiles by the end of operations. For scheduling and construction

Table 10. Estimated Schedule for Waste Rock Production and Disposal, Alternative 2.

Project Stage	Tons	Bank Cubic Yards	Disposal Area
Evaluation Drilling	298,000	130,000	Temporary lined storage pile at Libby Adit Site, then to tailings embankment
Pre-production Waste Rock	1,548,000	668,000	Temporary unlined storage pile at both adit sites, then to tailings embankment
Initial Production	288,000	128,000	Tailings embankment
Production with Tailings	576,000	256,000	Tailings embankment
	144,000	64,000	Inside mine
Production Only	864,000	384,000	Inside mine
Total Waste Rock	3,718,000	1,630,000	
Ore	333,000	148,000	Temporary unlined storage pile near the Ramsey Adit portal, then to mill

Source: MMC 2008.

reasons, some waste rock generated during adit construction would be stored temporarily near the adits (Libby Adit Site or Ramsey Plant Site). The majority of the waste rock would be directly hauled to LAD Area 1 (Figure 7) or to the tailings impoundment area for dam construction. During operations, waste rock generated that would not be required for the tailings impoundment would be placed in mined out areas underground.

The waste rock sampling plan is described in MMC's waste rock management plan (Geomatrix 2007b). During mining, MMC would collect representative rock samples from the adits; ore zones; above, below, and between the ore zones; and tailings. MMC would conduct static and kinetic testing on these samples to evaluate the acid-producing potential. Acid-base accounting results, total sulfur analyses, and pH measurements would be documented.

Acid-generating materials would be segregated for special handling as they were mined and would be placed under sufficient cover to minimize direct exposure to the atmosphere and precipitation. Such locations could include the inner portions of the tailings dam and inside the mine workings. No rock materials would be used for construction before determination of its acid-producing potential. In addition, waste rock generated from the underground lead zone would be minimized, to the extent possible, due to higher lead concentrations present in this rock zone, and the greater potential for acid generation. Lead zone waste rock would be segregated from other waste rock and disposed underground.

All waste rock data would be evaluated with water quality monitoring data to determine whether any changes in water quality were the result of acid or sulfate production. Annual reports documenting sample location, methodology, detection limits, and testing results would be submitted to the lead agencies. Acid-base accounting results would be correlated with lithology and total sulfur analyses.

2.4.1.5 Tailings Impoundment

2.4.1.5.1 Tailings Deposition Method

Tailings management depends on the amount of solution or water mixed into or removed from the tailings, *i.e.*, the slurry density, for purposes of deposition. The most appropriate method of tailings management for a given project depends on several factors including tailings characteristics, disposal site conditions, and project-specific factors such as production rates and environmental constraints. A detailed description of the agencies' analysis of tailings deposition methods available under current technologies is provided in section 6.0 of the *Tailings Disposal Alternatives Analysis* (ERO Resources Corp. 2011a) and summarized in section 2.13.7, *Surface Tailings Disposal Method Options.*

2.4.1.5.2 Site Location

MMC's proposed tailings impoundment site is 5 miles northeast of the Ramsey Plant Site, in the Little Cherry Creek watershed. The tailings impoundment would consist of several structures: a diversion dam, a starter dam, a main dam, two saddle dams, and a seepage collection system (Figure 8). The tailings impoundment has a design capacity of about 115 to 120 million tons and, at the planned operating period of 16 years, the tailings impoundment would have an excess capacity of an additional 22 million tons, or 3 years of production (Table 11). MMC would prepare a operation and maintenance manual and an emergency action plan consistent with the DNRC's requirements for high hazard dams.

Table 11. Daily and Total Tailings Production Estimates.

Time Frame	Daily Production (tons per day)	Total Production (tons)
Years 1-5	12,500	23 million
Years 6-10	17,000	31 million
Years 11-16	20,000	44 million
Years 17-19	20,000	22 million (excess capacity)
Maximum Capacity		120 million

2.4.1.5.3 Design Criteria

The design criteria for the Little Cherry Creek tailings impoundment is described in the Tailings Technical Design Report (Klohn Crippen 2005). The impoundment freeboard during operations would include the following: storage of 20 days of tailings discharge; storage of the design flood, which is the runoff from the two-week probable maximum precipitation (PMP) plus snowmelt; and freeboard of 3 feet above peak flood water surface.

Section 6.6 of the report indicates the design flood was determined in the following manner. Morrison Knudsen Engineers (1990) estimated the 24-hour probable maximum precipitation at the Little Cherry Creek impoundment site to be 11.9 inches, with an associated 3.9 inches of snowmelt. Applying a factor of safety of 2 to these values provides an estimated value of 32 inches, which is estimated to be equivalent to at least a two-week PMP, plus snowmelt. The required flood storage is therefore estimated as 32 inches over the total impoundment area or 1,170 acre-feet, which is equivalent to 15 feet of storage for the Starter Dam and 3 feet of storage for the Final Dam. Because of these design criteria, an emergency overflow structure in the impoundment was not included in the impoundment design of any alternative.

2.4.1.5.4 Diversion Dam and Channel

The initial step in constructing the tailings disposal facility would be the construction of a Diversion Dam and Channel. A permanent diversion dam and channel system would be constructed at the tailings impoundment area to route Little Cherry Creek around the tailings impoundment to an unnamed drainage (Drainage 10) in the Libby Creek watershed (Figure 8).

The Diversion Channel would consist of three main components: an "engineered" upper channel, a middle channel, and a lower channel. Overall length of the Diversion Channel would be 10,800 feet. The upper channel would convey the Probable Maximum Flood (4,150 cubic feet per second (cfs)) around the tailings impoundment. The upper channel would be 3,200 feet long, 40 to 60 feet deep, and 19 feet wide at the bottom. Within the upper channel, a secondary channel would be constructed. The secondary channel would be designed to contain the average annual high flow in the channel. Wetlands along the upper channel would be excavated. Excavated channel material would be used to construct the Diversion Dam and the Starter Dam; any remaining material from the excavation would be used to construct a portion of the South Saddle Dam. Excavated wetland soils may be used in wetland mitigation.

If the bedrock were deeper than anticipated or of poor quality, riprap would be used for erosion protection. The channel foundation would be lined with compacted silty clay/clay to keep surface flows above the riprap. The upper channel would include a 300-foot, stair-stepped chute structure at the channel outlet. This structure, which would be comprised of 3-foot-high gabions, would dissipate flow energy, minimize erosion potential, and increase channel stability. If erosion were observed during or at the end of operations, rockfill bars or gabions would be placed perpendicular to the natural stream channel below the Diversion Channel to provide energy dissipation and protect against erosion.

MMC identified two channels that could be used to convey water from the upper channel to Libby Creek: Drainage 10 and Drainage 5 (Figure 8). The northern drainage (Drainage 10) is currently a 3,800-foot long drainage that is primarily unchannelized in the upper part and has perennial channelized segments interspersed with unchannelized wet and dry segments in the lower part. The southern drainage (Drainage 5) is about 3,000 feet long with similar characteristics to Drainage 10. Flow in Drainage 5 does not appear to reach Libby Creek (Kline Environmental Research 2012). A larger culvert at NFS road #1408 west of Libby Creek would be installed. MMC proposed to install a control gate structure where Drainages 5 and 10 join to control flow in both drainages. Kline Environmental Research (2012) found that the two drainages were not joined and were separated by a small ridge. An energy dissipater would be constructed at the outlet section of both channels to reduce flow velocity of water entering Libby Creek. MMC identified a variety of measures that may be used to control erosion and sedimentation and to create aquatic habitat (Geomatrix 2006b).

After the upper engineered section of the Diversion Channel was constructed, and improvements to Drainages 5 and 10 were completed, MMC would construct a Diversion Dam across Little Cherry Creek. The Diversion Dam would initially act as a low water storage dam, which would direct Little Cherry Creek into the Diversion Channel. Initially, the Diversion Dam would be 60 feet high and have a crest elevation of 3,695 feet. The initial dam would have a low permeability center, with general fill in the upstream and downstream outer zones, and riprap on the diversion side to minimize erosion. The slopes would be steep (0.5H:1V) (Figure 9). Immediately before closure of the Diversion Dam, MMC would collect all fish in the existing stream section and move the fish to the newly constructed diversion channel. An intermediate holding pond or tank may be needed when relocating Little Cherry Creek fish. The old Little Cherry Creek channel below the tailings impoundment would no longer receive surface flows from above the Diversion Dam.

Toward the end of mine operations, when the tailings impoundment elevations would rise above the dam, it would be raised to a height of 83 feet (3,718 feet elevation) in conjunction with the tailings. Raising of the initial dam would be completed using a homogeneous low permeability fill material, with tailings providing support for the tailings impoundment side of the fill.

2.4.1.5.5 Borrow Areas

To supplement materials excavated during Diversion Channel construction, material would be excavated from borrow areas for use in the Starter Dam, North Saddle Dam, Diversion Dam, Diversion Channel, and other facilities. Material requirements and quality would vary by facility. Borrow material also would be required for rip rap, road material, reclamation capping, and other uses. MMC has identified four borrow areas, one within the impoundment area (Borrow Area A) and three west and south of the impoundment area (Borrow Areas B, C, and D), as sources of construction material (Figure 8).

2.4.1.5.6 Starter Dam

After the Diversion Dam and Channel were operational and Little Cherry Creek was diverted, a Starter Dam would be required to establish the initial impoundment area. The Starter Dam would be a 120-foot-high earthfill dam across former Little Cherry Creek, with a 30-foot-wide crest, and slopes of 2.5H:1V above 3,450 feet elevation and 4H:1V below 3,450 feet elevation on both the upstream and downstream sides of the dam (Figure 9). The fill would consist of locally available silt-sand-gravel glacial deposits from borrow areas. Waste rockfill from the underground mine development also would be used in the downstream portion of the dam (Table 10). The fill would be placed in maximum uncompacted lifts of 1 foot. All boulders larger than 1-foot diameter would be removed from the fill. Any wetlands within the Starter Dam footprint not filled during construction of the seepage collection system (see next section) would be filled with Starter Dam fill material. During Starter Dam construction, a temporary water reclaim/storage pond would be constructed upstream from the Starter Dam to hold water until the Starter Dam was complete.

Soft, clayey material is present beneath the south abutment of the Starter Dam. A portion of the clayey material would be excavated, stored within the disturbance area, most likely borrow areas, and backfilled with compacted fill to act as a "shear key" for stability (Figure 9). A shear key is an area excavated beneath the dam. Up to three shear keys (100 feet long by 35 feet wide) may be required under the final dam footprint. The extent of the glaciolacustrine clay and its strength would be assessed during final design to optimize the location and extent of the shear keys. Other soft, unsuitable materials, such as wetland soils under the footprint of the Starter and Main Dams, would be either excavated and transported as backfill for the borrow areas, or filled with suitable foundation material, such as general fill from borrow areas or Diversion Dam excavation. Final design for management of these types of materials would be submitted to the agencies for approval. A high-density, polyethylene (HDPE) geomembrane liner would be placed beneath the upstream portion of the Starter Dam fill, up to an elevation of 3,460 feet, and keyed into the low permeability zone of the dam (Figure 8 and Figure 9). Above an elevation of 3,460 feet, seepage control would be provided by a spigotted tailings beach and seepage collection drains.

2.4.1.5.7 Seepage Collection

In the 1992 and 1993 RODs and the DEQ Operating Permit #00150, the lead agencies required NMC to modify the impoundment design to minimize the seepage from the tailings impoundment to the underlying groundwater. MMC incorporated this requirement into the current tailings impoundment design. A seepage collection system would collect seepage from in and around the tailings impoundment. The collection system would consist of a Seepage Collection Dam and pond, underdrains beneath the dams and impoundment, blanket drains beneath the dams (Figure 9), and a pumpback well system, if required. The seepage collection system would be constructed concurrently with the Starter Dam.

The impoundment underdrain system would consist of a two main trunk drains, and a series of secondary lateral drains (Figure 8). One of the main drains would follow the former Little Cherry Creek channel. The lateral drains would be spaced 300 feet apart and would be constructed in the old stream channel, adjacent wetlands, and upland areas in the impoundment. The lateral drains would convey water to the main trunk drains, which would then convey water to the Seepage Collection Pond (see below). The lined water storage pond behind the Starter Dam would not have an underdrain system, but the main trunk would pass under the lined area to the toe of the Main Dam. To facilitate the construction of the trunk lines in the former Little Cherry Creek channel, compacted fill material would be placed in the former channel to facilitate the preparation of the main trunk drains. During construction of the seepage collection system, any wetlands uphill of the Main Dam would be filled. All drains would be placed in a geomembrane-lined trench and consist of a core of highly pervious 1- to 4-inch rock wrapped in geotextile and surrounded by sand and gravel filter material. Locally available sand and gravel alluvial material would be used to cover the drains to prevent the fine tailings from piping into the drain materials during operations.

The underdrain system beneath the Starter and Main dams would use the same design as the trunk drains. The majority of the system would be constructed along and in or above the former stream channel alignment. Lateral lines would be installed in the dam footprint and would be tied to the main trunk drains. The former stream channel and connected wetlands would be filled with sand material to provide a sand bedding to meet trunk and lateral drain design specifications. Blanket drains would be used to control the phreatic (water saturation) level within the Starter Dam, Seepage Collection Dam, North Saddle Dam, the South Saddle, and the Diversion Dam. The blanket drains would be placed under the downstream one-third of the dam footprint (Figure 9). Construction of the blanket drains would consist of a 3-foot thick sand filter and a sand/gravel drain.

After the Diversion Dam and Channel were operational and Little Cherry Creek was diverted, a Seepage Collection Pond and Dam would be built across former Little Cherry Creek, about 100 feet downstream of the tailings impoundment. The dam would collect seepage and runoff from the tailings impoundment (Figure 8). The dam would be designed as a homogeneous fill dam with a downstream toe filter/blanket drain. The dam would have 2.5H:1V slopes and a 30-foot-wide crest at an elevation of 3,325 feet (Figure 9). The final elevation of the dam would be controlled by the available storage developed by borrowing material from the interior of the pond. The pond would be lined with clay or a geomembrane to achieve a permeability of less than or equal to 10^{-6} cm/sec. The pond would be designed to hold one week of flow from the underdrain system and runoff from a 100-year/24-hour storm, or 2.6 acre-feet. An emergency spillway would be constructed in the right abutment of the Seepage Collection Dam. Water collected by the Seepage Collection Dam would be piped to the tailings impoundment and returned to the mill for reuse. The reclaim pumping system would be able to pump up to 2,000 gpm back to the impoundment.

MMC committed to implementing seepage control measures, such as pumpback recovery wells, if required to comply with applicable standards. Seepage pumpback wells could be installed along the downstream toe of the tailings dam. Given the heterogeneity of the foundation soils, additional wells could be required to ensure that all flow paths were intercepted. The wells may require active pumping, depending on the artesian pressures within the wells (Klohn Crippen 2005).

2.4.1.6 Transportation and Access

MMC would provide transportation to employees using buses, vans, and pickup trucks. Because transportation would be provided, the use of personal vehicles would be limited. The bus hub would be located in a convenient location in Libby, Montana, most likely the Kootenai Business Park. In addition to mine personnel traffic, necessary supplies for operations would be transported by road to the mine site. Deliveries of supplies would be scheduled for day shift, Monday through Friday only. During full production (20,000 tons/day), anticipated daily vehicle count including employee vehicles are shown on Table 12.

Table 12. Estimated Mine-Related Traffic during Operations on NFS Road #278.

Time	Vehicle and Capacity	Trips	Vehicle Total Per 24 Hours
Day shift 0800 to 1600	Concentrate trucks – 20-ton capacity Supply trucks – various capacity Pick-ups vans Employee transportation – buses/cars/pickups	21 5 10 5	42 10 20 10
Swing shift 1600 to 2400	Pick-ups vans Employee transportation – buses/cars/pickups	10 3	20 6
Night shift 2400 to 0800	Pick-ups vans Employee transportation – buses/cars/pickups	10 2	20 4
Total		**66**	**132**

Trip - 1 round trip = 1 vehicle in and out – counts as 2 vehicle passes
(vehicle up and back = 1 round trip, and equates to 2 vehicle passes)
Caravan of 3 vehicles up and back = 3 round trips. – equates to 6 vehicle passes
Source: MMC 2008.

Access road maintenance, including weed control, would be MMC's responsibility, unless additional use by the KNF or other interests would warrant a cost-share agreement. This responsibility would revert to the KNF or road owner following project completion.

The following sections describe road use and public access along the main access road (Bear Creek Road (NFS road #278) and in each proposed permit area. With the exception of the Bear Creek Road, all open roads in the proposed operating permit areas would be gated and limited to mine traffic only. Some gated or barriered roads would be used throughout operations for mine traffic only. Table 13 lists only those roads whose status would change in Alternative 2. For example, NFS road #2317 is listed in Table 13 because a 1-mile segment is currently open and would be gated in Alternative 2. NFS road #5184 is not listed in Table 13 because it is currently closed and would remain closed throughout the life of the project.

2.4.1.6.1 Bear Creek Road (NFS Road #278)

The first 9.5 miles of the Bear Creek Road is paved with hot mix asphalt, and the asphalt road surface is chip-sealed and in poor condition Bear Creek Road crosses Bear Creek at MP 9.5; the bridge across Bear Creek is 14 feet wide. The remainder of the road is a native (dirt) surface. In order for MMC and the public to use the road safely together, some upgrading and widening of the road would be required. MMC is proposing to do these improvements and maintain the road as part of the project activities. About 10 miles of the Bear Creek Road (NFS road #278), from US 2 to the Bear Creek bridge, would be reconstructed to applicable road standards set by the either the KNF or Lincoln County. The road would be widened on its existing alignment and chip-sealed. The roadway width would be 20 to 29 feet wide. The disturbed area, included ditches and cut-and-fill slopes, is expected to be up to 100 feet wide. Road widening would be generally on the fill side of the road. Between US 2 and the start of the proposed permit area boundary at Bear Creek, 79 acres would be disturbed.

Table 13. Proposed Change in Road Status for Roads used during Construction, Operations, and Closure Phases in Alternative 2.

NFS Road #	Road Name	Location	Existing Status	Length (miles)	Proposed Status
1408	Libby Creek Bottom	Tailings Impoundment	Open	0.9	Gated, mine traffic only
2316	Upper Libby Creek	Libby Adit Site	Open	1.4	Mixed Mine Haul and Public Traffic
2317	Poorman Creek	LAD Area 1	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.1	Gated, mine traffic only
2317	Poorman Creek	LAD Area 1	Open	1.0	Gated, mine traffic only
2317B	Poorman Creek B	LAD Area 1	Impassable, open to snow vehicles 12/1-3/31	0.8	Gated, mine traffic only
278	Bear Creek	Tailings Impoundment	Open	1.1	Gated, mine traffic only
278L	Bear Creek L	Tailings Impoundment	Barriered year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.3	Gated, mine traffic only
278X	Bear Creek X	LAD Area 2	Barriered year-long to motor vehicles, open to snow vehicles 12/1-3/31	1.0	Gated, mine traffic only
4781	Ramsey Creek	Between LAD Areas 1 and 2	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	2.8	Gated, mine traffic only
4781	Ramsey Creek	Between LAD Areas 1 and 2	Open	1.2	Gated, mine traffic only
5003	Cherry Ridge A Extension	Tailings Impoundment	Barriered year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.8	Gated, mine traffic only
5170	Poorman Creek Unit	LAD Area 2	Open	0.2	Gated, mine traffic only
5181	L Cherry Loop H Cowpath	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.5	Gated, mine traffic only
5181A	Little Cherry Loop H Cowpath A	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.2	Barriered, no mine traffic
5182	Little Cherry Bear Creek	Tailings Impoundment	Open	1.6	Gated, mine traffic only
5183	Little Cherry View	Tailings Impoundment	Impassable, open to snow vehicles 12/1-3/31	0.5	Gated, mine traffic only
5184	Bear-Little Cherry	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.7	Gated, mine traffic only
5184A	Bear-Little Cherry A	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.2	Gated, mine traffic only
5185	S Bear-Little Cherry	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.9	Gated, mine traffic only
5185A	S Bear-Little Cherry A	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.3	Gated, mine traffic only
5186	Ramsey Creek Bottom	LAD Area 2	Barriered year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.5	Gated, mine traffic only
6201	Cherry Ridge	Tailings Impoundment	Barriered year-long to motor vehicles, open to snow vehicles 12/1-3/31	1.2	Gated, mine traffic only
6201A	Cherry Ridge A	Tailings Impoundment	Barriered year-long to motor vehicles, open to snow vehicles 12/1-3/31	1.2	Gated, mine traffic only
6210	Libby Ramsey Creek	Libby Adit access	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	2.1	Gated, mine traffic only
6210	Libby Ramsey Creek	Libby Adit access	Open	0.4	Gated, mine traffic only

NFS Road #	Road Name	Location	Existing Status	Length (miles)	Proposed Status
6212	Little Cherry Loop	Tailings Impoundment	Open	3.4	Gated, mine traffic only
6212H	Little Cherry Loop H	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.6	Barriered, no mine traffic
6701	South Ramsey Creek	Ramsey Plant	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.4	Gated, mine traffic only
8749	Noranda Mine	Libby Adit Site	Private; gated	0.5	Gated, mine traffic only
8749A	Noranda Mine A	Libby Adit Site	Private; gated	0.2	Gated, mine traffic only
8838	Little Cherry MS 10377 8838	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.2	Gated, mine traffic only
8841	Little Cherry MS 10377 8841	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	1.8	Gated, mine traffic only

The road would be designed to handle speeds of 35 to 45 mph. Design exceptions for slower speeds may be needed on some curves. Mine Safety and Health Administration regulations (30 CFR 56, Subpart H) require that all mines establish and follow rules governing speed, right-of-way, direction of movement, and the use of headlights to assure appropriate visibility, and that equipment operating speeds be consistent with conditions of roadways, grades, clearance, visibility, traffic, and the type of equipment used. MMC would post warning signs for speed limits and other important road conditions and require all mine-related vehicles to follow all traffic control restrictions, such as speed.

MMC would inspect the Bear Creek bridge for load capacity, but expects it would be sufficient for mine use. While NFS road #278 was upgraded in the first 2 years of the Construction Phase, the Libby Creek Road (NFS road #231) would be used for access.

Within the tailings impoundment area, the Bear Creek Road would be relocated and reconstructed in four locations (Figure 8). These sections, and non-realigned sections, would be chip-sealed and the roadway widened to 20 to 29 feet, consistent with the road north of Bear Creek. About 0.5 mile south of the tailings impoundment area and west of the Bear Creek Road, MMC would build 1.7 miles of new single lane road that would connect the Bear Creek Road with the Ramsey Creek Road (NFS road #4781) (Figure 17). A new, single lane bridge over Poorman Creek would be built (Figure 13). Public access on Bear Creek Road would not be restricted. Public access to the new mine access road would be restricted to mine-related traffic.

In all mine alternatives, the KNF would transfer ownership of the Bear Creek Road, from US 2 to the intersection with the Libby Creek Road, to the Lincoln County after it was reconstructed.

2.4.1.6.2 Little Cherry Creek Tailings Impoundment Area

The roads used to haul waste rock from the Libby Adit and the Ramsey Adits to the Little Cherry Creek Tailings Impoundment Area are shown on Figure 17. Except for a short segment of Bear Creek Road (NFS road #278) in the Little Cherry Creek Tailings Impoundment Area, mine haul roads would be restricted to mine traffic only. MMC would use a segment of the existing Bear Creek Road north of LAD Area 2 for mine haul. The crossing of the old Bear Creek Road across

Poorman Creek would be built to accommodate the 100-year flow event and be constructed in compliance with INFS standards and Forest Service guidance (USDA Forest Service 1995, 2008a). It would either be a bridge or arched culvert. The crossing width would be consistent with the roadway width.

Besides the Bear Creek Road, Little Cherry Loop Road (NFS road #6212), NFS road #8838 and about a 1.6-mile long segment of NFS road #5182 are the only other roads within the tailings impoundment currently open to motorized access (Figure 17). Gates on the Little Cherry Loop Road (NFS road #6212) would be near the intersection with the Bear Creek Road on the north end and the tailings impoundment permit area boundary on the south end. NFS road #6212 would remain open to motorized access south of the proposed permit area boundary to the junction with Bear Creek Road. Gating the Little Cherry Loop Road (NFS road #6212) would restrict motorized access to NFS roads #5182 and #8838. At the end of operations, gates would be removed and motorized access reopened. A segment of the Little Cherry Loop Road (NFS road #6212) would be covered by the tailings impoundment and would not provide a loop between the Bear Creek Road.

Other NFS gated or barriered roads within the tailings impoundment that would be used during the construction, operations, and closure of the tailings impoundment include: #278L, #1408, #5181, #5183, #5184, #5184A, #5185, #5185A, #6201, #6212H, #8838, and #8841 (Figure 17). MMC does not anticipate using the following currently restricted or barriered roads within the proposed tailings impoundment operating permit area and they would remain closed: #5003, #6201A, and #8838. MMC would have to consult with the KNF before removing the gates or barriers on these roads and using them.

About 7.5 miles of realigned and new road would be needed from the Bear Creek bridge to the Ramsey Plant Site. Motorized access to upper Ramsey Creek and the Poorman Creek Road (NFS road #2317) via NFS road #4781 would be restricted by a gate at the intersection of the Bear Creek Road and the Poorman Creek Road (NFS road #2317). A new bridge across Ramsey Creek would be built between the Ramsey Plant Site and the Ramsey Adit portals (Figure 3). The bridge would be sized to allow for a 50-year flow event. A temporary crossing from the Ramsey Plant Site to the Ramsey portal patio would be used and then removed following bridge construction. MMC would remove the bridge after it was no longer required to support mine operations and/or reclamation activities for the project.

2.4.1.7 Electrical Power

Electrical power required for fans, pumps, mining equipment, and surface construction during the initial preproduction phase would be supplied by two 1,250-kW diesel generators located at the shop building at the Libby Adit Site (Figure 6); one generator would be a back-up. The generators would be sized to provide sufficient power until the 230-kV transmission line was installed. One generator would be the primary source of power, while the other would provide backup power if needed. A buried 34.5-kV transmission line along Bear Creek Road and the Ramsey Plant Access Road may be installed to replace the generators before the installation of the main transmission line. The line may be installed if it was needed and MMC acquired easements for its construction across private land on the Bear Creek Road. Flathead Electrical Cooperative would provide power for the 34.5-kV line and MMC would become a Cooperative member. Flathead Electrical Cooperative provides power to private owners along both the Libby Creek Road and the Bear Creek Road via above- and underground electric lines. MMC will upgrade the existing line to

34.5 kV and then extend the line if all necessary easements were acquired. Under Flathead Electrical Cooperative policies, an existing member cannot unreasonably withhold approval to extend the powerline to other members. If the buried 34.5-kV line was installed, which is anticipated to take about a year during reconstruction of the Bear Creek Road, the generators would be used as standby power during construction.

To provide power to the Libby and Ramsey adit activities, a temporary substation would be installed near the intersection of NFS road #6210 and the Ramsey Plant Site Access Road (Figure 7). If constructed, the 34.5-kV line along Bear Creek Road and the Ramsey Plant Access Road would connect to this substation. Power would be distributed from the temporary substation to the Libby Adit Site and Ramsey Plant Site. For full operations, a 230-kV transmission line would be installed that ties with the Noxon-Libby transmission line near Sedlak Park (Figure 1) to the Ramsey Plant Site Substation (Figure 5). After the Sedlak Park Substation was built and the main 230-kV transmission line (discussed under section 2.8*, Alternative B—MMC's Proposed Transmission Line (North Miller Creek Alignment Alternative)*) was installed, the temporary substation would be relocated to the Ramsey Plant Site. One of the generators on the Libby Adit Site would then be relocated to the Ramsey Plant Site and provide standby power for mine operations, the remaining generator at the Libby Adit Site would no longer be required and would be removed from the site.

2.4.2 Operations Phase

2.4.2.1 Mining

2.4.2.1.1 Ore Body Characteristics

The ore body is composed of two nearly parallel mineralized horizons that range from 14 to 140 feet thick and are separated by a waste zone called the barren zone (Figure 10). In the 1980s, NMC originally designated the upper zone of the ore deposit as the B-1 Zone and the lower zone as the B Zone. Perhaps to avoid confusion with various beds identified by others (Hayes 1983, Boleneus *et al.* 2005), Mine and Quarry Engineering Services in the Preliminary Economic Assessment (2011) indicated the B zone was subsequently renamed Zone 2 and the B1 zone was subsequently renamed Zone 1. This EIS follows the renamed zone nomenclature. The average thickness of the Zone 1 is 30 feet and Zone 2 averages 34 feet. A barren lead zone, ranging in thickness from 0 to 200 feet and averaging about 30 feet, separates the two ore zones. The ore body outcrops near the northern end of Rock Lake, and plunges about 15 degrees to the north and northwest. The ore body may extend farther to the north and northwest. Overburden thickness ranges from 0 feet at the ore outcrop near the northern end of Rock Lake to more than 3,000 feet near St. Paul Lake. The ore consists of quartzite, silty quartzite, and siltite of the lower Revett Formation. Section 3.9, *Geology and Geochemistry* provides a more detailed discussion of the ore body geology. Rock strength tests were conducted on samples collected from drill cores collected in the early 1980s. Data from the test work were used in mine design, pillar sizes, and other important criteria.

2.4.2.1.2 Mining Method

The ore deposit would be mined using conventional room-and-pillar methods, with both diesel and diesel-electric underground equipment. A room-and-pillar method is where some ore is not mined to provide pillars or columns of ore (Figure 10). MMC's preliminary mine design is based on a rigid-pillar approach. Rigid-pillar design means that all the pillars are designed so that their strength exceeds the loads expected to be imposed on them, and therefore they should not fail or yield. Different pillar types, based on their location within the deposit, are planned to support the overburden ceiling.

Preliminary mine planning was based on a standard pillar size of 40 feet wide by 60 feet long, laid out in a regular grid basis (Figure 10). Average mining height of 48 feet and an entry width (area between pillars) of 40 feet were assumed for initial mine planning. Until a sill analysis can be conducted, pillars would be aligned between the upper and lower zones. Initial estimates indicate 65 to 75 percent of the mineable reserves would be removed. Actual pillar sizes would vary depending on the ore thickness, overburden thickness, local rock quality, and hydrologic conditions. MMC would develop the final pillar design after the Libby Adit and subsequent underground testing were complete.

As part of the Libby Adit Evaluation Phase, MMC would conduct additional underground core drilling before developing final mine plans. The drilling would be used to collect detailed information on underground geologic structures, ore thicknesses, ore grades, and hydrology.

Initial mine development would start in the central section of the deposit. Mining would progress generally toward the outcrop area and take 7 to 8 years to reach the upper portion of the deposit near Rock Lake. MMC would stop mining 500 feet from Rock Lake and 100 feet from the Rock Lake Fault (Figure 11). It is expected that the Rock Lake Fault varies in structural thickness. Drilling would define the fault zone and establish the starting point for the 100-foot barrier in advance of approaching the buffer zone. Before the final barrier pillar design/location was completed, MMC would not mine within the 100-foot buffer zone but would conduct hydrologic and geotechnical studies to determine whether closer mining could be conducted. The following parameters would be determined by exploratory drilling ahead of development and flow testing:

- Fault location and dip (slope)
- Hydraulic conductivities and storage capacities for the fault zone and adjacent transition zones
- Width of the fault and transition zones
- Water pressures in the fault and transition zones

Similar studies would be conducted on the Rock Lake barrier pillar if mining were proposed closer than 500 feet to Rock Lake. These studies would be reviewed by the lead agencies and approval would be required before MMC could mine within a smaller buffer area. Microseismic and conventional monitoring would be used to evaluate long-term stability. Monitoring sensors would be located in operating and abandoned sections of the mine. The sensors would be connected to a continuous monitoring system and would record the size and approximate location of seismic events.

During full production, ore would be hauled from the ore passes to the primary underground crusher using 26- and 50-ton electric haul trucks. Crushed ore would be sent to the ore stockpile building via a 1,200-foot overland conveyor for further crushing and ore recovery (Figure 5). The conveyor crossing at Ramsey Creek would be completely enclosed to minimize fugitive dust and a secondary containment trough would catch falling rock to prevent ore from falling into Ramsey Creek. Spillage within the conveyor structure would be shoveled onto the belt or removed at clean out points at either end of the structure.

2.4.2.1.3 Geotechnical Monitoring

Geotechnical monitoring would be completed to collect rock mechanic data and geologic information that were pertinent to mine design criteria and employee safety. The geotechnical monitoring would be an update to geotechnical monitoring procedures and methods specified in DEQ Operating Permit #00150 and the 1993 ROD. The monitoring would include logging drillholes and mapping of the mine workings and surface features. Rock quality analysis would evaluate fracture and fault frequency, orientation, and other properties, rock strength testing for stress, strain, and strength, and *in situ* geomechanical tests. Microseismic monitoring would be used to assess long-term stability. Microseismic monitoring would include installation of sensor stations in operating and abandoned sections of the mine, and continuous monitoring of sensor stations. Stress monitors would be located near or on faults, barrier pillars, sill pillars, and other important structures/features. Data would be compiled, assessed, and reported to the lead agencies in an annual report.

The monitoring plan would be developed as mine activities were initiated during construction. Mapping would be completed as the adits, development, and mining activities progress. Drilling would be completed as part of the delineation drilling that would occur in advance of mine development and mining. The core would be available to assess fractures, faulting, and establish if the monitoring plan should be modified to include any new features or address any new issue.

2.4.2.2 Milling

2.4.2.2.1 Ore Processing

The mill would operate 7 days per week, 350 days per year for a total processing capacity of 7 million tons per year (20,000 tons of ore per day). Initial production would be 12,500 tons per day (tpd). The milling process would involve five major steps: crushing, grinding, flotation, concentrate dewatering, and tailings storage (see Figure 24 in MMC 2008). Crushing would occur underground while the remaining processes would occur in the mill facility. Reagents added during the flotation process would separate the copper and silver minerals (sulfides) from the host rock (generally quartzite), producing a copper-silver concentrate.

Ore would be processed into a concentrate using a conventional milling process known as froth flotation. In froth flotation milling, finely ground ore is mixed with water and various reagents and air is forced through the mixture in a series of large tanks called flotation cells. Sulfide minerals, such as copper, attach to air bubbles (or froth) that float to the top of the cell and are skimmed off the surface of the flotation cells and collected. Silver is found in its native form and is attached to the sulfide minerals, such as bornite, associated with the ore deposit. Silver would be collected concurrently with the sulfide minerals. Potassium amyl xanthate would be used as the collector and methyl isobutyl carbinol as the frother. These would be the only reagents required for flotation of the Montanore ore minerals. A polyacrylamide flocculant, such as Percol 352, would be used to assist the settling of the concentrate and the fine fraction of the final tailings in their respective thickeners. Percol 352 contains acrylamide, a regulated volatile organic chemical in Montana. The proposed reagents are the same reagents used at the nearby Troy Mine. Material safety data sheets for the proposed reagents are presented in MMC's Plan of Operations (MMI 2005a, MMC 2008).

The non-mineralized rock, called tailings, which would consist mainly of quartzite, would sink to the bottom of the flotation cells (see section 2.4.2.3, *Tailings Management*). Bench-scale testing of Montanore Project ore and evaluation of the Troy Mine milling process, which processes an ore similar to Montanore ore, indicate that the mill process would operate at a near-neutral pH. MMC does not anticipate the need for pH control. Process chemicals may be required periodically for testing, pH modification, or cleaning the flotation circuit and other process circuits in the mill. The flotation process would continue through cleaner flotation cells and would be repeated several times to improve mineral recovery and concentrate quality. After the flotation circuit, the concentrate would be sent to a dewatering system and stored until it was transported to the Libby Loadout (Figure 12) for shipment to the smelter. The concentrate would be the final economic product of the milling process.

2.4.2.2.2 Concentrate Shipment

After dewatering, the concentrate would be stored in a covered building and then loaded into 20-ton, covered, highway trucks by a front-end loader. Truck covers would be used to minimize loss of concentrate. At peak production, about 420 tons of concentrate, or 21 trucks per day, would be trucked daily via NFS road #4781, a new access road (the Ramsey Plant Site Access Road) (Figure 3), NFS road #278 (Bear Creek Road), reconstructed sections of NFS road #278, and US 2 to Libby, and then to an unnamed road accessing the Kootenai Business Park to a loadout facility. The loadout would be next to the Troy Mine loadout. MMC would limit concentrate haulage to daylight hours and not during major shift changes. Concentrates would be stored at the loadout inside an enclosed building with rail access on private land at the Kootenai Business Park in Libby, Montana, (Figure 12) and then shipped via rail to a smelter. For storage and handling of concentrates, a new building would be erected and either an existing concrete pad or a new pad constructed for the building would be used. The facility would be covered to eliminate any precipitation and runoff issues. Trucks would back onto a concrete pad and dump concentrate into the concentrate building. A front-end loader would stack the concentrate in the building for shipping. Rail cars would be loaded by a conveyor belt fed by a front-end loader. Dust control devices would be used during rail loading activities to minimize fugitive dust. The rail car would be located inside an enclosed area to minimize fugitive dust associated with concentrate handling and loading. The openings of the rail car loadout building would be covered with heavy plastic strips or other similar devices. The railroad track would be extended to permit storage of rail cars. Covers for the rail cars would be used to minimize loss of concentrate.

MMC and the Kootenai Business Park have signed a letter of intent to operate the loadout facility. During final design, MMC would finalize this agreement and discuss retention of the facility for future use by the Kootenai Business Park. For purposes of planning, Kootenai Business Park and MMC expect the building would be retained.

2.4.2.3 Tailings Management

2.4.2.3.1 Tailings Pipelines

Tailings from the milling process would be separated at the mill and tailings impoundment into coarse-textured sand (sand tailings) and fine-textured clay (fine tailings) fractions. The sand fraction and water would flow as a slurry by gravity through a 10-inch diameter double-walled, HDPE pipe on the surface from the mill 6.4 miles to the tailings impoundment, where the slurry would be sent to cyclone separators (cyclones) for further separation of dam construction material. Fine tailings from the mill would be transported to the tailings impoundment through a 14-inch double-walled, HDPE or equivalent type pipeline. Reclaimed process water would be returned to the mill from the tailings impoundment in a 14-inch to 16-inch HDPE pipe or similar pipe (Figure 13).

The fine tailings would flow to a thickener northeast of the mill (Figure 5). Thickener overflow (water) would be diverted directly back into the process circuit or to the mine/yard pond (see section 2.4.2.4, *Water Use and Management*). All pipelines would be routed in part on the ground surface along the existing road (Figure 3). A pump station would be needed at a low spot near a new Poorman Creek bridge (Figure 13). This pump station also would pump tailings and water to the tailings impoundment to clear the line in the event of a temporary shutdown due to mechanical or power failure.

MMC designed measures to prevent or mitigate ruptures in the tailings pipelines. MMC would construct a second sand fraction tailings line to use when the first line was in need of repair or replacement. The pipelines would be double-walled and fitted with air release/vacuum valves to ensure consistent flow. An automated leakage sensing system would continuously monitor line operation, and the sensing system would include the installation of magnetic flowmeters on the tailings line at the mill and at the tailings pond. If a flow differential signal were received at the control room, an alarm would sound, and the mill would be systematically shut down, starting with the feed conveyors to the grinding mills. Valves on the tailings line at the mill would be closed. The final tailings pump would by-pass the cyclones and pump directly to the tailings thickener. Sensors would also be installed along each pipeline to monitor the space between the inner and outer pipes. If a leak were detected, the signal would be sent to the control room, and the shutdown procedures would be initiated. The surface pipelines between the mill and the tailings impoundment would be visually inspected each shift. An additional inspection would take place during scheduled maintenance shutdowns. The pipelines would be routed in a 24-foot-wide flat bottom ditch to contain any leakage from the pipelines. An unlined 6-foot-wide ditch paralleling the entire length of the road and pipelines would intercept any released tailings (Figure 13). Containment and surface water runoff ditches would be constructed with an earthen berm between them. This berm would ensure that in the event of a rupture of the double-walled pipe, all tailings would remain in the ditch and not come in contact with surface waters. A lined flume and trestle would be constructed (Figure 13) where the pipelines would cross Poorman Creek.

2.4.2.3.2 Main Dam and Saddle Dams

The tailings impoundment would consist of four primary structures: Starter Dam (discussed in section 2.4.1.5, *Tailings Impoundment*), Main Dam, North Saddle Dam, and South Saddle Dam (Figure 8). The Main Dam would be a compacted cyclone sand dam constructed by the centerline method to an elevation of 3,718 feet with a crest width of 30 feet, and downstream slope of 4H:1V (Figure 9). It would be constructed over the Starter Dam. The maximum dam height would be 318 feet and the final crest length would be 5,200 feet. The dam would be raised using up to 30 million tons of cyclone underflow (sand tailings) hydraulically placed and compacted in cells. The cyclone overflow (fine tailings) would be discharged in the impoundment to form a tailings beach on the dam face, forcing water away from the dam. If necessary, mine waste rock would be used in dam construction to supplement the volume of cycloned sands.

The sand shell of the dam would be constructed by hydraulic sluicing of the sand into cells oriented parallel to the dam crest. Dikes of sand pushed up by bulldozers would confine the perimeter of the cells. The cells would range between 100 feet to 150 feet wide, up to 400 feet long, and a maximum of 3 feet thick. Cell construction would begin at the toe of the dam and progress back and forth across the dam face until the downstream slice reaches the dam crest. For each year of construction, sand placement would start at the downstream toe of the dam and be raised up the dam slope to the required crest elevation. Because the final crest elevation would not be achieved until October at the end of each season, each year's dam raise would provide the required storage needed until October of the following year. This would ensure that adequate dam freeboard and tailings storage capacity would be available at all times.

A collection system would be installed at the downstream end of the cells to decant the runoff water and segregated finer tailings out of the cells. The outflow would be carried in a pipeline to the dam toe where the fines would be settled in the Seepage Collection Pond, before pumping the water back the tailings facility. When the sand built up at the discharge end of the cells to between 10 feet to 15 feet, the cell deposition would be advanced along the dam slope. The cycle would be repeated when the full length of the dam had been raised 10 feet to 15 feet.

The South Saddle Dam would be a combination of a compacted general fill starter and cycloned sands, and would be constructed in Year 8 (Figure 8). The starter would contain 280,000 cubic yards of general fill. General fill would be excavated from borrow areas within the impoundment area and available mine waste rock. A North Saddle Dam would be constructed of 170,000 cubic yards of compacted general fill material and would be constructed in Year 11 (Figure 8). A blanket filter and drain would be installed under the compact fill on the impoundment side or downstream portion of the North and South Saddle dams.

2.4.2.4 Water Use and Management

2.4.2.4.1 Project Water Requirements

The project water balance is an estimate of inflows and outflows for various project components (Figure 14). Actual volumes for water balance variables (*e.g.*, mine and adit inflows, precipitation and evaporation, dust suppression) would vary seasonally and annually from the volumes estimated. MMC would maintain a detailed water balance that would be used to monitor water use (the agencies' modified requirements are in Appendix C). During the Evaluation and initial Construction Phases, mine and adit inflows would be sent to the LAD Areas, or the Water Treatment Plant, if necessary. After the Starter Dam was constructed, some water would be stored at the Little Cherry Creek Tailings Impoundment Site for initial mill use. Discharge at the LAD Areas would be 500 gpm during the 3-year Construction Phase (Table 14). After mill operations began, all mine and adit inflows would be needed for mill operations, and no discharges would occur. Seasonal fluctuations in mine and adit inflows and water intercepted by the impoundment would be managed by storing water in the impoundment.

Sometime after the first 5 years of mill operations, additional water, or make-up water, would be needed at the mill. Make-up water requirements are expected to average 159 gpm over Project Years 16 to 24 (Table 14). Additional water rights would be required to provide adequate make-up water (see next section). In accordance with DEQ Operating Permit #00150, MMC would notify the lead agencies if long-term surface water withdrawals would be necessary. Groundwater withdrawals from alluvial wells also would be covered under these requirements. MMC would modify the aquatic life monitoring plan to take into account such withdrawals. Withdrawals would proceed only upon the lead agencies' approval of an updated aquatic life monitoring plan. MMC would not withdraw any surface water for operational use whenever flow at the point of withdrawal was less than the average annual low flow. In lieu of measured annual low flows, calculated low flow at the point of withdrawal using data from similar drainages, would be acceptable.

Table 14. Average Water Balance, Alternative 2.

Phase—>	Evaluation Phase Two Years		Construction Phase Three Years			Operations Phase 1st 5 Years	Operations Phase 2nd 5 Years	Operations Phase 3rd 5 Years	Closure Phase 1st 5 Years	Post-Closure Phase 2nd 5 Years
Project Year—>	**Project Year 1**	**Project Year 2**	**Project Year 3**	**Project Year 4**	**Project Year 5**	**Project Years 6-10**	**Project Years 11-15**	**Project Years 16-24**	**Project Years 25-29**	**Project Years 30-39+**
Production Rate—>	**0 tpd**	**0 tpd**	**0 tpd**	**0 tpd**	**0 tpd**	**12,500 tpd**	**17,000 tpd**	**20,000 tpd**	**0 tpd**	**0 tpd**
Component	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**
Mine and Adit Inflows										
Adit inflow	230	230	340	395	450	270	270	200	0	0
Mine inflow	30	30	30	30	30	110	110	170	0	0
Total inflow	**260**	**260**	**370**	**425**	**480**	**380**	**380**	**370**	**0**	**0**
LAD/Water Treatment Plant										
Inflows - mine and adit flows	260	260	370	425	480	0	0	0	0	0
Runoff from Libby Adit waste rock stockpile	3	3	0	0	0	0	0	0	0	0
Water from tailings impoundment seepage/runoff collection	0	0	134	75	20	0	0	0	500	500
Water treatment plant/LAD Area discharge	**263**	**263**	**504**	**500**	**500**	**0**	**0**	**0**	**500**	**500**
Mill Inflow										
Flows from mine/adit	0	0	0	0	0	380	380	370	0	0
Water from tailings impoundment seepage/runoff collection	0	0	0	0	0	1,328	1,854	2,222	0	0
Make-up water (not specified)	0	0	0	0	0	0	89	159	0	0
Subtotal	**0**	**0**	**0**	**0**	**0**	**1,708**	**2,324**	**2,751**	**0**	**0**
Mill Outflow										
Water transported with tailings at deposition	0	0	0	0	0	1,702	2,315	2,742	0	0
Water in concentrate	0	0	0	0	0	6	9	9	0	0
Subtotal	**0**	**0**	**0**	**0**	**0**	**1,708**	**2,324**	**2,751**	**0**	**0**

Phase—>	Evaluation Phase Two Years		Construction Phase Three Years			Operations Phase 1st 5 Years	Operations Phase 2nd 5 Years	Operations Phase 3rd 5 Years	Closure Phase 1st 5 Years	Post-Closure Phase 2nd 5 Years
Project Year—>	Project Year 1	Project Year 2	Project Year 3	Project Year 4	Project Year 5	Project Years 6-10	Project Years 11-15	Project Years 16-24	Project Years 25-29	Project Years 30-39+
Production Rate—>	0 tpd	0 tpd	0 tpd	0 tpd	0 tpd	12,500 tpd	17,000 tpd	20,000 tpd	0 tpd	0 tpd
Component	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)
Tailings Impoundment Inflow										
Precipitation on stored water pond	0	0	0	117	176	176	448	713	851	470
Seepage collection pond net precipitation	0	0	89	177	266	266	266	266	41	15
Runoff captured from impoundment dam/beach/ catchment area	0	0	46	93	139	139	124	124	25	0
Runoff from waste rock stockpile within impoundment	0	0	4	4	4	4	12	0	0	0
Water transported with tailings at deposition	0	0	0	0	0	1,702	2,315	2,742	0	0
Water released from fine tailings consolidation	0	0	0	0	0	27	54	71	125	24
Water released from sand tailings consolidation (dams)	0	0	0	0	0	69	228	407	14	7
Groundwater interception/ seepage collection	0	0	0	0	0	246	246	246	246	246
Subtotal	0	0	139	391	585	2,628	3,693	4,570	1,302	761
Tailings Impoundment Outflow										
Dust suppression	0	0	5	5	5	12	24	33	33	0
Evaporation	0	0	0	109	163	163	415	662	790	436
Water retained by tailings voids	0	0	0	0	0	1,011	1,374	1,628	0	0
Water recycled to mill (water treatment plant/LAD Area in pre/post operations)	0	0	134	75	20	1,328	1,854	2,222	500	500
Seepage to groundwater	0	0	0	0	0	15	25	25	25	25
Change in water stored in impoundment	0	0	0	203	397	100	0	0	(45)	(200)
Subtotal	0	0	139	391	585	2,628	3,693	4,570	1,302	761

MMC proposes that mine and adit water discharged to the LAD Areas would receive treatment through the land application (*i.e.*, mine and adit water would not receive treatment before land application). MMC would use the Water Treatment Plant at the Libby Adit Site or install a new water treatment facility at the Ramsey Plant Site, if necessary to meet MPDES permitted effluent limits. The initial startup of the mill would require a large quantity of water. MMC would store sufficient water during construction to facilitate the mill startup process. The construction of the Starter Dam would be initiated concurrent with the Ramsey Adits development. Untreated water from the Ramsey Adits would be piped to the lined mine/yard pond at the Ramsey Plant Site, or LAD Area 1 and 2 until the Starter Dam was completed. After the lined pond behind the Starter Dam was built, water from the Ramsey Adits would be conveyed to the lined water reclaim pond behind the Starter Dam until the desired water quantity was achieved. Once this level of water was achieved in the Starter Dam, Ramsey Adit discharges to LAD Areas 1 and 2 for treatment and disposal would resume. During mine operations, the water reclaim pond would be maintained, within the impoundment area, at a minimum capacity of 30 million gallons for water clarification. Pond location would move throughout the life of the tailings impoundment but would remain along the approximate centerline of the tailings impoundment. Initially, the reclaim water pond would be located near the Starter and Main Dams and progress to the west. All lateral drains beneath the reclaim water pond would be underlain by either the geomembrane liner, or tailings before being covered with the reclaim pond. Water from the tailings impoundment would be pumped back to the mill in a 14- to 16-inch-diameter, 1-inch-thick double-walled HDPE or similar surface pipeline that would parallel the tailings pipelines. Post-closure water use and management is discussed on page 104.

2.4.2.4.2 Water Rights

MMC holds two 1902 surface water rights on Libby Creek, one for mining near the Libby Adit site in Section 15, Township 27N, Range 31West (with a maximum diversion of 44.9 gpm between April 1 and December 19, and maximum volume of 50.97 acre-feet), and one for domestic use in the same section (15 gpm year-round, and a maximum volume of 1.5 acre-feet). MMC also holds a 1989 groundwater right for mining near the Libby Adit site in Section 15, Township 27N, Range 31 West with a total diversion of 40 gpm year-round. These rights would likely be sufficient to meet anticipated uses for drilling and potable water use during the Evaluation Phase and potable water use and dust control during all other phases, but insufficient for mining uses. MMC estimated that water rights of 200 to 300 gallons per minute would be sufficient to cover water deficits. MMC did not apply for any beneficial water use permits for Alternative 2.

2.4.2.4.3 Wastewater Discharges

The DEQ issued a MPDES permit to NMC in 1997 for Libby Adit discharge to the local groundwater or Libby Creek. Three outfalls were included in the permit (Figure 15): outfall 001 – percolation pond; outfall 002 – infiltration system of buried pipes; and outfall 003 – pipeline outlet to Libby Creek. The percolation pond has an estimated capacity of 25 acre-feet (8.1 million gallons). If the pond reaches capacity, an overflow pipe routes water to a direct discharge to Libby Creek (outfall 003) (DEQ 2006). Since MMC began dewatering of the Libby Adit, it has only discharged to outfall 001. The DEQ renewed the permit in 2006. A minor modification of the MPDES permit in 2008 reflected an owner/operator name change from NMC to MMC. In 2011, MMC applied to the DEQ to renew the existing MPDES permit and requested the inclusion under the permit of five new stormwater outfalls needed in Alternative 3 for the next 5 years. In 2011, the DEQ determined the renewal application was complete and administratively extended the permit (ARM 17.30.1313(1)) until MMC receives the renewed permit. Other outfalls may be identified during the MPDES permitting process.

During operations, MMC would maintain the permitted outfalls at the Libby Adit Site and would apply for additional outfalls for wastewater disposal. Potential wastewater discharges associated with Alternative 2 include:

- Seepage or percolation to groundwater from LAD Areas 1 and 2
- Surface water runoff and/or seepage from waste rock stockpile(s) at LAD Area 1
- Surface water runoff from the Ramsey Plant Site and portal

Tailings seepage that did not reach surface water would be considered a discharge to groundwater. Discharges to groundwater by projects covered by a Hard Rock Operating Permit are exempted from Montana's groundwater discharge permitting requirements. The EPA established Effluent Limitations Guidelines (ELGs) applicable to mines that produce copper and silver and mills that use the froth-flotation process for the beneficiation of copper and silver (40 CFR 440.100). The following discharges subject to the ELGs would include, but not be limited to: mine and adit drainage, tailings impoundment seepage, tailings impoundment dam runoff, runoff and seepage for waste rock stockpiles, runoff from facilities constructed of waste rock if subjected to precipitation, and runoff of excess water from LAD Areas 1 and 2. The discharges would be regulated at an outfall in a MPDES permit. The following discharges would be subject to Montana's stormwater regulations, but not to the ELGs: soil stockpiles, access roads, parking areas, and runoff or seepage of facilities not constructed of waste rock or tailings. Management of stormwater discharges are discussed in the subsequent section 2.4.2.4.5, *Stormwater Control*.

Land Application Disposal

MMC constructed and operates a Water Treatment Plant to treat adit and mine inflows from the Libby Adit. MMC proposed to use the LAD Areas for treatment and disposal of adit and mine inflow water from the Ramsey Adits. MMC would dispose of adit and mine inflows during construction and operations at LAD Areas 1 and 2 between Ramsey and Poorman creeks (Figure 7) using spray irrigation techniques. As part of the overall water management plan, MMC would use the Water Treatment Plant at the Libby Adit Site or install a new water treatment facility at the Ramsey Plant Site if necessary to meet MPDES permitted effluent limits. If land application of excess water resulted in BHES Order limit or nondegradation criteria exceedances, MMC would treat the additional water at the Water Treatment Plant instead of discharging it to the LAD Areas.

Concurrent with the Ramsey Adit completion, MMC would construct a 10-acre lined surge pond at LAD Area 1 (Figure 7 and Figure 15). The surge pond would convey water to the spray irrigation system. During construction, mine and adit water from the Libby Adit could be discharged via the existing outfalls 001, 002, and 003 or LAD Area 1. MMC plans to install a pipeline from the Libby Adit area to the LAD Areas.

Wastewater would be disposed of through irrigation of 200 total acres at the two LAD Areas. MMC proposes to operate both LAD Areas concurrently, with the anticipated capability of irrigating at a peak rate of 558 gpm (279 gpm annually or 558 gpm over 6 months, Geomatrix 2007b). The combined LAD Areas would have a capacity of 2,000 gpm of water during the 6-month growing season. If disposal of higher quantities of water were required due to greater than expected mine dewatering rates, the water would be stored in the tailings impoundment and/or discharged to one or more of the supplemental LAD Areas following any necessary treatment to meet MPDES permitted effluent limits (see section 2.4.2.4.4, *Excess Water Management*).

Each LAD Area would have above-ground irrigation pipes and sprinklers 4 to 8 feet above the ground surface. The LAD Areas would require selective tree thinning to allow a 50-foot unrestricted spray radius around each sprinkler. Typical operation would cycle all sprinklers once per week and apply about one inch of water per cycle. The maximum application rate per sprinkler would be about 4 inches per month and 24 inches over the 6-month growing season. The average application rate is 0.04 inch per hour; the application rate would vary depending on climate and site-specific conditions. Additional detail about LAD operations is found in MMC's Plan of Operations (MMI 2005a, MMC 2008).

The LAD Areas would be 300 feet or more from any perennial stream (Figure 15). In addition, sprinkler systems would be designed so that areas within 100 feet of ephemeral drainages could be shut off during periods of surface water runoff. MMC is evaluating the option of using snow-making equipment to convert stored water into snow during the winter season. This snow would be spread over LAD Areas 1 and 2. Snow-making would only be performed after an assessment was completed and approved by the lead agencies regarding potential for excess loading to LAD Areas 1 and 2 during the winter season.

Infiltration and/or runoff from stormwater on the waste rock stockpile at LAD Area 1 is subject to MPDES permitting requirements. MMC proposes to collect LAD Area 1 surface water runoff in an unlined ditch extending northward along NFS road #4781 and routed into an unlined sediment retention pond (Figure 7). A second unlined ditch and pond are proposed for runoff from LAD Area 2. These two ponds would be sized to contain runoff from a 10-year/24-hour storm event. An overflow from either pond is proposed to discharge pipe to Poorman Creek via overland flow. Seepage from unlined ponds would discharge to groundwater. To reduce stormwater-mine drainage commingling on the LAD Areas, runoff from undisturbed upgradient areas would be diverted around both LAD Areas. LAD Areas 1 and 2 would be used seasonally.

The Waste Rock Stockpile at LAD Area 1 would be a staging area for temporary and intermittent placement of waste rock during construction of the tailings impoundment dams. In addition, MMC anticipates minimal to no surface water discharges from LAD Area ponds due to the design capacity (10-year/24-hour storm event).

Tailings Seepage

As part of the conditions of DEQ Operating Permit #00150, MMC designed an underdrain system to collect tailings water from beneath the tailings impoundment to minimize seepage to underlying groundwater (Figure 8). Water collected by the underdrain system would flow beneath the tailings dam, down a short segment of the former Little Cherry Creek, and be captured by the Seepage Collection Dam. MMC estimates 25 gpm of tailings water seepage would not be collected by the underdrains and would discharge to groundwater. A pumpback well system downgradient of the impoundment, if required to comply with applicable standards, would collect tailings seepage after it mixed with groundwater beneath the impoundment (see section 2.4.1.5.7, *Seepage Collection*).

2.4.2.4.4 Excess Water Management

The LAD Areas and tailings impoundment would be the primary wastewater storage and disposal areas. MMC would use a number of techniques for managing project-related inflows and discharges, such as the existing Water Treatment Plant, grouting fractures and joints to reduce groundwater inflows, storage in the tailings impoundment coupled with enhanced evaporation (evaporating water by spray irrigation, either at the tailings impoundment or LAD Areas 1 and 2), and LAD Area/Supplemental LAD Area. These techniques are briefly discussed in the following sections.

Water Treatment Plant

The Water Treatment Plant at the Libby Adit Site could be used to treat 500 gpm mine and adit water at its current capacity. Actual flow rate would depend on mine and adit water quality. The existing infrastructure at the Libby Adit Site would allow piping of the water from the Ramsey Adit and mine workings via the Libby Adit. A series of collection sumps would be constructed to remove sediment before discharge to the Water Treatment Plant.

Collection and segregation of "clean" groundwater from normal mine drainage water in areas where large water inflows occur could reduce the volume of water requiring treatment. The technique involves drilling an array of holes into a water-producing zone and directing the water into a collector pipe. The inflowing groundwater would be unaffected by mining activities and could be discharged without treatment while maintaining compliance with MPDES permitted effluent limits. Segregation of water may be difficult and not practical or feasible. This technique would not affect the water balance, but could reduce the mine water volume needing treatment.

Underground Water Management - Grouting

The bedrock encountered by the adits and mine would have low permeability. Several large faults and many smaller fractures, capable of storing and transmitting groundwater, would be encountered during mine development. To reduce the amount of water entering the adits and mining areas, MMC would grout areas where water was flowing into the adits and mine workings. Drilling would occur ahead of drift development to allow identification of potential inflows. Grouting would be used as the primary mechanism to reduce adit and mine inflows.

Tailings Impoundment Storage

An estimated 71 million gallons of water (220 acre-feet) would be required to initiate mill operations, and MMC plans to slowly build this water inventory during construction activities. The lined Starter Dam would be designed to hold the required amount of water for mill startup.

During Starter Dam construction, a temporary water retention structure upstream from the Starter Dam would be constructed to hold water temporarily until the Starter Dam was complete. Once the tailings facility was in full operation, MMC expects the impoundment would have ample storage capacity to hold excess water.

Winter Discharge/Supplemental LAD Areas

If necessary, LAD Areas 1 and 2 could be used in the winter months using snowmaking equipment for primary treatment of discharges. This method would be used sparingly as it would delay startup of LAD Areas 1 and 2 in the summer. MMC identified supplemental LAD Areas near the two Ramsey Creek LAD Areas 1 and 2 and the Little Cherry Creek impoundment for discharge of wastewater (Figure 16). Borrow pits at the tailings impoundment would be available for untreated water disposal and are anticipated to be required only to handle excess water or temporary increases in water during construction. If the borrow pits were used for land application, wastewater would be applied at a rate that would increase evaporation and plant consumption of water.

Temporary Diversions

Temporary diversion ditches within the tailings impoundment would be used to control water from undisturbed areas. In the event of surplus water, MMC would divert water collected by the temporary diversion ditches within the tailings impoundment, but above the expanding tailings pond. These ditches would divert surface runoff from undisturbed lands within the tailings impoundment perimeter into the Little Cherry Creek diversion, thereby reducing the amount of water entering the tailings impoundment.

Enhanced Evaporation, Infiltration, and Dust Control

Enhanced evaporation would be accomplished by spraying within the tailings impoundment and when land applying untreated water at the LAD Areas. Managing water through a sprinkling system would result in substantial evaporation during certain periods of the year. In addition to evaporation, the LAD Areas would provide infiltration where vegetation would consume some of the water applied. MMC plans to use water to control dust from the tailings beaches. This would consume/evaporate a portion of the water generated from the project.

2.4.2.4.5 Stormwater Control

Erosion Control

MMC would use standard Best Management Practices (BMPs) for sediment control such as interim reclamation, diversions, berms, sediment fence, sediment traps and ponds, and straw bales. Revegetation practices would be used to control water erosion by providing a stabilizing cover. Interim stabilizing measures such as water sprinkling, mulch, and tackifiers would be used until vegetation becomes established. Sediment would be contained from processing and material handling operations in lined sediment control ponds. Soil would be salvaged in two lifts at the impoundment. Subsoil with increased rock fragment content would be placed on the 4H:1V tailings dam face.

Reclamation equipment would be worked along contours where possible to minimize creation of erosion channels. When work on slopes must be perpendicular to contours, crawler tracking or dragging would be used. Windrows of woody debris or logs would be placed parallel to slope contours and the bases of long fills.

Reclaimed sites would be inspected periodically throughout the reclamation effort to assess progress toward meeting reclamation objectives. Slopes would be visually inspected for rills, gullies, and slope failures and repaired as needed.

Stormwater Runoff from Facilities

The Ramsey Plant Site and adit portal patios would be constructed with a combination of waste rock and native cut-and-fill material. The waste rock at the Ramsey Plant Site would be placed so that it was surrounded by native material, thereby preventing direct contact of surface water runoff with waste rock. Surface runoff from the Ramsey Plant Site would be mine drainage and would be directed to a collection ditch on the southern side of the Ramsey Plant Site (Figure 5). The water would then flow by gravity to a lined mine/yard pond sized to accommodate the 10-

year/24-hour storm event volume (including sediment), 4 hours retention of the thickener overflow, and 3 feet of excess capacity or freeboard as a safety factor. The mine/yard pond would be lined with clay or a geomembrane to achieve a very low permeability (less than or equal to 10^{-6} cm/sec). Excess water in the pond could be used as mill make-up water or disposed at the tailings impoundment or LAD Areas (Table 14).

Runoff and seepage from the plant site fill slopes above Ramsey Creek would be collected in ditches and directed to an unlined sediment trap (Figure 5). The sediment trap would be designed to contain runoff from a 10-year/24-hour storm event. Excess water beyond the capacity of the trap would discharge 300 feet from Ramsey Creek through a constructed discharge point. Seepage to groundwater may be considered a discharge to surface water and subject to MPDES permitting requirements if it has a direct connection to surface water. MMC expects that a surface water discharge from the unlined sediment trap would be "intermittent" because, at build-out, most of the surface area of the pad would be covered with impermeable materials and any surface runoff would flow to the lined mine/yard pond. Water from the lined mine/yard pond would be used in the mill as needed. MMC expects a discharge to Ramsey Creek from exposed waste rock would only occur intermittently during construction.

The portal patio surface water would be stormwater runoff and would be directed down the access road, through a culvert at the Ramsey Creek bridge toward the mine/yard pond. A unlined sediment trap would be constructed below the portal patio and would be sized to handle a 10-year/24-hour storm event.

MMC would be responsible for snow removal from all access roads and the Ramsey Plant Site. All snow and ice removed from the site would be deposited according to mine drainage water management plans, including being left at the Ramsey Plant Site or Libby Adit Site or hauled to LAD Areas 1 and 2 or tailings impoundment. All debris removed from the road surfaces except snow and ice would be deposited away from the stream channels. Snow removal would be conducted in a manner to minimize damage to travelways, prevent erosion damage, and preserve water quality. Culverts would be kept free of snow, ice, and debris. MMC would not use salt on the roads.

In addition to the temporary diversion of Little Cherry Creek at the tailings impoundment, a permanent diversion ditch would be installed adjacent to NFS road #278 to direct runoff from the tailings impoundment (Figure 8). Diversion ditches would be constructed to capture runoff down gradient from all disturbances. Below the tailings impoundment, where possible, ditches containing runoff would be directed toward the Seepage Collection Pond; otherwise, appropriate BMPs would be used to handle stormwater that was not classified as mine drainage water or process water. Collection ditches/berms would be installed around the soil storage piles to reduce soil erosion/loss and control sediment impacts. Interim and concurrent reclamation would be employed where possible to reduce sediment delivery and enhance soil stability.

Stormwater associated with disturbance activities at the LAD Areas 1 and 2 (*i.e.*, access roads) would be directed toward the main access road and managed as part of the stormwater management system. A series of ditches and berms would be constructed to control runoff from the road surface. Other areas would use standard BMPs to reduce sediment delivery and to control erosion. A run-on diversion would be installed up gradient of LAD Area 1 to minimize the amount of water that would enter the site. The access road would provide run-on control to LAD Area 2.

2.4.2.5 Fugitive Dust Control

Measures to control and minimize fugitive dust are provided in MMC's Application for Air Quality Preconstruction Permit (TRC Environmental Corp. 2006a). A final fugitive dust control plan would be developed and implemented. MMC would use BMPs during construction, operation, and closure to control wind and water erosion. All appropriate precautions would be taken to minimize fugitive dust from all construction and operation activities related to the project, including concentrate transfer and loading activities at the Libby Loadout. These measures would include watering or applying dust suppression agents on unpaved roads and work areas on an as-needed basis.

Dust emissions from ore crushing, conveying, and other handling activities would be controlled with water sprays, wet Venturi scrubbers, and enclosures. Such control devices would be included on the primary crusher located underground, the conveyor belt, and the ore stockpile located adjacent to the mill facilities.

MMC's expects that seasonally, dust control at the tailings impoundment would occur continuously, but the decision to operate sprinklers at the tailings impoundment would be made based on regular inspection of the tailings impoundment during the day and on-site weather criteria to be established as part of the fugitive dust control plan. The presence of visible emissions, observed through shift inspection of the tailings impoundment by environmental personnel trained in visual opacity monitoring and by shift operators staffing the tailings impoundment, would prompt sprinkler operation. In addition, specific thresholds for weather conditions such as wind speed, precipitation, and humidity would be developed as part of the fugitive dust control plan to indicate the potential for fugitive dust emissions to occur, prompting sprinkler operation. Weather conditions and sprinkler operations if required would be documented (TRC Environmental Corp. 2006a).

All transfer operations and storage areas at the Libby Loadout would be completely enclosed. Concentrate transported by haul truck to the loadout would be dumped in an enclosed storage bin, and then transferred to rail cars. Loaded rail cars waiting for consolidation into a unit train would be covered to prevent wind losses and water pollution. The potential accumulation of concentrate along the haul truck turn-around, at the concentrate storage area, and along the railroad tracks would be limited, and would be managed by regular clean-up with sweepers (TRC Environmental Corp. 2006a). Groundwater monitoring wells would be installed at the loadout (Figure 12). Regular visual inspections would be completed by site personnel on reclaimed areas to evaluate where fugitive dust emission control measures were in place and properly functioning.

2.4.2.6 Waste Management

During the initial development phase, temporary, fully contained systems would be brought to the site. The self-contained units would be located at the Ramsey Plant Site and the Libby Adit Site. Once construction was completed or they were no longer required, the units would be removed from the sites.

During operations, MMC would install a closed sanitary system that would function similar to the self-contained units and would collect all gray and black water associated with the office, mill, and administration areas. MMC would install buried sewage tanks adjacent to the mill/office building complex and portable toilets would be located underground. Low-flow toilets and shower heads would be installed to minimize the amount of waste water generated. All sanitary waste would be pumped and disposed off-site. MMC anticipates one or two truck trips per week would be necessary to remove sanitary wastes.

Solid waste (excluding domestic/sanitary) would be transported off site to the Lincoln County landfill. MMC anticipates that no hazardous wastes would be generated by the operation. MMC would manage and dispose of any hazardous waste in accordance with applicable federal and state regulations. MMC would dispose of certain materials (ventilation bag, plastic pipe, lumber, and other similar materials) that were used for underground operations and that were damaged or exceed their useful life, would be placed in mined out sections of the mine. Records would be kept on disposal of materials underground and would include the general types of material disposed and the location of the disposal area in the mined out areas.

2.4.2.7 Communications

Communications for the project would be provided by both a telephone system and a two-radio system. Telephone and data communications would be via new, buried utilities (the 34.5-kV electric line) along the Bear Creek Road from Libby if MMC acquired easements for its construction across private land on the Bear Creek Road. Telephone and data communications would be placed on the 230-kV transmission line structures if easements could not be acquired. MMC currently has radio communications to the Libby Adit Site and would use this system for secondary emergency communications. MMC is currently authorized to use the local county emergency radio system to communicate with emergency responders. In addition, a fiber optic line would be included on the transmission line and would provide communications between the substations. No additional disturbance would be required for any of the communication systems for the project.

2.4.2.8 Project Employment

Construction would commence during Year 1, with the hiring of 135 employees, and would last about 3 years (Table 15). Construction employment would peak at 155 employees during Year 2. During Years 3 and 4, construction employment would be 65 employees. Total operations employment during Year 1 would be 30 employees, and is expected to reach 450 employees from Years 6 through 16 of the project. The mine is expected to operate 24 hours per day, 7 days per week, for 350 days per year. Maintenance repair and security activities would be scheduled during the remaining 2 weeks of the year.

Table 15. Projected Project Employment.

Year	Construction			Production			
	1	2	3	1	2-5	6-10	11-16†
Production Rate (tons per day)	0	0	0	12,500	12,500	17,000	20,000
Construction‡	135	155	65	65	0	0	0
Operations	30	130	246	246	246	450	450
Total	165	285	311	311	246	450	450

†Production would continue for 3 to 4 more years if 120 million tons were mined; much lower employment during the 10- to 20-year closure period.
‡Construction employment includes a 23-person crew for the transmission line construction.
Source: MMC 2008.

Much of the construction work would be equipment and specialty services required for project development. Each vendor or supplier may have a local distributor or hire local construction employees to assist in the installation or construction of their particular piece of the project. MMC expects up to 80 percent of the construction workers would be hired locally. MMC is committed to local hire and would encourage contractors to use local hire where possible, including partnerships with local businesses. MMC would work with local job services and educational institutions to outline the types of jobs and skills necessary for training purposes.

2.4.3 Closure and Post-Closure Phases

MMC's reclamation goal is to establish a post-mining environment compatible with existing and proposed land uses and consistent with the KFP. Specific objectives are: 1) long-term site stability, 2) protection of surface water and groundwater, 3) establishment of a self-sustaining native plant community where applicable and possible, 4) wildlife habitat enhancement, 5) protection of the public health and safety, and 6) attaining post-mining land use. The reclamation plan would be periodically revised to incorporate new reclamation techniques and update bond calculations. Before temporary or final closure, MMC would submit a revised reclamation plan to the lead agencies for approval.

2.4.3.1 Closure and Reclamation of Project Facilities

MMC would accomplish reclamation objectives by stabilizing disturbed areas during and following operations. MMC developed specific plans for each disturbed area.

2.4.3.1.1 Rock Lake Ventilation Adit

The Rock Lake Ventilation Adit would be plugged with concrete and any surface disturbance regraded. The adit location is steep and is bare rock; salvaging and replacing soil will not be feasible. If the site had salvageable soil and it could be safely removed, it would be salvaged and seeded. At closure, soil would be replaced and the area reseeded.

2.4.3.1.2 Ramsey Adits and Portals

Adit portals would be permanently closed upon completion of operations. Closure techniques would depend on whether water was produced at the opening. Dry openings would be sealed by using a concrete plug and backfilling with waste rock recovered from the portal patio. MMC would use water inflow data obtained during mining to predict the amount and quality of water expected from the adits. For entries producing water, a water-retaining plug would be installed in competent bedrock. Design of the water-retaining plug would be determined by hydrologic and geotechnical data. Water-retaining plugs may be located deeper into the adit than a dry plug; thus, mine entries from the portal to the plug would be backfilled. Final plugging design for "wet" openings would be prepared for lead agencies' approved before cessation of operations.

2.4.3.1.3 Ramsey Plant Site

The mill building, conveyors, bridges, administration offices, substations, and other facilities associated with this area would be dismantled and removed once they were no longer required to support mine operations or closure activities. MMC expects the majority of the Ramsey Plant Site facilities be removed, sold, scrapped, and/or disposed locally. Concrete foundations would be broken up and buried on-site. Inert materials would be placed underground for disposal and would be identified in the final closure plan. Buried utilities and pipelines would be left in place and the segment of the system that was exposed at the surface would be cut off 2 feet below the regraded surface and plugged.

The portal opening would be covered with material from the patio and graded to meet adjacent topography (Figure 18). The remaining portal patio area would be regraded to blend with the adjacent topography and promote runoff away from the disturbed area. The slopes would be graded to 2H:1V slope. All portal areas would be soiled and seeded. The sediment control structure located below the portal patio would be regraded so it would not retain runoff once vegetation cover was established on this area. The access road from the Ramsey Creek bridge would be ripped and graded to match the surrounding topography. The bridge would be removed and the area regraded to minimize sediment delivery to Ramsey Creek.

The Ramsey Plant Site would be constructed using a cut and fill sequence supplemented by a quantity of waste rock from the mine operations. Once all the buildings were removed, a portion of the fill material used to construct the mill site would be "pulled" back up the slope away from Ramsey Creek and placed into the cut side of the area. If the cut slopes were not stabilized by interim reclamation at plant closure, the slopes would be reduced to a 2H:1V slope. It is estimated that 87,250 cy of material would be graded during reclamation of the plant site. Internal roads and parking areas would be graded to blend in with the proposed final slope and revegetated using seeding and mulch. The Ramsey Access Road (NFS road #4781) would be reclaimed to pre-operation conditions.

2.4.3.1.4 Libby Adit Site

The DEQ currently holds a reclamation bond to cover reclamation of 11.6 acres at the Libby Adit Site, including plugging the existing adit, associated with its approval of Minor Revision 06-002. The KNF has not approved the activities described in Minor Revision 06-002 that may affect National Forest System lands. Activities associated with the Montanore Project that are outside the scope of Minor Revisions 06-001 and 06-002 would be a pipeline to LAD Area 1 and 2 from the Libby Adit Site, temporary utilities, and the road connecting the adit site with the tailings impoundment. Reclamation of the Libby Adit Site would follow procedures described for the Ramsey Plant Site. All structures would be removed, and above- and below-grade features would be resloped (Figure 19). The water well would be plugged in accordance with state regulations and all surface piping would be removed to below the ground surface. Internal roads and parking areas would be graded to blend in with the original slope and revegetated using seeding and mulch. Because the Libby Adit Site is on private land, MMC would maintain control of the property with a fence after mining was complete. The agencies would require a bond for long-term monitoring and maintenance, and possible long-term, post-closure water treatment in order to ensure ground and surface waters would be protected from unanticipated impacts.

2.4.3.1.5 Waste Rock Stockpile and LAD Areas

MMC expects all waste rock to be used in various construction activities. It is anticipated that no waste rock would remain at the LAD Area 1 stockpile after cessation of mining operations. Soil removed from this area before its use would be replaced, and the area revegetated.

The surge pond and sprinkler systems at LAD Areas 1 and 2 would be removed when discharge at the LAD Areas was no longer needed. MMC expects to use the LAD Areas after mining cessation to discharge tailings water (see discussion of Tailings Impoundment reclamation below). Any piping used to convey water from the operations to the LAD Areas would be removed and disposed offsite. Concrete outflow boxes would be broken up and buried on site. Surface disturbance from the access road, diversion ditch, and surge pond would be reclaimed and revegetated.

2.4.3.1.6 Tailings Impoundment and Borrow Areas

Tailings Impoundment and Dams

The basic reclamation plan for the tailings impoundment would consist of the following operations:

- Where possible, concurrently distributing soil and revegetating tailings impoundment dam lifts as completed during mine life. Trees would be planted on the reclaimed dam faces. Depositing sand-fraction tailings into the tailings impoundment during the final year of operation to produce the desired tailings gradient at closure (Figure 20).
- Drying the tailings impoundment surface by promoting natural drying/consolidation of tails, and evaporation. Revegetated areas on the tailings surface. If water quality met applicable standards, tailings waters (supernatant of free standing water and water in the tailings mass at closure squeezed out of the tailings mass as the reclamation cap was placed) would be disposed through LAD Areas 1 and 2 or constructed wetlands peripheral to the tailings impoundment. If required, the Water Treatment Plant may be needed to meet MPDES permitted effluent limits.
- Grading the tailings surface as it dried enough to support equipment to eliminate any surface water ponding. The North Saddle Dam would be removed and the surface runoff from the reclaimed tailings impoundment surface would flow overland via a diversion ditch toward the northwest and ultimately into Bear Creek (Figure 20).
- Adding excess waste rock or borrow to help consolidate tailings, produce final reclamation gradients, and give structural support for placing the reclamation cover system.
- Replacing stockpiled soil salvaged from the site during construction in two lifts and revegetating all disturbances through seeding and planting.

All mechanical facilities associated with the tailings impoundment, including the above-ground pipelines, would be removed. All areas associated with the tailings impoundment would have soil replaced and revegetated following operations. The diversion structures for Little Cherry Creek above the reclaimed tailings impoundment would be reclaimed during operations and would remain, routing runoff into the permanent Diversion Channel to Libby Creek (Figure 20).

To minimize potential gully formation at the tailings dam crest, 83,000 cubic yards of riprap would be placed on the dam crest and uppermost part of the dam face. The coarse tailings portion of the dam face would be ripped and covered with 15 inches of rocky subsoil followed by 9 inches of topsoil. Nine inches of non-rocky subsoil followed by 9 inches of topsoil would be placed over the regraded surface of the tailings impoundment and the South Saddle Dam face. The riprap and rocky subsoil would either be excavated from within the impoundment footprint during impoundment and dam construction or excavated from borrow areas.

At closure, the tailings would continue to settle as the tailings consolidate, forcing some of the entrained water in the tailings mass to the surface. Dewatering activities would be implemented to remove this water while incrementally placing the reclamation cover as dewatering activities progressed. An estimated average of 4 feet of fill would be needed to create the proposed final grade needed before soil was placed on the tailings impoundment surface. The fill would either be excavated from within the impoundment footprint during impoundment and dam construction or excavated from borrow areas. It would take up to 20 years for settling and consolidation to stop and to complete the entire cover on the tailings impoundment surface. During operations, MMC would use conventional methods to estimate the amount of tailings settling. MMC would use the estimate to design the final reclaimed pond surface configuration and to determine the amount of earthwork that would be required. MMC anticipates that a shallow depression may form in the center of the tailings impoundment due to tailings settlement. Sand-fraction tailings would be used in the last year of operations to help create the final gradient needed. During grading activities, the depression would be filled with sand tailings, mine waste rock, and/or material from the North Saddle Dam. The amount of tailings consolidation would dictate the final soil and fill volume needed to meet plan designs and would be updated periodically during the life of the project.

During the last year of operations, when the tailings dam crest had been completed to its ultimate operating level, the remaining portion of the cycloned coarse tailings (370,000 cy) would be deposited into the impoundment along the eastern and southern sides of the impoundment and would form a berm. The berm would be graded to the northwest at a 0.5 to 1 percent slope (Figure 20). The final tailings topography would be contoured to direct surface water runoff toward Bear Creek. The North Saddle Dam would be removed so that runoff would drain from the reclaimed tailings impoundment surface toward the Bear Creek drainage. MMC would design a riprapped channel to Bear Creek. The design would incorporate features that provide for stability of this transition zone so that sediment delivery was not increased. Post-operation topography would be achieved primarily by spigoting arrangements in the final years of operation. A small, rockfill check dam would be located just beyond the northwest end of the reclaimed impoundment. The check dam would be designed for the 100-year storm event. Sediment would be removed from behind the dam, if necessary. The final runoff diversion ditch on the upper end of the tailings impoundment to divert water toward the northwest would be left (Figure 20). This ditch would be riprapped with rock to prevent erosion and would be designed for long-term stability. The ditch would be sized to convey the 100-year storm event.

Borrow Areas

The borrow areas would remain until the impoundment reclamation plan was completely implemented to ensure no fill material was required. The borrow area slopes would be reduced to at least a 2H:1V slope and graded to ensure stormwater does not leave the borrow area. The bottom of the borrow pit would be ripped to reduce water retention. Once the areas were no longer needed, the areas would be covered with soil and reseeded.

Post-Closure Water Management

At the end of operations, excess water would be present in the tailings impoundment. The volume of accumulated water would vary monthly in response to precipitation and evaporation and discharges to the LAD Areas 1 and 2. To enhance the removal of water and tailings consolidation, the use of evaporation by spraying on the tailings impoundment surface or LAD Areas 1 and 2, or other approved methods would be employed.

Following cessation of mining, the tailings impoundment would be partitioned to provide an area for water storage. The water level within the tailings would be lowered so construction equipment can work on the surface. Dewatering the top few feet of tailings would be accomplished by promoting natural drying and evaporation. MMC anticipates some difficulty in dewatering the tailings in the center portion of the tailings impoundment surface containing the fine tailings. The tailings in this area would have low bearing capacity. Subgrade reinforcement, such as a geotextile, may be needed for construction equipment to work on the tailings surface. MMC estimates that 10 percent of the area would require this technique and would likely be focused in the area where the final impoundment pond existed.

Seepage through the tailings dams would continue following reclamation. The seepage collection system would remain in place. Seepage to the underdrain system is expected to decrease from 930 gpm to 200 gpm 10 years after closure, reaching a steady state rate of 50 to 100 gpm over a longer period (Klohn Crippen 2005). Seepage collected in the pond would be pumped to the tailings impoundment where it would evaporate, be distributed to LAD Areas or Water Treatment Plant, if necessary, or be used to irrigate reclaimed areas. Seepage from the tailings not collected by the underdrain system is estimated to decrease from 25 gpm during operations, and 22 gpm at closure, to 17 gpm in the first 10 years after closure, and stabilizing at 5 gpm over the long term (Klohn Crippen 2005). The seepage would mix with the underlying groundwater and be intercepted by the pumpback well system, if required to comply with applicable standards. MMC would operate the seepage collection and the pumpback well systems until seepage from the underdrain system and groundwater adjacent to the reclaimed impoundment met BHES Order limits or applicable nondegradation criteria without additional treatment. Long-term treatment may be required if BHES Order limits or nondegradation criteria were not met. The length of time these closure activities would occur is not known, but may be decades or more.

Following removal, the Seepage Collection Dam and Pond would be graded to blend in with the original slope (Figure 20). After BHES Order limits or applicable nondegradation criteria were met and the Seepage Collection Dam and Pond was removed, seepage from the underdrain system would flow down the former Little Cherry Creek drainage to Libby Creek. Seepage not intercepted by the underdrain system would mix with underlying groundwater and flow to the former Little Cherry Creek or Libby Creek.

2.4.3.1.7 Roads

Roads retained after mine operations and reclamation plans are discussed in MMC's Road Use Technical Memo (MMC 2007). MMC's general road reclamation approach would be as follows:

- Bear Creek Road – The Bear Creek access road (NFS road #278), from US 2 to south of the tailings impoundment, would not be returned to its pre-mine width and the roadway would remain 20 to 29 feet wide. Cut-and-fill slopes associated with widening the Bear Creek access road from US 2 to the new Ramsey Plant access road would be reclaimed immediately following construction.
- New Roads – All new roads, except the Bear Creek access road, constructed for the project would be reclaimed, which would include grading to match the adjacent topography and obliterating the road prism.
- Open Roads – Reclamation of open roads upgraded for operations previously open to the public use would be completed to allow the road to be retained and used in a manner consistent with the pre-operational conditions. The surface would be bladed and sediment control systems inspected and replaced, as necessary. The bridge on NFS road #6210 would be removed and would be reclaimed consistent with open roads.

- Closed or Restricted Roads – Closed roads used for mine operations would be reclaimed to pre-mine conditions. Access restrictions would be upgraded or installed (gates, kelly humps, etc.) as required by the KNF, and the road surface would be scarified and seeded.

Available soil would be salvaged from disturbed areas and redistributed on fill and cut slopes where possible. Where soils were not salvaged during road construction, the road surface would be scarified and prepared for seeding. Soil would not be respread on cut slopes in consolidated material. Resoiled slopes would be broadcast seeded or hydroseeded with the planned seed mixture, dozer tracked where possible, and fertilized and mulched as necessary. Planting of trees and bareroot shrubs is not planned for the roads that were not completely obliterated. MMC would inspect sediment control features and repair or replace controls as needed.

2.4.3.1.8 Monitoring Wells

Monitoring wells associated with the tailings impoundment would be removed and plugged according to ARM 36.21.810. The well casing would be removed below the ground surface, and the well covers removed and disposed off-site. The small area associated with the monitoring well would be regraded to blend with the natural surroundings. The area would be ripped if appropriate and soil would be placed consistent with the general soils placement plans.

2.4.3.2 Interim and Concurrent Reclamation

To maximize site stabilization, weed control, and early completion of final reclamation, MMC would identify appropriate areas each year for interim and concurrent reclamation. Interim reclamation would be conducted in areas where disturbance was required during construction and/or operations. Potential interim reclamation areas include soil stockpiles, road cut/fill sections, borrow pits, plant site fill slopes, and other similar areas. Concurrent reclamation would be completed in areas where mine activities were completed and where no additional disturbance was anticipated. Potential concurrent reclamation areas include the tailings impoundment dam face, borrow pits, temporary roads, and other similar features. Interim and concurrent reclamation would be carried out using the same techniques, seed mixtures, and fertilizer types/application rates as described in the final reclamation activities for the project. Where possible, interim and concurrent reclamation would occur within the same year of disturbance. The necessity for additional reclamation in areas where interim reclamation had occurred would be evaluated by the lead agencies at closure.

2.4.3.3 Revegetation

Compaction and handling would be minimized as much as possible. Soil replacement depths would average 24 inches on the tailings impoundment dam and 18 inches on all other disturbed areas. Soils would be removed in two lifts on a portion of the tailings impoundment area. The areas selected for double lift salvage would have more rock fragments in the subsoil.

Before soil redistribution, compacted areas, especially the adit portal areas, roads, soil stockpile sites, and facilities area, would be ripped to reduce compaction. Ripping would eliminate potential slippage at layer contacts and promote root growth. Soil salvage and redistribution would occur throughout the life of the operation.

Selection of plant species for revegetation was based on pre-mine occurrence; post-operation land use objectives; establishment potential; growth characteristics; soil adaptation and stabilizing qualities; wildlife palatability; commercial availability; and expected moisture, temperature, and soil conditions. Two plant mixtures are proposed: one dominated by species typically found in moist, relatively cool sites, and one with species suited to a wider range of growing conditions. Seed mixtures may be modified, with the lead agencies' approval, due to limited species availability, poor seed quality, site differences, poor initial performance, or advances in reclamation technology. Forbs would not be used in seed mixtures used on roadsides to avoid attracting bears. Seed mixtures would be dominated by native species. Before reclamation, MMC would submit seed information such as seed content and germination testing results to the lead agencies. The lead agencies would adjust seed mixtures as appropriate for site conditions and to meet any KFP changes.

Seeding rates were designed to average 90 to 100 live seeds per square foot for drill seeding and roughly twice that for the broadcast seeding. Drill seeding would occur on slopes of 33 percent or less. Rocky slopes, areas where organic debris had been spread, or slopes greater than 33 percent would be broadcast or hydroseeded.

On slopes of 33 percent or less, the seedbed would be disced and harrowed. After seeding, straw mulch would be applied at 0.5 to 1.5 tons per acre and anchored with a straw crimper. Some hydroseeded areas of slopes steeper than 33 percent would be mulched with a cellulose fiber mulch and a tackifier. Fertilizer application rates would be based on soil tests; phosphorus fertilizer would be applied before seeding; and nitrogen fertilizer would be applied in growing seasons after seeding.

Tree and shrub seedlings would be planted in selected areas of the Ramsey Plant Site, the Libby Adit Site, and the tailings impoundment. Shrubs and trees would not be planted on soil stockpile sites, portal patios, or along road corridors. Planting density would be 435 trees per acre and 200 stems per acre for shrubs. Seedlings would be planted either continuously in strips on steeper slopes or in highly visible areas, or in randomly placed groupings on level to gently sloping areas. Containerized seedlings would be used when available. When bareroot stock was used, planting densities would be increased by 10 to 15 percent, depending on planting success of containerized stock versus bareroot stock.

Interim revegetation would take place on certain disturbed areas, such as roads, stockpiles, transmission lines, pipelines, and other areas, to reduce erosion and sedimentation. These areas would be broadcast seeded with the interim seed mixture, mulched, and fertilized as necessary. As the tailings dam increased in height, only final slopes would be reclaimed using the permanent seed mixture. All other unreclaimed disturbances would be reclaimed within 2 years after mining completion.

If feasible, seed or plant materials would be collected on site, and soils used for planting trees and shrubs would be inoculated with mycorrhizae. Seeds of species preferred by grizzly bears may be collected and used to supplement existing seed mixtures. When available, blister-rust resistant species would be used.

2.4.4 Temporary Cessation of Operations

Although a temporary cessation of operations is not planned, uncontrollable circumstances may cause a short-term stoppage in operations. Temporary cessation of operations refers to the suspension of ore processing and/or mining for an anticipated period of up to 1 year. Major steps to be undertaken would include the following:

- Continuing mine dewatering
- Maintaining water management (including treatment, etc.)
- Maintaining all monitoring activities
- Clearing and repairing site drainage and sedimentation control structures to ensure proper runoff and sedimentation control over a sustained period of time
- Contouring and seeding areas susceptible to erosion
- Securing monitoring wells, pumps, and intake structures to prevent equipment damage
- Maintaining access roads to insure project access
- Inspecting, repairing, or replacing signs and fencing around the property
- Implementing facility inspections
- Controlling noxious weeds
- Continuing dust suppression activities on the tailings beach and dam face

MMC would maintain the operation so that startup could be initiated quickly when the situation causing the temporary closure was eliminated. Staffing levels may be reduced to levels necessary but would provide staffing and coverage properly to maintain the facilities and permit. MMC would notify the lead agencies 30 days before any project startup. If the temporary closure were required for an extended period of time (greater than 1 year), MMC would meet with the lead agencies to discuss the project and issues that should be addressed in a temporary closure plan. MMC would submit the temporary closure plan that would outline the specific activities necessary to provide interim protection of resources.

After 5 years of any cessation of mine development or operation, for reasons other than litigation, the KNF would consult with MMC, DEQ, USFWS, Corps, tribal representatives, and other interested agencies on interim or final reclamation plans to be implemented and the timeframes for implementation.

2.4.5 Monitoring Plans

MMC would conduct operational and post-operational monitoring and provide monitoring results to the lead agencies in the annual report for hydrology, aquatic life, tailings impoundment, air quality, revegetation, and cultural resources. Proposed monitoring associated with waste rock is described in section 2.4.1.4, *Waste Rock Management* and monitoring associated with wetlands is described in section 2.4.6.1.3, *Monitoring*.

2.4.5.1 Hydrology

Surface water and groundwater would be monitored during operations at various locations throughout the project area. Groundwater monitoring would consist of periodic groundwater level measurements and collection of samples for laboratory analysis. Proposed monitoring well locations would be located above and below all major project facilities. MMC would install the groundwater monitoring wells before mine construction to establish pre-construction conditions. If the lead agencies determined additional monitoring wells were required for land application in the tailings area, these would be installed before construction activities.

Surface water monitoring would be conducted during the life of the project in conjunction with monitoring of aquatic life. Surface water monitoring would consist of periodic streamflow measurements and collection of samples for laboratory analysis. Any adit discharge would be monitored for quality and flow. Water levels in the tailings impoundment would be measured periodically. Sediment sampling at LB 2000/L2 downstream of the confluence of Little Cherry Creek with Libby Creek would be conducted daily during construction activities, every other day during initial mine operations, and once per week during mine operations/reclamation.

MMC would implement monitoring at Rock Lake to estimate existing groundwater discharge to the lake that would allow subsequent detection of small changes in discharge due to possible dewatering effects of the project. Water budget variables would be measured or estimated, including evaporation, precipitation, surface water inflows and outflows, groundwater inflows and outflows, and continuous lake levels. The lake monitoring system design and evaluation would be coordinated with the lead agencies. If substantial increased mine inflows occurred near Rock Lake, MMC would submit continuous lake level data, weather permitting, and any other lake level data accumulated during the year, within 5 working days and would provide data and evaluation at an increased frequency as determined by the lead agencies.

MMC would collect monthly samples to establish pre-construction conditions in the Little Cherry Creek groundwater wells from March, or as soon as weather permits, through November of the same year. Monitoring wells at LAD Areas 1 and 2 would be sampled monthly whenever mine water was discharged to the LAD Areas 1 and 2, and would continue for at least 1 year following the cessation of discharges. If nitrate or ammonia concentrations increased in groundwater, MMC would notify the lead agencies within 2 weeks and initiate twice-a-month monitoring of all adjacent surface water and groundwater stations.

At the end of the first monitoring year and following submittal of the annual report, MMC would meet with the lead agencies to discuss the monitoring results and evaluate the effectiveness of the LAD system. Following the annual review, the lead agencies would decide whether a change in monitoring or operations would be required. MMC would present the details of the additional monitoring in the final water management/treatment plan to be submitted to the lead agencies for approval that may be deemed necessary based on the annual reviews.

MMC would prepare a report briefly summarizing hydrologic information, sample analysis, and quality assurance/quality control procedures following each sample interval. Data would be submitted to the lead agencies by MMC within a reasonable time (5 to 7 weeks) after each sampling trip. MMC would submit an annual report to the lead agencies summarizing data over the year. In the annual report, MMC would present a detailed evaluation of the data. Data would be analyzed using routine statistical analysis, such as analysis of variance.

2.4.5.2 Aquatic Life and Fisheries

MMC would monitor aquatic insect and periphyton populations at nine sampling locations in the project area. Sampling locations would include one each in Ramsey, Poorman, Little Cherry, and Bear creeks, and five in Libby Creek. MMC would monitor during three periods: in April before runoff, in August during late summer flows, and in October before ice forming in the streams. MMC would monitor fish populations in Libby Creek at 2-year intervals in four stream reaches in lower Libby Creek. Population densities of each fish species captured during the monitoring would be estimated. The condition of all captured fish would be recorded. MMC would estimate the seasonal variation in fine sediment loading (embeddedness) at each sampling station using the "substrate score" methodology. If bull trout spawning or bull trout redds were observed at the four fish monitor stations (L1, L3, L9, and Be2), the surface embeddedness monitoring would be supplemented with the "McNeil Core" substrate sampling methodology, using five representative core samples.

MMC would measure background concentrations and document potential changes in the concentrations of cadmium, mercury, and lead in the fish of Libby Creek. Each year, for 5 years, MMC would collect 10 cuttbow trout, each greater than 4 inches in size, and 10 adult sculpins from Libby Creek at three stations. Collections would be completed during the late-summer to early fall low-flow period. Tissue samples, including homogenized flesh and skin from each fish, would be analyzed to determine cadmium, mercury, and lead concentrations. Thereafter, MMC would resample each site at a 3-year interval to document the trends in bioaccumulation of these metals. MMC would tabulate sampling data and present the monitoring results in the annual reports.

2.4.5.3 Tailings Impoundment

The monitoring consists of four primary areas to be monitored: milling and material production; water balance; geotechnical stability and dam construction; and environment and closure (Table 16).

Reconciliation of the mass balance would be carried out on an annual basis, in conjunction with the water balance. Milling, production, and cyclone records would be kept to document "as-built" conditions. Records of dam construction, including borrow, mine waste rock, and cyclone sand volumes would be maintained. During operations, annual surveys of the impoundment, including water stored of the pond, would be carried out to assist in the reconciliation of mass balance.

The water balance would be reconciled on an annual basis, in conjunction with the mass balance. Records of all flows would be reconciled and the water balance also would use the measured precipitation and evaporation rates on site and observations of areas of beaches and water ponds.

Table 16. Tailings Impoundment Monitoring, Alternative 2.

Technical Area	Item	Monitoring Parameters	Frequency	Comments
Milling and Materials	Thickener underflow feed line to tailings impoundment	Tons and Gallons	Daily	Compiled monthly and reconciled on an annual basis with the water balance Reconcile mass balance with density of tailings (dam and impoundment)
	Secondary cyclone feed line to dam.	Tons and Gallons	Daily	
	Secondary cyclone – underflow and overflow	Tons and Gallons	Daily	
	Water storage in impoundment	Volume of water	Annually	
Dam Volumes	Cycloned sand, borrow, and mine waste rock)	Tons and cubic yards per year	Annually	Annual reconciliation of fill materials

Technical Area	Item	Monitoring Parameters	Frequency	Comments
Water Balance	Reclaim pumping rates (volume)	Gallons/day	Daily	Compiled monthly and reconciled on an annual basis
	Irrigation pump rates	Gallons/day	Daily	
	LAD application rates	Gallons/day	Daily	
	Underdrain collection flows	Gallons/day	Weekly	
	Precipitation	Inches	Daily	
	Evaporation	Inches	Daily	
	Approximate pond areas	Acres	Monthly	
	Approximate wet and dry beach and dam areas	Acres	Monthly	
Water Quality	Reclaim water	All parameters listed in Operating Permit #00150 or MPDES Permit MT-0030279	Monthly	
	Mine water		Monthly	
	Groundwater seeps		Quarterly	
	Groundwater monitoring wells - Main dam (10) - South dam (1) - North dam (2)		Quarterly	
Geotechnical Stability	Piezometers - Main dam (10) - South dam (2) - North dam (2) - Diversion dam (2)	Piezometric levels	Monthly	Monitoring of potential pore pressures in the clay; and "normal" dam monitoring
	Inclinometers - Main dam (3)	Deformation (inches)	Monthly	To be located in areas of potential clay
Dam	Material properties	Density and gradation	Weekly	A QA/QC plan would be implemented to measure and monitor density and gradation
Environment	Dust	Visual	Monthly	Routine observations to document potential dust and wildlife use of area
	Wildlife	Visual	Monthly	

Technical Area	Item	Monitoring Parameters	Frequency	Comments
Closure[†]	Consolidation of tailings (10 - settlement plates)	Inches of settlement	Quarterly to annually	
	Piezometers in the impoundment (10)	Phreatic level	Quarterly to annually	
	Revegetation plots	Acres of replanting	Quarterly to annually	

[†]The operational monitoring would continue for the decommissioning stage until "steady state" conditions were met. Frequency would progressively decrease to quarterly and annually.
Source: Klohn Crippen 2005.

Groundwater monitoring wells would be installed downstream of the Main Dam and downstream of the Seepage Collection Dam. The groundwater monitoring wells would be installed along the two representative hydrogeological sections of Libby Creek and Little Cherry Creek. The location of groundwater monitoring wells would be determined during final design. The wells would be installed at various depths to monitor the main hydrogeologic units including both shallow and deep soil/weathered rock units. Additional wells would be installed downstream of the North Saddle Dam and South Saddle Dam, later in the life of the mine. A preliminary schedule of monitoring wells is presented in Table 16; final well number and locations would be determined during final design. Flow measurement weirs also would be installed downstream of the Seepage Collection Dam and, during operations, in any areas of observed flows. Flow in the Little Cherry Creek Diversion Channel would be measured monthly, and dam seepage flows would be measured quarterly.

During operations, stability monitoring would include the following:

- Piezometers in the dam foundation and fill
- Inclinometers extending through the potential clay units in the foundation
- Seepage monitoring

Electric piezometers would be installed in the dam foundation to measure pore pressures during construction, with particular attention to areas where the glaciolacustrine clay is present in the foundation. Appropriate "trigger" levels would be established, in conjunction with the detailed stability analysis, to provide a management tool to respond to higher than predicted responses. Piezometers also would be installed in the cycloned sand section to monitor the "drawdown" of cyclone water within the dam fill. The piezometers cables would be buried and led to a common readout station at the toe of each dam. Continuous data reading equipment would be installed.

Inclinometers would be used to monitor potential deformation of the dam foundation. The inclinometers would be installed in areas of glaciolacustrine clay and would be extended up through the dam fill. Quarterly observations of any seepage would be documented. The seepage observations would include evidence of piping, flow estimate, and water quality.

Construction QA/QC of dam construction activities would be carried out by a qualified consultant. Responsibilities of the site engineer(s) during construction would be detailed in a field manual before construction and would include standard field and laboratory quality control tests.

Observations would be taken and documented during operations, such as dust from the tailings beaches, including length of time dust was generated, and aerial extent of dried area. The use of the area by wildlife, such as waterfowl, also would be noted.

The monitoring would continue into the closure stage, although the frequency of records would be reduced accordingly as steady state conditions were reached. The following monitoring would be carried out during the Closure Phase:

- Piezometers would be installed within the tailings impoundment area to monitor the progressive "drawdown" of the phreatic surface
- Settlement plates would be installed over the tailings impoundment area to monitor the consolidation/settlement of the tailings to help confirm predicted consolidation behavior for closure
- Monitoring of the success of the ongoing progressive revegetation would be continued until steady state conditions were reached

Stability monitoring of the dam would be performed during operation and after closure. The downstream slope and toe of the tailings dam, the North and South Saddle dams, the Diversions Dam, and the Seepage Collection Dam would be visually inspected daily for evidence of seepage exiting the slope or the downstream toe. A V-notch weir would be located at the downstream toe of the dam to monitor seepage rates. If seepage were noticed, both the seep location and estimated quantity of flow would be recorded and the project geotechnical engineer immediately contacted for inspection and recommendation for mitigation measures, if necessary. During operations, the dam and associated structures would be inspected weekly and measurements taken of freeboard adequacy; beach width; cracking, sloughing, depressions, and erosion of the dam and abutments; changing trends in seepage quantities, piping, and wet spots; and the condition of the Diversion Channel.

2.4.5.4 Air Quality

MMC committed to implementing the monitoring requirements developed by the DEQ for the draft air quality permit. The monitoring plan is summarized in this section and discussed in the DEQ's Supplemental Preliminary Determination (DEQ 2011a). MMC would install, operate, and maintain three air monitoring sites near the mine and facilities. The exact location of the monitoring sites would be approved by the DEQ. MMC would begin air monitoring at the commencement of mill facilities or the tailings impoundment and continue air monitoring for at least 1 year after normal production was achieved. MMC would analyze for metals shown in Table 17 on the PM_{10} filters once the mill facilities and tailings impoundment were operational. At that time, the DEQ would review the air monitoring data and determine if continued monitoring or additional monitoring were warranted. The DEQ may require continued air monitoring to track long-term impacts of emissions for the project or require additional ambient air monitoring or analyses if any changes took place regarding quality and/or quantity of emissions or the area of impact from the emissions.

Table 17. Required Air Quality Monitoring, Alternative 2.

Location	Site	Parameter	Frequency
Plant Area	Site #1	PM-10[1] PM-2.5[3]	Every 3rd day according to EPA monitoring schedule
		As, Cu, Cd, Pb, Zn[2]	
Tailings Area (Up-drainage)	Site #2	PM-10[1] PM-2.5[3]	Every 3rd day according to EPA monitoring schedule
		As, Cu, Cd, Pb, Zn[2]	
Tailings Area (Down-drainage)	Site #3	PM-10[1]/PM-10[1] Collocated	Every 3rd day according to EPA monitoring schedule
		As, Cu, Cd, Pb, Zn[2]	
		PM-2.5[3]/PM-2.5[3] Collocated	(Collocated every 6th day)
		Windspeed, Wind Direction, Sigma theta[4]	Continuous

[1] PM-10 = particulate matter less than 10 microns.
[2] As = Arsenic, Cu = Copper, Cd = Cadmium, Pb = Lead, Zn = Zinc.
[3] PM-2.5 = particulate matter less than 2.5 microns.
[4] Sigma Theta = Standard Deviation of Horizontal Wind Direction.
Source: DEQ 2011a.

2.4.5.5 Revegetation

MMC would complete soil tests to determine the appropriate fertilizer mix required for successful reclamation. The fertilizer mix and rate would be approved by the lead agencies before being used. Interim reclamation activities would provide opportunities to evaluate the most effective use of fertilizers for final reclamation. The vegetation cover, species composition, and tree planting success would be evaluated during the first year following reseeding or replanting. In addition to a general evaluation, MMC would conduct vegetation monitoring every 2 years during operations at sites representative of various types of disturbance. Control sites in areas unaffected by the project would be established to provide information on site conditions. Reports summarizing survey data would be submitted to the lead agencies. MMC would develop reclamation bond release criteria as part of the overall reclamation plan reviewed and approved by the lead agencies. Part of the release criteria would involve specific, qualitative measurement of revegetation success.

At the end of mine operations, MMC would conduct similar vegetation monitoring every year at sites representative of various types of disturbance. The following characteristics would be evaluated:

- Plant species responses (germination, growth, competition)
- Total and vegetation cover
- Plant species and plant diversity (including weeds)
- Procedures to reclaim steep rocky slopes
- Soil redistribution depth
- Soil rock fragment content
- Effects of fertilizer rates
- Tree planting techniques
- Tree stocking rates

- Viability of bareroot versus containerized stock

MMC would request bond release in phases as specific tasks were completed. The following criteria for revegetation success and bond release would apply to areas where revegetation is the primary reclamation objective:

- Cover – Total cover was least 80 percent of the control site total cover, or the site met a total cover of 70 percent with at least 60 percent of that cover being a live plant community
- Diversity – Dominance by no more than three acceptable plant species, either in the seed mixture or the local native plant community
- Noxious Weeds – No more than 10 percent noxious weeds
- Rills and Gullies – No rills and gullies greater than 6 inches deep and/or wide

Success criteria must be met for 3 years to meet reclamation objectives. If success criteria were not met, MMC would modify seed types and reclamation techniques as appropriate and conduct a second seeding. If the site were stable but still did not meet vegetation release criteria, MMC may modify the plan and reseed again, and would request bond release by the lead agencies.

MMC would regrade and revegetate areas where rills and gullies exceeded the release criteria. If rills and gullies persisted, MMC would review run-on conditions and regrade and/or install sediment control features as appropriate. If site stability were still not achieved, MMC would consider armoring the rills and gullies with riprap, rock lining, or other similar materials to provide a stable drainage pathway. Once the site exhibited stability for 3 years, MMC would request bond release by the lead agencies.

Vegetation monitoring also would assess noxious weeds. Measures outlined in MMC's Weed Control Plan approved by the Lincoln County Weed Control District would be followed during operations and reclamation to minimize the spread of weeds to reclaimed areas. If weed content were above 10 percent, MMC would implement additional weed control methods and apply weed control treatment for 2 years. If after 3 years, the percent of weeds at the reclaimed site were 50 percent of the control site's weed population, MMC would request bond release.

2.4.5.6 Cultural Resources

All remaining un-inventoried potentially affected areas would be intensively inventoried for prehistoric and historic resources. If previously undiscovered cultural resources were encountered, work in the immediate area would stop, and the KNF and the State Historic Preservation Office would be notified. MMC would meet with KNF personnel to determine potential resource value and implement recordation and/or excavation as required. Site documentation would be provided to the KNF. No additional disturbance would proceed until the lead agencies gave approval.

2.4.6 Mitigation Plans

2.4.6.1 Wetlands and Waters of the U.S.

MMC developed a conceptual mitigation plan designed to replace wetland functions and services lost as a result of the project. MMC would replace the existing forested and herbaceous wetlands affected by the project on a 2:1 basis. For example, 10 acres of forested or herbaceous wetlands would be created for every 5 acres of forested or herbaceous wetlands disturbed. Herbaceous/ shrub wetlands would be mitigated with wetlands at a 1:1 ratio. MMC identified 44.6 acres of possible wetland mitigation areas. MMC believes the identified mitigation would be more than the required mitigation acres and should provide flexibility in selecting mitigation by the lead agencies and the Corps.

In all alternatives, the Corps would develop final mitigation requirements for jurisdictional wetlands and other waters of the U.S. In 2008, the Corps and the EPA issued regulations (33 CFR 332 and 40 CFR 230 Subpart J) regarding compensatory mitigation requirements for losses of aquatic resources, such as wetlands. These regulations require in cases where appropriate functional or condition assessment methods or other suitable metrics are available, these methods should be used where practicable to determine how much compensatory mitigation is required. If a functional or condition assessment or other suitable metric is not used, a minimum one-to-one acreage or linear foot compensation ratio must be used. Before issuance of the 2008 regulations, the Corps in Montana used ratios for various mitigation types in determining compensation requirements (Corps 2005). The Corps developed a stream mitigation procedure for projects adversely affected streams in 2010 and revised it in 2013 (Corps 2013a). MMC's plan is conceptual and would be refined during the 404 permitting process. MMC did not update its mitigation plan for Alternative 2 to reflect the new regulations and stream mitigation procedure but instead developed a mitigation plan for Alternative 3 (see section 2.5.7.1, *Jurisdictional Wetlands and Other Waters of the U.S.*.

The following sections discuss on-site and off-site mitigation. According to the compensatory mitigation regulations, on-site means an area located on the same parcel of land as the impact site, or on a parcel of land contiguous to the impact site. Off-site means an area that is neither located on the same parcel of land as the impact site, nor on a parcel of land contiguous to the parcel containing the impact site. Most of the wetland effects in all alternatives would occur on National Forest System lands, with some effect in Alternatives 2 and 4 occurring on land owned by MMC. In the following sections, mitigation is considered on-site if it occurs within a proposed facility permit area and off-site if it occurs outside of a permit area. The Corps is responsible for determining if a mitigation site is considered on-site or off-site.

MMC would create or expand existing wetlands at the following locations (Figure 21):

On-Site

- Little Cherry Creek–2.2 acres
- Little Cherry Creek Diversion–1.6 acres
- Unspecified Little Cherry Creek Site–5 acres

Off-Site

- North Poorman–3.4 acres
- South Poorman–9.7 acres
- Poorman Weather Station–14 acres
- Libby Creek Recreational Gold Panning Area–2 acres
- Ramsey Creek–6.7 acres

2.4.6.1.1 On-Site Wetland Mitigation

On-site wetland mitigation would consist of 8.8 acres within the permit area boundaries. The Diversion Channel around the tailings impoundment would be designed to provide hydrologic functions and values similar to those provided by the conifer-dominated wetlands in riparian areas. MMC anticipates 1.6 acres of wetlands would be created in the Diversion Channel.

Two mitigation sites are proposed in the Little Cherry Creek drainage downstream of the tailings impoundment. One site, not specifically identified, would use groundwater collected from beneath the tailings impoundment to create and maintain wetlands. Flows are expected in the range of 30 gpm and would be directed down low-gradient channels constructed to allow water to flow between and collect in a series of depressions. A complex of herbaceous/shrub wetlands of 5 acres would be created by directing these flows. The wetlands are anticipated to replace functions and values provided by existing herbaceous/shrub wetlands.

The other wetland mitigation site in Little Cherry Creek is along the northern side of the proposed tailings impoundment on land owned by MMC. This area contains a small existing wetland complex. MMC would increase the size of the existing wetlands through small excavations and dams that would retain water longer. MMC may use groundwater collected from beneath the tailings impoundment, if needed. An estimated 2.2 acres of additional shrub-dominated wetlands might be developed at this site.

2.4.6.1.2 Off-Site Wetland Mitigation

About 35.8 acres of potential wetland mitigation sites were identified near the project area but are outside the permit area boundaries: three sites in the Poorman Creek area, one site within the Libby Creek Recreational Gold Panning area, and one site along Ramsey Creek near the LAD Areas. The Poorman Creek sites include South Poorman, North Poorman, and Poorman Weather Station sites.

The proposed South Poorman site is adjacent to an existing 5.9-acre wetland. It could consist of 1.4 acres of new wetlands on the northern side of the existing wetland, and 8.3 acres immediately south of the existing wetland. The North Poorman site is adjacent to and north of a small existing wetland. About 3.4 acres of additional wetlands could be developed at this site. About 14 acres of new wetlands could be developed at this site.

All three Poorman sites have soils and terrain similar to that of the proposed Little Cherry Creek Impoundment Site. Wetlands would be developed through excavation of shallow depressions in locations where surface water would collect and be retained. Artesian wells would be developed to supply water if natural runoff were insufficient to maintain hydrophytic vegetation.

Two acres of newly constructed wetlands could be developed at the Libby Creek Recreational Gold Panning Area. Portions of the existing coarse placer piles would be removed, recontoured to expose groundwater, and revegetated. These new wetlands would be shrub and forb dominated initially, but would eventually become conifer dominated. The Ramsey Creek site is located near the proposed LAD Areas 1 and 2. It is part of an existing human-made wetland area, and would be expanded by spreading out streamflow that feeds the site. MMC estimates this site could be expanded by an additional 6.7 acres.

2.4.6.1.3 Monitoring

To determine the success of the wetland mitigation, monitoring would be initiated after construction of wetlands to assess vegetation growth, hydrological conditions, wildlife use, and integrity of constructed wetlands. Vegetation growth would be monitored in June and August following the first growing season. Monitoring would continue until the Corps had determined that wetland plant communities predominate and the mitigation wetland was self-sustaining, or for a period of 5 years, whichever was greater. Less intensive monitoring would then take place every 2 years thereafter until the end of operations. Species composition and canopy coverage would be recorded for constructed wetland plant communities. Growth of seeded and non-seeded (volunteer) species would be recorded. If seeded species did not become established, supplemental seedings and transplanting would be undertaken. If noxious weeds invaded wetland areas, they would be removed by mechanical methods or other methods approved by the Corps.

The hydrological status of wetlands would be monitored during spring and fall. Surface water depth would be recorded. If no surface water were present, test holes would be excavated to determine the depth of free water and saturated soil. Wildlife use would be monitored in the spring and late summer. Integrity of constructed wetlands would be monitored.

MMC would monitor any effects on existing wetlands downstream of the tailings impoundment. Monitoring of the downstream wetland areas would be completed annually for the first 5 years of mine operation. If functions and values of downstream wetlands were adversely affected, MMC, in cooperation with the lead agencies and the Corps, would develop additional wetland mitigation.

2.4.6.2 Fisheries

MMC proposed the fisheries mitigation developed collaboratively in 1993 by the KNF, FWP, Corps, and EPA to mitigate the fisheries impacts associated with the Little Cherry Creek diversion and the riprapped tailings impoundment overflow channel to Bear Creek. These impacts were the loss of recreational fishing opportunity, the loss of fisheries production in Little Cherry Creek, and loss of functions and values in Little Cherry Creek. MMC would implement one or more projects to mitigate for all identified impacts and would use the following principals in selecting and implementing projects:

- Emphasize mitigation for species of concern (sensitive species) where appropriate
- Strive to create isolated populations of genetically-pure fish. (bull trout, redband or westslope cutthroat)
- Protect, mitigate, and enhance biological production in the affected waters
- Mitigate off-site only when full mitigation of natural production is not possible within the affected waters
- Emphasize natural fish production and habitat when feasible
- Use artificial propagation of fish to enhance populations and provide recreational opportunities only when natural production is not possible

Before any other mitigation work was attempted, and immediately before closure of the Little Cherry Creek Diversion Dam, MMC would collect all fish in the existing stream section and move the fish to the newly constructed Diversion Channel. An intermediate holding pond or tank may be needed when relocating Little Cherry Creek fish. MMC would design the Little Cherry

Creek Diversion Channel, to the extent practicable, for fish habitat and passage. MMC's survey of Drainage 10 that would receive diverted water shows that most of the drainage would develop habitat comparable to Little Cherry Creek (Kline Environmental Research 2005a).

Other components of MMC's fisheries mitigation would include one or more of the following:

- Libby Creek Watershed — Conduct fish investigations to determine the genetics, distribution, and abundance of fishes of concern.
- Howard Lake — Construct paved access trails and three fishing platforms for physically challenged recreationists near existing facilities. Restrooms and other facilities would be modified to improve accessibility. Rehabilitate up to 100 feet of the lake outlet to provide spawning and rearing habitat, using pool-riffle control structures, overhead cover, clean gravels, and proper flow-depth controls.
- Ramsey Lake/Creek — Survey the upper reach of Ramsey Creek and Ramsey Lake for suitability as a trout species of concern fishery, implement habitat and barrier work as necessary, and stock with suitable type and number of fish. Construct a vehicle pullout, small parking area near the mill site accessible to motorized public, and a trail around the Ramsey Plant Site that leads to upper Ramsey Creek or Ramsey Lake.
- Libby Creek — Rehabilitate habitat upstream from the mouth of Howard Creek through creation of pool and hiding cover habitat, stabilization of old mining spoils, and channel narrowing; enhance habitat values in stream reach immediately downstream of the Libby Adit Site. Rehabilitation would be based on stream survey results.
- Libby Creek Watershed — Conduct a sediment-source inventory in the watershed, and stabilize, recontour, and revegetate priority source areas, which are typically roadcuts in Libby, Hoodoo, Poorman, Midas, and Crazyman creeks.
- Standard Creek — Survey upper reaches for rehabilitation opportunities. Implement habitat work to mitigate limiting factors. Stock with a trout species of concern. Construct an artificial fish barrier protection if needed.
- Snowshoe Creek — Survey upper reach for channel stabilization and habitat rehabilitation needs. Implement habitat and streambank work as needed to mitigate limiting factors. Stock with a trout species of concern. Liming of watershed to speedup recovery of an aquatic ecosystem may be required.
- Kilbrennan Lake—Rehabilitate the fish population in the watershed to create a self-sustaining wild trout population. Implement habitat rehabilitation work as needed based on a survey.

MMC would be responsible for maintenance of all fisheries mitigation projects until mitigation of fisheries losses were complete and accepted by the lead agencies. MMC would submit project surveys and designs for consultation and agencies' approval before implementation of any fisheries mitigation project. Five years of monitoring data indicating stable or increasing mitigation success would be required.

2.4.6.3 Grizzly Bear

The Montanore Project would affect existing grizzly bear habitat. The KNF's 1993 ROD revised the grizzly bear mitigation outlined in the 1992 Final EIS, and adopted the USFWS recommendation of a “reasonable and prudent” alternative identified in a 1993 Biological Opinion for the project. The USFWS’ reasonable and prudent alternative is the basis for MMC’s grizzly bear mitigation plan. The plan consists of habitat protection, measures to reduce mortality risks, and mitigation plan management.

2.4.6.3.1 Habitat Protection

Habitat protection would consist of three parts: road management, habitat acquisition, and management of patented mill claims. Each part is discussed briefly below. As part of its mitigation, MMC would request that the KNF implement access changes on two roads. NFS road #4784 (upper Bear Creek Road) would be closed year-long for the life of the project. The change would be at the location of the existing seasonal gate, which is 2.1 miles from the end of the road. NFS road #4784 was proposed for an access change by the Rock Creek Project, and is no longer available for Montanore mitigation. If Alternative 2B was selected in the KNF’s ROD, and if the Rock Creek Project had not yet implemented the closure on the Upper Bear Creek Road #4784 before MMC wanted to begin the Evaluation Phase, MMC would implement or fund the decommissioning or placement into intermittent stored service and barrier NFS road #4784 prior to Forest Serve authorization to initiate the Evaluation Phase. MMC would maintain and monitor the effectiveness of this barrier until Rock Creek Project initiated activity. The closure would remain in place for the life of either mine. NFS road #4724 (South Fork Miller Creek) would be closed on a seasonal basis (April 1 to June 30) for the life of the project. The change (6.6 miles) would be at the junction of the main Miller Creek NFS road #385.

MMC would purchase 2,826 acres to mitigate for habitat losses not offset by KNF’s road access changes. MMC would complete all acquisitions within a 6-year period, beginning at the time of construction, with at least 50 percent completed within the first 3 years. Acquired lands would be approved by the KNF, in consultation with the USFWS and FWP. The location of acquired lands would be within the Cabinet portion of the Cabinet-Yaak Ecosystem (CYE). Preference would be given for lands within the affected Bear Management Units and lands along the eastern side of the Cabinet Mountains. For biological reasons, and because of the potentially limited amount of lands that may be available for acquisition within this area, lands within other portions of the Cabinet Mountain area of the CYE may be considered. Any of the following could occur with the acquired parcels, including mill site or mining claims that MMC might patent as a result of the Montanore Project:

1. MMC may purchase the private parcels directly, and then transfer title to the KNF or other state or federal resource management lead agencies. If the KNF acquired these lands, they would be managed as Management Situation 1 grizzly bear habitat.
2. MMC may purchase the private parcels directly, and then transfer title to a private conservation organization, along with an acceptable conservation easement directed at protecting the land for use by grizzly bears.
3. MMC may purchase private lands directly, and then retain title to the lands, along with an acceptable conservation easement directed at protecting the land for use by grizzly bears.
4. In some instances, MMC may purchase a conservation easement with fee title remaining with the private party. Conservation easements generally would be established in perpetuity.

The KNF may, on a case-to-case basis and in cooperation with the USFWS and the FWP, accept conservation easements established for a fixed period of time extending throughout the life of the impacts. KNF would be given a chance to purchase the land before offering fee title of acquired lands to third parties. The KNF would seek a mineral withdrawal on any acquired lands to prevent future mineral entry. Under certain conditions, MMC might also be able to enter into a land exchange with the KNF, and in return receive lands outside of grizzly bear habitat. After the KNF, in counsel with the USFWS and the FWP, determines that project impacts have ended, the acquired lands could be used by others seeking mitigation for effects on grizzly bears, providing that acceptable conservation easements or other conditions are satisfied to protect these lands for use by grizzly bears.

Prior to construction activities, MMC would provide a $6,217,200 bond (based on $2,000 per acre) to the Forest Service to ensure adequate funding would be available for the required land acquisition. The bond would take into account any lands that MMC might have purchased before construction, providing that the Forest Service, in counsel with USFWS and the FWP, accepted such lands for mitigation. In the event that MMC forfeited the surety bond, MMC would be responsible for all legal fees incurred by the Forest Service. Completion of the acquisition would be a provision of project approval and failure to comply could result in project shutdown. The bond would be reviewed annually to determine if the bond amount should be adjusted.

2.4.6.3.2 Measures to Reduce Mortality Risks

MMC would fund two new full-time wildlife positions, a law enforcement officer, and an information and education specialist, with duties aimed directly at minimizing effects on grizzly bears. The estimated total cost would be about $3.1 million over the life of the project. MMC would fund both positions on an annual basis and coordinate with the employing agency to establish a collection agreement. In the future, if additional mines were developed in the CYE, funding for both positions may be shared by other mining companies.

Duties of the law enforcement officer would be established by the KNF in counsel with the USFWS and FWP, and would be focused toward those enforcement activities needed to: (1) deter illegal killing of bears; (2) investigate reported/suspected bear deaths and help prosecute illegal actions; (3) minimize/eliminate mortality due to mistaken identity during black bear hunting seasons; (4) enforce applicable federal and state laws, regulations, and policy/guidelines regarding proper sanitation practices and elimination of bear attractants; and (5) enforce road access changes and help prosecute violations of road access changes and vandalism. Similarly, the duties of the information and education specialist would focus on: (1) education of school-age children regarding grizzly bear conservation; (2) development of educational materials and programs oriented toward mine employees; (3) implementation of informational/educational materials and programs oriented toward the general public and local community; and (4) integrating with the actions and programs of the Interagency Grizzly Bear Committee and its Subcommittees.

MMC would take additional measures to reduce mortality risk, including the following:

- Request the KNF restrict public motorized travel in upper Ramsey Creek
- Report road-killed animals to FWP as soon as road-killed animals were observed; FWP would either remove road-killed animals or direct MMC how to dispose of them
- Prohibit MMC employees from carrying firearms into permit areas
- Bear-proof all garbage containers

- Prohibit the feeding of bears and leaving of food or other bear attractants in the field

2.4.6.3.3 Plan Management

The KNF would prioritize and direct the land acquisition of the grizzly bear habitat preservation program. MMC would be responsible for carrying out the acquisition, either directly or through contract with a third party. The KNF's duties in overseeing the mitigation plan would be as follows:

- Prioritize and direct the land acquisition and grizzly bear habitat preservation program
- Evaluate proposals and approve specific habitat enhancement projects for acquired lands
- Review MMC's annual progress reports on the status of the mitigation
- Direct the Information and Education program, and determine if the program were needed after 5 years or if the program's funds should be redirected to other mitigation needs
- Evaluate the effectiveness of reclamation and determine if and when access changes on roads as part of the mitigation could be reversed, and the specific timing for releasing acquired lands
- The Forest Service, in counsel with the USFWS and the FWP, would be responsible for approval of each acquisition before purchase and approval of conservation easements

2.4.6.4 Hard Rock Mining Impact Plan

Lincoln County approved an updated Hard Rock Mining Impact Plan for the Montanore Project in 2007. The plan describes how the Montanore Project would affect local government services, facilities, costs, and revenues. The plan specifies the measures MMC would undertake to mitigate adverse fiscal impacts on local governments. MMC would prepay about $180,000 in taxes before construction to offset the net negative fiscal impact on the county budget during the first year. Because the Montanore Project as currently proposed would change employment projections, MMC submitted a petition for an amendment for consideration by the Hard Rock Mining Impact Board (Klepfer Mining Service 2008b). The Board approved the petition for amendment in 2008.Alternative 3—Agency Mitigated Poorman Impoundment Alternative.

2.5 Alternative 3—Agency Mitigated Poorman Impoundment Alternative

2.5.1 Issues Addressed

Alternative 3 would incorporate modifications and mitigating measures proposed by the agencies to reduce or eliminate adverse environmental impacts. These measures are in addition to or instead of the mitigations proposed by MMC. Proposed modifications were developed in response to the issues identified during the scoping process (ERO Resources Corp. 2006a).

In Alternative 3, three major mine facilities would be located in alternate locations. MMC would develop the Poorman Tailings Impoundment Site north of Poorman Creek for tailings disposal, use the Libby Plant Site between Libby and Ramsey creeks, and construct two additional adits in upper Libby Creek (Figure 23). The LAD Areas would not be used in Alternative 3. Any excess water would be treated at the Water Treatment Plant at the Libby Adit Site and discharged at existing permitted outfalls. The issues addressed by the modifications and mitigation measures are summarized in Table 18.

Table 18. Response of Alternative 3 Modifications and Mitigations to Issues.

Key Issue	Mine Plan	Tailings Storage	Water Use and Manage-ment	Reclamation	Monitoring and Mitigation Plans
Issue 1-Acid Rock Drainage and Metal Leaching	✓		✓	✓	✓
Issue 2-Water Quality and Quantity	✓	✓	✓	✓	✓
Issue 3-Aquatic Life	✓	✓	✓		✓
Issue 4-Visual Resources	✓	✓		✓	
Issue 5-Threatened or Endangered Wildlife Species	✓	✓		✓	✓
Issue 6-Wildlife	✓	✓		✓	✓
Issue 7-Wetlands and Streams	✓	✓	✓	✓	✓

The lead agencies completed an alternatives analysis and evaluated numerous tailings impoundment sites. The sites the agencies considered for an impoundment are described in the section 2.13.5, *Tailings Impoundment Location Options*. The Poorman Impoundment Site was retained for detailed analysis because it would avoid the diversion of a perennial stream (Issue 2), and the loss of aquatic habitat (Issue 3), and would minimize wetland effects (Issue 7). Additional site comparisons between Alternatives 2 and 3 tailings facilities are presented in section 3.14.3.3, *Little Cherry Creek (Alternatives 2 and 4) and Poorman (Alternative 3) Tailings Site Comparison*.

Similarly, the lead agencies considered numerous sites for locating the plant site (see section 2.13.6, *Plant Site and Adit Location Options*). MMC's proposed plant site in the upper Ramsey Creek drainage would affect RHCAs (Issue 3), core grizzly bear habitat (Issue 5), and Inventoried Roadless Areas (IRAs). An alternative plant site on a ridge separating Libby and Ramsey creeks was retained for detailed analysis to address these issues. Preliminary evaluation indicates the Libby Plant Site could be built of fill material from the large cut on the west side of the plant site. The cut and fill materials would be balanced, and waste rock would not be used in plant site construction. Avoiding the use of waste rock in plant site construction would address (acid rock drainage and metal leaching (Issue 1). To avoid disturbance in the upper Ramsey Creek drainage, the adits in Alternative 3 would be in the upper Libby Creek drainage. This modification would address the same issues as the alternate plant site (Issues 3 and 5).

The lead agencies modified the proposed water management plan to address the uncertainties about quality of the mine and adit inflows, the effectiveness of LAD for primary treatment, quantity of water that the LAD Areas would be capable of receiving, and the effect on surface water and groundwater quality. In Alternative 3, MMC would use the Libby Adit Water Treatment Plant to treat water before discharge. MMC would divert water from Libby Creek near the impoundment site during high flows (April through July) to provide adequate make-up water for mill operations. MMC would cease diversions from Libby Creek and discharge treated water to Libby Creek from the Water Treatment Plant during low flows to avoid adversely affecting senior water rights. Discharges to Ramsey Creek from the Water Treatment Plant at low flows also may be needed for the same reason. These modifications would address Issue 2, water quality and quantity.

The modifications and proposed mitigations that comprise Alternative 3 are described in the following sections. All other aspects of MMC's mine proposal would remain as described in Alternative 2. Chapter 3 contains a more detailed discussion of how the modifications and mitigating measures would reduce or eliminate environmental impacts. Many of the modifications and mitigations also would be incorporated into Alternative 4. All plans, mitigation measures, and monitoring requirements must be submitted and approved by the KNF as sequenced and outlined in this alternative prior to the Forest Service authorizing MMC to proceed with those actions affecting National Forest System lands. MMC would submit amended Plan of Operations consistent with the alternative after final design, including all monitoring and mitigation plans, to the KNF for approval. MMC would submit an amended application to amend Hard Rock Operating Permit #00150 consistent with the alternative after final design, including all monitoring and mitigation plans, to the DEQ for approval. All disturbances related to the operation would be fully bonded for reclamation prior to commencement of the surface disturbing activity (see section 1.6.3, *Financial Assurance*.

2.5.2 Evaluation Phase

2.5.2.1 Objectives

As described in Chapter 1, MMI acquired the DEQ Operating Permit #00150, private land at the Libby Adit Site and in the Little Cherry Creek drainage, and water rights previously held by NMC (now Montanore Minerals Corporation). In 2006, MMI proposed and received approval from the DEQ for two minor revisions to DEQ Operating Permit #00150. The revisions involved reopening the Libby Adit and re-initiating the evaluation drilling program that NMC began in 1989. A description of DEQ Operating Permit #00150 is provided in Chapter 1. The KNF determined the activities associated with the Libby Adit evaluation drilling were a new Plan of Operations under the Federal Locatable Minerals Regulations (36 CFR 228 Subpart A), and MMC needed KNF approval before dewatering and continuing excavation, drilling, and development work at the Libby Adit. Under the authority of Minor Revision 06-002 of the DEQ operating permit, MMC installed a Water Treatment Plant and is treating water from the adit.

In 2006, the KNF initiated a NEPA analysis that included public scoping for the proposed road use and evaluation drilling at the Libby Adit Site. In 2008, the KNF decided the best approach for disclosing the environmental effects of the Libby Adit evaluation program was to consider this activity as the initial phase of the overall Montanore Project in this EIS. The Libby Adit evaluation program would be the first phase of the Montanore Project in Alternatives 3 and 4. The objectives of the evaluation program would be to:

- Expand the knowledge of the mineralized zones of the deposit

- Assess and define the mineralized zone within established valid existing rights
- Collect, provide, and analyze additional geotechnical, hydrological, and other information required to finalize a mine plan and to confirm and support the analysis for the Construction and Operation Phases of the mine

2.5.2.2 Proposed Activities

The evaluation drilling program is designed to delineate the first 5 years of planned production. An estimated 35,000 feet of primary drilling and 12,800 feet of infill drilling are planned. The drill core would be used to support resource modeling, mine planning, metallurgical testing, preliminary hydrology assessment, and rock mechanic studies for the full Montanore Project. If adit closure and site reclamation were necessary after completion of the evaluation drilling program, MMC would install a concrete-reinforced hydraulic plug in bedrock, reconstruct the original adit plug, remove all surface facilities, and regrade and revegetate the disturbed areas. Additional information about the evaluation drilling program and site operations and reclamation can be found in MMC's *Notification to Resume Suspended Exploration and Drilling Activities for the Montanore Project, Revision 2* (MMC 2006), on file with the lead agencies.

The Libby Adit would be rehabilitated and the drift extended 3,300 feet. An additional 7,100 feet including the 14 drill stations would be developed under the currently defined ore zones. During the Evaluation Phase, MMC would drill ahead of the drifts and keep all drill stations 300 feet from the Rock Lake Fault and 1,000 feet from Rock Lake. During the dewatering of the Libby Adit, an array of small diameter boreholes would be installed from within the Libby Adit, and instrumented with continuous recording pressure transducers. Because the intent of the underground piezometers would be to obtain pre-mining pressure data and to track drawdown as the mine void was dewatered, the piezometers would be drilled out in front of the existing working face. At each station, the two inclined piezometers would be drilled from a cutout as close to the working face as possible without causing risk to the piezometers during subsequent blasting. The piezometers would be equipped with pressure recording devices before the drift or adit was advanced. Additional description of the Pre-Evaluation and Evaluation Phase monitoring is presented in Appendix C.

MMC holds two 1902 surface water rights on Libby Creek, one for mining near the Libby Adit site in Section 15, Township 27N, Range 31W (with a maximum diversion of 44.9 gpm between April 1 and December 19, and maximum volume of 50.97 acre-feet), and one for domestic use in the same section (15 gpm year-round, and a maximum volume of 1.5 acre-feet). MMC also holds a 1989 groundwater right near the Libby Adit site in Section 15, Township 27N, Range 31W (with a total diversion of 40 gpm year-round). MMC would use either its groundwater right with a year-round diversion or its surface water right with a diversion between April 1 and December 19. MMC would not appropriate any mine or adit water for beneficial use during any phase of the mining operations, including the Evaluation Phase. (Water use and management during operations is discussed in section 2.5.4.3, *Water Use and Management*.) MMC would install a DNRC-approved water use measuring device at both point of diversion locations. Water must not be diverted until the required measuring device is in place and operational. On a form provided by the DNRC, MMC would keep a written monthly record of the flow rate and volume of all water diverted including the period of time. Records would be submitted to the KNF, DEQ, and DNRC by January 31 of each year and upon request at other times during the year. MMC would maintain the measuring device so it always operated properly and measured flow rate and volume accurately.

Section 1.3.1, *Mineral Rights,* discusses the history pertaining to the two mining claims (HR-133 and HR-134) that contain the copper and silver mineralization proposed for mining. The two claims, shown on Figure 11, were patented in 2001. The apex provision of the General Mining Law entitles the owner of a mining claim a right to mineralization extending in a downward course beyond the sidelines, but within the endlines of the claims. This entitlement is referred to as extralateral rights. MMC's extralateral rights are defined by the west endline of HR 133 and the east endline of HR 134. In MMC's Minor Revision 06-002 to its Hard Rock Mine Operating Permit #00150 (MMC 2006), MMC proposed areas of exploration outside of its extralateral rights. In Alternatives 3 and 4, MMC would not explore or mine for any ore outside of its extralateral rights. MMC would notify the KNF within 48 hours when ore was encountered during either the extension of the Libby Adit, development of any drifts, or exploration drilling. MMC would isolate underground any ore encountered outside of its extralateral rights from waste rock in case a future authority provides for the disposal of those valuable minerals.

An estimated 256,000 tons (174,000 cubic yards) of waste rock would be generated and stored on private land at the Libby Adit Site. The waste rock storage areas would be lined to collect runoff from the area and seepage through the waste rock. A sump would be located at the toe of the pile where runoff and seepage would be collected and pumped up to the Water Treatment Plant. MMC would implement two monitoring programs to assess water quality of runoff and seepage from waste rock. These two programs would be a waste rock test pad and waste rock column tests. The information collected by these tests would assist the agencies in determining if the full facility would be lined. MMC would submit the information and a request to modify the plan if lining was not needed to meet MPDES permitted effluent limits. In the waste rock column tests, MMC would collect samples at the working face within the adit before the material was removed for disposal on the lined facility. The objective of the test would be to determine the amount of residual nitrate and ammonia that remains in the waste rock; metal analyses also would be completed.

In 2008, MMC installed a small lined waste rock stockpile at the Libby Adit. Rock excavated for sumps in the Libby Adit was placed onto a lined area. A sump was constructed that collected runoff and seepage from the waste rock stockpile. Collected water was pumped to the Water Treatment Plant and discharged in the MPDES-permitted outfall. Runoff and seepage from the waste rock pile was analyzed for metals, nutrients and other parameters. Data from water in the sump at the Libby Adit waste rock stockpile (Appendix K-10) were used to represent changes in water quality related to waste rock to be used at the impoundment site.

The Libby Adit would be dewatered and water would be treated before discharging to one of three permitted outfalls. MMC's MPDES permit MT-0030279 regulates wastewater discharges from the Libby Adit, and sets effluent limits for both surface water and groundwater. Treated water would be discharged to a percolation pond located at the Libby Adit Site. Some of the downstream surface water quality monitoring stations used in assessing effects of the discharges would be located on the National Forest System lands or MMC's private land.

The underground evaluation is anticipated to last 18 to 24 months. MMC would employ 30 to 35 people at the Libby Site and would work two 10-hour shifts 7 days per week. The hours of operation would fluctuate based on daily requirements, but would operate 7 days per week.

Supporting surface facilities are located on private lands at the Libby Adit Site and include an office, shop, generators, waste rock stockpile, and other ancillary facilities. All of the proposed underground work would be beneath the CMW. Power to the Libby Adit would be supplied by up to two EPA Tier 4, if available, or Tier 3 diesel generators and the combined total maximum rated design capacity of the diesel engine/generators would not exceed 1,500 brake horsepower. The new diesel stationary engines would be required to meet current nitrogen oxides emission standards and comply with current federal engine emission limitations. The generators would be supplied by a third-party contractor, which would provide the generators and be responsible for holding an air quality permit for them.

During all phases of the project, MMC would maintain the structures, equipment, and other facilities in a safe, neat, and workmanlike manner. Hazardous sites or conditions resulting from operations will be marked by signs, fenced, or otherwise identified to protect the public in accordance with federal and state laws and regulations. MMC also will comply with all applicable federal and state fire laws and regulations, take all reasonable measures to prevent and suppress fires on the area of operations, and require employees, contractors, and subcontractors to do likewise within the permit boundary.

2.5.2.3 Transportation and Access

2.5.2.3.1 Development of Plans

MMC would develop a Transportation Plan for life of the mine to be approved by the agencies before the Evaluation Phase. The plan would be incorporated into an amended Plan of Operations for the Evaluation Phase. The plan's objectives would be to minimize mine-related vehicular traffic traveling between US 2 and the plant site, and minimize parking at the plant site. Busing employees to the plant site, requiring managers to car pool to the extent practicable, and establishing a supply staging area in Libby to consolidate shipments to the mine site would be a part of the plan. The bus hub would be located in a convenient location in Libby, Montana, most likely the Kootenai Business Park. The plan would specify that exceptions to staging and consolidation of supplies would include full load shipments, expedited shipments to repair equipment and other emergencies as specified in the plan. Deliveries of supplies would be scheduled for day shift, Monday through Friday only.

INFS standard RF-2 requires the development and implementation of a Road Management Plan. MMC would develop for the lead agencies' approval a final Road Management Plan before the Evaluation Phase that would address roads used during the Evaluation Phase (NFS road #231 and #2316) and other roads affected by the Evaluation Phase of the project, including roads with access changes required to be implemented for wildlife mitigation. The plan would describe:

- Criteria that govern road operation, maintenance, and management
- Requirements for pre-, during-, and post-storm inspections and maintenance
- Regulation of traffic during wet periods to minimize erosion and sediment delivery and accomplish other objectives
- Implementation and effectiveness monitoring plans for road stability, drainage, and erosion control
- Mitigation plans for road failures
- Analysis of any new road constructed in a RHCA, documenting it is the minimum necessary for the approved mineral activity

The plan would describe management of road surface materials during plowing, such as snow and ice. Sidecasting of snow mixed with soil would be avoided. Sidecasting of road material would be prohibited on road segments within or abutting RHCAs in priority bull trout watersheds. MMC would install or fund the installation of signage where sidecasting would be avoided.

2.5.2.3.2 Plan Development, Updates and Implementation

Mitigation Plans

The lead agencies developed specific design features and mitigation for Alternatives 3 and 4, with a majority of the measures common to both Alternative 3 and Alternative 4. The agencies' mitigation plans are summarized in section 2.5.7, *Mitigation Plans*. Each plan describes the timing of implementation. For example, the grizzly bear mitigation plan specifies the timing of required land acquisition, some of which must be acquired before the Evaluation Phase commenced. In all cases, the mitigation would be in place before the effect for which the mitigation applied occurred. MMC would submit final designs and mitigation plans specific for the alternative as part of it amended Plan of Operations, Operating Permit, and other permits or approvals.

Monitoring Plans

The agencies' conceptual monitoring plans are summarized in Appendix C. Each plan describes the timing of implementation. In all cases, the monitoring would begin before or concurrently with the effect for which the monitoring applied occurred. MMC would submit final monitoring plans as part of its amended Plan of Operations, Operating Permit, and other permits or approvals.

Road-Related Plans

Prior to the Evaluation Phase, MMC would submit for lead agencies' approval a Road Management Plan for the two roads (NFS road #231 and #2316) and other roads affected by the Evaluation Phase of the project including access changes required to be implemented for wildlife mitigation. The Road Management Plan would become part of the amended Plan of Operations for the Evaluation Phase. Before initiating the Construction Phase, MMC would update the plan for the lead agencies' approval to address all access management changes and all new and reconstructed roads affected by the Construction and Operations Phases of the mine and transmission line. The plan's elements would include BMPs to minimize sediment delivery to area streams and would be the same as described in section 2.5.2.3.2, *Plan Development, Updates and Implementation.* The plan would include the timing and level of management for each road depending upon the determined purpose for that road. The plan would incorporate safety signing such as "Caution Truck Traffic" signs at several locations on both Libby Creek and Bear Creek roads between US 2 and the mine facilities (Poorman Tailings Impoundment Site, Libby Adit sites, and Libby Plant Site). MMC would post warning signs for speed limits and other important road conditions and require all mine-related vehicles to follow all traffic control restrictions, such as speed. Other appropriate wording may be used as approved in the Road Management Plan. MMC also would continue to implement the Transportation Plan described for the Evaluation Phase.

Before initiating the Construction Phase, MMC would submit a traffic impact study report to the agencies and MDT that address the requirements of MDT's System Impact Action Process (Montana Department of Transportation 2007). The purpose of the traffic impact study would be to:

- Identify the traffic loads (i.e., traffic impacts) that the project would contribute to the roadway system
- Provide a credible basis for estimating site access requirements and off-site roadway improvements that are attributable to the project
- Assess whether on-site functions would compromise off-site operations
- Assess compatibility with State and local transportation plans

MMC would submit a Traffic Impact Study Report in accordance with MDT requirements (MDT 2007) to the lead agencies and the MDT. The report would describe anticipated traffic generated by the project, anticipated impacts on capacity and level of service and traffic safety, and recommendations for improvements. Final decisions regarding necessary road improvements would be made by the road owner (MDT, County, Forest Service). MMC would fund all road improvements required by the project.

Soil Salvage and Handling Plan

During final design and after all areas were intensively surveyed, MMC would submit a final Soil Salvage and Handling Plan to the lead agencies for approval. The plan would include means to ensure that the necessary amount of suitable soil would be salvaged in disturbed areas, that soils would be stockpiled and redistributed properly, and that losses from handling and erosion on stockpiles and in reclaimed areas would be minimized. Also, the timing and sequencing of stockpile use (for respreading) would be detailed to ensure that visual impacts would be mitigated, and that direct-haul methods would be maximized.

Stormwater Pollution Prevention Plan

As part of final design and submittal of an amended Plan of Operations and operating permit application before the Construction Phase, MMC would prepare a final Stormwater Pollution Prevention Plan (SWPPP) for the agencies' approval. The plan would address stormwater runoff from mine-related facilities including topsoil stockpiles, access/haul roads, adit pads not constructed of waste rock, and parking lots. The plan also would address stormwater runoff from transmission-related facilities. The plan would incorporate special conditions or requirements for the SWPPP identified by the DEQ as a part of the MPDES permit. The final SWPPP would be approved by the KNF and the DEQ. The BPA would develop a SWPPP for construction of the Sedlak Park Substation and loop line.

Vegetation Removal and Disposition Plan

As part of final design and submittal of an amended Plan of Operations and permit application before the Construction Phase, MMC would prepare a Vegetation Removal and Disposition Plan for the agencies' approval. The plan would evaluate the opportunities to minimize tree and other vegetation clearing, particularly in RHCAs, and consider potential uses of vegetation removed from disturbed areas, and describe disposition and storage plans during mine life. The plan would apply to all National Forest System lands covered by the Plan of Operations and all private lands covered by the operating permit and transmission line certificate. It would not apply to private or State lands along the mine access road. Vegetation removal and disposition on private lands along the access road would be governed by the easement between the Forest Service and the private land owner. It also would address vegetation removal along the transmission line (see transmission line Alternatives C-R, D-R, and E-R).

Weed Control Plan

MMC has a Weed Control Plan approved by Lincoln County Weed Control District. The plan would be modified as described section 2.5.3.2.5, *Noxious Weed Mitigation Measures* and submitted to the lead agencies during final design for their approval. Following KNF's and DEQ's approval of the final Weed Control Plan, MMC would submit it to the Lincoln County Weed Control District for approval. Weed control measures would be applied to all mine permit areas. Weed control measures along the transmission line are described in the agencies' Environmental Specifications (Appendix D).

2.5.2.3.3 Road Use and Improvements

MMC would use Libby Creek Road (NFS road #231), and Upper Libby Creek Road (NFS road #2316) as the primary year around access to the surface facilities at the Libby Adit Site during the Evaluation Phase. These roads would continue to be snow plowed to allow access during winter. MMC installed a gate on the Libby Creek Road. Unless as directed by the KNF or the Oversight Committee discussed in the grizzly bear mitigation plan, MMC would continue to maintain the gate and the KNF would continue to seasonally restrict access on the two roads as long as MMC used and snowplowed the two roads during the Evaluation Phase.

MMC would implement prior to the Evaluation Phase and maintain during the Evaluation Phase the BMPs shown in Table 19, such as installing, replacing, or upgrading culverts, to bring the Evaluation Phase access roads (NFS roads #231 and #2316) up to INFS standards and Forest Service guidance (USDA Forest Service 1995, 2008a). All ditches on NFS roads #231 and #2316 would be cleaned out to enhance drainage and reduce sedimentation. MMC would implement and

Table 19. Proposed Road Improvements on NFS roads #231 and #2316.

Milepost from Junction with NFS Road #4778	Required Activity
MP 0.05	Install 24-inch ditch-relief culvert.
MP 0.10	Replace existing 18-inch corrugated metal pipe (CMP) with 24-inch CMP.
MP 0.13	Install 24-inch CMP. Scoured channel enters ditch; no pipe present to allow water to cross road.
MP 0.30	Install surface drainage. Drain to the east side of road.
MP 0.40	Surface drainage needed. Drain to the east.
MP 0.50	Lower existing 18-inch CMP and replace if necessary.
MP 0.60	Clean out existing CMP.
MP 0.70	Replace CMP and armor outlet.
MP 0.84	Replace existing CMP with a 24-inch CMP.
MP 0.90	Provide surface drainage needed; drain to south.
MP 0.91	Repair or replace existing 18-inch CMP inlet.
MP 1.03	Provide road surface drainage. Drain to the south.
MP 1.20	Provide road surface drainage. Drain to the south.
MP 1.30	Armor inlet of existing 24-inch CMP inlet.
MP 1.41	Install 24-inch CMP. Install a drainage ditch on MMC's Libby Adit road on private property.
MP 1.43	Provide road surface drainage. Drain to the south.

maintain BMPs on roads required to be closed or stabilized for wildlife mitigation. In RHCAs, MMC would not sidecast snow or surface materials.

2.5.2.4 Reclamation

MMC would reclaim facilities associated with the evaluation program in the following manner if the full project were not approved, or if MMC decided not to proceed with the project. MMC may retain the dewatering pumps and operation of the treatment plant beyond the evaluation program. Dewatering and water treatment would continue until a bedrock portal plug was installed. As part of permanent closure and site reclamation, a portal plug would be installed in bedrock near the bedrock/colluvial contact point 800 feet from the portal opening. To ensure long-term stability, waste material would be backfilled into the adit from the bedrock plug out to the surface opening where another plug would be re-installed as originally designed. Once this surface plug was installed, excavated material would be placed back over the portal plug and general opening and regraded to match the surrounding topography. Other surface features, such as the waste rock stockpiles and the percolation pond would be regraded. All surface facilities, buildings, power supply and equipment would be removed. The stockpiled 18 inches of soil would be placed over the regraded and scarified areas. The disturbed sites would be reseeded.

2.5.2.5 Final Design Process

2.5.2.5.1 Pre-construction Surveys

The Construction Phase would begin after MMC analyzed the data from the Evaluation Phase, collected the necessary data for final design, submitted final design plans to the agencies, and received agency approval to implement the Construction Phase. Before any ground-disturbing activities occurred and receiving agency approval to implement the Construction Phase in Alternatives 3 and 4, MMC would complete an intensive cultural resources inventory and a jurisdictional wetland delineation on all areas proposed for disturbance for any areas where such surveys have not been completed and that would be disturbed by the alternative. Similarly, MMC would update surveys for threatened, endangered, and Forest and state sensitive plant species on National Forest System lands for any areas that would be disturbed by the alternative where such surveys have not been completed or for any species listed as threatened, endangered, or Forest Service or state sensitive since 2005. Survey reports would be submitted to the agencies for approval. If wetlands or species of concern were identified and adverse effects could not be avoided, MMC would develop appropriate mitigation plans for the agencies' approval. MMC would implement the mitigation plan and receive agency concurrence of mitigation implementation before any ground-disturbing activities. The plan, once approved, would become a component of the amended Plan of Operations.

An intensive cultural resource inventory of the APE would meet the requirements of the 36 CFR 800, the guidelines in the 2009 KNF Site Inventory Strategy, and Montana SHPO. An intensive cultural resource inventory is a pedestrian survey with transects no more than 100 feet apart that covers the entire APE. The adequacy of past intensive cultural resource inventories would be decided by the KNF in consultation with the Montana SHPO. Following completion of a cultural resources survey, MMC would follow the requirements of a Programmatic Agreement between the KNF and the Montana SHPO. MMC would submit to the KNF an inventory report meeting Montana SHPO requirements. The report would include eligibility for listing on the National Register of Historic Places recommendations for all identified historic properties. When an adverse effect to an eligible historic property was anticipated, MMC may choose to redesign the project to avoid the property. If avoidance is not feasible, MMC would undertake actions to mitigate any adverse effect following the requirements of 36 CFR 800.6. A mitigation plan would be developed by MMC, reviewed by the KNF, reviewed by culturally affiliated tribes, and submitted to the SHPO and the Advisory Council on Historic Preservation for approval. Upon the conclusion of the consultation with the SHPO, the documentation needed to formalize the conclusion would be determined by the KNF, in consultation with the SHPO and the Corps. MMC would implement the mitigation plan and receive KNF concurrence of mitigation implementation before any ground-disturbing activities.

MMC also would complete a detailed Order I soil survey for all areas that have not been intensively surveyed and from which soils would be salvaged. During final design and after all areas were intensively surveyed, MMC would submit a final Soil Salvage and Handling Plan to the lead agencies for approval before any ground-disturbing activities (see next section).

2.5.2.5.2 Final Tailings Impoundment Design Process

The design developed for project facilities in Alternatives 3 and 4, such as the Poorman tailings impoundment site, is conceptual and is based on limited geotechnical investigations. Additional site information is needed to complete a final design. The design process would include a preliminary design phase and a final design phase. Site information would be collected during geotechnical field studies during final design. MMC would submit a tailings impoundment site geotechnical field study plan to the agencies for their approval before commencing activities. Once approved, the Site Exploration Plan would become a component of the amended Plan of Operations. A preliminary site program would be completed to confirm the geotechnical suitability of the Poorman Tailings Impoundment Site. A similar process would be used for the Libby Plant Site. The field studies would include a site reconnaissance and a drilling and sampling program to evaluate:

- Site geology and foundation conditions
- Groundwater conditions and water quality
- Borrow material availability
- Geotechnical characteristics of foundation and borrow materials

Site data to be collected would include an assessment of artesian pressures and their potential influence on impoundment stability, an assessment of a subsurface bedrock ridge between Little Cherry Creek and the effect it may have on pumpback well performance, aquifer pumping tests to refine the impoundment groundwater model and update the pumpback well design, and site geology to identify conditions such as preferential pathways that may influence the seepage collection system, the pumpback well system, or impoundment stability. Based on these data, a preliminary design of the facility sites would be completed to confirm the site layout and design/operation feasibility. Field studies would be completed to collect data and material samples necessary for the final design.

With the exception of tailings density at initial deposition, design criteria proposed for the Poorman tailings impoundment (Klohn Crippen 2005) would be used unless alternative criteria are approved by the agencies. In Alternatives 3 and 4, MMC would, during final impoundment design:

- Update the seismic stability analysis using the most recent attenuation relationships that are based on instrumental records of attenuation collected in the United States and internationally (*e.g.,* Spudich *et al*. 1999, Boore and Atkinson 2007, or Petersen *et al*. 2008)
- Complete circular failure and block failure assessments through various critical dam sections, and through the foundation
- Update the pumpback well design and analysis using geologic and hydrologic data collected as part of geotechnical field studies, with a focus on minimizing drawdown north of impoundment
- Avoid or minimize, to the extent practicable, filling wetlands and streams, such as described in Glasgow Engineering Group, Inc. (2010)
- Avoid or minimize, to the extent practicable, locating facilities, such as the Seepage Collection Pond, in a floodplain
- Submit final design to the agencies for approval
- Fund an independent technical review of the final design as determined by the lead agencies

The functionality of the Alternative 3 tailings impoundment would depend on determination and design of the water removal system (such as deep tank or high compression thickeners) and the strict control of final slurry parameters such as moisture content, deposition sequences, and impoundment water management. During final design, MMC would determine the proper thickener and distribution system and deposition plan for the tailings (see section 2.5.4.2.2, *Tailings Deposition* for a discussion of target tailings density). MMC would develop an optimum filling plan and operation and monitoring manual that addressed plant operations, tailings thickening parameter tolerances, contingencies for tailings density not meeting specifications, monitoring of the thickening process, and reporting to the lead agencies. Similar monitoring and reporting for the tailings impoundment as proposed in Alternative 2 would be implemented for Alternative 3 (see Appendix C).

MMC would develop a general operating plan for the tailings impoundment site including a final Fugitive Dust Control Plan to control wind erosion from the tailings impoundment site. Before commencing operations, MMC would submit to the agencies for approval a general operation plan for the tailings impoundment site including a Fugitive Dust Control Plan. The plan would include, at a minimum, the embankment and cell (if any) configurations, a general sprinkler arrangement, and a narrative description of the operation, including tonnage rates, initial area, and timing of future enlargement. Should these measures not be adequate to control wind erosion from the impoundment, MMC would submit a revised plan to the agencies for approval, incorporating alternative measures, such as a temporary vegetation cover

As part of final design, MMC would submit an Operations, Maintenance and Surveillance Manual for the Libby Plant and tailings impoundment. The manual would identify maintenance requirements and operation guidelines to reduce risks of system upsets, describe the leak detection system for tailings and reclaim water lines, and outline spill response procedures. MMC also would submit and implement a comprehensive Environmental Health and Safety Plan.

Technical review of the final tailings facility design would be made by a technical advisory group (TAG) established by the lead agencies. The tailings TAG would be comprised of agency experts in geotechnical, geochemical, and water quality issues related to current practices in the construction, operations, and closure of tailings facilities. The tailings TAG's review would encompass the technical aspects of tailings design including impoundment groundwater model, the pumpback well system, and the short- and long-term stability of the tailings storage facility.

The TAG would advise on the development of the quality assurance/quality control protocols for the tailings facility. The tailings TAG would also advise the lead agencies as to whether the environmental impacts associated with final design remained within the scope of those impacts identified in the Final EIS. The lead agencies would review and approve the final design before construction.

The KNF and the DEQ would guide, organize, and chair the tailings TAG meetings, and consolidate and document the consensus review recommendations. The lead agencies may also retain the services of a third-party tailings consultant if they determined additional technical expertise was required. MMC would fund any required third-party services. During the review process, MMC may be asked to provide additional information or clarification to the tailings TAG on certain aspects of the plan, as determined by the KNF and the DEQ. Possible members of the TAG include the KNF, the DEQ, the EPA, U.S. Army Corps of Engineers, Confederated Salish Kootenai Tribe, and Lincoln County.

The lead agencies may form additional TAGs if they determine a need. As explained previously, the KNF and the DEQ may also consider retaining the services of third-party consultants with expertise on specific issues. The third-party services would be funded by MMC. The lead agencies would determine whether a TAG would be formed and which approach would be used with a particular issue on a case-by-case basis. The lead agencies would decide this based on where the most expert review would best be obtained for the specific issue being considered, and the complexity and significance of that issue.

2.5.2.5.3 Final Underground Mine Design Process

MMC would submit a detailed final mine plan, including final plans for underground geotechnical monitoring, for agencies' approval before any underground development began in the Construction Phase. The mine plan would:

- Include the physical setting of the ore body (for each ore zone, the elevation of the floor or back, thickness, depth below surface) and the planned extent of mining.
- Use a variety of pillar strength estimation approaches such as Obert and Duvall (1967), Wilson Abel (1972), Hedley and Grant (1972), Hardy and Agapito (1975), Bieniawski (1981), Stacey and Page (1986), Abel (1988) and Esterhuizen *et al.* (2008) to calculate pillar strength and corresponding factor of safety. This would allow the agencies to better evaluate the MMC design in relation to other standard approaches.
- Use a minimum 0.8 pillar width to height ratio as a preliminary numeric criterion (Agapito Associates, Inc. 2014a). Pillars with less than a 0.8 width to height ratio would require justification by MMC as to their stability.
- Explicitly assess sill pillar stability during all mine planning phases.

- Identify two barrier pillars 20 feet wide across the width of the ore body that would be left in place (except for openings needed for access) until additional refinement of the hydrologic model was completed and the need for barrier pillars was evaluated. The purpose of the barrier pillars would be to minimize post-mining changes in East Fork Rock Creek and East Fork Bull River streamflow and water quality. The evaluation of the barrier pillars is discussed in more detail in section 2.5.4.1, *Mining* (p. 156) and in the Groundwater Hydrology section under Mitigation (p. 582).
- Maintain at least a 1,000-foot buffer from Rock Lake and a 300-foot buffer from the Rock Lake Fault. MMC also would maintain during mining a 100-foot buffer from faults identified on Figure 61 unless the agencies approved a narrower buffer. MMC would keep the size and number of drives through the faults identified on Figure 61 to the minimum necessary to achieve safe and efficient access across the fault unless the agencies approved a narrower buffer.
- Include an Explosive Handling and Blasting Plan that describes measures to minimize pillar size reduction from overblasting.
- Explicitly state that no secondary mining (reduction in pillar width or length, or increase in pillar height from designed final dimensions) would be allowed.
- Exclude the mining of ore outside MMC's extralateral rights defined by the west endline of HR 133 and the east endline of HR 134.

One concern with underground mining is the potential for subsidence to affect the environment. Subsidence is the sudden sinking or gradual downward settling of the earth's surface with little or no horizontal motion. Subsidence is a concern because the underground mine would be beneath the CMW. In addition to MMC's proposed underground geotechnical monitoring discussed on page 87, MMC would implement the following measures to reduce the risk of subsidence:

- **Pre-mine Topographic Survey**—MMC would perform pre-mining a baseline survey over the ore body using aerial methods (LiDAR, InSAR, or equivalent) approved by the agencies. Surveys using the chosen method would be repeated periodically before production mining to (a) establish the variability of the monitoring method employed (with respect to its technical limitations and outside factors such as snow and vegetation cover, natural rockfalls, landslides, etc.), and (b) as a reference point for measuring any suspected mining-related subsidence.
- **Pre-mine Geologic Survey**—During the Evaluation Phase, MMC would complete and provide to the agencies a detailed surficial geologic survey of lands overlying the mine area to identify structures that could affect subsidence potential and implement the Evaluation Phase activities described in the Rock Mechanics Monitoring Plan (Appendix C).
- **Pillar Design**—MMC would reference the Troy Mine experience in its pillar designs, and highlight how the designs account for and differ from failed designs at the Troy Mine. As pillar designs were refined, numerical modeling would be undertaken to further evaluate expected underground mine design performance, including the potential for shear failure at the pillar/roof or pillar/floor interface.

- **Structural Setting**—Improving the understanding of the structural setting, including faulting, jointing, bedding, and the horizontal stress regime would improve the geotechnical design. The description of one Troy Mine pillar collapse indicates that adverse pillar orientation with regard to bedding dip may have played a role, and the Troy Mine sinkhole events appear to be related to faulting. Hydrologic effects could be exacerbated by reactivation of fault zones, such as the Rock Lake Fault or any sympathetic and/or undocumented faulting that may exist. A better understanding of the structural environment at Montanore would benefit the mine design effort and improve the understanding of potential impacts that may arise. These data would be obtained through lineament analysis of surface features, joint mapping and statistical analysis of joint frequency and attitude, strain-relief overcoring to measure the horizontal stress field, and further exploratory drilling.
- **Interaction of Workings**—Initial numerical modeling for the Montanore Project in 1989 studied the issue of pillar columnization and sill pillar stability between the two ore zones. More sophisticated and powerful modeling approaches have become available since that time. Such approaches would be used, along with current design assumptions, to further study candidate designs for the two ore zones, as interaction of workings may be crucial to overall pillar/sill stability.
- **Entry Stability and Primary Support**—Roof support analysis would be completed during final design to finalize the support plan and mining span.
- **Third Party Review and Reporting**—The agencies would retain the services of an independent third party technical advisor. This advisor would be similar to third-party consultants retained by the lead agencies for review of the tailings impoundment. MMC would fund this independent technical advisor to assist the agencies in review of the final subsidence monitoring plan, underground rock mechanics data collection, and mine plan. The technical advisor also would assist the agencies with underground mine quality assurance and quality control oversight during construction and operations. The technical advisor would be selected and directed by the agencies through an agreement with MMC. MMC would provide the agencies and their representatives access to the underground workings to observe data collection and mine development. MMC would provide mine access, logistical support, and all information required by the technical advisor to complete a review of underground rock mechanics data and MMC's mine plan. The advisor would review monitoring reports submitted by MMC and may engage in monitoring independent of that required under MMC's monitoring program. Assessments of the underground workings by the technical advisor may occur as frequently as quarterly, with the results of the inspections compiled into an annual assessment report. This annual report from the technical advisor would incorporate data collected as part of the ongoing monitoring program, and would be in addition to the annual report prepared by MMC. The technical advisor would have no financial interest in the Montanore Project.

2.5.2.5.4 Final Groundwater Model Development Process

MMC developed separate 3D groundwater models for the mine area and the Poorman Impoundment Site. Before the Construction Phase started, MMC would update both models, incorporating the hydrologic and geologic information collected during the Evaluation Phase. The required monitoring of the underground mine and at the tailings impoundment site during the Evaluation Phase is described in Appendix C. Required characterization data at the tailings impoundment site during the Evaluation Phase is described in section 2.5.2.5.3, *Final Tailings Impoundment Design Process.* The agencies anticipate the mine area model's uncertainty for predicting inflows and water resource impacts may be reduced based on the empirical data obtained from underground testing. Effects on surface resources would be re-evaluated based on the updated mine and tailings impoundment modeling. The agencies would modify the monitoring requirements, such as the Groundwater Dependent Ecosystem (GDE) inventory and monitoring, described in Appendix C for the Construction and Operations phases if necessary to incorporate the revised model results. Similarly, the agencies would use adaptive mitigation to modify the mitigation plans described in Section 2.5.7, *Mitigation Plans,* if necessary to incorporate the revised model results.

2.5.2.5.5 Final Road Design Process

The following sections describe the agencies' design requirements for US 2 and National Forest System roads proposed for use in Alternative 3. During final design, MMC would complete a preliminary and final road design using these specifications for KNF approval. MMC would use appropriate road design and construction techniques and standards to minimize the amount of disturbance within the road prism on National Forest System lands, and private lands where the Forest Service holds a right-of-way easement.

Design Requirements for US 2 Improvements

The Bear Creek Road is a public approach to US 2. MMC would evaluate the approach for the largest design vehicle and modify the intersection if the approach did not meet the design requirements for that vehicle. The approach would be designed to maintain the transportation system level of service and safety along US 2. This mitigation also would apply to the intersection of US 2 and Kootenai Business Park access road to the Libby Loadout. All US 2 improvements would be identified in the traffic impact study report to be submitted to the agencies and MDT.

Design Requirements for Bear Creek Road Reconstruction

About 14 miles of the Bear Creek Road (NFS road #278), from US 2 to the junction of a new road proposed to be constructed in the Poorman Tailings Impoundment Site, would be widened to two 12-foot wide travel lanes and two shoulders of 1 foot, for a total width of 26 feet. The KNF may decide during final design that a narrower width would be sufficient to provide for safe and efficient use. Additional widening would be necessary on curves and short segments of new road would be needed. The disturbed area, including ditches and cut-and-fill slopes, may be up to 100 feet wide. The existing Bear Creek bridge, which currently is 14 feet wide, also would be replaced and widened to a width compatible with a 26-foot wide Bear Creek Road. The roadway would be paved with hot mix asphalt, and the asphalt road surface would then be chip-sealed.

As in Alternative 2, a buried 34.5-kV transmission line along Bear Creek Road and the Libby Plant Access Road may be installed if it was needed and MMC acquired easements for its construction across private land on the Bear Creek Road. Telephone and data communications would be via new, buried utilities along the Bear Creek Road and the Libby Plant Access Road from Libby if MMC acquired easements for its construction across private land on the Bear Creek Road. Flathead Electrical Cooperative will provide power for the 34.5-kV line and MMC will become a Cooperative member. Flathead Electrical Cooperative provides power to private owners along the Bear Creek Road via above- and underground electric lines. MMC will upgrade the existing line to 34.5 kV and then extend the line if all necessary easements were acquired. Under

Flathead Electrical Cooperative policies, an existing member cannot unreasonably withhold approval to extend the powerline to other members.

A travel lane on the Bear Creek Road would be maintained to allow continued motorized public access during Bear Creek Road reconstruction. If road closures were necessary during bridge replacement, closure would be limited to Monday through Friday. MMC would develop signage on US 2 notifying road users of construction conditions, possible delays, or necessary detours. Signage on US 2 would be posted north of the Libby Creek Road intersection, and north and south of the Bear Creek Road intersection. Detour information would include alternative route directions.

MMC would hold a field review with KNF after completion of preliminary road and utility corridor design. Individual property owners would be invited to attend the preliminary design field review in the event the reconstructed road would exceed the current right-of-way width. The design would include a plan for accommodating continued access by local landowners and recreational forest users during road reconstruction. If preliminary design indicates the reconstructed road would exceed the current right-of-way width, MMC would make a reasonable effort during the Evaluation Phase to secure all necessary easements to accommodate the needed road right-of-way width. A "reasonable effort" is one in which MMC offers the current property owner a fair market offer for a right-of-way no wider than the minimum necessary to accommodate the needed road width.

MMC would be responsible for all costs, including legal fees, associated with the acquisition of easements. Any easement obtained by MMC for additional right-of-way would be established until final bond release, would be conveyed to the Forest Service, and would be consistent with the Forest Service's standard right-of-way easement language. MMC would submit all proposed easements to the KNF for approval before purchase. In cases where a landowner was unwilling to grant an easement to MMC but was willing to grant an easement directly to the Forest Service, MMC would still be responsible for all costs associated with acquisition of the easement. MMC also would make a reasonable effort during the Evaluation Phase to reconcile areas where the access road was outside existing right-of-way easements. MMC would be responsible for all costs associated with easement reconciliation.

In those areas where MMC cannot obtain additional right-of-way width or achieve easement reconciliation after a reasonable effort has been made, MMC would submit written documentation of MMC's reasonable efforts. MMC would concurrently submit for KNF approval design changes for a road that could be constructed with the existing right-of-way. The necessary specifications that could be implemented without obtaining additional right-of-way would be incorporated into the design.

Design Requirements for Main Haul Road

MMC would use segments of NFS roads #2317, #4781, #6210, and #2316 as the main haul road between the Libby Adit Site and the Poorman Impoundment Site. The roads used to haul waste rock from the Libby Adit and the Upper Libby Adit to the Poorman Tailings Impoundment Area are shown on Figure 29. Except for a segment of the Upper Libby Creek Road (NFS road #2316) and the Poorman Creek Road (NFS road #2317) south of the impoundment, mine haul roads would be restricted to mine traffic only. These two segments would require joint public and mine traffic. During final design, MMC and the KNF would determine the most appropriate method to accommodate joint traffic. The Mine Safety and Health Administration (Mine Safety and Health

Administration 1999) recommends a road width of 56 feet wide when using a 16-foot haul truck to accommodate joint-use traffic safely. For the Poorman Creek Road (NFS road #2317), joint traffic could be segregated by building a new road parallel to the existing road. A parallel road may have less effect than a 56-foot wide road.

South of Little Cherry Creek, MMC would build 0.7 miles of new road west of and parallel to the Bear Creek Road that would connect Bear Creek Road with Ramsey Creek Road (NFS road #4781) (Figure 29). MMC would construct a new bridge crossing Poorman Creek just upstream and adjacent to the existing crossing. The road would have a chip-seal surface and be constructed to a width to accommodate haul traffic. Mine traffic would use the Libby Plant Access Road and the public would use the existing Bear Creek Road. The crossing of the new mine access road across Poorman Creek and Ramsey Creek would be built to accommodate the 100-year flow event and be constructed in compliance with INFS standards and Forest Service guidance (USDA Forest Service 1995, 2008a). The crossing width would be consistent with the roadway width.

MMC would use the same roads (NFS road #4781, NFS road #6210 between Ramsey Creek and Libby Creek, and NFS road #2316) for access to the Libby Adit Site and Libby Plant Site (Figure 29). Modifications to these roads also would be the same as Alternative 2, except for a segment of NFS road #2316 west of NFS road #6210. MMC would use a segment of NFS road #2316 west of the Libby Adit Site for access to the Upper Libby Adit Site. MMC would install a gate on NFS road #2316 west of the Libby Adit Site and maintain the existing hiking trail beyond the Upper Libby Adit Site. For the segment on the Upper Libby Creek Road (NFS road #2316) that would have joint use, the agencies anticipate low public traffic use. An alternative to a 56-foot wide road at this location would be the development of administrative procedures either to eliminate or accommodate through traffic control mine hauling when public use occurred.

MMC would develop a small (4 to 5 vehicle) graveled recreational parking area at the gate on the Poorman Creek Road (NFS road #2317). The parking area would facilitate non-motorized access to the Poorman Creek drainage via the Poorman Creek Road. MMC also would develop a new hiking trail between Poorman and Ramsey creeks to provide non-motorized access to upper Ramsey Creek.

The Bear Creek Road from the junction of the new Libby Plant Access Road to the Libby Creek Road would be surfaced with 6 inches gravel at its existing width (a minimum of 16 feet) (Figure 29). A segment of the Bear Creek Road north and west of Libby Creek is on private property. The Forest Service has an easement with the property owner that allows the Forest Service to maintain the road. The easement is 100 feet wide from the western boundary of the northernmost private parcel (Raven Placer) and is 50 feet wide on either side of the Bear Creek Road in most locations in the parcel north of the junction with the Libby Creek Road. This surfacing would ensure the safe transition from the improved section north of the new Libby Plant Access Road and the unimproved section to the Libby Creek Road.

2.5.3 Construction Phase

2.5.3.1 Permit and Disturbance Areas

Disturbance area boundaries around the plant site and tailings impoundment site would be marked in the field with fenceposts or fenced and signed to limit potential disturbance outside permitted disturbance areas. Fences, if used, would be designed and built to avoid debris jams at stream crossings. The operating permit area would total 2,157 acres and the disturbance area would total 1,565 acres (Table 20).

During the Construction Phase, MMC would reconstruct portions of the Bear Creek Road (NFS road #278). These activities are described in section 2.5.2.5.6, *Final Road Design Process*.

2.5.3.2 Vegetation Clearing and Soil Salvage and Handling

2.5.3.2.1 Vegetation Removal and Disposition

MMC would implement the approved Vegetation Removal and Disposition Plan during the Construction Phase and continue to implement the plan whenever vegetation was cleared or removed.

To minimize metal leaching problems and low pH seepage from soil stockpiles containing large amounts of coniferous vegetation, the coniferous forest debris would be removed before soil removal to the extent feasible. Merchantable timber would be measured, purchased from the KNF, and then cleared before soil removal. Non-merchantable trees, coniferous forest debris, and slash from vegetation clearing in the mine disturbance areas and along the transmission line would be managed in accordance with Montana law regarding reduction of slash (76-13-407, MCA) and, on National Forest System lands, KNF objectives regarding fuels reduction. Except

Table 20. Mine Surface Area Disturbance and Operating Permit Areas, Alternative 3.

Facility	Disturbance Area† (acres)	Permit Area (acres)
Existing Libby Adit	18	219
Upper Libby Adit	1	1
Rock Lake Ventilation Adit	1	1
Libby Plant Site and Adits	76	172
Poorman Tailings Impoundment Site and Surrounding Area	1,272	1,506
Poorman Tailings Impoundment and Seepage Collection Pond	608	
Borrow areas outside impoundment footprint	92	
Soil stockpiles	48	
Other potential disturbance (roads, storage areas, ditches, etc.)	524	
Access and Other Roads†		
Bear Creek Road (NFS road #278 from US 2 to Tailings Impoundment permit area)	90	0
Tailings Impoundment permit area to Libby Plant Site (NFS roads #278, #2317, #4781, #6210 and new road)	66	214
Libby Plant Site to Libby Adit Site and Upper Libby Adit Site (NFS roads #6210 and #2316)	41	44
Total	1,565	2,157

†Disturbance area shown for roads excludes 33 feet of existing disturbance along roads.

where used in wildlife or fisheries mitigation, excess slash would be removed or burned in all timber clearing areas and within 0.5 mile of any residence. Slash management on Plum Creek and other private lands not owned by MMC would be in accordance with Montana law and the landowner/MMC easement agreement. Non-merchantable trees and coniferous forest debris would be removed using a brush blade or excavator to minimize soil accumulation. MMC would comply with DNRC open burning requirements. Where possible, slash of non-coniferous forest debris or dead coniferous forest snags would be salvaged and chipped to be sold, used as mulch, or used as an additive to stored soil. All mulching materials would be certified noxious weed-seed free.

2.5.3.2.2 Soil Salvage

MMC would implement the approved Soils Salvage and Handling Plan during the Construction Phase and continue to implement the plan whenever soil was removed, stockpiled or replaced. MMC would salvage soils in all disturbed areas, with the exception of slopes exceeding 50 percent and soil stockpiles. Suitability of soils proposed for reclamation was determined from physical and chemical data collected during the baseline soils survey. Soils would be salvaged in two lifts in the tailings impoundment site, borrow areas, and Libby Plant Site. The first lift would include the relatively organic-rich surface layers (topsoil), and the second lift would include the subsoil immediately below the topsoil to a depth based on need and suitability. At road disturbances, soils would be salvaged in one lift. Soils with more than 50 percent rock fragment generally would not be salvaged. Soils with rock fragment contents up to 60 percent by volume would be salvaged in some areas to provide erosion protection on the tailings impoundment embankments.

Not all soils within the impoundment area would be salvaged during the Construction Phase. Disturbances from which soils would be salvaged from within the impoundment site during the Construction Phase include Starter Dam, Seepage Collection Pond, Borrow Areas, roads, and wetlands within the impoundment footprint. Other soils within the impoundment footprint would be salvaged incrementally during operations.

2.5.3.2.3 Soil Stockpiles

The two-lift soil salvage would segregate soils according to erodibility (*i.e.*, rock fragment content) and first lift versus second lift. For example, glaciolacustrine soils, having the greatest erodibility and few rock fragments, would be stockpiled separately from first lift materials that contain a large amount of rock fragments, and second-lift glaciolacustrine clay-rich soils would be stockpiled separately from other second-lift soils. The stockpiles would be signed, based on the use in the post-mining landscape. Soil stockpiles would be constructed with 40 percent side slopes and 33 percent sloping ramps, where possible. In the tailings impoundment area, stockpiles would be located in the soil stockpile area shown on Figure 26, within the borrow areas area after borrow materials had been removed, temporarily within the impoundment footprint or within the disturbance area provided they were more than 250 feet from a wetland. Any stockpile within the impoundment footprint would eventually be moved to a borrow area until final reclamation.

Soil stockpiles would have organic matter and fertilizer added to help retain soil quality and promote successful revegetation. Noxious weeds on stockpiles would be controlled throughout the stockpile life, and sprayed before soil redistribution.

In Alternative 2, MMC proposes to stabilize soil stockpiles when they reach their design capacity and seed during the first appropriate season following stockpiling. In Alternatives 3 and 4, MMC would incrementally stabilize soil stockpiles (rather than waiting until the design capacity was reached) to reduce erosion and maintain soil biological activity in the surface. Seeding should be done as soon after disturbance as possible rather than waiting until the next appropriate season. Immediate seeding of road cuts-and-fills would reduce erosion on Forest Service roads regardless of planting time. To the extent possible, MMC would stockpile soils in clearings or recent timber harvest areas that were immediately adjacent to new roads, which would be operational for mine life, rather than stockpiling along the entire road corridor.

MMC would report soil stockpile volumes and disturbance acres in each annual report to the lead agencies. MMC would prepare an annual soil reconciliation report to document that the soils in stockpiles were sufficient to reclaim the current disturbed acres. If a shortfall existed, MMC would submit a plan to make up for the soil shortfall in the following year (see section 2.5.5.2.3, *Soil Replacement and Handling* regarding replaced soil thickness).

2.5.3.2.4 Direct Haul and Temporary Storage of Soil

Direct haul soil salvage and replacement would be required for use whenever, and as much as possible, to enhance revegetation success of native unseeded species (Prodgers and Keck 1996). Direct haul would be done primarily at the tailings impoundment.

Areas such as road cut-and-fill slopes, transmission line structure locations, access roads, and other disturbances that would remain post-mine should be reclaimed as soon as final grades were achieved with direct haul soil or soil that had been stockpiled for less than 1 year. This would increase the chances of direct transplantation and propagation of many of the local ecotypes on the reclaimed surface (Prodgers and Keck 1996).

2.5.3.2.5 Noxious Weed Mitigation Measures

MMC would implement all weed BMPs identified in Appendix A of the KNF Invasive Plant Management Final EIS (KNF 2007a) for all weed-control measures. MMC would focus mitigation on prevention as the most effective and least expensive weed management strategy, and early detection and eradication as the best alternative once a new species had been introduced. For established invaders, treatment and containment of noxious weeds species would be the main objective. MMC would include integrated noxious weed management in the environmental training.

MMC would comply with state and local laws and agencies' guidelines for all noxious weed-control activities. All herbicides used in the project area would be approved for use in the KNF, and would be applied according to the labeled rates and recommendations to ensure the protection of surface water, ecological integrity, and public health and safety. Herbicide selection and application timing would be based on target species on the site, site factors (such as soil types and distance to water), and with the objective to minimize impacts on non-target species. MMC would coordinate with the KNF Weed Specialist for use of biocontrol agents as they become available.

To the extent possible, MMC would survey all proposed ground disturbance areas for noxious weeds before initiating disturbance. Where noxious weeds were found, MMC would treat infestation the season before the activity was planned. For example, if timber clearing were planned to be in the spring or early summer, the survey and control would be implemented the previous fall. Areas surveyed would include roads, borrow areas, tailings impoundment, transmission line, and any other areas designated for timber removal. MMC would describe in final design plans the extent of which surveys and pretreatment would not be feasible. The proposed survey and treatment approach would be a part of the final Weed Control Plan, to be reviewed and approved by the lead agencies.

MMC would include road-related weed mitigation in any road access that was approved for the project (including access routes to the transmission line). MMC would treat noxious weeds along all haul and access roads yearly with the appropriate herbicide mix for the target species. MMC would broadcast treat every other year and spot treat the alternate years.

MMC would minimize soil disturbance and mineral soil exposure during ground-disturbing activities. Ground disturbance should be no more than needed to meet project objectives. MMC would prevent road maintenance machinery from blading or brushing through known populations of new invading noxious weed species. In areas where noxious weeds were established and activities require blading, MMC would brush and blade areas with uninfested segments of road systems to areas with noxious-weed infested areas. MMC would limit brushing and mowing to the minimum distance and height necessary to meet safety objectives in areas of heavy weed infestations.

MMC would pressure wash all off-road equipment including equipment for mining, vegetation clearing, road construction and maintenance, and reclamation before entering the project area to help prevent the introduction of new invader noxious weed species to the area.

MMC would continue to monitor/survey the project area for existing and new invader weed species and populations annually. MMC would monitor weed population levels with particular emphasis on haul routes, access routes, borrow areas, soil stockpiles, and the transmission line corridor. MMC would treat weed infestations as needed.

In areas where timber was to be removed, MMC would consider winter vegetation clearing to reduce mineral soil exposure and the chance of spreading existing noxious weeds.

MMC would develop and implement site-specific guidelines to be followed for weed treatments within or adjacent to known sensitive plant populations. MMC would evaluate all future treatment sites for sensitive plant habitat suitability; suitable habitats would be surveyed as necessary before treatment.

MMC would submit an annual report to the lead agencies describing weed control efforts. The report would provide a map showing areas of weed infestation that were treated in the preceding year. It also would provide a qualitative evaluation of the weed control efforts.

2.5.3.3 Libby Plant Site and Adits

Pre-production development would be similar to Alternative 2, but the Libby Plant Site would be located on a ridge separating Libby and Ramsey creeks (Figure 25). The same facilities proposed for the Ramsey Plant Site (Figure 5) would be built at the Libby Plant Site. Access to the plant site would be via NFS roads #4781 and #6210. A permanent bridge would be constructed across Ramsey Creek to provide access to NFS road #6210 from the Ramsey Creek Road. The bridge would be built in compliance with the INFS standards and guidelines (USDA Forest Service 1995, 2008a). Soil from the Libby Plant Site would be salvaged and stored in a stockpile at the Plant Site.

In Alternative 3, four adits would be required for the project, similar to Alternative 2. The two Ramsey Adits would be relocated into the Libby Creek drainage area (Figure 25). The ventilation adit located near Rock Lake proposed in Alternative 2 would remain the same (Figure 4) and the existing Libby Adit would be enlarged. The Rock Lake ventilation adit would be used only as an air intake adit and any pollutant emissions from the adit would be prohibited. The relocation of the Ramsey adits would not significantly alter the targeted access points into the deposit (crusher area, etc.) as proposed in Alternative 2.

The existing Libby Adit would be enlarged to about 30 feet wide by 30 feet high. An additional adit would be constructed on MMC's private land near the existing Libby portal and would be 17,000 to 18,000 feet long and decline to the ore body at 5 percent grade, depending on the portal location selected. These two adits would serve the same function as the two Ramsey Adits with one adit containing the underground conveyor and the other used for personnel access and material delivery into the mine. The exact location of the second adit on private land has not been determined. Two options for this adit portal were identified.

A third adit (Upper Libby Adit), upstream of the Libby Adit Site, would provide ventilation and emergency access. This adit would be 13,700 feet long, and decline to the ore body at about a 7 percent grade. To the extent feasible, the Upper Libby Adit would be constructed from underground, and waste rock hauled out of the Libby Adit Site, and not the Upper Libby Adit site.

Geotechnical investigations of the Libby Plant Site have not been completed. If the depth to bedrock at the site were similar to the Libby Adit Site, preliminary evaluation indicates the Libby Plant Site could be built out of fill material from the large cut on the west side of the plant site. The cut and fill materials would be balanced, and waste rock would not be used in plant site construction. Consequently, the fill slopes at the plant site would not be subject to the ELGs, and a MPDES-permitted outfall would not be needed at the site. MMC would determine waste rock management at the plant site during final design.

Electrical power for the Construction Phase would be supplied by two diesel, Tier 4 generators, if available, or Tier 3 generators at the Libby Adit. The limitations described for the generators during the Evaluation Phase would apply. A buried 34.5-kV transmission line along Bear Creek Road and the Libby Plant Access Road may be installed to replace the generators before the installation of the main transmission line. If the buried 34.5-kV line were installed, the generators would be used as standby power during construction. If constructed, the 34.5-kV line along Bear Creek Road and the Libby Plant Access Road would connect to a substation at the Libby Plant Site. Power would be distributed from the substation to equipment in various locations at the Libby Plant Site, the Libby Adit Site, the Poorman Tailings Impoundment site, and within the underground mine. Once the power was available from a transmission line (either the buried 34.5-kV line or the overhead 230-kV line), the generators at the Libby Adit Site would be moved to the Libby Plant Site and used as a backup power source. The backup generators at the mill after power was available from a transmission line would not be used more than 16 hours during any rolling 12-month time period.

2.5.3.4 Waste Rock Management

The estimated schedule for waste rock management in Alternatives 3 and 4 is shown in Table 21. Waste rock developed extending the Upper Libby Adit and the new Libby Adit would be hauled to a waste rock stockpile within the Poorman Tailings Impoundment footprint, the location of which would be determined during final design. As part of the Libby Adit evaluation program,

Table 21. Estimated Schedule for Waste Rock Production and Disposal, Alternatives 3 and 4.

Phase	Prichard, Burke, and Revett Waste Rock (tons)		Revett Barren Lead Waste Rock (tons)	Total Waste Rock (tons)	Ore (tons)
Current	424,400	0	0	424,400	0
Evaluation	545,300	0	0	545,300	0
Construction	0	2,115,900	134,900	2,250,800	333,000
Operations (Years 1-5)	0	85,000	245,000	330,000	0
Operations (Years 6+)	0	121,400	231,300	352,700	0
Total	0	3,292,000	611,200	3,903,200	0
Proposed Placement Pending Analysis	Temporary lined Libby Adit stockpile; then to tailings impoundment	Tailings impoundment construction	Underground		Temporary unlined storage pile near the Libby Adit portal, then to mill

Conversion from bank cubic yards presented in MMC 2009 based on a density of 12.18 cubic feet/ton
Source: Table C-3 in Appendix C, MMC 2009.

MMC would complete a test of water that infiltrated and ran off of the waste rock stockpile at the Libby Adit Site (see section 2.5.2*, Evaluation Phase)*. This testing was a condition in DEQ's approval of Minor Revision 06-002. MMC stockpiled some waste rock on a liner at the Libby Adit and began collecting samples in 2008. A summary of the water quality data from the waste rock stockpile is in Appendix K-10. The available results of metal and nutrient release testing on the Prichard Formation as waste rock, particularly for arsenic, copper, lead, antimony and nitrate, confirm that additional monitoring would be required (see geochemistry sampling and analysis plan in Appendix C.9). If monitoring results or other waste rock testing indicated water treatment would not be necessary, a retention pond sized to store a 10-year/24-hour storm would retain any runoff. The Seepage Collection Pond or the Starter Dam may serve this purpose if they were constructed before waste rock generation. If monitoring results or other waste rock testing indicated treatment would be necessary, the waste rock stockpile would be lined with clay or a geomembrane to achieve a permeability of less than or equal to 10^{-6} cm/sec. MMC would provide a stability analysis if the area were lined. If treatment were necessary, collected water would be pumped to the Water Treatment Plant at the Libby Adit site.

Limited pre-mining access to subsurface portions of the Montanore deposit makes additional sampling of waste and ore during the Evaluation Phase necessary. Further sampling and analysis also would be conducted during mine construction and operation. Together with baseline information, these data would be used to confirm and/or refine MMC's plans for operational waste rock sampling, selective handling and management of mined rock and tailings (Geomatrix 2007a). During the Evaluation Phase, MMC would:

- Collect representative samples from previously unexposed zones of waste rock. Specifically, these zones should include any unsampled, altered waste zones within the Revett, Burke and Wallace formations, as well as portions of the Prichard Formation to be exposed during construction of new adits. Samples would be analyzed using acid base accounting (ABA), multi-element whole rock analyses, and petrography to determine (1) conformity of new sample populations with previously analyzed samples and described field-scale geochemical analogs; (2) overall adequacy of sampling; and (3) relative need for additional metal mobility and/or kinetic testing. The number of samples required to statistically compare populations, and anticipated needs for kinetic and metal mobility testing, are estimated in Appendix C, but would be adjusted based on professional judgment at the time of sampling.
- Collect representative samples of ore within the portion of the Revett Formation to be exposed in the evaluation adit, for additional evaluation of metal release potential. The number of required ore samples is also estimated in Appendix C.
- Collect a bulk ore sample for metallurgical test work, to obtain representative tailings for additional geochemical analysis using ABA, whole rock, synthetic precipitation leaching procedure (SPLP), and mineralogy methods. The primary goal of these analyses is to refine estimates of metal release potential for tailings. Five tailings samples are estimated in Appendix C, but the number required would be contingent upon the metallurgical test design.
- Re-evaluate predicted water quality using Evaluation Phase kinetic and metal mobility test results. Kinetic test methods would reflect the geochemical environment of proposed rock management facilities (*e.g.*, saturated or unsaturated, aerobic or anaerobic conditions). In particular, MMC would use geochemistry data to further refine the predicted volume and quality of groundwater flow post-closure and assess potential for solute attenuation downgradient of the tailings impoundment.
- If appropriate, update operational sampling and analysis plans based on all available data.
- Identify operationally achievable handling criteria for waste management.
- Re-evaluate proposed methods of managing exposed underground workings (*e.g.*, grouting, barrier pillars), backfilling waste rock, and managing impounded tailings using data obtained during the Evaluation Phase.

Until water quality predictions, operational geochemistry, and rock management plans are finalized using Evaluation Phase data, MMC would:

- Isolate and place waste rock on a liner as described in section 2.5.2*, Evaluation Phase*
- Continue to treat water from the adit and waste rock stockpiles at the Water Treatment Plant

RC Resources, Inc. (RCR) is the proposed operator of the Rock Creek Project, a proposed mine on the west side of the Cabinet Mountains. RCR funded the development of a geochemical database that contains all data relating to ore, waste rock and tailings of the formations likely encountered by the Montanore Project and the Rock Creek Project, such as the Revett, Prichard, and Burke formations. The database is part of the Montanore and Rock Creek project record.

MMC would fund the maintenance and updating of the database. Should RC Resources continue the development of the Rock Creek Project, funding for the maintenance and updating of the database could be shared equally by MMC and RCR.

2.5.3.5 Tailings Management

The agencies developed a conceptual layout of a tailings impoundment at the Poorman Tailings Impoundment Site as an alternative because it would avoid the diversion of Little Cherry Creek, reduce the loss of aquatic habitat, and minimize wetland effects. The Poorman Tailings Impoundment Site would not provide sufficient capacity for 120 million tons of tailings without a substantial increase in the starter dam crest elevation if tailings were deposited at a density proposed in Alternative 2. The tailings thickener requirements to achieve higher tailings slurry density (and hence higher average in-place tailings density) are uncertain without additional testing of simulated tailings materials. Such testing would be completed during the Evaluation Phase. These issues and the development of the Poorman Impoundment Site for tailings disposal are discussed in the following sections. Additional site comparisons between Alternatives 2 and 3 tailings facilities are presented in section 3.14.3.3*, Little Cherry Creek (Alternatives 2 and 4) and Poorman (Alternative 3) Tailings Site Comparison.*

2.5.3.5.1 Impoundment Site Location

The Poorman Tailings Impoundment Site, which would be between Little Cherry and Poorman creeks in an unnamed watershed tributary to Libby Creek, could be developed to hold 120 million tons of tailings and support facilities (Figure 26). The site would be entirely on National Forest System lands. Private property not owned by MMC is located 300 feet east of the southern two-thirds of where the tailings dam alignment would be located. The Poorman site is in Sections 24 and 25, Township 28N, Range 31 West. Tailings would be transported to the site from a mill as a slurry, the same as proposed by MMC in Alternative 2. At the site, the tailings would be sent to a thickener plant and deposited in the impoundment as high-density tailings.

The Poorman Tailings Impoundment Site is a broad, east-facing slope about 0.25 mile west of Libby Creek. Like the Little Cherry Creek site, groundwater beneath the site exhibits artesian pressures in the base of the slopes above Libby Creek (Morrison-Knudsen Engineers, Inc. 1989a). The geology and near surface soils of the site are similar to the materials found in the Little Cherry Creek tailings site (Alternative 2) except that soft weak clays do not appear to be present in the soil strata (Morrison-Knudsen Engineers, Inc. 1989a).

2.5.3.5.2 General Proposed Facilities

In Alternative 3, the cyclone overflow (the fine tailings fraction after the sand is removed to build the sand dam), would be deposited as high-density tailings slurry with an average slurry density of 70 percent. The ability to achieve these densities is discussed in section 3.14.3.3, *Little Cherry Creek (Alternatives 2 and 4) and Poorman (Alternative 3) Tailings Site Comparison*. The agencies assumed thickening to an 80 percent density for the Rock Creek Project, which is proposing the mine in the same formation as the Montanore Project (see section 3.9.4, *Environmental Geochemistry* for a discussion of the geologic similarities between the Rock Creek and Montanore deposits). At a 70 percent slurry density, the average settled density of the tailings over the life of the project is estimated to be 85 pounds per cubic foot (pcf). As excess water drains from the fine tailings mass and the mass consolidates under long-term conditions, the average mass density could exceed 90 pcf. The time frame for such consolidation and the final average tailings density would depend upon the characteristics of the tailings and deposition patterns around the impoundment. The tailings slope is estimated to be 5 percent and the tailings shear strength sufficient to remain stable. During final design, laboratory tests would be run to confirm the slurry densification and shear strength characteristics, and seepage-induced consolidated tests would be performed on representative tailings samples to determine the appropriate slurry density, slope at deposition, and expected consolidation behavior of the tailings. During impoundment construction and operations, MMC would fund a third party technical advisor to assist the agencies with tailings impoundment quality assurance and quality control oversight.

Site development would include site stripping and foundation preparations followed by construction of a Starter Dam built from waste rock and borrow materials (as in Alternative 2), a Rock Toe Berm from waste rock and borrow materials under the toe of the Main Dam for stability, a drainage system within the impoundment area (as in Alternative 2), a Seepage Collection Pond (as in Alternative 2) and associated pumpback well system, a Saddle Dam on the north side of the impoundment, a tailings thickening plant, a waste rock stockpile, topsoil and subsoil stockpile areas, and relocation of NFS road #278.

The tailings dam would consist of three sections, the Starter Dam along the upstream toe of the Main Dam section, a Rock Toe Berm to buttress/support the sand dam along the Main Dam section, and a Main Dam section consisting of the sand fraction cycloned from the tailings (Figure 26 and Figure 27). The dam would have a final crest length of 10,300 feet at an elevation of 3,664 feet. The dam would have a vertical height of 230 feet above the Rock Toe Berm and 360 feet including the Rock Toe Berm. The dam layout is designed to maximize the height of the dam section based on estimated quantities available from the cyclone operations and to minimize fill requirements to balance the fill volume required for the total dam. Based on initial evaluation, the layout is considered feasible, but would be revised in final design, if possible, to reduce total fill quantities.

An impoundment with a Main Dam crest of 3,664 feet would contain almost all of the thickened tailings. With an average in-place density of 85 pcf at completion of tailings deposition (91.4 million tons), about 1 foot of additional dam crest would be required for complete storage of the tailings at a level surface. Assuming a level tailings surface, the impoundment capacity at the estimated dam crest elevation in the final years of operation would not allow for water storage within the impoundment area nor account for lost capacity due to the slope of the tailings surface. The dam maximum crest would be set at about 3,664 feet based on the Starter Dam and Rock Toe Berm layouts and the volume of cyclone sand available for construction of the Main Dam. Perimeter tailings deposition from an elevated position along the back slope of the impoundment would be required to store all of the tailings and allow for water storage within the impoundment during the final years of operation as discussed in subsequent sections. The cross-section shown in Figure 27 shows the estimated height and slope of the tailings surface with deposition from the perimeter slopes.

Foundation Preparations

Foundation preparations would be as described in Alternative 2. Additional field exploration will be required to assess foundation conditions at the Poorman site. This field work will be completed during the Evaluation Phase. Based on limited field data, there are indications that there may be deposits of low strength, highly compressible glaciolacustrine clay underlying the Poorman site.no unsuitable foundation conditions relative to dam stability are anticipated in the Poorman Site. The extent of the glaciolacustrine clay and its strength will be assessed during final design to assess the need for shear keys. In the event unsuitable materials were identified in subsequent design studies, or otherwise encountered in the site, such material would be excavated and stored in a stockpile. The material would be used for cover material in closure of the tailings facility or backfilled into borrow areas.

Rock Toe Berm

A Rock Toe Berm constructed as a compacted rock fill structure in the toe area of the Main Dam is currently part of the conceptual design. The Rock Toe Berm is designed to reduce the volume of cyclone sand required to construct the dam to the design height, and limit the height of the sand dam to allow a steeper downstream face to reduce the required sand volume. The Rock Toe Berm would be a free draining structure to prevent buildup of a water surface in the toe of the Main Dam. The Rock Toe Berm would have a 30-foot wide crest at an elevation of 3,440 feet with a 2.5H:1V downstream slope and a 3H:1V upstream slope. The upstream face of the Rock Toe Berm would be of screened material to create a surface that is filter compatible with the tailings sand to prevent the tailings sand from migrating into the Rock Toe Berm. The crest length is 4,400 feet and the vertical height at the maximum section is 140 feet. The total estimated volume of the Rock Toe Berm is 2.7 million cubic yards. About 1.2 to 1.5 million cubic yards of waste rock would be available from initial mine development and early mine operations. The balance of material would be obtained from either a rock borrow quarry developed in the upper elevations of the site where soil cover is minimal (Figure 26) or from suitable sand and gravel lenses noted in the glacial deposits located at the site (Morrison-Knudsen Engineers, Inc. 1989a).

Starter and Saddle Dams

The Starter Dam would be a compacted earthfill embankment with a 70-foot wide crest at an elevation of 3,480 feet (Figure 26). Upstream and downstream slopes would be 2.5H:1V. The wide crest was selected to reduce sand requirements in the Main Dam. The estimated crest length is 6,000 feet and the maximum section about 100 feet high. The Starter Dam would be constructed with waste rock and borrow material excavated from surface and near surface glacial deposits within or adjacent to the impoundment (Figure 26). The conceptual layout volume of the Starter Dam is estimated to be 1.7 million cubic yards. The fill would be placed in maximum uncompacted lifts of 1 foot or less and compacted with suitable equipment. All boulders larger than 8 inches diameter would be removed from the fill. A Saddle Dam of similar construction would be required in the north perimeter of the impoundment area. The Saddle Dam volume is estimated to be 730,000 cubic yards. The estimated volume of available borrow within the impoundment area is in excess of 5 million cubic yards; an estimated 1.2 million cubic yards of waste rock also would be available (Table 21). A HDPE geomembrane liner would be placed beneath a portion of the tailings impoundment and keyed into the low permeability zone of the dam (Figure 26 and Figure 27). During Starter Dam construction, a temporary water reclaim/storage pond would be constructed upstream from the Starter Dam to hold water until the Starter Dam was complete.

After the Starter and Saddle Dams were constructed, the impoundment footprint would be prepared for tailings deposition after operations began. Any soft, unsuitable materials would be either excavated and transported as backfill for the borrow areas, or filled with suitable material, such as general fill from borrow areas. An average of 24 inches of surface soils and 12 inches of subsoils at all wetlands would be excavated and used at isolated wetland mitigation sites (see section 2.5.7.2, *Isolated Wetlands*). Final design for management of wetland soils would be submitted to the agencies for approval. No tailings would be deposited directly into waters of the U.S. because other materials would first be placed in these areas before depositing the tailings.

Borrow Materials

The primary source for borrow materials for the starter and Saddle Dams would be local borrow materials from within the impoundment footprint (Figure 26). The borrow source for the Rock Toe Berm would be waste rock from the mine stockpiled at the site supplemented by local borrow within or adjacent to the impoundment area. Borrow for the Rock Toe Berm from within the impoundment site would consist of sands and gravels obtained for lenses in the underlying glacial alluvial material or bedrock obtained from a quarry site that could possibly be developed in the higher elevations where soil cover appears to be shallow compared to most of the impoundment area.

Drain materials would be obtained from on-site crushing and screening of suitable borrow (such as the sand and gravel lenses referenced in the glacial alluvial deposits) or obtained from a commercial source. Table 22 is a summary of anticipated material and volumes based on the conceptual layouts for Alternative 3.

Table 22. Estimated Tailings Impoundment Facility Volumes, Alternative 3.

Facility	Volume (million cubic yards)
Starter Dam	1.7
Rock Toe Berm	2.7
Cyclone Sand Dam	22.2
Saddle Dam	0.7
Seepage Collection Pond Fill	<0.1

2.5.3.5.3 Seepage Collection

In Alternative 3, a seepage collection system similar to that proposed in Alternative 2 would be used. A system of trunk drains and smaller lateral drains over the impoundment floor and beneath the tailings dam would convey seepage to the toe of the dam (Figure 26). Smaller secondary drains would convey water laterally into the trunk drains. Because the proposed underdrain system of the Little Cherry Creek and Poorman Impoundment as well as the hydrogeologic setting of the two sites were similar, the agencies assumed tailings seepage would be equal to the flow rates estimated for Alternative 2. For example, the estimated seepage flow rate into the foundation below the impoundment is 25 gpm and the seepage water from tailings consolidation is based on 75 percent of consolidation water migrating downward and 25 percent moving upward into the surface pond. MMC requested a groundwater mixing zone beneath and downgradient of the Poorman Impoundment for changes in water quality. A mixing zone a limited area of a surface water body or a portion of an aquifer, where initial dilution of a discharge takes place and where water quality changes may occur and where certain water quality standards may be exceeded (ARM 17.30.502(6)). The requested mixing zone extended from all areas beneath the impoundment to compliance monitoring wells downgradient of the pumpback wells. The DEQ would determine if a mixing zone beneath and downgradient of the impoundment would be granted in accordance with ARM 17.30.518 and, if so, would determine its size, configuration, and location. If DEQ granted a mixing zone, water quality changes might occur, but BHES Order limits could not be exceeded outside the mixing zone, and for other water quality parameters, nondegradation criteria could not occur outside the mixing zone unless authorized by DEQ.

Artesian conditions are present along the toe area of the dam footprint. A drainage collection system would be designed (similar to Alternative 2) and installed under the Rock Toe Berm and extend upstream under the Main and Starter dam footprints as necessary to collect and control groundwater. The Rock Toe Berm would be designed as a separate facility, but with its base layer compatible with the underlying drain system. Design of the groundwater drain system in the toe area of the dam would be separate from the tailings impoundment seepage collection system to enable separate monitoring of the two systems before flowing into the Seepage Collection Pond. Final design of the groundwater drain system would consider the need and benefit of a seepage collection trench along the toe of the dam upstream of the private property (Figure 26).

Drain designs (both gravity and pressure relief drains) would be similar to those used in Alternative 2. Drains within the impoundment would be installed in trenches into the native ground and covered with a permeable protective layer to prevent erosion and plugging of the drains during initial placement of the tailings (Figure 26). During construction of the seepage collection and drain system, any wetlands uphill of the Main Dam would be filled. All drains would be placed in a geomembrane-lined trench and consist of a core of highly pervious 1- to 4-inch rock wrapped in geotextile and surrounded by sand and gravel filter material. Locally available sand and gravel alluvial material would be used to cover the drains to prevent the fine tailings from piping into the drain materials during operations. Seepage collection drains through and under the dam footprint would be designed as integral parts of the dam foundation and compatible with each of the overlying dam sections. MMC would install pumpback recovery wells to collect tailings seepage not intercepted by the Seepage Collection System. The pumpback recovery wells would be located beyond the dam toe, and would be designed to collect seepage not collected by the drain system.

A Seepage Collection Pond and return facility would be 500 feet west of Libby Creek and 500 feet downstream of the impoundment. The facility design would include collection of water from the impoundment seepage collection drains, the groundwater relief drains, and runoff from the downstream slope and toe area of the tailings dam facility. The pond would have a crest elevation of 3,240 feet and be lined with HDPE (or equivalent). The outside compacted fill slopes would consist of material excavated from the pond area and graded to have 2.5H:1V slopes. The perimeter crest would be 30 feet wide for maintenance purposes. The design criteria for the pond would be to contain up to 30 days of drain flow plus runoff from the 6-hour PMP storm event. (The Seepage Collection Pond in Alternative 2 was designed to accommodate the smaller 100-year/24-hour storm.) The capacity of the Seepage Collection Pond shown in Figure 26 is 153 acre-feet (50 million gallons).

A pump station would be located on the west side of the Seepage Collection Pond (Figure 26). The return water pipelines would plumb either into the return water lines in the thickener plant, or into the tailings facility where the water would combine with the tailings water and then would be recovered through the tailings impoundment return water system. The pumps would be rated at 125 percent of the estimated maximum flow into the ponds.

2.5.3.6 Transportation and Access

The following sections describe road use and public access along the main access road (Bear Creek Road (NFS road #278), Libby Creek Road (NFS road #231), and within the proposed permit areas during the Construction, Operations, and Closure Phases. With the exception of the Bear Creek Road, all open roads in the impoundment site permit area would be gated and limited to mine traffic only. Non-motorized public access would be restricted within each permit area by signage at the permit area boundary. Table 23 lists those roads with a change in road status in Alternative 3; these roads are shown on Figure 29. MMC would be responsible for maintaining all existing or new roads and stream crossings used by the operation.

2.5.3.6.1 US 2 Improvements

MMC would fund and implement roadway improvements to US 2 and intersections with US 2 required by MDT.

2.5.3.6.2 Bear Creek Road Reconstruction

In Alternative 3, MMC would use the Bear Creek Road as in Alternative 2 for main access during operations. As discussed previously, the agencies incorporated the Libby Adit evaluation program into Alternatives 3 and 4. MMC would continue to plow and use the Libby Creek Road (NFS road #231) and the Upper Libby Creek Road (NFS road #2316) year-round during the 2-year evaluation program and the 1-year period during reconstruction of the Bear Creek Road. MMC would install and maintain a gate on the Libby Creek Road and the KNF would seasonally restrict access on the Libby Creek Road (NFS road #231) and the Upper Libby Creek Road (NFS road #2316) as long as MMC used and snowplowed the two roads, or as directed by the KNF or the Oversight Committee. Any work in a RHCA along an access road would be completed in compliance with INFS standards and Forest Service guidance (USDA Forest Service 1995, 2008a).

MMC would reconstruct the Bear Creek Road in accordance with the road design developed during the final design process. MMC would implement the plan for maintaining continued access by local landowners and recreational forest users during the Bear Creek Road reconstruction.

South of Little Cherry Creek, MMC would build 0.7 miles of new road west of and parallel to the Bear Creek Road that would connect Bear Creek Road with Ramsey Creek Road (NFS road #4781) (Figure 29). Once oversized haul vehicles were no longer needed between the tailings impoundment and Libby Plant Site, the mine and public traffic would both use the new alignment. When the road was used jointly, the primary road use would be mine traffic (vendors, concentrate haulage, deliveries, and personnel) similar to the use patterns on the lower segment of Bear Creek Road. The segment of the Bear Creek Road parallel to the new access road would be decommissioned, and the culvert crossing Poorman Creek would be removed. Decommissioned roads are discussed in 2.9.4.2, *Access Road Construction and Use*.

Similar to Alternative 2, MMC would use open and closed roads in Alternative 3. Some currently open roads would be gated. The agencies' wildlife mitigation includes access changes, either with gates or barriers. MMC would be responsible for installing and maintaining each closure. MMC would check the status of the closures twice-a-year (spring and fall), and repair any gate or barrier that is allowing access. The gates would have dual-locking devices to allow the KNF fire or administrative access. When accessing areas regulated by the Mine Safety and Health Administration, KNF personnel would check in at the mine office before entering regulated areas.

Table 23. Proposed Change in Road Status for Roads used during Construction, Operations, and Closure in Alternative 3.

Road #	Road Name	Location	Existing Status	Length (miles)	Proposed Status
1408	Libby Creek Bottom	Tailings Impoundment	Open	0.8	Gated, mine traffic only
2316	Upper Libby Creek	Libby Adit Site	Open	2.2	Mixed mine haul and public traffic
2316	Upper Libby Creek	Libby Adit Site	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.3	Gated, mine traffic only
2316	Upper Libby Creek	Libby Adit Site	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.7	Trail
2317	Poorman Creek	Up Poorman Creek	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	1.8	Trail
2317	Poorman Creek	Up Poorman Creek	Open	0.3	Mixed mine haul and public traffic
2317B	Poorman Creek B	Up Poorman Creek	Impassable, open to snow vehicles 12/1-3/31	0.5	Trail
4781	Ramsey Creek	Up Ramsey Creek	Open	0.7	Gated, mine traffic only
4781	Ramsey Creek	Up Ramsey Creek	Open	0.5	Decommission
4781	Ramsey Creek	Up Ramsey Creek	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	2.2	Trail
5181	L Cherry Loop H Cowpath	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.5	Gated, mine traffic only
5181A	L Cherry Loop H Cowpath A	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.2	Gated, mine traffic only
5184	Bear-Little Cherry	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.2	Gated, mine traffic only
5184A	Bear-Little Cherry A	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.2	Gated, mine traffic only
5185	S Bear-Little Cherry	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.9	Gated, mine traffic only
5185A	S Bear-Little Cherry A	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.3	Gated, mine traffic only
5187	L Cherry Loop L Clearing	Tailings Impoundment	Barriered year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.2	Gated, mine traffic only
6201	Cherry Ridge	Tailings Impoundment	Barriered year-long to motor vehicles, open to snow vehicles 12/1-3/31	1.2	Gated, mine traffic only
6201A	Cherry Ridge A	Tailings Impoundment	Barriered year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.6	Gated, mine traffic only

Road #	Road Name	Location	Existing Status	Length (miles)	Proposed Status
6210	Libby Ramsey	Libby Adit Access Road	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	2.95	Gated, mine traffic only
6210	Libby Ramsey	Libby Adit Access Road	Open	0.4	Gated, mine traffic only
6212	Little Cherry Loop	Tailings Impoundment	Open	2.1	Bridge across Poorman Creek removed during construction; road south of Poorman Creek decommissioned; Gated, mine traffic only
6212H	Little Cherry Loop H	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.6	Gated, mine traffic only
6212L	Little Cherry Loop L	Tailings Impoundment	Barriered year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.4	Gated, mine traffic only
6212M	Little Cherry Loop M	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	1.1	Gated, mine traffic only
6212P	Poorman Pit	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.3	Gated, mine traffic only
8749	Noranda Mine	Libby Adit Site	Private, gated	0.5	Gated, mine traffic only
8749A	Noranda Mine A	Libby Adit Site	Private, gated	0.2	Gated, mine traffic only
14403	Lower Ramsey	Libby Plant Site	Barriered year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.4	Gated, mine traffic only
14404	Bare Road	Tailings Impoundment	Barriered year-long to motor and snow vehicles	0.6	Gated, mine traffic only

Public access would be eliminated on the Little Cherry Loop Road (NFS road #6212) during the Construction, Operations, and Closure Phases and used exclusively for mine traffic (Figure 29). The bridge on NFS road #6212 across Poorman Creek would be removed during construction and the road south of Poorman Creek to the intersection of NFS road #278 would be decommissioned. A gate on the road would be installed near the tailings impoundment permit area boundary on the north end. Depending on timing of project construction, the KNF may need administrative access to NFS road #6212P to allow access to a gravel pit at the road's terminus. The following closed National Forest System roads within the impoundment area would be used in Alternative 3: #1408 to the private land in the NW¼, Section 25, Township 28N, Range 31 West, #5181, #5181A, #5185, #5185A, #5187, #6212H, #6212L, #6212M, and #6212P (Figure 29).

Access and road use on NFS road #4781 up Ramsey Creek and NFS road #6701 would change from gated to barriered to provide grizzly bear mitigation. A short segment of the Ramsey Creek Road would be placed in intermittent stored service (Figure 29).

2.5.3.7 Other Modifications

2.5.3.7.1 Updated Closure Plan

MMC would update the closure plan, including a long-term monitoring plan, during the Construction Phase in sufficient detail to allow development of a reclamation bond for the Closure Phase. A final closure and post-closure plan, including a long-term monitoring plan, would be submitted 3 to 4 years before mine closure.

2.5.3.7.2 Underground Equipment

MMC would use of Tier 4 engines on underground mobile equipment and emergency generators, if available, and use of ultra-low sulfur diesel fuel in those engines beginning in the Construction Phase and continuing during the Operations Phase.

2.5.3.7.3 Scenery and Recreation

MMC would design and construct a scenic overlook with information and interpretive signs on NFS road #231 (Libby Creek Road) downstream of the Midas Creek crossing with views of the tailings impoundment. MMC would develop two interpretative signs, one on the mining operation and another one on the mineral resource and geology of the Cabinet Mountains. Parking would be developed in cooperation with the KNF.

MMC would gate certain roads currently open in the mine permit areas beginning during the Construction Phase for the life of the project (Table 23). These roads would be different in Alternative 4. The KNF would change the access to other roads for wildlife mitigation (see section 2.5.7.4,*Wildlife*). In Alternatives 3 and 4, MMC would check the status of the closures twice-a-year (spring and fall), and repair any gate or barrier that was allowing access.

MMC would pay the reimbursement funding for a volunteer campground host from Memorial Day through Labor Day at Howard Lake Campground using an Volunteer Services Agreement for Natural Resources Agencies (Optional Form 301a), during the Construction and Operations Phases of the mine. MMC would shield or baffle night lighting at all facilities.

MMC would complete vegetation clearing operations under the supervision of an agency representative with experience in landscape architecture and revegetation. Where practicable, MMC would create clearing edges with shapes directly related to topography, existing vegetation community densities and ages, surface drainage patterns, existing forest species diversity, and view characteristics from Key Observation Points (KOPs). MMC would avoid straight line or right-angle clearing area edges. MMC would not create symmetrically-shaped clearing areas.

MMC would transition forested clearing area edges into existing treeless areas by varying the density of the cleared edge under the supervision of an agency representative. MMC would mark only trees to be removed with water-based paint, and not mark any trees to remain. MMC would cut all tree trunks at 6 inches or less above the existing grade in clearing areas located in sensitive foreground areas such as within 1,000 feet of residences, roads, and recreation areas. These locations would be determined and identified by an agency representative before clearing operations.

MMC would submit plans and specifications to the agencies to locate above-ground facilities, to the greatest extent practicable, without the facilities being visible above the skyline as viewed from the KOPs.

2.5.3.7.4 Reporting

MMC would submit as part of its annual report to the lead agencies a discussion of its compliance with all the monitoring and mitigation requirements specified in the DEQ Operating Permit and the KNF's approved Plan of Operations. Each monitoring and mitigation requirement of the selected alternative would be listed in the report.

2.5.4 Operations Phase

2.5.4.1 Mining

The agencies made seven changes to the mine plan: ore conveyance, mining outside MMC's extralateral rights, changes in buffer thicknesses, the use of barrier pillars, underground monitoring and inspection, sound levels and limitations on air emissions.

Ore would be conveyed via an above-ground covered conveyor from the Libby Adit Site 6,000 or 7,500 feet (depending on the adit location) to the covered coarse ore stockpile at the Libby Plant Site. The conveyor would parallel NFS roads #2316 and #6210. The agencies identified two options for the conveyor: one would be about 10 feet wide and 10 feet high, and the other would be lower (8 feet), but wider (16 feet) (Figure 24). The conveyor and three transfer points would be fully enclosed to minimize emissions, contact with precipitation and loss of ore. Any spillage would be promptly cleaned up to avoid contact with precipitation.

In MMC's Minor Revision 06-002 to its Hard Rock Mine Operating Permit #00150 (MMC 2006), MMC proposed areas of exploration outside of its extralateral rights. In Alternatives 3 and 4, MMC would not explore or mine for any ore outside of its extralateral rights.

In Alternative 3, MMC would be required to maintain at least a 1,000-foot buffer from Rock Lake and a 300-foot buffer from the Rock Lake Fault. MMC also would maintain during mining a 100-foot buffer from faults identified on Figure 61 unless the agencies approved a narrower buffer. MMC would keep the size and number of drives through the faults identified on Figure 61 to the minimum necessary to achieve safe and efficient access across the fault unless the agencies approved a narrower buffer. During the Evaluation Phase, MMC would conduct hydrologic and geotechnical studies and update the hydrologic model, as described in Appendix C, to determine if the buffer dimensions should be changed. The results would be reviewed by the lead agencies and approval would be required before MMC could mine within a smaller buffer area.

For the purpose of analyzing the effects of possible mitigations to minimize effects on surface water from mine dewatering, MMC simulated two options in its 3D groundwater model: grouting, during Operations Phase, of the sides of the three uppermost mine blocks and corresponding access ramps, as well as installing two 20-foot thick concrete pressure grouted wall bulkheads with a hydraulic conductivity of 1×10^{-9} cm/sec in two mining blocks in the mine at Closure. The agencies' evaluation of the constructed bulkheads, discussed in more detail in the *Groundwater Hydrology* section under Mitigation (p. 582), concluded that man-made concrete bulkheads would unlikely provide the necessary mitigation over the long-term, assuming the hydrologic modeling was representative of underground conditions. The agencies also concluded that leaving a "pillar" of unmined ore with characteristics similar to the constructed bulkheads simulated in the modeling would likely provide the necessary mitigation over the long-term, again assuming the hydrologic modeling was representative of underground conditions. Consequently, by the fifth year of operations, MMC would assess the need for barrier pillars to minimize post-mining changes in East Fork Rock Creek and East Fork Bull River streamflow and water quality. If needed, MMC would submit a revised mine plan with one or more barrier pillars with constructed bulkheads at access openings to the agencies for approval. One or more barriers would be maintained underground, if necessary based on the hydrologic monitoring, after the plan's approval. The underground barriers are described in section 2.5.2.2, *Proposed Activities* in the discussion of the Evaluation Phase.

To ensure MMC only mined ore within its valid existing rights and that the underground mine development adhered to required buffer zone boundaries, the Plan of Operations and DEQ operating permit would include requirements for underground monitoring. MMC would fund and facilitate biannual surveys of the underground workings that would be completed by an independent qualified mine surveyor. The surveyor would be selected and directed by the agencies through an agreement with MMC. The surveyor would have no financial interest in the Montanore Project. The agencies may also require more frequent surveys and/or as-built drawings if discrepancies arose. MMC would provide mine access, logistical support, and all information required by the surveyor to complete independent inspections and resulting documentation for the identified tasks. This would include all company-conducted mine surveys of the underground workings. After completing the monitoring survey, the independent surveyor would submit maps of the workings to the agencies and would report any underground disturbances that crossed the established extralateral rights boundary, entered into designated buffer zones, or deviated from agency approved mine design.

MMC would fund a third party technical advisor to assist the agencies with underground mine quality assurance and quality control oversight during operations. The technical advisor would assist the agencies in evaluating underground mine stability and adherence to the approved mine plan. MMC would provide mine access, logistical support, and all information required by the technical advisor to complete a review of underground rock mechanics data and MMC's mine plan. Assessments of the underground workings by the technical advisor may occur as frequently as quarterly, with the results of the inspections compiled into an annual assessment report. This annual report from the technical advisor would incorporate data collected as part of the ongoing monitoring program, and would be in addition to the annual report prepared by MMC. The technical advisor is described in section 2.5.2.5.4, *Final Underground Mine Design Process.*

MMC would compile the results from its surface and underground monitoring programs as developed during the final design process, and provide the results to the agencies in an annual report.

MMC would operate all surface and mill equipment so that sound levels would not exceed 55 dBA, measured 250 feet from the mill for continuous periods exceeding an hour. Backup beepers may exceed 55 dBA 250 feet from the mill. MMC's proposal in Alternative 2 to install silencers on intake and exhaust ventilation fans in the Ramsey Adits so that they generate sounds less than 82 dBA measured 3 feet downwind of the portal would apply to the three Libby Adits. As in Alternative 2, MMC also would locate all fans a minimum of 10,000 feet from the portals during operations.

MMC would adhere to all emission limitations in the final air quality permit. The DEQ's Supplemental Preliminary Determination on MMC's air quality permit (DEQ 2011a) contains a number of limitations on air emissions, including:

- The maximum ore production (measured as throughput at the primary crusher) would be limited to 20,000 tons during any 24-hour rolling period and to 7,000,000 tons during any rolling 12-month time period.
- The maximum diesel fuel consumption by underground equipment would be limited to 3,576 gallons during any rolling 24-hour time period and to 1,305,279 gallons during any rolling 12-month time period.
- The maximum diesel fuel consumption by surface equipment would be limited to 3,769 gallons during any rolling 24-hour time period and to 1,375,712 gallons during any rolling 12-month time period.
- The maximum propane consumption by the propane fired heaters would be limited to 488,448 gallons during any rolling 12-month time period.
- The maximum RU Emulsion explosive use would be limited to 4,770.5 tons during any rolling 12-month time period.
- The stack height of the diesel engine/generator would be a minimum of 10 feet above ground level.
- The emissions from the Libby #1 Exhaust Ventilation Adit would be limited to 8.74 tpy of particulate matter with an aerodynamic diameter of 10 microns or less (PM10); 2.03 tpy of particulate matter with an aerodynamic diameter of 2.5 microns or less (PM2.5); 23.22 tpy of oxides of nitrogen (NOx); and 1.91 tpy of oxides of sulfur (SOX).
- The Libby #1 and Libby #2 Exhaust Ventilation Adits would not exhaust more than 350,000 cubic feet per minute (cfm) of air.
- Emissions from the baghouses used to control emissions from the surface ore handling activities at the SAG mill and at the Libby Load-Out facility would be limited to 0.05 grams per dry standard cubic meter (g/dscm) or 0.020 grains/dscm.
- Emissions from the wet venturi scrubber used to control emissions from the coarse ore stockpile transfer to the apron feeders would be limited to 0.05 g/dscm or 0.020 grains/dscm.
- MMC would not cause or authorize to be discharged into the atmosphere stack emissions that exhibit 7% opacity or greater averaged over 6 consecutive minutes from the baghouse.
- MMC would not cause or authorize to be discharged into the atmosphere any fugitive emissions from process equipment that exhibit 10% opacity or greater averaged over 6 consecutive minutes.

2.5.4.2 Tailings Management

2.5.4.2.1 Main Dam

The Main Dam would be a compacted cyclone sand dam constructed by the centerline method to an elevation of 3,664 feet (Figure 26 and Figure 27). A crest width of 70 feet was used to account for the upstream slope of the sand deposition and working crest area for the proposed cyclone towers. The downstream slope was set at 2.75H:1V and would be buttressed by a Rock Toe Berm described above. Based on the height and position of the Rock Toe Berm, the vertical height of the Main Dam would be 230 feet above the Rock Toe Berm crest (Figure 26 and Figure 27). The final crest length would be 10,300 feet, and the main north-south axis would be 5,000 feet long. The left and right abutment sections would be both angled back at about 75 degrees from the main section centerline and tie into the existing ground at the crest elevation (Figure 26). The dam would be raised with cyclone underflow sand hydraulically placed and compacted in cells as described for Alternative 2. The cyclone overflow (fine tailings fraction) would be routed to the tailings thickener plant and combined with the primary thickener underflow and thickened to a target slurry density of 70 percent. The density would be determined during final design.

2.5.4.2.2 Tailings Deposition

In Alternative 3, tailings would be thickened to a target density of 70 percent at a thickener plant at the impoundment site. Density can vary between deposition methods depending on the physical and geotechnical characteristics of site-specific tailings. Deposition of tailings slurries at thicker densities can offer several advantages over tailings slurries at 55 percent or less, including increasing water recovery; reducing requirements for make-up water and water storage; providing greater impoundment stability; and under certain conditions, potentially depositing tailings higher than the level surface of the tailings. The Poorman Impoundment Site is amenable to thickened tailings deposition from the upstream perimeter slopes, whereas the Little Cherry Creek site has limited capacity for thickened tailings deposition from slopes upstream of the impoundment. In Alternatives 2 and 4, thickened tailings deposition would only increase impoundment storage capacity if the drainage area above the diversion dam on Little Cherry Creek were used.

Tailings Pipelines

Tailings slurry would be pumped in buried double-walled HDPE or HDPE/steel combination pipelines from the mill at the Libby Plant Site to a thickener facility west of the impoundment. In Alternative 3, the pipeline corridor would parallel the road except where the road curved (Figure 23, Figure 24). Tailings pipelines would be double-walled to reduce the risk of leaks; one type of pipeline used successfully at the Stillwater Mine complex consists of a HDPE pipe inside a steel pipe. The leak detection system proposed by MMC would be used. In the event that the leak detection system monitored a leak, the mill operator would change flows to the second tailings line and flush the other line of all solid material. The investigation of the leak would then commence.

MMC would bury tailings pipelines adjacent to the proposed access road between the Libby Plant Site and the Poorman Impoundment Site in most locations. Unless it was impracticable, pipelines would be buried at least 3 feet deep adjacent to the access road. The pipelines would not be buried at the Ramsey Creek and Poorman Creek crossings, but would set in a lined, covered trestle adjacent to the bridge. The creek crossings would have secondary containment built into the crossings besides the double-walled pipe. The containment would be covered and drain toward a designed sump or tank system. Values would be installed on either side of the crossings to minimize the quantity of tailings that would reach the creek. The ditch proposed by MMC in Alternative 2 would not be constructed. MMC would prepare an as-built drawing showing pipeline depths. Burying the pipelines would provide better protection from vandalism, eliminate the visible presence of the pipelines, and facilitate concurrent reclamation in the pipeline corridor along most of the route between the mill and the tailings thickener plant. In addition to the pump station at the Poorman Creek crossing proposed in Alternative 2, another pump station, similar to the Poorman Creek pump station, would be needed at the Ramsey Creek crossing. These pump stations would be outside of the 100-year floodplain to comply with INFS requirements (Figure 24). Once the pipelines were no longer needed, they would be flushed out into the tailings impoundment. They would be removed from all stream crossings and anywhere they were less than 3 feet below the surface. For other segments of the pipelines, the pipelines would be left in place. They would be cut at 0.5-mile intervals, and capped.

Thickener Facility

The thickener facility would remove water, or dewater, the tailings to a target density of 70 percent solids and deposited to achieve an average in-place tailings density of 85 pcf or greater. Water removed from the tailings would be sent to the water storage pond on the north end of the Poorman Tailings Impoundment (Figure 26). It is anticipated that either a high compression thickener or a deep tank thickener system would be required. A high compression thickener is basically a high rate thickener with higher sidewalls so that a higher mud level is maintained in the thickener. This produces a higher percent solids underflow, referred to as high-density slurry. The deep tank thickener has a high sidewall so that the aspect ratio of diameter to height is about 1:1. A higher mud level and residence time results in higher percent solids than the high compression thickener. The appropriate selection would be based on a series of rheology tests (test to evaluate the physical relationship between the slurry density and size/material type of the pipe to determine the "pumpability" of the slurry) using representative tailings samples. The number of thickeners would depend on the test results coupled with the production rate. The plant would be expanded in stages to accommodate the increasing tailings production rate over time (from 12,500 to 20,000 tons of tailings per day). The water removed from the tailings slurry would be routed to the storage pond in the impoundment and then returned to the mill as make-up water.

The area required for the facility would depend on final design and arrangement of the thickeners. An area up to 300 feet by 200 feet would be located above the impoundment area. The main building and any exterior thickeners/facilities would be painted to help reduce visual impacts. Vegetation surrounding the thickener plant would be retained or planted to help visually blend the plant site with adjacent hillsides. The thickener plant would be designed to receive, dewater, and pump up to 20,000 tons of tailings per day.

Pumping and Deposition

The selection of pumping equipment would depend largely on the type of thickener selected, the pumping pressures required, and rheology of the tailings. Either centrifugal pumps or positive displacement pumps likely would be required for this alternative. The selection would be determined as part of final design studies.

Initially, the high-density slurry would be applied to the ground surface from the crest of the Starter Dam and initial raises of the Main Dam, and retained by a Starter Dam and subsequent Main Dam similar to Alternative 2. Deposition from the dam crest would continue through about Year 5 of operation to establish a back slope for the upstream side of the sand dam and a contact with the tailings slurry. After about Year 5, the thickened tailings would be deposited to the ground from multiple points upslope of the tailings impoundment area to form several mounds of tailings. As tailings deposition continues, the slope of the mounded tailings would overlap and migrate down into the impoundment area. The thickened tailings would form a surface at about a 3 to 5 percent gradient to create a slope of tailings graded down into the impoundment area (Figure 28). The mass of tailings deposited to form the slope would be balanced with the tailings volume within the impoundment area so as not to exceed the height of the Main Dam and provide adequate solution and stormwater management capacity within the impoundment area. The last year or two of operations, tailings would be deposited to facilitate final closure of the facility with surface water drainage reporting to the northern corner of the impoundment. Distribution pipelines around the impoundment would be surface mounted for maintenance and operation purposes.

Dust Control at Impoundment

The DEQ's Supplement Preliminary Determination (DEQ 2011a) has specific requirements for tailings dust management. Spigots distributing wet tailings material and water would cover about one-half of the total tailings at any time. The spigots would be moved regularly and would cause wetting of all non-submerged portions of the tailings impoundment to occur each day. This wetting would be supplemented by sprinklers as necessary when weather conditions could exist to cause fugitive dust. MMC would implement the Fugitive Dust Control Plan throughout operations. At closure, MMC would maintain wind erosion control during the interim period after the end of active tailings deposition and before final reclamation of the site. Any revisions to these requirements in the final air quality permit would be implemented.

2.5.4.3 Water Use and Management

2.5.4.3.1 Project Water Requirements

The water balance in Alternative 3 (Table 24) would differ from the water balance in Alternative 2 in four aspects: the Water Treatment Plant at the Libby Adit Site would be used instead of land application water treatment (see section 2.5.4.3.3, *Water Treatment*), all mine and adit inflows would be treated and discharged from Libby Adit Water Treatment Plant; additional water would be discharged from the Libby Adit Water Treatment Plant during Operations, Closure and Post-Closure Phases whenever flow in Libby Creek at LB-2000 was less than 40 cfs, and make-up water for ore processing would be diverted from an infiltration gallery adjacent to Libby Creek. The Alternative 3 water balance is based on the same assumptions regarding mine and adit inflows, precipitation, and evaporation used in Alternative 2. MMC would maintain a detailed water balance that would be used to monitor water use. Actual volumes for water balance variables (*e.g*., mine and adit inflows, precipitation and evaporation, and dust suppression) would vary seasonally and annually from the volumes shown in Table 24.

Mine and adit water would not be used beneficially in any phase, and would be treated and discharged from the Water Treatment Plant during all phases. In all phases except the Evaluation Phase when water was used beneficially, water would be discharged whenever flow in Libby Creek at LB-2000 was less than 40 cfs. The capacity of the existing Water Treatment Plant would be expanded to accommodate operational discharges (see section 2.5.4.3.3, *Water Treatment*). Diversions from Libby Creek would be necessary to provide adequate water for project use. Section 2.5.4.3.2, *Water Rights,* discusses appropriations and discharges associated with water rights.

Using thickened tailings may affect the ability to use the impoundment as a reservoir to maintain a water balance. In final design, MMC would re-evaluate the water balance and the tailings deposition plan. Several options for water storage would be available. One option would use the drainage in the northern end of the impoundment area as a dedicated water storage area and readjust the dam alignment and deposition plan. If chosen, during the final few years of operations, the dedicated water storage area could be infilled if needed as part of final tailings deposition and contouring for reclamation. Preliminary evaluation of this option indicates that this may be possible with only minor changes to the Alternative 3 layout and site development. A second option would be to use the Seepage Collection Pond for excess water storage. A third option would be to use one or more borrow areas for storage. The Alternative 3 water balance assumes that all collected water would be returned to the impoundment and no water storage would occur in the Seepage Collection Pond.

Table 24. Average Water Balance, Alternative 3.

Phase—>	Evaluation Phase 2 Years		Construction Phase 3 Years			Operations Phase 1st 5 Years	Operations Phase 2nd 5 Years	Operations Phase 3rd 5 Years	Closure Phase 1st 5 Years	Post-Closure Phase 2nd 5 Years
Project Year—>	Project Year 1	Project Year 2	Project Year 3	Project Year 4	Project Year 5	Project Years 6-10	Project Years 11-15	Project Years 16-24	Project Years 25-29	Project Years 30-35
Production Rate—>	0 tpd	0 tpd	0 tpd	0 tpd	0 tpd	12,500 tpd	17,000 tpd	20,000 tpd	0 tpd	0 tpd
Component	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)
Mine and Adit Flow										
Adit inflow	230	230	340	395	450	270	270	200	0	0
Mine inflow	30	30	30	30	30	110	110	170	0	0
Total flow	**260**	**260**	**370**	**425**	**480**	**380**	**380**	**370**	**0**	**0**
Water Treatment Plant										
Inflows - mine and adit flows	260	260	370	425	480	380	380	370	0	0
Runoff from Libby Adit waste rock stockpile	3	3	0	0	0	0	0	0	0	0
Water from tailings impoundment seepage/runoff collection	0	0	98	75	20	0	0	0	405	270
Mitigation water from impoundment during low flow (August-March) ‡								**395**		
Water treatment plant discharge †	**263**	**263**	**468**	**500**	**500**	**380**	**380**	**765**	**405**	**270**
Mill Inflow										
Flows from mine/adit	0	0	0	0	0	0	0	0	0	0
Water from tailings impoundment seepage/runoff collection	0	0	0	0	0	498	815	1,044	0	0
Make-up water from Libby Creek alluvium stored in tailings impoundment‡	0	0	0	0	0	380	380	370	0	0
Subtotal	**0**	**0**	**0**	**0**	**0**	**878**	**1,195**	**1,414**	**0**	**0**
Mill Outflow										
Water transported with tailings at deposition	0	0	0	0	0	872	1,186	1,405	0	0
Water in concentrate	0	0	0	0	0	6	9	9	0	0
Subtotal	**0**	**0**	**0**	**0**	**0**	**878**	**1,195**	**1,414**	**0**	**0**

Phase—>	Evaluation Phase 2 Years		Construction Phase 3 Years			Operations Phase 1st 5 Years	Operations Phase 2nd 5 Years	Operations Phase 3rd 5 Years	Closure Phase 1st 5 Years	Post-Closure Phase 2nd 5 Years
Project Year—>	**Project Year 1**	**Project Year 2**	**Project Year 3**	**Project Year 4**	**Project Year 5**	**Project Years 6-10**	**Project Years 11-15**	**Project Years 16-24**	**Project Years 25-29**	**Project Years 30-35**
Production Rate—>	**0 tpd**	**0 tpd**	**0 tpd**	**0 tpd**	**0 tpd**	**12,500 tpd**	**17,000 tpd**	**20,000 tpd**	**0 tpd**	**0 tpd**
Component	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**	**(gpm)**
Tailings Impoundment Inflow*										
Precipitation on stored water pond	0	0	2	33	33	181	357	323	67	9
Seepage collection pond net precipitation	0	0	84	165	165	139	139	139	32	5
Runoff captured from impoundment dam/ beach/catchment area	0	0	18	24	24	212	138	162	44	0
Runoff from waste rock stockpile within impoundment	0	0	4	4	4	3	10	0	0	0
Water transported with tailings at deposition	0	0	0	0	0	872	1,186	1,405	0	0
Water released from fine tailings consolidation	0	0	0	0	0	28	101	137	102	20
Water released from sand tailings consolidation (dams)	0	0	0	0	0	133	181	214	0	0
Groundwater interception/ seepage collection	0	0	0	0	0	221	221	221	221	221
Make-up water from Libby Creek alluvium‡								765		
Subtotal	**0**	**0**	**108**	**226**	**226**	**1,789**	**2,333**	**3,366**	**466**	**255**
Tailings Impoundment Outflow*										
Dust control	0	0	5	6	6	12	24	24	6	0
Evaporation	0	0	8	45	45	216	444	423	81	10
Water retained by tailings voids	0	0	0	0	0	710	965	1,143	0	0
Water recycled to mill (to Water Treatment Plant in pre/post operations)‡§	0	0	72	75	20	498	815	1,414	405	270
Seepage to groundwater	0	0	0	0	0	15	25	25	25	25
To Water Treatment Plant during August-March‡								395		
Change in water stored in impoundment	0	0	23	100	155	338	59	(59)	(51)	(50)
Subtotal	**0**	**0**	**108**	**226**	**226**	**1,789**	**2,333**	**3,366**	**466**	**255**

gpm = gallons per minute

†Water Treatment Plant discharge rates are based on current plant capacity, which would be increased in Alternatives 3 and 4.

‡Rates of water to the impoundment and from the impoundment to Water Treatment Plant for water rights mitigation discussed in section 2.5.4.3.2, *Water Rights* were calculated for full operations.

§Rates of water to Water Treatment Plant during Closure and Post-Closure Phases are based on current plant capacity, which would be increased in Alternatives 3 and 4; see section 2.5.4.3.3, *Water Treatment*.

In 2011, MMC applied to the DEQ to renew the existing MPDES permit and requested the inclusion under the permit of five new stormwater outfalls needed for Alternative 3 for the next 5 years. In 2011, the DEQ determined the renewal application was complete and administratively extended the permit (ARM 17.30.1313(1)) until MMC receives the renewed permit. Other outfalls may be identified during the MPDES permitting process.

2.5.4.3.2 Water Rights

MMC submitted four beneficial water use permit applications to the DNRC for the use of surface water and groundwater associated with the project (MMC 2012a). One application was subsequently withdrawn and two applications were modified. If permitted, the three rights would be in addition to MMC's two existing surface water rights and one groundwater right in Libby Creek. The three permit applications are summarized in Table 25.

Table 25. Summary of MMC's Beneficial Water Use Permit Applications.

Variable	Water Source		
	Groundwater	Groundwater	Surface Water
General Description	Groundwater from pumpback wells	Groundwater from Libby Creek alluvium	Precipitation captured by impoundment
Purpose	Mining	Mining	Mining
Period of Use	1/1-12/31	4/1-7/31	1/1-12/31
Point of Diversion	Poorman Impoundment Site	Libby Creek alluvial groundwater near Poorman Impoundment Site	Poorman Impoundment Site
Point of Use	Libby Plant Site and Poorman Impoundment Site	Libby Plant Site and Poorman Impoundment Site	Libby Plant Site and Poorman Impoundment Site
Average Flow Rate over Period of Use (gpm)	250	765	625
Maximum Flow Rate (gpm)	250	1,125	1,950
Maximum Volume (acre-feet/year)	403	410	1,038

The values shown for each water source is what MMC requested and may be different from those in any beneficial water use permit issued.
Source: MMC 2012a.

Any new water right for water use issued pursuant to Montana law for water use in Alternative 3 would be consistent with the terms of an approved Plan of Operations. An approved Plan of Operations consistent with Alternative 3 would contain the stipulation that any water right acquired solely for the purposes of mineral development in an approved Plan of Operations would terminate when the Plan of Operations terminated. Any change in beneficial use or place of use of water authorized under an approved Plan of Operations would cause the authorization for that water use to terminate unless prior written approval from the KNF was obtained.

MMC would create 7.5 acres of new wetlands in the Libby Creek drainage (see section 2.5.7.2, *Isolated Wetlands*). MMC would acquire a permit for the created wetlands if the DNRC determined water use for creating wetlands was a beneficial use. In Alternatives 3 and 4, MMC would acquire a parcel along US 2 through which Swamp Creek flows for wetland and stream mitigation (see section 2.5.7.1, *Wetlands*). Rehabilitation of the site to improve its functions as a wetland would not require a water right. The current owner of this parcel has a surface water right to flood irrigate 26 acres of hay meadow between May 1 and October 31, with a maximum diversion rate of 291.72 gpm, and maximum volume of 52 acre-feet per year. MMC would file for a change of use for this water right to an instream flow right. Any water right used for wetland mitigation would be conveyed to the Forest Service when the mitigation sites were conveyed.

Construction and Operations Phases Diversions and Discharges

The Forest Service has an instream water right for 40 cfs in Libby Creek at the confluence of Bear Creek with a 2007 priority date. Any new water right obtained by MMC associated with its Plan of Operations would be junior to the Forest Service right and would terminate when the Plan of Operations expired. Senior rights have an earlier priority date and claimants who hold them have a higher priority to divert water from a stream or water body than those with later, or junior rights. Consequently, MMC would divert groundwater from Libby Creek during high flows (April through July) and store it in the tailings impoundment, Seepage Collection Pond, or mine water pond at the Libby Plant Site. No appropriation would be made whenever flow at LB-2000 was less than 40 cfs. Storage of diverted water would occur during the late Construction Phase after the Starter Dam was lined and MMC began storing water for mill startup, during the Operations Phase, and during the Closure Phase until the impoundment was dewatered for reclamation.

MMC would establish a flow gaging station at LB-2000 near the upstream point-of-diversion of the Forest Service's 40-cfs right. The gaging station would consist of a staff gage and pressure transducer. The pressure transducer would be set to collect stream stage data at 1-hour intervals and transmitted electronically to the mine office. MMC would review the transducer data daily at 9 AM and if it indicates a flow below 40 cfs, MMC would cease appropriating Libby Creek water. Site-specific flow measurements would be conducted at the gaging station for a range of low, medium, and high flow measurements to establish a rating curve for the staff gage and pressure transducer data. A specific height on the staff gage would be identified that equates to a flow of 40 cfs in Libby Creek. After initial equipment setup and verification of proper operation, the staff gage would be measured monthly, and the pressure transducer data would be downloaded monthly.

In an average precipitation year, groundwater tributary to Libby Creek would be appropriated from Libby Creek alluvium between April 1 and July 31 at an average flow rate of 765 gpm and a maximum flow rate of 1,125 gpm (410 acre-feet/year maximum volume). Water would be diverted using a subsurface infiltration gallery installed in the gravels along the west side of the Libby Creek channel at the proposed point-of- diversion (Figure 26). The gallery would be connected to a pumping station that would pump water in a single pipe to the Poorman tailings impoundment. Groundwater tributary to Libby Creek also would be appropriated year-round at an average and maximum flow rate of 250 gpm (403 acre-feet/year maximum volume) from the pumpback wells. Precipitation captured by the impoundment would be appropriated year-round at an average flow rate of 625 gpm and a maximum flow rate of 1,950 gpm (1,038 acre-feet/year maximum volume). (The values shown in Table 25 are what MMC requested and may be different from those in any beneficial water use permit issued.) Diverted water would be stored in the impoundment water pond and would be pumped to the plant/mill for ore-processing make-up water.

Whenever flow in Libby Creek at LB-2000 was less than 40 cfs, stored water would be treated at the Libby Adit Water Treatment Plant, and discharged at a rate equal to all Libby Creek appropriations, including created wetlands in the Libby Creek drainage. The rates would vary, depending on actual precipitation and the total pumping rate of the pumpback wells. As part of the water balance monitoring described in Appendix C, MMC would measure precipitation and evaporation at the tailings impoundment and total pumping rate of the pumpback wells to determine the appropriate rate of discharges to avoid adversely affecting senior water rights. Any water from the tailings impoundment to be treated and discharged would be mine drainage and precipitation commingled with process water. No process water would be discharged unless one of the two exemptions in the ELGs was met (40 CFR 440.104(b)(2)).

On Ramsey Creek, a senior water right holder has a 1 cfs surface water right on Ramsey Creek between RA-200 and RA-400. When the 3D model was updated after the Evaluation Phase, MMC would re-evaluate baseflow changes in Ramsey Creek. If baseflow changes in Ramsey Creek may adversely affect this right on Ramsey Creek during any mining phase, MMC would develop a plan during final design to convey treated water from the Water Treatment Plant to a location upstream of the senior water right's point of diversion (RA-300). Discharge to Ramsey Creek would equal MMC's Ramsey Creek baseflow changes whenever the flow at RA-300 was less than 1 cfs. Discharge of treated water to Ramsey Creek would require a new outfall in the MMC's MPDES permit.

Closure and Post-Closure Phases Diversions and Discharges

During operations and at closure, the three adits would be hydraulically connected to the mine void, and without plugs, water would drain toward the mine void until the void filled to the level of the adits. During the Closure Phase, MMC would place two or more plugs in each adit. The plugs would be located to isolate the adits hydraulically from the mine void and to ensure any groundwater tributary to Libby and Ramsey creeks would flow into the adits, and remain within the Libby Creek watershed. The plug locations would be determined by the agencies using the 3D groundwater model maintained and updated throughout the project. MMC would provide a plugging design and the required groundwater modeling as part of the final closure plan.

Following adit plugging, water flowing into the adits would begin to refill the adits. As long as MMC appropriated or diverted water from Libby Creek whenever flow at LB-2000 was less than 40 cfs, MMC would treat, if necessary to meet MPDES permitted effluent limits, stored adit water and discharge it to Libby Creek at a rate equal to all of MMC's Libby Creek appropriations or diversions occurring at that time. Discharges to Ramsey Creek also would be required if the modeling indicated adit inflows during the Closure Phase would adversely affect the senior water right on Ramsey Creek.

After facilities were reclaimed and precipitation was no longer intercepted, appropriations or diversions from the Libby Creek watershed would be limited to adit inflows and pumping from the pumpback well system. Inflow into the adits, during the period when Libby Creek would have a flow of 40 cfs or more at LB-2000, would begin to refill the adits. Whenever flow at LB-2000 was less than 40 cfs, MMC would set a datum at the current water level in each adit. The datum would be the location of the water level in each of the adits at the time water would be required for mitigation. Through discharges, MMC would maintain water levels in each adit at that datum as long as flow in Libby Creek at LB-2000 was less than 40 cfs. In other words, MMC would discharge from the adits so as not to increase the storage in any adit whenever mitigation was required. Discharges would cease and water levels in the adits would increase whenever flow in Libby Creek at LB-2000 was 40 cfs or more. A new datum would then be established whenever mitigation was again needed.

When the water level in the adits reached the bedrock-colluvial interface (about 800 feet from the adit portal), MMC would place an additional plug in bedrock at the bedrock-colluvial interface and allow the adits to reach steady state hydrologic conditions. Construction of the second plug would begin when flow at LB-2000 was 40 cfs or more. A third plug would be placed at the opening of each adit. The adit portals then would be reclaimed.

Water appropriated by the pumpback well system during the Closure and Post-Closure Phases would be treated and discharged at the Water Treatment Plant. After the second plug was placed in each adit, no further discharges to Libby Creek other than from the pumpback well system would be required to avoid adversely affecting senior water rights.

2.5.4.3.3 Water Treatment

MMC proposes in Alternative 2 to use the LAD Areas for primary treatment of excess mine and adit inflows. Currently, MMC is permitted by the DEQ under Operating Permit #00150, Minor Revision 06-002, to treat Libby Adit inflows through an existing Water Treatment Plant at the Libby Adit Site before discharge to MPDES-permitted outfalls. In Alternative 3, the existing Water Treatment Plant would be used solely to treat any waters before discharge at the existing MPDES-permitted outfalls. Water would not be discharged at the LAD Areas. MMC would conduct the monitoring required in the MPDES permit.

The agencies anticipate that the Water Treatment Plant would be modified to increase capacity and to treat nitrogen and phosphorus, and possibly dissolved metals. The degree of treatment needed for nitrogen and phosphorus would depend on whether MMC applied for and received either a general or individual variance to the base nutrient standards. In either case, MMC would have to comply with the BHES Order limit of 1 mg/L total inorganic nitrogen. MMC's analysis of discharges during operations indicated maximum discharges would be 1,024 gpm during an average year, and 1,178 gpm during the estimated wettest year in a 10-year period (36 inches of precipitation) (MMC 2012a). A discharge of 1,178 gpm would exceed the current design capacity of the Water Treatment Plant, estimated to be 500 gpm. During final design, MMC would estimate the maximum discharge rate during the estimated wettest year in a 20-year period using best available precipitation data and modify the Water Treatment Plant such that it would have adequate capacity to treat discharges during such a year. MMC also would evaluate the size of the percolation pond at the Libby Adit, and enlarge it, if necessary, to accommodate higher flow rates. The increased capacity and treatment modifications would be in place at mill startup.

If MMC's Ramsey Creek diversions may adversely affect a senior right on Ramsey Creek during any mining phase, MMC would develop a plan during final design to convey treated water from the Water Treatment Plant to a location upstream of senior water right's point of diversion. Discharge of treated water to Ramsey Creek would require a new outfall in MMC's MPDES permit.

MMC evaluated several treatment alternatives for treating nitrogen compounds (Apex Engineering, PLLC and Morrison-Maierle, Inc. 2008). The recommended alternative for treating nitrates and ammonia is a moving bed biofilm reactor (MBBR). In a MBBR, microorganisms grow as a biofilm on the surfaces of plastic carriers, called media, in a treatment reactor. Air is forced into the reactor, and as the media circulate through wastewater in the reactor, the microorganisms remove nitrogen compounds through biological processes. The media provide high surface area and protected interior space for growth of the microorganisms, enabling high treatment capacity in a small footprint. This system is in use currently at the Stillwater Mining Company (Stillwater) mining complex in Montana.

Treatment would be a two-step process. Ammonia would be removed from water through the biological process called nitrification, which converts (oxidizes) ammonia to nitrate. Nitrates are removed through another biological process called denitrification. Microorganisms convert nitrate to inert nitrogen gas that vents from the system. With addition of a carbon energy source, the biological processes are optimized and carbon dioxide is also produced and vented with the nitrogen gas. Based on Stillwater's treatment system, the agencies anticipate the MBBR technology would be capable of meeting existing MPDES permitted effluent limits.

At the current design flow rate of 500 gpm, the MBBR system for nitrification would consist of a concrete tank about 24 feet long, 24 feet wide and up to 13 feet deep. The nitrification concrete tank would be filled about 50 percent with plastic media and supplied with forced air. An MBBR system for denitrification would be a concrete tank about 20 feet long, 24 feet wide and 10 feet deep (plus 2 to 3 feet of freeboard). The denitrification tank would be filled about 40 percent with plastic media. A carbon energy source would be added to the denitrification tank. Both tanks would be on the south side of the existing water treatment building.

Phosphorus treatment, if needed to meet MPDES permitted effluent limits, may involve chemical addition to wastewater with aluminum- or iron-based coagulants followed by filtration, which can reduce total phosphorus concentrations in the final effluent to low concentrations. Phosphorus reduction may also be accomplished by chemical precipitation or adsorption, biological assimilation, or enhanced biological nutrient removal.

The existing Water Treatment Plant uses ultrafiltration to remove metals sorbed onto particulates suspended in the water, thereby reducing total metal concentrations. The current system has been successful in treating adit discharges to concentrations less than MPDES permitted effluent limits. MMC currently samples untreated water monthly for both total and dissolved metals. MMC would continue the monitoring described in Appendix C, and make appropriate modifications to the Water Treatment Plant if necessary to remove dissolved metals. Treatment technologies for dissolved metals could include the addition of chemicals to promote chelation (formation of a larger, filterable compounds) followed by the existing ultrafiltration system, or reverse osmosis.

2.5.4.3.4 Stormwater Control

Sediment and runoff from all disturbed areas would be minimized through the use of BMPs developed in accordance with the Forest Service's *National Best Management Practices for Water Quality Management on National Forest System Lands* (USDA Forest Service 2012a). Localized sediment retention structures and BMPs would be used along the downslope perimeter of the impoundment for control, sampling, and recovery of drainage from the impoundment, sediment, and stormwater runoff. These structures and collection ditches would act as stormwater diversions to channel the water and sediment from the tailings thickener facility into stormwater ponds. The ditches would be sized to accommodate a 10-year/24-hour storm event.

Stormwater from undisturbed lands above the tailings facility would be diverted around the impoundment site toward the Poorman Creek and Little Cherry Creek drainages during mine operations. Settling ponds for runoff from newly reclaimed areas along the perimeter of the tailings thickener facility would be unlined but vegetated, and would drain through a constructed drainage network to existing intermittent drainages. Stormwater from reclaimed areas that were not fully stabilized would be captured along with runoff from the tailings facility. Undisturbed portions of the facility would either drain into existing drainages or be diverted away from active areas, soil stockpiles, and the stormwater pond. All diversions would be sized to handle a 10-year/24-hour storm event. The diversions would be reclaimed and permanent drainageways established when mine operations ended when the site was fully reclaimed.

The EPA considers runoff from tailings dams when constructed of waste rock or tailings to be mine drainage, or, if process water if process fluids are present. MMC would design all ditches and sediment ponds that would contain process water or mine drainage for a 100-year/24-hour storm (rather than the 10-year/24-hour storm proposed in Alternative 2). In Alternative 2, MMC indicated that below the tailings impoundment ditches containing runoff would be directed, where possible, toward the Seepage Collection Pond; otherwise, appropriate BMPs would be used to handle stormwater that was not classified as mine drainage water or process water. The Plan of Operations did not specify how runoff from the impoundment would be managed as process water or mine drainage and not stormwater. In Alternative 3, all runoff from the tailings impoundment dam would be directed to the Seepage Collection Pond or to lined containment ponds. Water from the ponds would be returned to the impoundment and then mill for reuse. Alternative water management techniques may be identified during final design and the MPDES permitting process.

In Alternative 2, MMC proposes to use mine or adit water and/or chemical stabilization on unpaved mine access roads for dust suppression. Mine, adit, or tailings water may have elevated concentrations of suspended sediment, nutrients (nitrates), or metals. These compounds could enter surface water if water for dust suppression ran off of the roads. To reduce the potential for adversely affecting water quality in Alternative 3, MMC would use either a chemical stabilization, groundwater, or water with nitrate concentrations of 1 mg/L or less and with concentrations of all other parameters less than the mine drainage ELG, to control dust on unpaved mine access roads.

2.5.4.3.5 Fugitive Dust Control

Fugitive dust control in Alternative 3 would be similar to Alternative 2 and would include all measures identified by the DEQ in its Supplemental Preliminary Determination on MMC's air quality permit application (DEQ 2011a). Dust control at the tailings impoundment is discussed in section 2.5.4.2.2, *Dust Control at Impoundment*. The Supplemental Preliminary Determination identified the following emission control requirements:

- Water sprays would be used at the primary crusher.
- Water sprays would be used at the five underground coarse ore conveyor transfer points to be located along the conveyor route from the primary crusher to the Libby Adit portal.

- Water sprays would be used at the transfer of ore from the underground conveyor system to the coarse ore stockpile.
- Conveyor emissions from the Libby Adit portal to mill would be controlled by a using a fully enclosed conveyor. All three transfer points on this conveyor would also be fully enclosed.
- Coarse ore stockpile would be surrounded by a pole structure with an enclosure on the top and two sides.
- A wet scrubber would control particulate emissions from the coarse ore stockpile transfer to the apron feeders.
- The conveyor discharge to the SAG mill would occur inside the Mill Building.
- The concentrate transfer and loading of concentrate into highway trucks for shipment to the Libby Load-out facility would be entirely enclosed within the Mill Building.
- The oversize material transferred to the oversize hopper and oversize reclaim belt originate from the SAG mill, which would be a wet process. The material passes through a sump and pump to the reclaim route and would be wet material.
- A baghouse would control emissions from the oversize screen, crusher, and transfer to the SAG mill.

2.5.4.4 Solid Waste Management

MMC’s proposal in Alternative 2 to use buried sewage tanks adjacent to the Ramsey Plant Site for storage of sanitary wastes and then dispose of them off-site would be modified in Alternatives 3 and 4. MMC would submit plans and specifications for public water supply wells, as well as plans for construction of a sanitary waste treatment facility to the DEQ for approval. In Alternatives 3 and 4 during the Evaluation and Construction Phases, MMC would use an on-site sewage treatment and disposal system at the Libby Adit Site. The system consists of the four components: four 1,000-gallon septic tanks; a two-pod treatment unit and combination recirculation tank/drainfield dosing tank; effluent distribution system; and infiltrator trenches. Expected discharge is 585 gallons per day (Geomatrix 2010a). During Operations, MMC would use a similar system consisting of septic tanks for primary treatment, followed by discharge to the tailings impoundment for final disposal. The effluent from the septic tanks would be disinfected before pumping to the impoundment. Disinfection would be by chlorination, ozonation, or ultraviolet light. This step would disinfect the effluent to reduce the number of microorganisms and eliminate potential hazards due to human exposure of the water in the impoundment. Disinfection would be conducted as the effluent water is pumped from the septic tanks to the impoundment. Expected discharge is 6,100 gallons per day; a rate of 7,000 gallons per day was used for design purposes (Geomatrix 2010a). Sanitary waste management after the impoundment was no longer available for final disposal would be determined in the final closure plan.

In Alternative 2, MMC would occasionally bury certain wastes underground in mined-out areas. Because the mill office buildings and tailings impoundment would be on National Forest System lands and the mine would be beneath National Forest System lands, MMC would comply with Forest Service policies when disposing of demolition debris during closure in Alternatives 3 and 4. It is Forest Service policy (FSM 2130) to discourage the disposal of solid waste on National Forest System lands unless such use is the highest and best use of the land. No solid wastes other than waste rock would be buried underground in mined-out areas. Reinforced concrete foundation materials may be buried on National Forest System lands under the following conditions:

- The concrete must be free from contaminants, such as petroleum products.
- Contaminated sections of concrete would be removed and disposed of at an approved waste disposal facility off of National Forest System lands in accordance with Montana's solid and hazardous waste regulations (ARM 17-50-101 *et seq*. and ARM 17-53-101 *et seq*.).
- The concrete must be cut or broken into sections no larger than 4 feet square and buried in a manner that would not create large voids that could lead to future settling of the materials. This may involve mixing glacial borrow material with the concrete sections during backfill operations. The rebar could remain in the concrete provided it was cut flush with the individual sections.
- The concrete would be buried with a minimum of 4 feet of glacial borrow material graded in a manner that would not concentrate surface water runoff or allow water to pond.
- If new federal regulations prohibit burying of any materials at time of mine reclamation and closure, all materials would be hauled off-site.
- All other demolition materials, whether originating above or below ground, would be disposed of off National Forest System lands in an approved, off-site waste disposal facility.

2.5.5 Closure and Post-Closure Phases

Short- and long-term reclamation objectives would remain the same as for Alternative 2. These objectives would be achieved through interim and final reclamation of all disturbed sites as described for Alternative 2, with additional mitigation described below and implementing all erosion- and sediment-control measures described for Alternative 2.

2.5.5.1 Closure and Reclamation of Project Facilities

The post-mining topography of project facilities would follow the procedures outlined for Alternative 2 with the following modifications. MMC would develop final regrading plans for each facility to reduce visual impacts of reclaimed mine facilities. These plans would require the agencies' approval before implementation. At the end of operations, any waste rock not used in construction would be either placed back underground or used in regrading the tailings impoundment. Any waste rock used at the Libby Plant Site could require an MPDES permit modification to include runoff or seepage from the waste rock.

MMC would develop plans to shape slopes of the Libby Plant Site (Figure 30), mine portal areas, and Libby Adit Site to closely resemble the surrounding landscape. Final grading would involve regrading and shaping flat surfaces to blend with the adjacent landscape and have natural dendritic drainages. Additional fill would be used as necessary to create smooth transitions between human-made and natural landforms.

2.5.5.1.1 Underground Mine and Libby Adits

No solid wastes other than waste rock would be buried underground in mined-out areas. MMC would place two or more plugs in each of the three mine adits. The plugs would be located to isolate the adits hydraulically from the mine void and to ensure any groundwater tributary to Libby and Ramsey creeks would flow into the adits, and remain within the Libby Creek watershed. The plugs are described in section 2.5.4.3.2, *Water Rights*.

If necessary to minimize post-mining changes to the streamflow in East Fork Rock Creek and East Fork Bull River, MMC would construct concrete bulkheads in access openings in any barrier pillar left within the mine void. Barrier pillars are discussed in section 2.5.4.1, *Mining.*

2.5.5.1.2 Libby Plant Site

The mill building, conveyors, bridges, administration offices, substations, and other facilities associated with this area would be dismantled and removed once they are no longer required to support mine operations or closure activities. Plant Site facilities would be removed, sold, scrapped, or disposed locally off of National Forest System lands. Concrete foundations may be broken up and buried on-site in accordance with the Forest Service policy regarding solid waste disposal discussed in section 2.5.4.4, *Solid Waste Management*.

2.5.5.1.3 Poorman Tailings Impoundment

As part of reclamation, all surface facilities would be removed from the site. Facilities at the impoundment site would be removed, sold, scrapped, or disposed locally. Concrete foundations may be broken up and buried on-site in accordance with the Forest Service policy regarding solid waste disposal discussed in section 2.5.4.4, *Solid Waste Management*.

The tailings surface and disturbed areas would be covered as outlined Alternative 2. MMC would survey tailings settlement at closure on a 100-foot by 100-foot grid to document settlement. The area would be surveyed after borrow material used for fill was placed to create final reclamation gradients, and again after soil placement to ensure runoff gradients were achieved and soil thicknesses were met. Rocky borrow and geotextile would be needed for construction equipment to work on the tailings surface. In Alternative 2, MMC would place riprap on the dam crest and uppermost part of the dam face to minimize potential gully formation at the tailings dam crest. In Alternative 3, MMC would use rocky borrow from within the disturbance area to provide erosion protection. Borrow material volumes would be determined during final design.

Deposition of the tailings at closure would produce a final surface that would drain toward an unnamed tributary of Little Cherry Creek (Figure 31). Once all water from the tailings surface in the northern area of the impoundment had been removed (evaporated, or treated, if necessary, and discharged), and the near surface tailings had stabilized for equipment access, a channel would be excavated through the tailings and Saddle Dam abutment to route runoff from the site toward a tributary of Little Cherry Creek. The channel would be routed at no greater than 1 percent slope and along an alignment requiring the shallowest depth of tailings to be excavated down to the channel grade. The side slopes would be designed to a stable slope and covered with coarse rock to prevent erosion. As part of the final closure plan, MMC would complete a hydraulic and hydrologic (H&H) analysis of the proposed runoff channel during final design, and submit it to the lead agencies and the Corps for approval. The H&H analysis would include a channel stability analysis and a sediment transport assessment. Based on the analysis, modifications to the final channel design would be made and minor modifications to the upper reaches of the tributary of Little Cherry Creek may be needed to minimize effects on channel stability in the tributary of Little Cherry Creek and to avoid allowing water to pond on the surface of the reclaimed tailings. Other drainage alternatives for the surface of the reclaimed tailings impoundment that protect against erosion but also provide aquatic habitat may be developed with agency approval.

Water would not flow toward Little Cherry Creek as long as water was needed for water rights mitigation, described in section 2.5.4.3.2, *Water Rights.* A stormwater/sediment retention pond would be built on the impoundment surface near the North Saddle Dam that would be designed to contain the 10-year/24-hour storm, or an estimated 40 million gallons of water.

Post-operational seepage management would be the same as Alternative 2. MMC would operate the seepage collection and the pumpback well systems until groundwater adjacent to the reclaimed impoundment met BHES Order limits or applicable nondegradation criteria without additional treatment. The Seepage Collection Pond and mill pond at the Libby Plant Site also would remain in place. MMC estimates total water storage capacity at closure to be 110 million gallons. Long-term treatment may be required if BHES Order limits or nondegradation criteria were not met. The length of time these closure activities would occur is not known, but may be decades or more. Following removal of the Seepage Collection Dam, the disturbed area would be graded to blend with the original slope. After BHES Order limits or applicable nondegradation criteria were met, seepage from the underdrains and seepage not intercepted by the underdrains would flow to Libby Creek. Klohn Crippen (2005) estimated a steady state flow from the underdrain system after closure of 50 to 100 gpm for the Little Cherry Creek impoundment and the agencies anticipate conditions at the Poorman Impoundment Site would be similar.

MMC would develop a design to recontour faces of the tailings impoundment dams to more closely blend with the surrounding landscape than proposed in Alternative 2. Sand deposition would be varied during final cycloning and placement of sand on the dams. This design would incorporate additional rocky borrow at selected locations on the dam face and use benches in some locations. Islands of trees and shrubs would be planted in the rocky areas. The seed mixture on the dam face would vary to reduce uniformity of the revegetated dam.

2.5.5.1.4 Roads

Reclamation of the Bear Creek Road, new roads, currently open roads, and all new bridges used in Alternative 3 would be the same as Alternative 2. The existing Bear Creek Road and the new Bear Creek Road from the Poorman Tailings Impoundment Site to south of Poorman Creek would remain chip-sealed and 26 feet wide. Any segment of the existing Bear Creek Road parallel to the new road that was graveled and not disturbed by the tailings impoundment would be decommissioned. All currently gated or barriered roads used in Alternative 3 would be decommissioned by using a variety of treatment methods to achieve desired conditions for other resources.

2.5.5.1.5 Monitoring and Potable Water Supply Wells

Any monitoring well used by MMC for monitoring during any project phase would be plugged and abandoned according to ARM 36.21.810 when it was no longer needed for monitoring. Any potable water supply well on National Forest System lands would be plugged and abandoned according to ARM 36.21.810. The well casing would be removed to below the ground surface, and the well covers removed and disposed off-site. The area associated with all abandoned wells would be regraded to blend with the natural surroundings. The area would be ripped if appropriate and revegetated with in accordance with Alternative 3 revegetation plan.

2.5.5.2 Revegetation

2.5.5.2.1 Revegetation Success/Bond Release Criteria

The following criteria for all reclaimed areas, including the transmission line right-of-way and access roads, would be used to determine revegetation success and bond release. MMC and the lead agencies would establish disturbed/reclaimed control sites for the project before operations.

These sites would be based on previous disturbances and be close as possible to the mine area. Minimum vegetation cover would be 80 percent of the disturbed/reclaimed control site total cover. If the required minimum cover were not obtained, MMC would implement remedial action such as reseeding with a modified seed mixture, mulching, fertilizer, or other changes to address the issue. If after two remedial attempts the particular site still did not meet the minimum vegetation cover standard but met 80 percent of the average of selected disturbed/reclaimed control sites, did not exhibit rills or gullies, and met the weed standard, the portion of the reclamation bond would be released. If the site continued to fall short of meeting the cover requirement, a third remedial effort, approved by the lead agencies, would be applied. If the standard still were not met but the site had 70 percent of the disturbed/reclaimed control cover and did not exhibit rills and gullies and met the weed standard, the portion of the reclamation bond attributed to revegetation success would be released.

MMC would develop a final Vegetation Monitoring Plan from these disturbed/reclaimed sites and collect vegetation data during the mine life. This information would be used to validate the release criteria numbers with respect to minimum cover requirements, tree/shrub density, weeds, and other provisions preliminarily set in the EIS. The intent is to provide long-term site-specific data to support the release criteria established for the project. The monitoring plan would be approved by the lead agencies and would require the report be submitted annually or as outlined in the plan or as approved by the lead agencies. Monitoring would continue for 20 years after planting or seeding to ensure revegetation requirements were met, or less if the reclamation portion of the bond were released by the lead agencies before this period expired.

Category 1, 2, and 3 noxious weed species cover would have less than or equal to the cover of noxious weed species present on agency-approved disturbed/reclaimed control sites in the area. Category 2 and 3 (new invaders and potential invaders) are described in the latest edition of the KNF Noxious Weed Handbook. A minimum of 400 trees and 200 shrubs per acre would be living after 15 years (density may be lower in some areas where no trees or shrubs were planted, such as herbaceous wetlands and meadows).

2.5.5.2.2 Seed Mixture Modifications

MMC would revise all seed mixes so that mixes would be composed of species native to northwestern Montana, if they were available at the time of revegetation. MMC would select seed mixes to be compatible with dry and moist forest conditions. On dry south-facing slopes, a seed mix with more aggressive plant species able to establish under harsh conditions would be used, while in moist areas, the aggressive species would be avoided. Native seed mixes would have the ability to be updated in conjunction with ongoing research and as more information becomes available, or as directed by the lead agencies. MMC would include introduced species only with prior approval from the lead agencies.

The interim and permanent seed mixes proposed for Alternative 2 contain introduced species (Table 26). In the Alternative 3 and 4 seed mixes, MMC would not use the species shown in Table 26, and would replace them with native species, to the extent native species were commercially available. MMC would assess which native species were available commercially, and submit final permanent seed mixes to the lead agencies for approval. In the event native species were not establishing rapidly enough to control invasive plants, MMC would submit an alternative seed mixture to the lead agencies for approval. The alternative mixture could include non-native species that would meet the overall goals and objectives of the reclamation plan. MMC would conduct seeding between September 15 and October 31, or between April 1 and June 15. All areas would be seeded with the permanent seed mix; the interim seed mix proposed in Alternative 2 would not be used. Change in the seeding schedule would be approved by the lead agencies.

Table 26. Introduced Species Eliminated from MMC's Proposed Seed Mixes.

Revegetation Mixture 1	Revegetation Mixture 2
Redtop (*Agrostis gigantea*)	Redtop (*Agrostis gigantea*)
Meadow foxtail (*Alopecurus pratensis*)	Orchardgrass (*Dactylis glomerata*)
Tall fescue (*Festuca arundinacea*)	Canada bluegrass (*Poa compressa*)
Timothy (*Phleum pratense*)	White clover (*Trifolium repens*)
White clover (*Trifolium repens*)	

2.5.5.2.3 Soil Replacement and Handling

MMC would replace soils in all disturbed areas, with the exception of soil stockpiles and cut slopes in consolidated material. In Alternative 2, MMC proposed to redistribute 24 inches of soil on the embankment of the tailings impoundment in two lifts: 15 inches of rocky subsoil on the bottom followed by 9 inches of topsoil on the top. Replaced soils depths on other disturbed areas would be 18 inches including the top of the tailings impoundment. Other reclaimed sites in Montana have shown that 24 inches of replaced soil provides sufficient rooting depth (Plantenberg, pers. comm. 2006). In Alternatives 3 and 4, where redistributed soils cover non-native material, the replaced soil depth would average 24 inches using two lifts, including over the entire tailings impoundment. Soils replacement depths at other disturbances where soil is to be replaced, except road disturbances, would be 18 inches and would be applied in two lifts. If MMC demonstrated through test plots that site-specific soils would provide sufficient root zone and revegetation success with thinner soil replacement, the replaced soil thickness could be reduced with the lead agencies' concurrence.

Soils in the impoundment area would be replaced based on soil erodibility and slope steepness. For example, the least erodible colluvial/glacial soils having the greatest rock fragment content for both first lift and second lift soils, would be used on the impoundment face to minimize erosion potential. The soils with the greatest erodibility, primarily glaciolacustrine soils, would be used on slopes less than 8 percent, such as the relatively flat tailings impoundment surface. Soil salvage and redistribution would occur throughout the life of the mine operation. Soils should be handled and worked at the minimal moisture content to reduce the risk of compaction and tire rutting.

Disturbed areas, such as parking areas, roads, adit portal areas, and building sites would be ripped to 18 inches deep with dozer ripping teeth before soil replacement to reduce any root zone barriers due to compaction and to facilitate stormwater infiltration after reclamation. Any disturbed area to be seeded would be scarified to a depth of 6 to 12 inches before seeding for best seed establishment. All disturbed areas would be seeded, fertilized, and mulched as necessary. Where soil fertility may be low and tilth poor, organic matter (weed-free agencies-approved wood-based compost) would be incorporated into respread soils before planting. All permanent cut and fill slopes on roads would be seeded, fertilized, and stabilized with hydromulch, netting, or by other methods.

Mycorrhizae, which are structures in the soil important in maximizing plant establishment and productivity, especially for woody plants, are eliminated in soil stored for prolonged periods. In reclaimed areas where trees would be planted, an agencies-approved wood-based compost would be incorporated into the upper 6 inches of respread soil that had been stored for prolonged periods to promote the rebuilding of mycorrhizae in the soil (Plantenberg, pers. comm. 2006), and/or inoculated tree-planting stock with the appropriate mycorrhizal fungi would be used, or mycorrhizal fungi would be incorporated into the soil as pellets during seeding. Additional nitrogen fertilizer may be needed to compensate for wood-based mulch.

2.5.5.2.4 Planting

MMC cites recommendations for establishment of seedlings (not planting) ranging from 400 to 680 trees per acre, but plans 435 trees per acre and 200 shrubs per acre. At a success rate of 65 percent, this would yield 283 trees and 130 shrubs per acre, which would be at the low end of the densities recommended by KNF. In Alternative 3, MMC would plant sufficient trees and shrubs to achieve 400 trees and 200 shrubs per acre 15 years after planting.

To help prevent noxious weed establishment, MMC would plant trees and shrubs randomly by hand unless safety issues require machine planting. MMC would mulch around planted trees and shrubs, and control weeds adjacent to trees and shrubs, but apply native seed elsewhere. If noxious weeds colonized planting areas, and weed control with herbicides were necessary, trees would likely be lost. MMC would use an agencies-approved wood-based compost to promote fungi-based communities and tree growth rather than straw or manure based compost that promotes bacteria-based grassland communities.

2.5.5.2.5 Organic Amendments

MMC would amend the top 0 to 4 inches of soil before seeding with an agencies-approved wood-based organic amendment to raise the organic matter level in the soil to a minimum of 1 percent by volume.

2.5.6 Monitoring Plans

Numerous operational and post-operational monitoring programs proposed by MMC are described in Alternative 2. The agencies revised these plans, which are presented in Appendix C.

2.5.7 Mitigation Plans

In Alternative 3, the wetlands, fisheries, and wildlife mitigation plans would differ from that proposed in Alternative 2. The proposed plans for these resources are discussed below. The Hard Rock Mining Impact Plan would be the same as Alternative 2.

2.5.7.1 Jurisdictional Wetlands and Other Waters of the U.S.

The objective of the compensatory mitigation plan for jurisdictional wetlands and other waters of the U.S. is to offset unavoidable adverse impacts to wetlands, streams, and other aquatic resources authorized under a Clean Water Act Section 404 Permit (i.e., discharge of dredged or fill material into a water of the U.S.). For impacts authorized under section 404, compensatory mitigation is not considered until after all appropriate and practicable steps have been taken to first avoid and then minimize adverse impacts to the aquatic ecosystem pursuant to 40 CFR 230 (the 404(b)(1) Guidelines). The lead agencies prepared a 404(b)(1) analysis discussing compliance with the Guidelines (Appendix M) and provided it to the Corps so that the Corps may conduct a 404(b)(1) compliance determination on MMC's 404 permit application for the Montanore Project. The analysis in Appendix M is not intended to represent the Corps' conclusions or their final 404(b)(1) determination. It is MMC's responsibility to demonstrate compliance with the Guidelines.

MMC used the mitigation sequencing required by compensatory mitigation regulations (33 CFR 332.3(b), 40 CFR 293(b)) in developing its proposed mitigation for Alternative 3. Mitigation bank credits and in-lieu fee program credits were not available. MMC submitted a draft conceptual waters of the U.S. mitigation plan to the Corps, the KNF, and the DEQ in 2011 for the agencies' preferred alternatives (Mine Alternative 3 and Transmission Line Alternative D-R) and a Preliminary Mitigation Design Report for impacts on waters of the U.S. in 2013 (Geomatrix and Kline Environmental Research 2011, NewFields Companies and Kline Environmental Research 2013). MMC submitted a revised Preliminary Mitigation Design Report in 2014 (MMC 2014a); the proposed mitigation for Alternative 3 is based on the 2014 report.

MMC is proposing permittee (MMC)-responsible mitigation. MMC would use the Swamp Creek site, which is considered an off-site mitigation site, as compensatory mitigation for all unavoidable effects on jurisdictional wetlands (Figure 34). The discussion found on page 115 regarding mitigation requirements and on-site and off-site mitigation also applies to Alternative 3. Mitigation for other waters of the U.S., such as streams, is described below. MMC would be responsible for meeting the Corps' mitigation requirements for jurisdictional wetlands and other waters of the U.S. The amount of jurisdictional and non-jurisdictional wetlands affected by the mine alternatives are listed in Table 184. The functions and services provided by each mitigation site are discussed in section 3.23, *Wetlands and Other Waters of the U.S.* The monitoring of the mitigation sites is described in section C.4 of Appendix C.

During plan development, MMC coordinated with the MDT on the plans and MDT's proposed improvements to US 2 adjacent to the Swamp Creek mitigation site. MMC would continue to coordinate with MDT as necessary as final plans were developed.

2.5.7.1.1 Jurisdictional Wetlands

The proposed Swamp Creek off-site wetland mitigation area is about 4 miles east of the project area and encompasses 67 acres along US 2 (Figure 34). The meadows cover an area of about 30 acres. In the early 1950s, a new channel of Swamp Creek was excavated across the property, enhancing surface water drainage and lowering the shallow groundwater surface. Other side ditches were excavated to channel water from several natural springs on the property. As a result of the ditching effort, productive hayfields were developed on the property.

MMC completed a wetland delineation in 2011 and the site has 20 acres of degraded wetland. MDT holds an easement on the property for a stabilization berm for reconstruction of US 2 (Figure 34). The total area rehabilitated would be 18 acres, with 15 acres attributed to wetland mitigation and 3 acres attributed to stream restoration. Wetland rehabilitation is the manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historic functions of degraded wetland. Rehabilitation results in a gain in wetland function but does not result in a gain in wetland acres (33 CFR 332.2, 40 CFR 230.92). Most of this degraded wetland area would be rehabilitated from the current condition of hayfields to a viable ecological habitat by planting wetland vegetation throughout the site, increasing water availability to the rooting zones of plants, and preventing cattle grazing on the property.

The Swamp Creek wetland mitigation project would be accomplished by completing the following specific activities: (1) prolong valley bottom flooding and near-surface groundwater levels by constructing meanders and raising the channel bottom of Swamp Creek and two spring-fed channels; (2) terminate hay production in the valley bottom; burn the grass (one or more times), followed by plowing the soil and seeding the area with wetland vegetation; 3 acres of this area would be used for riparian corridor planting along the stream channels; (3) plant willow/alder shrubs in separate “pods” throughout the 15-acre mitigation area in the valley bottom and around the springs to increase wetland diversity and habitat; (4) prohibit cattle grazing on the 18-acre meadow area and the Spring #1 area of the Swamp Creek property and (5) implement a weed control program to prevent invasion of undesirable species into the wetland mitigation areas.

A minimum 50-foot-wide vegetated upland vegetated buffer (3 acres) would be maintained around the wetland rehabilitation area. The east and west sides of the Swamp Creek property are bordered by National Forest System lands; the buffer zone around the wetland mitigation area would help provide some connectivity for the two sides of public land. Construction of the wetland mitigation area on the Swamp Creek property is expected to be conducted over a 2-year period before filling of wetlands at the Poorman Impoundment Site. Once wetland rehabilitation and vegetation planting were completed, the residential house and other buildings on the site would be removed, which would improve overall habitat conditions on the entire 67-acre Swamp Creek property.

MMC would coordinate with the KNF Native Seed Coordinator and the Corps on planting plans and seed mixtures. The KNF’s seed mixture guidelines would be followed. No introduced species would be used unless unavailability of native seed required such species and unless the KNF and Corps approved such species.

Reed canarygrass is an “exotic” species that is not native to Montana. Reed canarygrass is not considered a noxious weed but it is also not a desired species for wetland restoration. Based on three sites evaluated, reed canarygrass makes up 25 to 80 percent of the cover of the Swamp Creek mitigation site. Reed canarygrass is difficult to control because it has vigorous, rapidly spreading rhizomes and forms a large seed bank. Control of reed canarygrass is most effective when it includes an integrated approach implemented in a sequential and timely order (Waggy 2010). MMC would complete a vegetation survey of the entire mitigation site to define distribution of the grass and presence of more desirable species. MMC’s initially would burn areas where reed canarygrass was found during late spring. In areas where reed canarygrass was dominant and/or pervasive, herbicides would be applied. Application of herbicide would be limited to areas where reed canary grass was the dominant species and where the vegetation survey did not identify sufficient quantities of desirable wetland species. Burning would be completed for the first 3 years to ensure long-term treatment. Vegetation surveys would be completed to assess the success of burning to reduce reed canarygrass presence. Where mowing of the hayfield could reduce the presence of reed canarygrass, it would be completed in conjunction with burning to reduce the ability of reed canarygrass to produce seed heads. Vegetation monitoring would be conducted to ensure mowing was occurring effectively when combined with burning.

Garrison creeping foxtail is another “exotic” species that is not native to Montana that is increasing its dominance in wetland areas. MMC would develop a plan similar to reed canarygrass to control its dominance in the wetland mitigation area.

The water right associated with this Swamp Creek allows for flood irrigation of 26 acres of hay meadow. Rehabilitation of the site to improve its functions as a wetland would not require a water right. The current owner of this parcel has a surface water right to flood irrigate 26 acres of hay meadow between May 1 and October 31, with a maximum diversion rate of 291.72 gpm, and maximum volume of 52 acre-feet per year. MMC would file for a change of use for this water right to an instream flow right. MMC would convey any water right used for the Swamp Creek site to the Forest Service when the title or a perpetual conservation easement of the Swamp Creek mitigation site was conveyed to the Forest Service.

MMC would convey the title to or a perpetual conservation easement on the Swamp Creek mitigation site to the Forest Service after the Corps has determined the sites' performance standards have been met. The requirements for conveyance are described in the grizzly bear mitigation plan (see p. 195). If a perpetual conservation easement was conveyed, the easement would allow for public access to the property. Known Native American traditional use areas are on the uplands adjacent to the proposed Swamp Creek wetlands mitigation site and within the private land boundary. The upland areas at the Swamp Creek site protected by a conservation easement or conveyed to the Forest Service would be managed to protect and provide for future traditional cultural uses. Developed recreational use would not be encouraged.

2.5.7.1.2 Jurisdictional Waters (Streams)

Swamp Creek Site

The Swamp Creek stream mitigation would consist of constructing about 6,500 linear feet of new meandering channels, planting a 10-foot wide riparian zone on each side of the channels totaling about 3 acres, and removing cattle on the property to prevent grazing along the channels. Three primary drainage channels located on the Swamp Creek site would be subject to channel restoration: main Swamp Creek channel and two tributary channels from Spring #2 and Spring #3. The Swamp Creek channel flows through the center of the valley bottom on this property. The two spring-fed tributaries of Swamp Creek flow year-round, with Spring #2 having the highest flows (1.0 to 1.5 cfs baseflow).

The three Swamp Creek channels would be subject to reconstruction to natural meandering conditions that would be accomplished by completing the following: (1) reconstruct the channels to a meandering configuration, raise the channel bottom of Swamp Creek and two spring-fed channels, and incorporate small woody debris structures along some stream bank reaches; (2) plant riparian vegetation, including willow/alder shrubs, in a buffer zone along the new meandering channels to create a riparian corridor; and (3) protect the valley bottom area by prohibiting cattle grazing along Swamp Creek and tributary channels. Construction of the stream mitigation project on the Swamp Creek property is expected to be conducted over a 2-year period before filling wetlands at the impoundment site or along the access road.

In some reaches of the new channels, specific areas of hedge-brush layering, willow fascines, and/or salvaged wetland sod mats would be constructed on the channel banks as protection from erosion and to improve establishment of riparian vegetation. These features typically would be limited to selected locations along the outside bank of meanders. The abandoned segments of the original straight channels would be filled with soil from the excavated new channels, and planted with wetland vegetation. These fill areas would remain as slight topographic depressions to provide some small areas of open-water near the new stream channels during periods of high groundwater.

In some reaches of the new channels, specific areas of hedge-brush layering, willow fascines, and/or salvaged wetland sod mats would be constructed on the channel banks as protection from erosion and to improve establishment of riparian vegetation. These features typically would be limited to selected locations along the outside bank of meanders. The abandoned segments of the original straight channels would be filled with soil from the excavated new channels, and planted with wetland vegetation. These fill areas would remain as slight topographic depressions to provide some small areas of open-water near the new stream channels during periods of high groundwater. A riparian buffer zone 10 feet wide (3 acres) would be developed along each side of the reconstructed channels. Riparian vegetation would be planted in these stream corridors where there is sufficient soil and sod to allow the successful plantings. Shrubs and herbaceous wetland vegetation would be planted in the riparian zone.

Little Cherry Creek Site

Stream mitigation at the Little Cherry Creek sites would consist of replacing the culvert at NFS road #6212 with a bridge, bottomless arch pipe, or a new culvert that would comply with Forest Service stream simulation techniques. The culvert would be replaced before the project affected streams in the impoundment site.

Poorman Creek Sites

Stream mitigation at the Poorman Creek sites would consist of replacing one culvert across the creek at NFS road #278, removing one bridge on a decommissioned NFS road #6212 and stabilizing 400 feet of eroding cut slope adjacent to NFS road #6212. The bridge on NFS road #6212 across Poorman Creek would be removed during construction. MMC would dispose of the bridge structure in accordance with section 2.5.4.4, *Solid Waste Management.* Concrete footers and reinforcement structures would be demolished and removed. Fill material that was placed to provide the proper elevation for the bridge structure and adjacent topography would be excavated and removed. Material removed from the bridge area would be relocated to the Poorman Impoundment Site to be used in construction of the impoundment or placed behind the impoundment. The culvert removal would follow procedures described for the Little Cherry Creek site.

Libby Creek Sites

During the Evaluation Phase, MMC would implement the BMPs shown in Table 19, such as installing, replacing, or upgrading culverts, to bring the proposed access roads (NFS roads #231 and #2316) up to INFS standards and Forest Service guidance (USDA Forest Service 1995, 2008a).

Stream Improvements on Lands Acquired for Grizzly Bear Mitigation

MMC would convey the title to or a perpetual conservation easement on 5,387 acres of land to the Forest Service or private conservation organization independent of MMC for grizzly bear mitigation for Alternative 3. All lands would be acquired before the start of the Construction Phase. The Forest Service would ensure that the specified acres of mitigation properties were managed for grizzly bear habitat in perpetuity. The grizzly bear mitigation plan also would require MMC to implement access management improvements, such as road decommissioning and culvert removal, on mitigation lands. MMC would conduct a survey to assess all mitigation lands for opportunities to improve aquatic resources. Some of the types of activities that would be conducted to mitigate streams include: remove culverts and restore the floodplain, restore disturbed riparian buffer areas by removing roads and revegetating, add woody debris to the floodplain, remove riprap and bridge abutments below the ordinary high water mark, remove berms and other impervious fill material, and install instream habitat features to increase the value to aquatic life. MMC would use the Corps' Montana Stream Mitigation Procedure and the Corps' compensatory mitigation regulations (33 CFR 332) in assessing mitigation opportunities. For the purposes of assessing stream mitigation credits, MMC identified 21 culverts that would be removed and adjacent riparian habitat would be restored on 908 linear feet of stream on potential wildlife mitigation lands (MMC 2014a).

2.5.7.1.3 Performance Standards for Jurisdictional Wetlands and Waters of the U.S.

Proposed performance standards for mitigation sites (MMC 2014a) are discussed in section C.4.2 in Appendix C. The Corps may modify proposed performance standards in accordance with any 404 permit issued for the project.

2.5.7.1.4 Monitoring

The Corps would use wetlands monitoring to determine if the compensatory mitigation was meeting the performance standards established in any 404 permit issued for the project. The monitoring described in section C.4 in Appendix C may be modified in a 404 permit.

2.5.7.2 Isolated Wetlands

Section 3.23, *Wetlands and Other Waters of the U.S.* discusses that isolated wetlands may be 1) directly affected by facility construction, such as the tailings impoundment and 2) indirectly affect by mine operations, such as operating of a pumpback well system or mine dewatering. The directly-affected wetlands are those affected by a facility, such as the tailings impoundment, and those that are within the disturbance area but outside the footprint of a facility. Federal agencies have responsibilities to avoid, minimize, and mitigate unavoidable impacts on wetlands under Executive Order 11990. Executive Order 11990 requires federal agencies to "consider factors relevant to a proposal's effect on the survival and quality of the wetlands." Federal agencies must find that there is no practicable alternative to new construction located in wetlands, and that the proposed action includes all practicable measures to minimize harm to wetlands. The Corps' wetland mitigation requirements would fulfill the Executive Order's requirements to minimize harm to jurisdictional wetland. The following measures are the KNF's proposed practicable measures to minimize harm to isolated wetlands.

The objective of the compensatory mitigation plan for isolated wetlands is to minimize harm to isolated wetlands and to offset unavoidable adverse impacts on isolated wetlands authorized under a Forest Service approved Plan of Operations. Section 2.5.2.5.3, *Final Tailings Impoundment Design Process,* describes the agencies' requirements for the impoundment design before construction would begin. One mitigation measure requires MMC to avoid or minimize, to the extent practicable, filling wetlands and streams, such as described in Glasgow Engineering Group, Inc. (2010). This mitigation would ensure adverse effects would be minimized before considering compensatory mitigation.

Before issuance of the 2008 regulations regarding compensatory wetland mitigation, the Corps in Montana used ratios for various mitigation types in determining compensation requirements (Corps 2005). In the absence of specific USDA or Forest Service policy or guidance regarding compliance with Executive Order 11990 for isolated wetlands, the KNF used the Corps' mitigation ratios and performance standards as a guide in determining compensation requirements for isolated wetlands. For the analysis purposes, the KNF used 1:1 ratio for created wetlands established and viable before project impact and a 2:1 ratio for created wetlands not established and viable before project impact. For example, wetlands created concurrent with tailings impoundment construction using wetland soils from the impoundment site would receive a credit at a 2:1 ratio. Mitigation credits for the proposed isolated wetland mitigation are discussed in section 3.23.4. MMC would develop final facility designs for agency approval as well as update the two 3D groundwater models (mine area and tailings impoundment) (see section 2.5.2.5, *Final Design Process*). MMC would be responsible for developing mitigation requirements for isolated wetlands for submittal to the KNF. The KNF would review the mitigation plan and is responsible for ensuring that the mitigation plan meets the requirements of Executive Order 11990. The KNF would use the Corps' wetland mitigation regulations (33 CFR 332) and applicable regulatory guidance as guidelines for determining whether the wetland mitigation and monitoring plan meets Executive Order 11990 requirements. Final mitigation requirements for isolated wetlands, which would be incorporated into an amended Plan of Operations, would be based on final facility designs and the updated groundwater models. MMC would be responsible for the isolated wetland mitigation sites and the proper management of those sites until performance standards have been met. The KNF would be responsible for developing and approving final mitigation requirements for isolated wetlands. The KNF would use the Corps' wetland mitigation regulations (33 CFR 332) and applicable regulatory guidance as guidelines for the development of the wetland mitigation and monitoring plan. Final mitigation requirements for isolated wetlands, which would be incorporated into an amended Plan of Operations, would be based on final facility designs and the updated groundwater models.

MMC submitted a previous Preliminary Mitigation Design Report in January 2014 (MMC 2014b). The report included the creation of wetlands at three sites in the Little Cherry Creek watershed that primarily are on land owned by MMC and a gravel pit on National Forest System lands. In 2014, the Corps indicated that the hydrology information provided by MMC in the revised Preliminary Mitigation Design Report for three Little Cherry Creek sites and the Gravel Pit site was not adequate to demonstrate an adequate hydrology source without compromising existing adjacent wetlands. The KNF retained three Little Cherry Creek sites and the Gravel Pit site as mitigation for isolated wetlands. The KNF recognizes that the proposed sites are within the drawdown area of the pumpback wells as predicted by the 3D tailings impoundment groundwater model. Section 3.10.4.2 indicates operation of a pumpback well system may not affect groundwater levels and five of the springs south of Little Cherry Creek because of an apparent subsurface bedrock ridge that separates groundwater flow between the watershed of Little Cherry Creek from those of Drainages 5 and 10 in the Poorman Impoundment Site (Chen Northern 1989). Because geologic and hydrologic data from the area between the Little Cherry Creek and Poorman drainages are limited, they are not sufficient to eliminate the possibility of the pumpback well system adversely affecting surface resources, particularly groundwater-supported wetlands. The model would be rerun after MMC collected additional data in the Poorman Impoundment Site during the Evaluation Phase. The KNF also retained the three Little Cherry Creek sites and the Gravel Pit site as mitigation for isolated wetlands because many of the isolated wetlands are supported by surface water and not groundwater. Developing the three Little Cherry Creek sites and the Gravel Pit site as wetland mitigation sites concurrent with impoundment construction would allow soils from wetlands to be filled to be used at the mitigation sites, further enhancing their mitigation success. After the 3D model has been rerun, MMC would reevaluate the feasibility of the three Little Cherry Creek sites and the Gravel Pit site as mitigation for isolated wetlands. Should one or more of the sites be determined to be infeasible, MMC could develop similar sites north of Little Cherry Creek where groundwater drawdown would not occur, as described in MMC's submittal for isolated wetland mitigation (MMC 2014c).

2.5.7.2.1 Little Cherry Creek Sites

The three Little Cherry Creek sites have a total combined area of 9 acres; MMC would create 4.5 acres into new wetlands. The Little Cherry Creek sites would be on land owned by MMC, except for a small area of LCM-2 on National Forest System lands. Wetlands would be developed through excavation of shallow depressions in locations where surface water would collect and be retained. Existing vegetation, primarily coniferous forest, would be removed before excavation. The depressional areas would be excavated 4 to 5 feet below ground surface, with some variations in depth and overall shape configuration to improve habitat diversity. Once the depressions were excavated to within 1 or 2 feet of the spring/early summer water table, hydrologic conditions would likely be present for at least 20 days of the growing season.

Wetland soil, sod, and shrubs would be excavated from existing wetlands at the Poorman Impoundment Site before filling during construction and placed in the wetland mitigation areas. An average of 24 inches of surface soils and 12 inches of subsoils at all wetlands would be excavated and used at wetland mitigation sites. Final design for management of wetland soils would be included in the Soil Salvage and Handling Plan.

A minimum 25-foot-wide vegetated upland buffer would be maintained around the three wetland mitigation areas. Assuming a total upland buffer perimeter of 4,500 feet for the three areas, a 25-foot buffer would create a 2.5-acre buffer. The sites would be constructed concurrently with construction of the Poorman Impoundment so that wetland soil removed from the impoundment disturbance area could be hauled directly to the mitigation sites. MMC expects the three mitigation sites could be constructed and planted during a single non-winter period.

In 2010, MMC installed shallow piezometers (monitoring wells) in the proposed Little Cherry Creek mitigation sites and measured water levels in June and September. Water levels were also measured in May through September in 2011, 2012, and 2013. At the Little Cherry Creek sites, the water table is shallow in the spring and early summer (typically less than 2 feet below ground surface), declining more than 2 feet during late summer and early fall, and then rising again in late fall. Hydrologic support would be provided by direct precipitation or shallow groundwater. Groundwater from beneath the tailings impoundment would not be used to provide hydrologic support as proposed in Alternative 2. MMC would acquire a water right for the created wetlands if the DNRC determined water use for creating wetlands was a beneficial use. Any water rights used for wetland mitigation would be conveyed to the Forest Service when the mitigation sites were conveyed.

If the title to or a perpetual conservation easement on Little Cherry Creek mitigation sites had not already been conveyed as part of the grizzly bear mitigation plan, MMC would convey the title or a perpetual conservation easement on the Little Cherry Creek mitigation sites to the Forest Service as compensatory mitigation to offset impacts to isolated wetlands when the sites' performance standards had been achieved. Conveyed lands would be the isolated wetland mitigation sites, vegetated upland buffers, and adjacent existing wetlands contiguous to National Forest System lands. The requirements for conveyance are described in the grizzly bear mitigation plan (see p. 195).

2.5.7.2.2 Gravel Pit Site

The 4-acre Poorman gravel pit site is National Forest System land south of the Poorman Impoundment (Figure 33). MMC would create a 3-acre wetland in this area by excavating several small depressions in the former gravel pit, and lining the depressions with low permeability wetland soil removed from the Poorman Impoundment disturbance area. Hydrologic support would be provided by direct precipitation. A minimum 50-foot-wide vegetated upland buffer would be maintained around the site, creating a 2-acre buffer. The site would be developed concurrently with the Little Cherry Creek sites.

2.5.7.2.3 Performance Standards for Isolated Wetlands

The KNF would use the Corps and EPA's compensatory mitigation regulations (33 CFR 332 and 40 CFR 298) as a guide to offset unavoidable impact on wetlands and to ensure performance standards and the effectiveness of isolated wetland mitigation. Performance standards for jurisdictional wetland mitigation sites described in the Corps' 404 permit would be used as a guide in developing performance standards to assess the success of the isolated wetland mitigation sites.

2.5.7.2.4 Monitoring

Water levels in piezometers in four wetlands (LCC-29, LCC-35A, LCC-36, and LCC-39A) would be measured monthly April through September. Vegetation in these four wetlands also would be monitored, following the methods used for the GDE monitoring (see section C.10.4.2, *Groundwater Dependent Ecosystem Monitoring* in Appendix C). The monitoring would continue through the Closure Phase as long as the pumpback well system operated. Other monitoring for jurisdictional wetland mitigation sites described in the Corps' 404 permit would be used as a guide in developing monitoring requirements.

2.5.7.3 Bull Trout

In the 2013 Biological Assessment (BA) for aquatic species (USDA Forest Service 2013a), the KNF submitted a mitigation plan for Mine Alternative 3 and Transmission Line Alternative D-R to the USFWS that completely replaced MMC's proposed Fisheries Mitigation Plan for Alternative 2. The following description summarizes the KNF's mitigation plan.

2.5.7.3.1 Objectives

The objectives of the proposed bull trout mitigation measures would be to establish conservation actions that in the long-term would fully offset projected impacts from the mine project to bull trout populations and bull trout critical habitat. Because of the uncertainties involved in conservation measure development and the uncertainties in biological response of bull trout to the measures, planning and other activities leading to implementation of the conservation measures would be assessed during the Evaluation Phase with a bull trout mitigation program to follow. An adaptive management approach to the overall mitigation plan would be adopted to implement mitigation.

A hydrologic assessment would be completed during the Evaluation Phase, which would be critical to understanding the extent that streamflow depletion may occur based on a revised and improved numerical groundwater model. Assessment of the various stream reaches proposed in this mitigation plan would be conducted during the Evaluation Phase to provide guidance to the agencies regarding the implementation of the proposed mitigation. Once the hydrologic model results were known, a bull trout mitigation program would be focused to address the predicted impacts.

This Plan describes actions and implementation mechanisms developed with objectives to offset potential adverse impacts on bull trout populations and projected adverse modifications to bull trout critical habitat in the two bull trout Core Areas associated with the proposed project: the Lower Clark Fork Core Area (including Rock Creek, East Fork Rock Creek, and East Fork Bull River) and the Kootenai Core Area (including Libby Creek). To this end, mitigations were developed for each Core Area that have the potential to reestablish, maintain, create or improve self-sustaining local bull trout populations in stream reaches where they occurred historically but are currently absent, occur at low densities, are at risk of invasion by non-native fish species, or are at risk of being detrimentally impacted by the proposed project, and to improve habitat conditions in Core area streams that are currently not designated as critical habitat.

2.5.7.3.2 Conceptual Mitigation Actions

Proposed mitigation actions for these streams may include:

- Create or secure genetic reserves through bull trout transplanting or habitat restoration to protect existing bull trout populations from catastrophic events.
- Rectify factors that are limiting the potential of streams to support increased production of bull trout.
- Eradicate non-native fish species, especially brook trout that are a hybridization threat to bull trout.

Based on available information on the current condition of the selected streams, factors that influence bull trout populations and the mitigation potential of each stream have been tentatively identified, as described below.

Copper Gulch

Restoration of the aggraded lower reach would be the focus for mitigation. It is anticipated that modification of this reach would provide habitat, and alleviate seasonal drying to allow improved access for migratory bull trout to the central perennial reach where habitat is available to support a viable, self-sustaining bull trout population. An integral part of mitigation planning on Cooper Gulch would be an assessment of the feasibility of eliminating brook trout from the stream and development of a stream rehabilitation plan, if brook trout removal was feasible. Additional feasibility studies for potential bull trout donor stocks would be required to determine genetic health and availability of nearby bull trout populations (e.g. East Fork Bull River) and development of a genetic management plan (if re-introduction of bull trout is considered). If successfully implemented, fish passage restoration and bull trout reintroduction in Copper Gulch could potentially contribute to offsetting both projected losses of bull trout numbers and critical habitat in the East Fork Bull River and the lower Clark Fork Core Area.

West Fork Rock Creek

Available data for this stream indicate that habitat is underutilized by bull trout compared to previous population density estimates. Additional habitat and population surveys would be conducted to identify limiting factors for bull trout in this stream and to evaluate its potential to provide spawning opportunities for migratory bull trout. If the limiting factors analyses so indicate, mitigation measures in this drainage may be able to partially offset both the projected reductions of bull trout populations and the loss of bull trout critical habitat in Rock Creek and the Lower Clark Fork Core Area.

Rock Creek

Salmon Environmental Services (2012) suggested that bull trout populations in East Fork and West Fork Rock Creek are currently isolated from the threat of brook trout hybridization by an expanse of seasonally intermittent stream which separates the primary bull trout population from a brook trout population downstream of the intermittent stream reach. Removal of the brook trout population in lower Rock Creek (Rock Creek Invasive Species Eradication Project) would lower the risk of brook trout invading the bull trout habitat further upstream. As such, this mitigation measure would complement any habitat of bull trout population mitigation measures deemed appropriate in the West Fork Rock Creek (see above). Additionally, if this mitigation measure (brook trout removal from Rock Creek) is feasible and implemented in a timely manner (before brook trout invade upstream bull trout habitat) it could enhance the chances of success of any mitigation actions taken in the West Fork Rock Creek and contribute to offsetting projected losses of bull trout in Rock Creek. Additionally, migratory bull trout are known to spawn and rear in the stream reach currently occupied by brook trout in lower Rock Creek, implementation of a bull trout population enhancing mitigation measure (removal of brook trout) could contribute to offsetting losses to upstream bull trout populations in Rock Creek.

Libby Creek

On-site mitigation proposed in upper Libby Creek would be preferable to offset potential detrimental impacts on the bull trout population and critical habitat in that stream reach as it would be directly impacted. Projected effects are based on current modeled streamflow depletion estimates which hypothetically could be off-set by habitat improvements to increase the quality of available habitat. The Flower Creek mitigation, which is proposed as primarily a genetic reserve for the unique upper Libby Creek resident bull trout would be retained as a contingency measure to be considered if the Libby Creek mitigation is not successful. Mitigation success would be based on long-term trend monitoring of bull trout densities in the affected reach showing either a maintained or increasing bull trout population.

The reach of Libby Creek upstream of the falls and adjacent to the Libby Adit site displays braiding and channel shifting. Decreased baseflows would further reduce the quality of existing habitat. Installing large wood aggregates in the floodplain and riparian zone would stabilize this reach, restore riparian function, improve spawning and rearing habitat for bull trout by increasing channel depth, complexity and stability, and sediment retention. Large wood aggregates would also allow establishment of riparian vegetation, specifically black cottonwood. Because no brook trout in this reach, there would be no concern for increased interspecific competition for available habitat or a threat of hybridization.

Flower Creek

If the mitigation in Libby Creek above the falls failed, the next highest potential for effective bull trout mitigation in the Kootenai River Core Area lies in Flower Creek. Flower Creek provides a limited contingency to the proposed Libby Creek mitigation. Flower Creek, a historical bull trout stream, is the municipal water supply for the city of Libby. Brook trout are present above and below the existing dams and complete eradication would be impossible. Securing the reach above the upper dam as bull trout habitat would require repeated physical removal of brook trout through electrofishing and gillnetting. Piscicides would never be an option as the watershed is the sole municipal water supply for the city of Libby.

There are several additional mitigation options available in Flower Creek: 1) salvage the Flower Creek bull trout population (if it is still functional) upstream of the water storage dam and rehabilitate the watershed with a non-native species (brook trout) eradication program; 2) establish a genetic reserve with bull trout from upper Libby Creek and Bear Creek in the water supply storage reservoir and upstream in Flower Creek by implementing non-native fish eradication and transferring bull trout to the Flower Creek drainage; 3) re-establish cold water habitats downstream of the water storage dam through construction of a selective withdrawal mechanism in the dam or a stream water by-pass system through the reservoir; 4) rehabilitate the new cold water channel (3, above) with a non-native species eradication program and re-introduce migratory bull trout to the stream; 5) re-establish cold water stream habitat in Flower Creek downstream of the water storage dam through construction of a water bypass channel through the diversion dam reservoir; and 6) re-establish a migratory bull trout population above and below the water diversion dam utilizing fish transfer from other bull trout populations, non-native fish eradication, and selective upstream passage techniques at the low-head water diversion dam. Re-established bull trout populations would offset projected bull trout population declines in the Kootenai River Core Area. Re-established quality bull trout habitat would offset projected permanent losses of bull trout critical habitat, and establishment of a bull trout genetic reserve would protect existing at-risk bull trout populations (Libby Creek) by lowering the risk of catastrophic mine-related incidents affecting that population.

Preferably, upper Libby Creek mitigation would restore habitat for an existing bull trout population in the area of predicted flow depletion. Flower Creek would provide contingency mitigation in the event mitigation in the upper Libby Creek reach above the falls is determined unsuccessful. At that point, the Flower Creek mitigation concepts would be further prioritized based on habitat conditions below the lower dam, habitat conditions between the two dams, non-native species suppression opportunities above the upper dam, the potential to create a genetic reserve, assessment of fish transfer and passage for the lower dam, and assessment of cold water release feasibility.

2.5.7.3.3 Timing

Logically, the Core Area Bull Trout Mitigation Plans would be developed in phases to support advancement of more detailed plans and designs. The phases are intended to allow an iterative approach for MMC to collaboratively work with the KNF, FWP and USFWS on any modifications that may be determined necessary as more information is collected on the selected streams and improvements are made to the numerical groundwater model during the Resource Evaluation Phase. The first three periods, described below, essentially would be planning phases involving supplemental data collection, project-level plan and design development, and implementation plan and specific work plan development. These activities would begin immediately upon KNF authorization to implement the Evaluation Phase, and would be completed during the Resource Evaluation Program. Phase Four would be mitigation project implementation that would be time dependent on a number of factors and would likely not begin for most projects until the KNF authorized MMC to begin the mine Construction Phase (estimated to last 3 to 4 years). Phase Five would be monitoring and maintenance of all fisheries-related mitigation measures, including bull trout. This phase would extend from issuance of KNF authorization to implement the Evaluation Phase through when monitoring data indicate mitigation was successful and sustainable. The timeframe for this phase may extend well beyond closure and reclamation of the mine. Depending on the actual post-mining effects on stream baseflows and the success of mitigation measures, all mitigation plan phases could be extended beyond the mine Closure Phase (this would require additional MMC funding or forfeiture of an appropriately sized bond).

A subset of the Core Area Bull Trout Mitigation Plans would be the "feasibility assessments" needed to ascertain the steps necessary to proceed with selected mitigation proposals in each Core Area; Upper Libby Creek Conservation Project, Flower Creek Bull Trout Conservation Project and Rock Creek Invasive Species Eradication Project (see 1. d, e and f, above). It is proposed that these assessments and subsequent planning phases would begin immediately upon issuance of the KNF authorization to implement the Evaluation Phase and be completed within 18 months of initiation of the Evaluation Phase. Preliminary work plans would be prepared for consideration of approval by the KNF, in consultation with FWP and USFWS (and other partners as deemed appropriate by Forest Service).

Phase One: Study Plan

One of the first activities to be conducted under phase one of mitigation planning would be to conduct more detailed surveys of the proposed bull trout mitigation streams. These fisheries and habitat surveys would be designed to gain a better understanding of the status of bull trout populations, non-native fish populations, barriers, and habitat quality. Stream specific study plans would be developed by MMC and submitted as a component of a proposed annual work plan to KNF and appropriate agencies for review and approval. The study plans would describe the methods, effort and costs that would be necessary to collect information needed to support the development of specific objectives and preliminary mitigation project designs for each stream.

Phase Two: Preliminary Design and Supplemental Information

The results from Phase One would be used to refine development of the objectives and preliminary mitigation designs for each proposed mitigation project. It is expected that additional mitigation opportunities could be identified to enhance the original planned mitigation measures. Results from Phase One and the revised numerical groundwater model that would be generated during the Resource Evaluation Program may identify a need for supplemental investigation to support a final mitigation project design. If so, supplemental study plans could be developed prior to or in conjunction with the preliminary mitigation project design. Preliminary mitigation project designs would be submitted to KNF for approval before further planning commences.

Phase Three – Mitigation Work Plan

After completion of Phase One and Phase Two, MMC would advance the approved preliminary design into a final design and proposed implementation work plan. Again, it is possible that additional field work or design work (Phases One and Two) would be required to provide final details prior to completion of a final implementation work plan. A schedule of activities would be part of the final work plan that would consider seasonal flows, fish spawning, and other factors that would influence timing of implementation of the work plan. The final work plan would also include a description of monitoring and maintenance to ensure that mitigation measures are stable and meet objectives (for long-term effectiveness assessments, any fishery monitoring would be incorporated into the Fisheries Monitoring Plan and proposed annual work plans). A draft plan would be submitted for KNF and other agency review and approval. Based on KNF direction, MMC would prepare a Final Mitigation Project Work Plan.

The work plan would also describe what authorizations, approvals, and permits may be required before implementation. MMC would be responsible for applying for and obtaining necessary approvals to support in-stream work and other activities that have not been obtained as part of the overall Montanore Project approval, including access agreements or other similar legal documents that may be required. MMC would provide the agencies with all authorizations to ensure compliance with applicable laws and regulations.

Phase Four – Implementation

MMC would implement the Final Mitigation Project Work Plan following KNF approval of the Plan and of an annual work plan. Implementation would be conducted in cooperation with the various agencies, property owners, and other parties as appropriate. Due, in part, to seasonal constraints, the implementation schedule may take several seasons to complete and would be coordinated with all parties involved.

Phase Five – Monitoring and Maintenance

The final phase of the plan would be fish population and stream habitat monitoring to assess mitigation success and stability of any stream modifications. Maintenance and repairs would be accomplished by MMC based on the monitoring results. Based on principals of adaptive management, this phase would include any modifications or re-implementation that would be required if mitigation objectives were not being met. Through principals of adaptive management, this could include the development and implementation of new mitigation measures within the affected Core Areas.

2.5.7.4 Wildlife

Alternatives 3 and 4 would incorporate some of the elements of the wildlife mitigation plan for Alternative 2, but would include additional measures to avoid, minimize, and mitigate impacts on wildlife. The agencies' alternatives would include implementation of a wildlife awareness program prepared by MMC. The objectives of the wildlife awareness plan are to: reduce the risk of human-caused mortality of threatened and endangered species, identify other wildlife issues of concern for the Montanore Project, establish company procedures and protocols that address these issues, and develop employee and contractor awareness of wildlife issues. The wildlife awareness program includes the education of employees about bear awareness and safety, refuse management, company policies regarding wildlife, and other wildlife concerns. The following sections describe Alternative 3 and 4 wildlife mitigation measures, which replace the wildlife mitigation plan for Alternative 2.

2.5.7.4.1 Grizzly Bear

The lead agencies' grizzly bear mitigation plan would have similar components as the Alternative 2 mitigation plan: measures to reduce mortality risks, maintain and enhance core habitat, and for mitigation plan management. A number of roads proposed for access changes in Alternative 2 are no longer available for mitigation. In the 2013 BA (USDA Forest Service 2013b), the KNF submitted a mitigation plan for Mine Alternative 3 and Transmission Line Alternative D-R to the USFWS that completely replaced MMC's proposed grizzly bear mitigation plan for Alternative 2. The following description summarizes the KNF's mitigation plan and has been modified slightly to provide an estimate of mitigation requirements needed for the agencies' mine and transmission line alternatives (Table 28, Table 30, and Table 31). MMC would be responsible for submitting a grizzly bear mitigation plan consistent with the KNF wildlife mitigation plan for incorporation into an amended Plan of Operations. Once approved, the Wildlife Mitigation Plan would become a component of the amended Plan of Operations. Mitigation measures would be implemented prior to the Evaluation and Construction Phases. Some measures implemented prior to the Evaluation Phase would be expanded for the Construction Phase. The mitigation plan is included in its entirety in the KNF BA (USDA Forest Service 2013b).

Measures to Reduce Mortality Risks

MMC would fund two new full-time wildlife positions, a Law Enforcement Officer, and a local FWP Grizzly Bear Specialist in Libby in 5-year increments for the life of the mine and through the closure and Closure Phase, or as otherwise agreed by Forest Service in consultation with USFWS. If both Montanore and Rock Creek projects were concurrent, MMC would fund a local FWP Habitat Conservation Specialist, to address grizzly bear/land use issues, coordinate and account for implementation of the mitigation plan, and coordinate all land acquisition and/or conservation easements for required grizzly bear mitigation. Funding would be provided prior to initiation of the Evaluation Phase and implementation of the land acquisition program, and then 5-year increments for the life of the mine through the Closure Phase, including shut-down periods, or until the Oversight Committee determined that the position was no longer needed.

MMC would implement the following measures prior to Forest Service authorization to initiate the Evaluation Phase:

- Install and maintain fencing surrounding the Libby Adit Site for the life of the mine.
- Develop a transportation plan for life of the mine to be approved by the Forest Service.
- Fund, develop, and implement an enhanced public outreach information & education (I&E) program to build support and understanding for the conservation of the Cabinet-Yaak grizzly population that would increase to full funding and implementation prior to the Construction Phase, for life of the mine.
- Prohibit use of salt during winter plowing operations for life of the mine.
- Remove big game animals killed by any vehicles daily from road rights-of-way within the permit area and along roadways used for access or hauling ore (NFS roads #231, #278, #4781, and #2316 and new roads built for the project) for life of mine.
- Monitor the number of big game animals killed by vehicle collisions on these roads and report findings annually.
- Monitor and report (within 24 hours) all grizzly bear, lynx, wolf, and black bear mortalities within the permit area and along the access roads for life of the mine.
- Provide funding for purchase and maintenance of up to 35 bear-resistant refuse containers for use at Montanore Project mine facilities and for personal use by mine employees that live in or near grizzly bear habitat, and fund replacements as needed for life of the mine.
- Provide funding for fencing and electrification and maintenance of garbage transfer stations within grizzly bear habitat adjacent to and throughout the CYRZ.
- Provide funding for an initial 10 electric fencing kits that can be installed by FWP bear specialists at additional bear problem sites within grizzly bear habitat adjacent to and throughout the CYRZ. In addition, fund 2 replacements electric fencing kits per year that can be installed by FWP bear specialists at bear problem sites.
- Implement a wildlife awareness program for employees and contractors prepared by MMC.

- Agree that all mortality reduction measures would be subject to modification based on adaptive management, where new information supports changes.

Measures to Maintain and Enhance Grizzly Bear Core Habitat

The analysis of impacts on core grizzly bear habitat within BMU 2, 5, and 6 and impacts on the north-south movement corridor are described in greater detail in the BA. Core habitat effects and required core habitat creation are shown in Table 27. Figure 94 displays which road access changes specified in Table 28 and Table 29 would create core habitat in the agencies' transmission line alternatives.

Under the direction of the Forest Service, MMC would implement or fund access changes on roads specified in Table 28 and Table 29. These roads would be included in the Road Management Plan. All roads specified in Table 28 and Table 29 are shown on Figure 35. In addition MMC would implement or fund monitoring of the effectiveness of closure devices at least twice annually; and complete any necessary repairs immediately. Roads shown in Table 28 that would be seasonally gated would improve conditions on an estimated 808 acres of spring grizzly bear habitat but because these roads would not be gated for the entire active bear season, habitat improved through these seasonal road access changes would not contribute to core or for habitat compensation for core.

As noted in Table 28, if the Rock Creek Mine mitigation restricting the Upper Bear Creek road #4784 with a barrier has not been implemented prior to Forest Service authorization to initiate the Evaluation Phase, then MMC would implement or fund this mitigation. MMC would only implement this mitigation if Rock Creek has not yet done so. Monitoring the effectiveness of the closure device at least twice annually and completing any necessary repairs immediately would also be required of MMC until the Rock Creek Mine initiated activity.

Measures to Compensate for Displacement Effects and the Loss of Grizzly Bear Habitat

The analysis of impacts and displacement effects on grizzly bears are described in detail in the BA. Methods used to evaluate displacement effects from the Montanore Project and corresponding habitat compensation are described in the *Revised FEIS Analysis of Grizzly Bear Displacement Effects* (ERO Resources Corp. 2015).

All activities for both transmission line construction seasons and during decommissioning of the transmission line on National Forest System and State trust lands located within the CYRZ and Cabinet Face BORZ would occur between June 16 and October 14.

Prior to KNF authorization to initiate the Operations Phase, to reduce grizzly bear habitat displacement, MMC would ensure sounds emitted from the facilities and adits during the estimated 16- to 20-year Operations Phase would comply with noise levels specified in the plan.

Table 27. Impacts on Grizzly Bear Core Habitat and Core Habitat Created by Phase.

Alternative	BMU 2 (acres)	BMU 5 (acres)	BMU 6 (acres)	Total (acres)	Core Replaced 2:1 (acres)
Core Habitat Lost[1]					
3C-R	0	253	0	253	506
3D-R	0	248	18	266	532
3E-R	0	253	18	271	542
4C-R	0	73	0	73	146
4D-R	0	73	18	91	182
4E-R	0	73	18	91	182
Phase and Location	**BMU 2 (acres)**	**BMU 5 (acres)**	**BMU 6 (acres)**	**Total (acres)**	
Created Core from Access Changes[2]					
Prior to Evaluation Phase					
Within North-South Corridor		806	1,001	1,807	
Outside North-South Corridor	274	811	90	1,175	
Prior to Construction Phase					
Within North-South Corridor		2,971		2,971	
Outside North-South Corridor[3]			1,053	1,053	
Total Core Created	274	4,587	2,145	7,006	
Core created for loss of core	0	146-502	0-36	36-542	
Core created to reduce constriction in the north-south corridor (1,070 acres) and core created to mitigate for remaining effects	274	4,085 to 4,441	2,109 to 2,145	6,464 to 6,970	

Acres do not tally to 100% due to rounding.

[1]Core habitat lost (acres) includes both existing core and "core" created prior to Evaluation Phase. This created core resulted from the creation of a larger block of core and was not meant to function as core. However for this analysis it was included in the core total and mitigation for core habitat lost (acres) required at 2:1 ratio.

[2]See *Measures to Compensate for Displacement Effects* section for planned measures to address constriction within the north-south corridor.

Core acres shown for within and outside north-south corridor and totals differ slightly from the Montanore Biological Opinion, Appendix C, Table 1, page 10, USFWS 2014a due to the differences in projects considered for the baseline conditions, road layers used, and the updated ArcGIS calculations used in this NEPA analysis.

Table 28. KNF's Proposed Road Access Changes Prior to Evaluation Phase.

NFS Road Number	Road Name	Length (miles)		Total Miles	Current Access Status	Proposed Access Status	Proposed Closure Period	Notes
		In BMU	In BORZ					
231 2316	Libby Creek Road Upper Libby Creek	2.0 1.5	0.0 0.0	2.0 1.5	Open[1]	Gated seasonally[2]	April 1 to May 15	Mine traffic only during closure period. Implemented 2008.
4778 4778E 5192 5192A	Midas-Howard Creek Midas-Howard Creek E Midas Bowl Midas Bowl A	5.8 0.8 1.6 0.2	0.9 0.0 0.0 0.0	6.7 0.8 1.6 0.2	Open[1]	Gated seasonally[2]	April 1 to June 15	Restricted to all motorized vehicles, including over-snow vehicles, during the closure period.
4776A 4778C	Horse Mtn Lookout A Midas Howard Creek C	1.5 1.8	1.2 0.1	2.7 1.9	Open	Barriered	Year-long	Open to over-snow vehicles Dec. 1 to March 31.
14458	Midasize	0.6	0.0	0.6	Open	Barriered	Year-long	Restricted to all motorized vehicles, including over-snow vehicles, during the closure period
4776C 4776F 4778C 6200 6200D 6200E 6200F 6214 6214F	Horse Mtn Lookout C Horse Mtn Lookout F Midas Howard Creek C Granite-Bear Creek Granite-Bear Creek D Granite-Bear Creek E Granite-Bear Creek F Cable-Poorman Creek Cable-Poorman Creek F	0.0 0.7 1.5 1.8 0.9 0.3 0.4 3.6 0.6	0.9 0.4 0.0 0.0 0.0 0.0 0.0 0.0 0.0	0.9 1.1 1.5 1.8 0.9 0.3 0.4 3.6 0.6	Gated	Barriered	Year-long	Open to over snow vehicles Dec. 1 to March 31.
6745	Standard Creek	3.9	0.0	3.9	Gated	Barriered	Year-long	Convert to trail; restrict all motorized vehicles year-long, including over-snow vehicles
4784[3]	Upper Bear Creek	2.7	0.0	2.7	Gated seasonally	Barriered	Year-long	MMC would only implement if Rock Creek Mine has not yet done so. Convert to trail; restrict all motorized vehicles year-long, including over-snow vehicles
	Total access change	32.3	3.4					Without the #4784 access change, miles 29.6/3.4

[1]Seasonal closures implemented with the KNF's authorization in 2008 to MMC for snow plowing authorization of NFS roads #231 and #2316; Road 4778E is impassible with a closure implemented in 2006.
[2]The seasonal access changes, which minimize potential for displacement and reduce mortality risk for grizzly bears on spring range, do not change the status of these existing open roads during the active bear year, and thus do not change OMRD or TMRD within the BMU or open or total linear miles within the BORZ.
[3]Road 4784 is open July 1 to October 14 to motorized vehicles in existing condition. MMC would only implement if Rock Creek Mine has not yet done so.

Table 29. KNF's Proposed Road Access Changes Prior to the Construction Phase.

NFS Road Number	Road Name or Drainage	Length (miles)		Miles	Current Access Status	Proposed Access Status	Period	Notes
		In BMU	In BORZ					
2316 2317 4781 150A	Upper Libby Creek Poorman Creek Ramsey Creek Rock Lake Trail #935	0.7 1.8 2.8 2.9	0.0 0.0 0.0 0.0	0.7 1.8 2.8 2.9	Gated[1]	Barriered	Year-long	Convert to a trail where necessary; restricted to all motorized vehicles, including over-snow vehicles.
6701 6702	South Ramsey Creek Upper Libby Creek	0.4 0.4	0.0 0.0	0.4 0.4	Gated[1]	Barriered	Year-long	Restricted year-long to all motorized vehicles, including over-snow vehicles
4725	North Fork Miller Creek	4.2	0.0	4.2	Gated[2]	Barriered	Year-long	Restricted year-long to all motorized vehicles including over-snow-vehicles.
14442[3] 6205D 6787B 6209E 4776B	Lampton Pond/Cherry Cr Big Hoodoo/Getner Cr Big Hoodoo Bear/Crazyman Crazyman Creek Horse Mtn/Libby Creek	0.0 0.0 0.0 0.0 0.0	0.6 4.0 1.6 1.1 2.9	0.6 4.0 1.6 1.1 2.9	Gated seasonally Open Open Open Open	Barriered[4] Barriered[4] Barriered[4] Barriered[4] Barriered[4]	Year-long	Restricted year-long to motorized vehicles, including over-snow-vehicles
	Total	13.0	10.2					

[1]Roads 2316, 2317, 4781, 150A, 6701, 6702 are currently restricted yearlong to motor vehicles, Open to snow vehicles December 1 through April 30
[2]Road 4725 is currently restricted year-long to motorized vehicles, including over snow vehicles. In Alternatives 3C-R and 4C-R, NFS road #4725 would be barriered after the road was no longer needed for transmission line construction.
[3]Road 14442 is currently restricted to motor vehicles October 15 thru June 30, open to snow vehicles December 1 thru April 30
[4]Road access changes implemented for big game mitigation, but which also benefit grizzly bears in the Cabinet Face BORZ.

MMC would secure or protect (through conservation easement or acquisition in fee with conveyance of fee or perpetual conservation easement to the Forest Service or private conservation organization independent of MMC) from development (including but not limited to housing and motorized access) and use (timber harvest, grazing, and mining) replacement habitat to compensate for acres lost by physical alterations or displacement (Table 30). All replacement habitat for either displacement or habitat physically lost would be committed by MMC prior to the associated phase of the mine and accepted by the Forest Service (i.e. mitigation habitat review, acquisition, conservation easements, recordation, and transfer to the Forest Service or private conservation organization independent of MMC complete prior to the Evaluation Phase or Construction Phase as required for the phase specific mitigation (Table 30). The Forest Service, in coordination with FWP and after review by USFWS, would establish and maintain priorities for potential mitigation lands within and outside the recovery zone. Following the priority list is required. If necessary, MMC would coordinate with KNF, FWP and USFWS to prioritize replacement habitat lands and priority linkage zones and modify priorities as needed. The Forest Service would ensure that the specified acres of mitigation properties are managed for grizzly bear habitat in perpetuity. Costs of processing mitigation lands would be funded by MMC.

First choice for replacement habitat required for habitat physically lost would be within the disturbed BMUs (5, 6, or 2 in order of priority) and within the north-south movement corridor. If adequate replacement acres were not available in those BMUs or north-south movement corridor, then lands may be located in other BMUs (4, 7, and 8) within the CYRZ. The first 500 acres of replacement habitat required for displacement would be within the north-south corridor within impacted BMUs (5, 6 or 2) due to evaluation adit displacement. The remaining 1,828 acres required for displacement in Alternative 3D-R could be in or outside the north-south corridor within the CYRZ (priority for 774 acres to be located in the north-south corridor) with up to half (914 acres) may be located in the identified linkage area). For both fee title or conservation easements, any habitat enhancement activities needed to improve the mitigation properties, such as the trail conversion, road access changes or removal of buildings and debris, would be planned and funded prior to construction and implemented as soon as feasible.

Fee-title properties must meet standards, requirements, and legal processes for federal acquisition, including, but not limited to:

- be approved by the Office of General Counsel;
- be a Warranty Deed conveyance;
- comply with Department of Justice standards;
- be free of hazardous materials, or develop an agreement among MOU signers as to appropriate remedy prior to acquisition;
- include all surface and subsurface rights including rights-of-way, mineral claims, and/or other easements, unless otherwise advised by the USFWS;
- be acquired in priority order. Lower priority acquisitions may be allowed, after approval of the Forest Service and when consistent with advice from the USFWS to ensure that such a property would contribute to meeting the requirements of the Biological Opinion;

Table 30. Grizzly Bear Habitat Physically Lost and Grizzly Bear Habitat with Increased and/or New Displacement and Required Replacement Habitat Compensation Acreage.

Alternative	Habitat Physically Lost[1]		Required Habitat Compensation for Displacement Effects[2, 5]							Total Required Habitat Replacement for Both Habitat Physically Lost and Displacement Effects (acre)
	Grizzly Bear Habitat Physically Lost (acre)	Required Habitat Replacement Prior To Construction Phase (acre)[1]	Displacement Effects Evaluation Phase[5] (acre)			Displacement Effects Construction Phase[4, 5] (acre)			Total Required Habitat Replacement for Mitigation of Displacement (acre)[2, 6]	
			BMU 2	BMU 5[3]	BMU 6	BMU 2	BMU 5[4]	BMU 6		
3C-R	1,560	3,120	0	500	0	119	1,674	0	2,293	5,413
3D-R	1,567	3,134	0	500	0	119	1,674	0	2,293	5,427
3E-R	1,562	3,124	0	500	0	119	1,674	0	2,293	5,417
4C-R	1,919	3,838	0	500	0	120	1,719	0	2,339	6,211
4D-R	1,926	3,852	0	500	0	120	1,719	0	2,339	6,225
4E-R	1,921	3,842	0	500	0	120	1,719	0	2,339	6,215

[1]Requires conservation easement or acquisition; mitigation requirement for habitat physically lost is shown at 2 to 1 ratio.

[2] Requires conservation easement or acquisition; mitigation requirement for habitat affected by displacement is shown at 1 to 1 ratio.

[3]Priority is 500 acres of replacement habitat within the north-south corridor, although displacement actually occurs on 468 acres within north-south corridor (includes 5-acre Rock Creek Meadows parcel) and 32 acres outside of north-south corridor

[4]Priority for Alternatives 3C-R, 3D-R, and 3E-R is for 774 acres within north-south corridor, and the remaining 900 acres following the priority list developed by the FS/USFWS/FWP; priority for Alternatives 4C-R, 4D-R, and 4E-R would be decided by the FS/USFWS/FWP.

[5]The Final EIS displacement analysis is in ERO Resources Corp. 2015.

[6]Does not include potential displacement due to helicopter use as that impact would be minimized with a timing restriction.

Source: ERO Resources Corp. 2015.

- meet fair market appraised value, according to Forest Service appraisal processes, as approved by the Comprehensive Grizzly Bear Management Plan (see *Plan Management* section, p. 199). Advance approval by the Forest Service, after consultation with the USFWS regarding the ability of the proposed lands to meet the requirements of the Biological Opinion, is required; and
- be acquired, recorded and transferred prior to agency authorization to proceed with the associated phase of the mine, with total acquisitions completed prior to the Construction Phase of the mine.

Conservation easements must include language approved in the Comprehensive Grizzly Bear Management Plan (see *Plan Management* section, p. 199) and meet standards, requirements and legal processes for federal acquisition including, but not limited to:

- be approved by the Office of General Counsel;
- be an attachment to the Warranty Deed;
- comply with Department of Justice standards;
- include all surface and subsurface rights including rights-of-way, mineral claims, and/or other easements, unless otherwise advised by the USFWS;
- meet fair market appraised value, according to Forest Service appraisal processes, as approved by the Comprehensive Grizzly Bear Management Plan (see *Plan Management* section, p. 199), if the affected parcels were consistent with advice from the USFWS as being important.
- be based on consultation, current priority ratings (including grizzly bear credit units as described by Kasworm *et al.* 2013b) and other criteria as established by this plan;
- be acquired and recorded prior to agency authorization to proceed with the associated phase of the mine, with all mitigation habitat acquired and recorded prior to the Construction Phase of the mine, except for the mitigation habitat associated with the effects of the Rock Lake ventilation adit (about 1 acre). Mitigation habitat for the ventilation adit would be acquired prior to agency authorization to proceed with development of the Rock Lake ventilation adit, should it be necessary.

Measures to Address Habitat Constriction and Fragmentation within the North-south Movement Corridor

Prior to Forest Service authorization to initiate the Evaluation Phase, MMC would secure or protect through conservation easement, including motorized route access changes, or acquisition in fee with conveyance of fee or perpetual conservation easement to the Forest Service or private conservation organization independent of MMC from development (including but not limited to housing, motorized access) and use (timber harvest, grazing, and mining) about 5 acres of replacement habitat near Rock Creek Meadows (NW ¼ Section 6, Township 26N, Range 31 West) that would enhance the north to south habitat corridor in the Cabinet Mountains. The property is located in the East Fork Rock Creek drainage and is accessed by motorized trail #935. These 5 acres contribute toward the 500 acres replacement acres required for displacement.

Prior to Forest Service authorization to initiate the Construction Phase, MMC would provide funding for the Forest Service to create core habitat for grizzly bear along trail #935 (Table 28). This would include but is not limited to: replacement of the gate at the trailhead with a barrier, and conversion of motorized trail tread to foot traffic tread conditions where necessary. This measure has a net result of creating 1,065 acres of core habitat. In addition, 288 acres of core created prior to the Evaluation Phase through access changes in NFS roads #2316 and #6702 (Table 28) contribute to this measure. The net result is widening of the main constriction area from about 0.9 miles to 3.4 miles.

Prior to Forest Service authorization to initiate the Construction Phase, MMC would provide funding for bear monitoring in the area south of Libby between the CYE and Northern Continental Divide Ecosystem as identified by USFWS. The linkage identification work along US 2 would involve 3 years of monitoring movements of grizzly and black bears along the highway to identify movement patterns and key movement sites. Funding would cover aerial flights for 2 hours per week, 30 weeks per year for 3 years, salary for two seasonal worker for 6 months per year for 3 years, and 15 GPS collars and collar rebuilds each year for 3 years. Funding would supplement ongoing research and monitoring activities in the CYE, would be conducted or coordinated by the USFWS' grizzly bear researcher in Libby or the equivalent, and would focus on grizzly bears in the Cabinet Mountains. Other monitoring methods may be considered if approved by the Oversight Committee.

Measures to Reduce Effects in Grizzly Bear Outside the Recovery Zone (BORZ) Reoccurring Use Areas

MMC would fund and the KNF would implement year-long road access changes to three roads (4776A, 4776C, and 4776F) that would reduce open and total road miles within the Cabinet Face BORZ (see Table 28 and Figure 35). As a result of these changes, open roads within the BORZ would be reduced by 1.2 miles, and total roads would be reduced by 2.5 miles. The KNF also would implement year-long road access changes to reduce effects to big game. The KNF would change the status of new transmission line roads on National Forest System lands to intermittent stored service after line installation was completed and would retain that status throughout operations. Intermittent stored service is discussed in section 2.9.4.2, *Access Road Construction and Use*. Some of these road access changes would occur within the Cabinet Face BORZ and would improve grizzly bear habitat. Access changes associated with big game mitigation that would improve grizzly bear habitat in the BORZ are shown in Table 29 and Figure 35 (4776B, 6205D, 6209E, 6787B and 14442).

Impacts from the proposed activities on grizzly bears in the BORZ and on adjacent private and State lands would also be mitigated through measures, such as funding for grizzly bear personnel, education and outreach, bear-resistant containers, fencing and electrification, and grizzly bear monitoring.

Plan Management

Prior to initiating the Evaluation Phase, the Forest Service, DEQ, FWP and MMC would participate in the development of a MOU, while only the Forest Service, DEQ and FWP would be signers on the MOU. The MOU would establish roles, responsibilities, and time lines of an Oversight Committee comprised of members of the Forest Service, FWP, and other parties deemed appropriate by the parties named. The USFWS would be an ex-officio, non-voting member of the Oversight Committee, with only advisory responsibilities.

The Oversight Committee would be responsible for the development of a Comprehensive Grizzly Bear Management Plan and its implementation. MMC would have a participating role on the Oversight Committee. The Comprehensive Grizzly Bear Management Plan would focus on the

Cabinet portion of the CYE and would fully include all provisions of the mitigation plan for grizzly bears, except where superseded by the USFWS' Biological Opinion. It also would include provisions for adaptive management. The plan would be developed in detail by the parties to ensure that human access to grizzly bear habitat, grizzly bear mortality, and habitat fragmentation would be minimized and that grizzly bear habitat quality would be maintained or improved. Advice and comments on the plan from the USFWS would be requested and fully considered, including advice on whether the plan would meet the requirements of the Biological Opinion. The Oversight Committee, led by the Forest Service, would assume responsibility for coordinating various aspects of the Comprehensive Grizzly Bear Management Plan/Grizzly Bear Mitigation Plan; maintaining effective communication, between parties, and integrating principles of adaptive management.

Prior to Forest Service authorization to initiate the Evaluation Phase, MMC would establish a trust fund and/or post a bond, to adequately fund the mitigation plan implementation costs. The amount in the fund or posted in a bond would be commensurate with projected work and associated required mitigation items by phase The Oversight Committee would determine the amount of trust fund deposits, to be made in 5-year increments over the life of the mine. If implementation costs prior/or during either evaluation or Construction Phases exceeded the amount deposited in the trust fund/and or bond, MMC would contribute additional funds to fully implement those actions in a timely manner (as determined by the KNF in consultation with the USFWS). The amount in the fund or posted in a bond would be commensurate with projected work and associated required mitigation items by phase.

Prior to Forest Service authorization to initiate the Construction Phase, MMC would contribute funding to support monitoring of bear movements and population status for native Cabinet Mountain bears as well as grizzly bears trans-located into the Cabinet Mountains to confirm the effectiveness of mitigation measures. The Forest Service would ensure that adequate funding, provided by MMC, was available to monitor bear movements and use of the Cabinet Mountains to confirm the effective implementation of mitigation measures. Information gained would be useful in determining whether the mitigation plan was working as intended.

2.5.7.4.2 Canada Lynx

Prior to Forest Service authorization to initiate the Construction Phase, MMC would fund habitat enhancement on lynx stem exclusion habitat to mitigate for the physical loss of suitable lynx habitat due to the construction of project facilities and transmission line. Enhancement would be at a 2:1 ratio (2 acres treated for every acre lost). Impacts on lynx habitat and required habitat enhancement are shown in Table 31. Selected stands with poorly-developed understories that do not currently provide winter snowshoe hare habitat would be thinned to allow sun to reach understory vegetation and accelerate development of the dense, horizontal vegetation favored by snowshoe hare. Habitat enhancement work would be done by Forest Service personnel or by others under the direction of the Forest Service. Field verification with snowshoe hare horizontal cover surveys would be conducted before any treatment occurred.

Remote monitoring is difficult and impractical, and new off-road use can easily be monitored from the access roads. To address Northern Rockies Lynx Management guideline HU G4, Forest Service personnel would monitor new snow compaction activities (such as snowmobiling) in the project area and take appropriate action if compaction monitoring identified increased predator access to new areas.

Table 31. Impacts on Lynx Habitat and Habitat Enhancement Requirements.

Agencies' Alternative	Lynx Habitat Impacted (acre)	Required Habitat Enhancement (acre)
3C-R	218	436
3D-R	263	526
3E-R	242	484
4C-R	145	290
4D-R	190	380
4E-R	169	338

Final EIS mitigation requirements based on effects shown in Table 248.

2.5.7.4.3 Gray Wolf

If a wolf den or rendezvous site was located in or near the project facilities by FWP wolf monitoring personnel, MMC would provide funding for FWP personnel to implement adverse conditioning techniques before wolves concentrate their activity around the den site (in early to mid-March) to discourage use of the den. This would occur in the spring before the expected start-up of construction activities. Discouraging use before denning starts would give wolves time to excavate an alternate den site at a safer, more secluded location.

2.5.7.4.4 Key Habitats

Mitigation common to both the mine and transmission line alternatives is discussed in the following sections. Wildlife mitigation specific to the transmission line is discussed in section 2.9.6, *Wildlife Mitigation Measures*.

Old Growth

The KNF would designate effective or replacement old growth on National Forest System lands within the affected PSUs (first priority) or adjacent PSUs (second priority) at a 2:1 ratio for old growth within the disturbance area of the mine Alternatives 3 or 4, or the clearing width of transmission line Alternatives C-R, D-R, or E-R (Table 32). Similarly, the KNF would designate effective or replacement old growth on National Forest System lands at a 1:1 ratio for old growth affected by "edge effect" or designated old growth within areas newly designated MA 31 not already accounted for by edge effect (see section 2.12, *Forest Plan Amendment*). Specifically, this would consist of old growth between the proposed mine facilities disturbance and permit area

Table 32. Old Growth Designation Requirements by Mine and Transmission Line Alternative Combination in the Crazy and Silverfish PSUs.

Old Growth Impact	Agencies' Alternative					
	3C-R	3D-R	3E-R	4C-R	4D-R	4E-R
Physical Disturbance (acres)†	484	480	472	440	436	428
Edge Effect (acres)	294	281	282	231	218	219
MAs Changed to MA 31 (acres)‡	48	48	48	186	186	186
Total Designation	826	809	802	857	840	833

†Physical acreage shown equals twice the acres that would be removed.

‡Designated old growth reallocated to MA 31 but not included in disturbance area or edge effect. No physical changes would occur to old growth in these areas.

boundaries. Any private land acquisition for grizzly bear habitat mitigation could also be used to offset habitat loss, if old growth habitat characteristics were present on the acquired parcels.

Snags (Cavity Habitat)

MMC would leave snags within the disturbance area of the mine Alternatives 3 or 4, or the clearing width of transmission line Alternative C-R, D-R, or E-R, unless required to be removed for safety or operational reasons. This mitigation would be incorporated into the Vegetation Removal and Disposition Plan (section 2.5.2.5.2*, Vegetation Removal and Disposition Plan*).

2.5.7.4.5 Indicator Species

Big Game

The KNF would change the access of five roads year-long by earthen barrier to mitigate for the loss of big game security (see Table 29 in the previous discussion on grizzly bear mitigation and Figure 35). The roads would be either placed in intermittent stored service or decommissioned.

Mountain Goat

MMC would fund surveys to monitor mountain goats to examine response to mine-related impacts. The surveys would be integrated into the current monitoring effort of the FWP. Aerial surveys would be conducted three times annually (winter-late spring-fall) by the FWP along the east front of the Cabinet Mountains from the Bear Creek drainage south to the West Fisher Creek drainage. Surveys would be conducted for 2 consecutive years before construction, and every year during construction activities. Survey results would be analyzed by the KNF, in cooperation with the FWP, at the end of the construction period to determine the appropriate level and type of survey work needed during the Operations Phase. If the agencies determined that construction disturbance were significantly affecting goat populations, MMC would develop, fund, and implement mitigation measures to reduce the impacts of mine disturbance. Surveys would be conducted using the current protocol of the FWP. Currently, the FWP conducts one aerial survey of the east Cabinet Mountains every other year. This additional level of monitoring would provide information on the status of mountain goat use adjacent to the project area, and potential effects of the project.

MMC would not conduct any blasting at the entrance to any adit portals during May 15 to June 15 to avoid disturbance to the potential goat kidding area on Shaw Mountain.

2.5.7.4.6 Migratory Birds

MMC would coordinate with the KNF and Regional bird monitoring partnership group to fund monitoring of landbird populations as part of the Forest Service Regional effort of the "Integrated Monitoring in Bird Conservation Regions" (IMBCR). The KNF is located with the Northern Rockies Bird Conservation Region 10 (BCR 10), which is characterized by high-elevation mountain ranges with mixed conifer forests and intermountain regions dominated by sagebrush steppe and grasslands (Partners in Flight 2000). BCRs approximate an eco-province, and are the scale recommended by Partners in Flight for monitoring. Across the KNF, transects were identified in 2010, with at least 10 transects monitored each year. Two of these 10 annually monitored transects are located within the Crazy and Silverfish PSUs.

Prior to the Evaluation Phase, and continuing for the life of the mine, MMC would coordinate with the KNF and Forest Service Region 1 bird monitoring specialist to fund and initiate annual monitoring of up to 12 IMBCR transects; up to eight located within a 1 mile influence zone of the proposed facilities or transmission lines (MT-BCR10-K078; MT-BCR10-KO271; MT-BCR10-KO102; MT-BCR10-KR53; MT-BCR10-KR229; MT-BCR10-KR277; MT-BCR10-KO138 if transmission line Alternative C-R was selected, and MT-BCR10-KR133 located adjacent to the private property at Rock Lake where a ventilation adit may potentially be built), and an additional four transects located outside of the facilities and transmission line influence zones for comparison with the influence zone transects.

2.5.7.5 Cultural Resources

All mine and transmission line alternatives would require additional cultural resource inventory to satisfy requirements of Section 106 under the NHPA and 22-3, MCA. Additional survey would be conducted in all previously undisturbed areas where surface disturbance would occur in the alternative selected in the ROD. Such areas would include any surface disturbance required in mitigation plans described in Alternatives 3 or 4, such as culvert replacement and other compensatory wetland mitigation sites. The number of cultural resources that would require mitigation may increase pending the result of these additional inventory efforts. The appropriate type of mitigation would depend on the nature of the cultural resource involved and would ultimately be determined during consultation between MMC, the KNF, and Montana SHPO. Any mitigation plan for cultural resources would be developed by MMC and approved by the KNF in consultation with the Montana SHPO under the project-specific Programmatic Agreement, and would include consulting Confederated Salish and Kootenai Tribes and the Kootenai Tribe of Idaho (Tribes), if affected cultural resources were of cultural significance.

Mitigation could include data recovery (excavation) of prehistoric archaeological sites, a Historic American Building Survey (HABS) for standing structures, or Historic American Engineering Record (HAER) for built resources such as mines, roads, and trails. For landscape-level resources such as the Libby Mining District, the USDI National Park Service's (NPS) Cultural Landscapes Program would be implemented. Mitigation also would include monitoring during ground disturbing activities when the subsurface spatial extent of the resource is unknown or because of the fragility of the resource and its proximity to the activity. Table 82 and Table 83 lists potential mitigation measures for known resources in the analysis area.

The Tribes would be afforded the opportunity to monitor any ground disturbing activities associated with all agency mitigated mine and transmission line alternatives. Section C.3, *Cultural Resources*, of Appendix C discusses monitoring requirements.

2.6 Alternative 4—Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would be similar to Alternative 3, but would have modifications to MMC's proposed Little Cherry Creek Tailings Impoundment as part of the alternative. All other modifications and mitigations described in Alternative 3, other than those associated with the Poorman Tailings Impoundment Site, would be part of Alternative 4. As in Alternative 3, the Libby Adit evaluation program would be the initial phase of the project and would be completed before construction of any other project facility.

The final design process for Alternative 3 would be used in Alternative 4. Although more subsurface hydrogeologic data are available for the Little Cherry Creek Tailings Impoundment Site, additional data would be need to implement the agencies' mitigation measures at the Little

Cherry Creek Site. Data to be collected would include an assessment of artesian pressures and their potential influence on impoundment stability, an assessment of a subsurface bedrock ridge between Little Cherry Creek and the effect it may have on pumpback well performance, aquifer pumping tests to refine the impoundment groundwater model and update the pumpback well design, and site geology to identify conditions such as preferential pathways that may influence seepage collection system, the pumpback well system, or impoundment stability. The pumpback well system would be designed and operated to minimize effects on wetlands and other waters of the U.S. Technical review of the final tailings facility design would be made by a TAG described in Alternative 3.

In Alternative 4, MMC would use the Libby Plant Site between Libby and Ramsey creeks, construct two additional adits in upper Libby Creek, and use the Water Treatment Plant for treatment and disposal of water instead of the LAD Areas, as in Alternative 3 (Figure 36). In addition to the modifications from Alternative 3, MMC would modify the proposed Little Cherry Creek Tailings Impoundment Site operating permit and disturbance areas to avoid RHCAs (Issue 3) and old growth (Issue 6) in the Little Cherry Creek drainage. Borrow areas would be reconfigured to maximize disturbance within the impoundment footprint and to minimize disturbance of RHCAs (Issue 3), core grizzly bear habitat (Issue 5), and old growth (Issue 6). Waste rock would be stored temporarily within the impoundment footprint to address potential acid rock drainage and metal leaching (Issue 1) and water quality and quantity (Issue 2). The proposed permanent Little Cherry Creek Diversion Channel below the engineered upper section would be modified so it would adequately convey anticipated flows. At closure, surface water runoff would be directed toward the Little Cherry Creek Diversion Channel, and not Bear Creek, an important bull trout stream. The operating permit area would be 2,979 acres, and the disturbance area would be 1,924 acres. The operating permit area would encompass 433 acres of private land owned by MMC for the proposed mine and associated facilities. All other aspects of MMC's mine proposal would remain as described in Alternative 2, as modified by Alternative 3.

2.6.1 Issues Addressed

Alternative 4 would be similar to Alternative 3, but would have modifications to MMC's proposed Little Cherry Creek Tailings Impoundment as part of the alternative. All other modifications and mitigations described in Alternative 3, other than those associated with the Poorman Tailings Impoundment Site, would be part of Alternative 4. In Alternative 4, MMC would use the Libby Plant Site between Libby and Ramsey creeks, construct two additional adits in upper Libby Creek, and elimination of the LAD Areas, as in Alternative 3 (Figure 36). In addition to these modifications from Alternative 3, MMC would modify the proposed Little Cherry Creek Tailings Impoundment Site disturbance areas to avoid RHCAs (Issue 3) and old growth (Issue 6) in the Little Cherry Creek drainage. Borrow areas would be reconfigured to maximize disturbance within the impoundment footprint, and to minimize disturbance of RHCAs (Issue 3), core grizzly bear habitat (Issue 5), and old growth (Issue 6). Waste rock would be stored temporarily within the impoundment footprint to address acid rock drainage and metal leaching (Issue 1) and water quality and quantity (Issue 2). The proposed permanent Little Cherry Creek Diversion Channel below the engineered upper section would be modified to adequately convey anticipated flows. At closure, surface water runoff would be directed toward the Little Cherry Creek Diversion Channel, and not Bear Creek, an important bull trout stream. The issues addressed by the modifications and mitigation measures are summarized in Table 33. The modifications and proposed mitigations that comprise Alternative 4 are described in the following sections. All other aspects of MMC's mine proposal would remain as described in Alternative 2.

Chapter 3 contains a more detailed discussion of how the modifications and mitigating measures would reduce or eliminate environmental impacts.

Table 33. Response of Alternative 4 Modifications and Mitigations to Issues.

Key Issue	Mine Plan	Tailings Storage	Water Use and Manage-ment	Reclamation	Monitoring and Mitigation Plans
Issue 1-Acid Rock Drainage and Metal Leaching	✓		✓		
Issue 2-Water Quality and Quantity	✓	✓	✓	✓	✓
Issue 3-Aquatic Life	✓	✓	✓		✓
Issue 4-Visual Resources	✓	✓		✓	
Issue 5-Threatened or Endangered Wildlife Species	✓	✓		✓	✓
Issue 6-Wildlife	✓	✓		✓	✓
Issue 7-Wetlands and Streams	✓			✓	✓

2.6.2 Evaluation Phase

The Libby Adit evaluation program, described as the Evaluation Phase in Alternative 3, would be implemented in the same manner as Alternative 3. Other modifications specific to Alternative 4 are described in the following sections. As in Alternative 3, MMC would submit a final Plan of Operations after final design, including all monitoring and mitigation plans, to the KNF for approval. MMC would submit a final application for a modification of Operating Permit #00150, including all monitoring and mitigation plans, to the DEQ for approval.

2.6.3 Construction Phase

2.6.3.1 Permit and Disturbance Areas

All permitted disturbance area boundaries would be marked in the field with fence posts and signed to limit potential disturbance outside permitted disturbance areas. Permit areas would total 2,979 acres and the total disturbance area would be 1,924 acres (Table 34).

Table 34. Mine Surface Area Disturbance and Operating Permit Areas, Alternative 4.

Facility	Disturbance Area (acres)	Permit Area (acres)
Existing Libby Adit	18	219
Upper Libby Adit	1	1
Rock Lake Ventilation Adit	1	1
Libby Plant Site and Adits	**76**	**172**
Modified Little Cherry Creek Tailings Impoundment Site and Surrounding Area	**1,619**	**2,215**
Little Cherry Creek Impoundment and Seepage Collection Pond	628	0
Borrow areas outside impoundment footprint	**252**	0
Soil stockpiles	53	0
Other potential disturbance (Diversion Channel, roads, storage areas)	**686**	0
LAD Area 1	**0**	**0**
LAD Area 2	**0**	**0**
Access Roads†		
Bear Creek Road (NFS road #278 from US 2 to Tailings Impoundment)	**79**	**10**
Tailings Impoundment permit area to Libby Plant Site (NFS roads 2317 and #4781, NFS road #278, NFS #6210 and new road)	**89**	**316**
Libby Plant Site to Libby Adit Site and Upper Libby Adit Site (NFS roads #6210 and #2316)	**41**	**44**
Total	**1,924**	**2,979**

†Disturbance area shown for roads excludes 33 feet of existing disturbance along roads.
Bolded values differ from Alternative 2.

2.6.3.2 Modified Little Cherry Creek Tailings Impoundment

MMC would modify the proposed permit and disturbance areas to avoid old growth, core grizzly bear habitat, and RHCAs in the Little Cherry Creek drainage (Figure 22). To the extent feasible, MMC would maximize borrow areas within the footprint of the Little Cherry Creek tailings impoundment footprint (Figure 37) to avoid impacts on old growth in Borrow Areas B and C. Acceptable borrow on either side of Little Cherry Creek more than 200 feet from the upstream dam face would be used in Borrow Areas A and B. If suitable borrow were not available within the footprint of the impoundment, MMC would use Borrow Areas C and E, in that order. MMC would locate Borrow Area D south of the Little Cherry Creek impoundment between NFS roads #278 and #6212 to avoid core grizzly bear habitat (Figure 22). As in Alternative 3, unsuitable materials would be stockpiled and backfilled into borrow areas outside the impoundment footprint in borrow areas C and E. Waste rock would be managed in the same manner as Alternative 3.

NMC conducted geotechnical investigations at the Little Cherry Creek Impoundment Site between 1988 and 1990. NMC reported that bedrock is exposed in the Little Cherry Creek channel and bedrock extended 800 feet downstream of the proposed Seepage Collection Dam (Morrison-Knudsen Engineers, Inc. 1990). Groundwater modeling conducted of the Little Cherry Creek Impoundment Site for MMC (Klohn Crippen 2005) and independently verified by the lead agencies (USDA Forest Service 2008b) assumed that the fractured bedrock strata in the Little Cherry Creek drainage is the primary aquifer for groundwater flow at the site. In Alternative 4, MMC would conduct additional geotechnical work near the Seepage Collection Dam during final design and site the dam lower in the drainage if technically feasible.

In Alternative 4, MMC would use only Drainage 10 for diverted Little Cherry Creek and Drainage 5 would not be used. MMC would complete a hydraulic and hydrologic (H&H) analysis of the proposed runoff channel during final design, and submit it to the lead agencies and the Corps for approval. The H&H analysis would include a channel stability analysis and a sediment transport assessment. The channel would begin at the outlet of the engineered channel and would be designed to have the following characteristics:

- A constructed floodplain and terrace that would allow passage of the 100-year flow volume
- A stream portion of the diversion corridor constructed to meet the 2-year flow event volume and approximate the cross-section, profile, and channel materials of similar sized watersheds found in the project area
- Establishment of fish habitat similar to that currently provided by Little Cherry Creek to the extent feasible with the anticipated lower flows

Several mitigation measures would be implemented along the channel to ensure that erosion and sedimentation resulting from heavy rainfall and from high flow events would be minimized. These measures would include:

- The channel and floodplain would be constructed during low flow periods in late summer or early fall
- Floodplain and channel banks would be seeded with an agencies-approved seed mix immediately following construction
- A temporary biodegradable erosion control fabric would be installed along the channel banks, where needed, and on the floodplain immediately following seeding
- Structures of natural materials, which could include boulders or rock/log weirs or vanes, may be installed to protect stream banks where needed
- Alders would be planted along the channel banks at and above bankfull elevation following placement of the erosion control fabric at a density similar to what is currently present along Little Cherry Creek
- Coarse woody debris would be placed along the channel banks to increase surface roughness to reduce flow velocities

Flow in the diversion channels would increase substantially during two periods, one during the construction period after the Diversion Dam was constructed and flow from upper Little Cherry

Creek was diverted into the channel, and one after closure when runoff from the impoundment surface and South Saddle Dam flowed into the channel. MMC would complete habitat surveys in the diverted Little Cherry Creek every 2 years until the reclamation bond had been released. The survey would document distance, elevation, macrohabitat type, pool dimensions, large woody debris, substrate, valley slope and width, and riparian characteristics continuously along the entire length of the creek.

The agencies anticipate the channel would require long-term maintenance; MMC would fund a long-term maintenance account to pay for such maintenance. The decision regarding long-term maintenance funded would be made following closure and before bond release, after runoff from the tailings impoundment flowed into the Diversion Channel. In Alternative 4, soil would be salvaged in two lifts at the Little Cherry Creek Diversion Channel. Soils salvaged from the Diversion Channel would be used as replaced soil on the created floodplain and stream banks of the lower diversion channels and possibly at other disturbances.

In Alternative 2, MMC would build temporary diversion ditches to control run-on within the impoundment site to minimize run-on into the tailings impoundment after Year 2 of operations. As the impoundment filled, new ditches would be excavated farther uphill. Because of the difficulty in routing the run-on into the Little Cherry Creek Diversion Channel, MMC in Alternative 4 would build a permanent diversion ditch between the North Saddle Dam and the Little Cherry Creek Diversion Channel, directing flow either into the Diversion Channel, or Bear Creek (Figure 37). The ditch would be integrated into the surface water management plan of the tailings impoundment at final closure.

The tailings facility design would be finalized as additional site information is obtained during the final design process. The artesian pressures and their potential influence on the stability of the tailings dam would be evaluated during final design and would be based on additional data collection of the impoundment site. A 3D groundwater model would be used to develop a design for a pumpback well system, with a goal of minimizing indirect effects on wetlands and other waters of the U.S. Technical review of the final design would be the same as Alternative 3.

2.6.3.3 Transportation and Access

In Alternative 4, MMC would use the same roads as Alternative 2 for main access during the Libby Adit evaluation program and during operations. MMC would continue to plow the Libby Creek Road (NFS road #231) and the Upper Libby Creek Road (NFS road #2316) year-round during the 2-year evaluation program and the 1-year period during reconstruction of the Bear Creek Road. Road-related mitigation measures described in Alternative 3, such as the Road Management Plan, Transportation Plan, and traffic impact study, would be implemented.

US 2 improvements, reconstruction of the Bear Creek Road (NFS road #278), from US 2 to the Bear Creek bridge, Bear Creek bridge replacement, culvert replacement on NFS roads #231 and #2316, and new Libby Plant Access Road parallel to the existing Bear Creek Road would be the same as Alternative 3. Methods to accommodate joint public and mine haul traffic would be determined by MMC and the KNF during final design. Once oversized haul vehicles were no longer needed between the impoundment and plant site, the segment of the Bear Creek Road parallel to the new Libby Plant Access Road would be decommissioned, and the two culverts crossing Poorman Creek would be removed.

MMC would surface the existing Bear Creek Road (NFS road #278) from the new Libby Plant Access Road to the Libby Creek Road (NFS road #231) with 6 inches of gravel 16 feet wide (Figure 38). This surfacing would ensure the safe transition from the improved section north of the new Libby Plant Access Road and the unimproved section to the Libby Creek Road.

The following sections describe road use and public access along the main access road (Bear Creek Road (NFS road #278) and each proposed permit area. With the exception of the Bear Creek Road in the impoundment permit area, all open roads would be gated and limited to mine traffic only. Non-motorized public access would be restricted within each permit area by signage at the permit area boundary. Table 35 lists those roads with a change in road status in Alternative 4; these roads are shown on Figure 38. MMC would be responsible for maintaining all existing or new roads and stream crossings used by the mine.

2.6.3.3.1 Little Cherry Creek Tailings Impoundment Area

Road use and access in the tailings impoundment area in Alternative 4 would be similar to Alternative 2. All roads in the operating permit area would be closed to all public access. Little Cherry Loop Road (NFS road #6212) would be gated during operations and used for mine traffic only (Figure 38). The gates would be near the intersection with the Bear Creek Road on the north end and the tailings impoundment permit area boundary on the south end. NFS road #6212 would remain open to motorized access south of the proposed permit area boundary to the junction with Bear Creek Road. At the end of operations, gates on these roads would be removed and the roads would be reopened to motorized access. A segment of the Little Cherry Loop Road (NFS road #6212) would be covered by the tailings impoundment and would not provide a loop between the Bear Creek Road. With the exception the Cherry Ridge Road (NFS road #6201), other currently gated or barriered roads proposed for use in Alternative 2 in the tailings impoundment area would be used in Alternative 4.

2.6.3.3.2 Libby Plant Site, Libby Adit, and Upper Libby Adit

Access and road use in the Libby Plant Site, Libby Adit, and Upper Libby Adit in Alternative 4 would be the same as Alternative 3 (Figure 38 and Table 35). MMC would develop a parking area and trail as described in Alternative 3.

2.6.3.3.3 Ramsey Creek Drainage

Access and road use on NFS road #4781 up Ramsey Creek and NFS road #6701 would change from gated to barriered to provide grizzly bear mitigation. A short segment of the Ramsey Creek Road would be decommissioned (Figure 38).

Table 35. Proposed Change in Road Status for Roads used during Construction, Operations and Closure in Alternative 4.

Road #	Road Name	Location	Existing Status	Length (miles)	Proposed Status
1408	Libby Creek Bottom	Tailings Impoundment	Open	0.9	Gated, mine traffic only
2316	Upper Libby Creek	Libby Adit Site	Open	2.2	Mixed mine haul and public traffic
2316	Upper Libby Creek	Libby Adit Site	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.3	Gated, mine traffic only

Road #	Road Name	Location	Existing Status	Length (miles)	Proposed Status
2316	Upper Libby Creek	Libby Adit Site	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.7	Trail
2317	Poorman Creek	Up Poorman Creek	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	1.8	Trail
2317	Poorman Creek	Up Poorman Creek	Open	0.3	Mixed mine haul and public traffic
2317B	Poorman Creek B	Up Poorman Creek	Impassable, open to snow vehicles 12/1-3/31	0.5	Trail
278L	Bear Creek L	Tailings Impoundment	Barriered year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.3	Gated, mine traffic only
4781	Ramsey Creek	Up Ramsey Creek	Open	0.7	Gated, mine traffic only
4781	Ramsey Creek	Up Ramsey Creek	Open	0.5	Decommission
4781	Ramsey Creek	Up Ramsey Creek	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	2.2	Trail
5181	L Cherry Loop H Cowpath	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.5	Gated, mine traffic only
5181A	L Cherry Loop H Cowpath A	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.2	Gated, mine traffic only
5182	Little Cherry Bear	Tailings Impoundment	Open	1.6	Gated, mine traffic only
5183	Little Cherry View	Tailings Impoundment	Impassable, open to snow vehicles 12/1-3/31	0.5	Gated, mine traffic only
5184	Bear-Little Cherry	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.7	Gated, mine traffic only
5184A	Bear-Little Cherry A	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.2	Gated, mine traffic only
5185	S Bear-Little Cherry	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.9	Gated, mine traffic only
5185A	S Bear-Little Cherry A	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.3	Gated, mine traffic only
6210	Libby Ramsey	Libby Adit Access Road	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	2.1	Gated, mine traffic only
6210	Libby Ramsey	Libby Adit Access Road	Open	0.4	Gated, mine traffic only
6212	Little Cherry Loop	Tailings Impoundment	Open	3.7	Gated, mine traffic only
6212H	Little Cherry Loop H	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.6	Gated, mine traffic only
8749	Noranda Mine	Libby Adit Site	Private, gated	0.5	Gated, mine traffic only
8749A	Noranda Mine A	Libby Adit Site	Private, gated	0.2	Gated, mine traffic only
8838	Little Cherry MS 10377 8838	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.2	Gated, mine traffic only
8841	Little Cherry MS 10377 8841	Tailings Impoundment	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	1.8	Gated, mine traffic only
14403	Lower Ramsey	Libby Plant Site	Barriered year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.4	Gated, mine traffic only

2.6.4 Operations Phase

2.6.4.1 Water Use and Management

2.6.4.1.1 Project Water Requirements

The water balance in Alternative 4 would be the same as the water balance in Alternative 2. Discharges would occur at the Water Treatment Plant during all phases. In Alternative 4, MMC would maintain MPDES permit MT0030279 at the Libby Adit Site and would seek authorization for additional stormwater outfalls. When the 3D model was updated after the Evaluation Phase, MMC would re-evaluate diversions from Ramsey Creek. If MMC's Ramsey Creek diversions may adversely affect this right on Ramsey Creek during any mining phase, MMC would develop a plan during final design to convey treated water from the Water Treatment Plant to a location upstream of this right's point of diversion. Discharge of treated water to Ramsey Creek would require a new outfall in MMC's MPDES permit. Modifications to the Water Treatment Plant described in Alternative 3, such as developing nutrient treatment capability, and increasing treatment capacity, would be implemented in Alternative 4.

2.6.4.1.2 Water Rights

For all mine alternatives, MMC would acquire beneficial water use permits from the DNRC for any new surface water and groundwater appropriation to use water for mining purposes. MMC applied for new surface water and groundwater rights using the project components of Alternative 3 (MMC 2012a). These applications are discussed in section 2.4.3.4.2, *Water Rights.* The rate and points of diversion for each right in Alternative 4 would vary slightly from those described in Alternative 3 (Figure 37).

2.6.5 Closure and Post-Closure Phases

2.6.5.1 Closure and Reclamation of Project Facilities

Short- and long-term reclamation objectives would remain the same as for Alternative 2. These objectives would be achieved through interim and final reclamation of all disturbed sites as described for Alternative 2, with additional mitigation described for Alternative 3 and implementing all erosion- and sediment-control measures described for Alternative 2. The modifications described in section 2.5.5.2, *Revegetation* would be implemented for Alternative 4.

2.6.5.1.1 Little Cherry Creek Tailings Impoundment

Before closure, MMC would manage tailings deposition and beaches to ensure that the final tailings surface would slope southwest toward the Diversion Dam (Figure 39). A spillway in the dam would convey surface flow for the final impoundment surface to a diversion ditch and then to the Diversion Channel. Minor modifications to the design of the Diversion Channel, Diversion Dam, and North Saddle Dam would be completed during final design to incorporate this modification.

As in Alternative 3, MMC would survey tailings settlement at closure on a 100-foot by 100-foot grid to document settlement. The area would be resurveyed after borrow material used for fill was placed to create final reclamation gradients, and again after soil placement to ensure runoff gradients were achieved and soil thicknesses were met. Rocky borrow and geotextile would be needed for construction equipment to work on the tailings surface. In Alternative 2, MMC would place riprap on the dam crest and uppermost part of the dam face to minimize potential gully formation at the tailings dam crest. In Alternative 4, MMC would use rocky borrow from within the disturbance area to provide erosion protection. Borrow material volumes would be determined during final design.

MMC would develop a design to recontour faces of the tailings impoundment dams to more closely blend with the surrounding landscape. Sand deposition would be varied during final cycloning and placement of sand on the dams. This design would incorporate additional rocky borrow at selected locations on the dam face and use benches in some locations. Islands of trees and shrubs would be planted in the rocky areas. The seed mixture on the dam face would vary to reduce uniformity of the revegetated dam.

2.6.5.1.2 Roads

Reclamation of the Bear Creek Road, new roads, and all new bridges used in Alternative 4 would be the same as Alternative 2, except for the following changes. In Alternative 4, the two gates on the Little Cherry Creek Loop Road (NFS road #6212) (near the intersection of the Bear Creek Road on the north side and at the permit area boundary on the south side) would remain in place. Motorized access on Little Cherry Creek Loop Road (NFS road #6212), NFS road #5182, and NFS road #8838 would be restricted to administrative use. All currently gated or barriered roads used in Alternative 4 would be decommissioned by using a variety of treatment methods to achieve desired conditions for other resources.

2.6.6 Monitoring Plans

Operational and post-operational monitoring programs described for Alternative 3 in Appendix C would be implemented for Alternative 4, with the exceptions described below. Plans not modified in Alternative 3 would be the same as Alternative 2. A number of springs and wetlands occur downstream of the proposed Little Cherry Creek Tailings Impoundment. The GDE monitoring would be revised slightly from that proposed in Alternative 3.

2.6.6.1 Groundwater Dependent Ecosystem Inventory and Monitoring

2.6.6.1.1 Spring and Seep Monitoring

The monitoring of GDEs would be completed in Alternative 4, as described in Alternative 3. In addition, flow from springs SP-02, SP-10, S-12, SP-14, SP-15, and SP-29 (Figure 40) would be measured twice in Alternative 4, once in early June when the area was initially accessible, and once between mid-August and mid-September 1 year before construction began. (Springs SP-02 and SP-15 would not be monitored if they were covered by impoundment facilities.) Samples from these springs would be collected 1 year before construction began and analyzed for total dissolved solids, nitrate + nitrite, sulfate, antimony, and manganese. Sampling would be repeated every 2 years until tailings disposal ceased. At each spring, a vegetation survey would be completed 1 year before construction began; the survey and establishment of a prevalence index to monitor wetland vegetation (Appendix C) would be the same as Alternative 3.

2.6.6.1.2 Monitoring of Wetlands Downstream of Tailings Impoundment

In Alternative 2, MMC would monitor unspecified wetlands downstream of the tailings impoundment annually for the first 5 years of mine operation. In Alternative 4, MMC would monitor three wetlands if not filled by project activities: LCC-24, LCC-25, and LCC-39 (Figure 40). MMC would use the procedures established for monitoring of wetland mitigation sites described in Alternative 3 to assess vegetation characteristics and establish a prevalence index.

The index would be used to assess changes in vegetation composition. Samples from any standing water in these three wetlands would be collected in mid-summer 1 year before construction began and analyzed for total dissolved solids, nitrate + nitrite, sulfate, antimony, and manganese. Sampling would be repeated in mid-summer every 2 years until tailings disposal ceased.

2.6.7 Mitigation Plans

In Alternative 4, the Wetland Mitigation Plan and the Fisheries Mitigation Plan would differ from that proposed in Alternative 2. The proposed plans for wetlands and fisheries are discussed below. The same general components in the Bull Trout, Wildlife, and Cultural Resources Mitigation Plans of Alternative 3 would be incorporated into Alternative 4. The Hard Rock Mining Impact Plan would be the same as Alternative 2.

2.6.7.1 Wetland Mitigation

2.6.7.1.1 Proposed Sites

In Alternative 2, MMC proposed to mitigate affected forested and herbaceous wetlands at a 2:1 ratio, and herbaceous/shrub wetlands at a 1:1 ratio. MMC's proposed mitigation sites are two sites in the Little Cherry Creek drainage, the Little Cherry Creek Diversion Channel, three sites between Little Cherry and Poorman creeks (in Alternative 3, the Poorman Impoundment Site), one site east of the LAD Area 1, and one site at the Libby Creek Recreational Gold Panning Area.

In Alternative 4, possible wetland mitigation sites would include 2.2 acres at the North Little Cherry Creek site; 27.1 acres at the South Poorman, North Poorman, and Poorman Weather Station sites; and 6.7 acres at the Ramsey Creek site (Figure 33). The Poorman Weather Station site was not included in NMC's 1993 404 permit. According to MMC (MMC 2008), the Poorman Weather Station is not within an area of existing wetlands and has no well-defined drainage. Subsequent to MMC's 2008 updated Plan of Operations submittal, surveys by Kline Environmental Research (2012) found that the site was adjacent a tributary to Libby Creek, segments of which were jurisdictional (Figure 33). Wetlands created at this site may not be jurisdictional if the site did not have a hydrologic connection to a jurisdictional water. If jurisdictional wetlands could not be created at the site, additional mitigation sites would be developed. Six months (April–September) of groundwater monitoring at the mitigation sites would be implemented at sites without any hydrologic data.

According to MMC (MMC 2008), the Ramsey Creek mitigation site is part of an existing man-made wetland area. This description is not consistent with NMC's 1993 404 permit. The Ramsey Creek mitigation site is described in NMC's 1993 404 permit as being located on a gently sloping clearcut, about 20 feet in elevation above Ramsey Creek During periods of runoff, water flows intermittently through the site via a diffuse, poorly defined system of shallow drainages. The natural hydrology of the site has been altered by construction of a logging road through the upper portion of the site. MMC would conduct a wetland delineation of the proposed area during final design to ensure the wetland is jurisdictional. If the site were appropriate for mitigation of effects on jurisdictional wetlands, the site would be expanded by spreading out streamflow that would provide hydrologic support.

In Alternative 4, the site at Little Cherry Creek not specifically identified by MMC in Alternative 2 would not be used. At this site, MMC would use groundwater collected from beneath the tailings impoundment to create and maintain wetlands. Groundwater beneath the tailings impoundment may be mixed with tailings water, and contain elevated nutrients and metal concentrations. Use of groundwater beneath the tailings impoundment would not provide hydrologic support after operations cease. The mitigation site at the Libby Creek Recreational Gold Panning Area was not part of the NMC's 1993 404 permit. Because of the proximity to high public use at the Recreational Gold Panning Area, it would not be used in Alternative 4.

MMC would implement the wetland rehabilitation and stream restoration at Swamp Creek, the culvert replacement on NFS road #278 at Poorman Creek, and culvert removal on lands acquired for grizzly bear mitigation. The discussion found on page 115 regarding mitigation requirements and on-site and off-site mitigation also applies to Alternative 4. Insufficient mitigation sites were identified to achieve the Corps' minimum ratios for effects on jurisdictional wetlands, and additional mitigation sites would be necessary if this alternative were permitted. MMC would implement the mitigation described for the Gravel Pit site in Alternative 3 for mitigation for isolated wetlands.

2.6.7.1.2 Monitoring of Wetland Mitigation Sites

Monitoring of mitigation sites would be the same as Alternative 3, except for wetlands downgradient of the tailings impoundment (see sections C.4 and C.10 in Appendix C).

2.6.7.2 Fisheries

2.6.7.2.1 Fish Loss in Little Cherry Creek Diversion

In Alternative 2, MMC proposed to implement the mitigation developed in 1993 to mitigate the loss of recreational fishing opportunity and the loss of fisheries production in Little Cherry Creek. The effects analysis and mitigation did not consider the likely need for a pumpback well system to prevent tailings seepage from reaching surface water. Flow in the diverted Little Cherry Creek would be substantially reduced during operations and closure, as the pumpback well system, as long as it operated, would likely eliminate very low flow in the diverted creek. The loss of available habitat in the diverted Little Cherry Creek would adversely affect the redband trout population in the diverted creek because the remaining habitat would not support the population at its current numbers, if at all. In Alternative 4, additional mitigation for fish loss described for Alternative 2 in section 2.4.6.2, *Fisheries* would be implemented. Projects to be implemented would follow the principals described for Alternative 2.

2.7 Alternative A—No Transmission Line

In this alternative, MMC would not build a 230-kV transmission line to provide power. The BPA would not tap the Noxon-Libby 230-kV transmission line nor would it build the Sedlak Park Substation. The environmental, social, and economic conditions described in Chapter 3 would continue, unaffected by the construction and operation of the transmission line. If the transmission line was not constructed, generators could be used to meet the electrical power requirements of the mine. The DEQ's approval of the Montanore Project, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands. The conditions under which the permitting lead agencies could select the No Action Alternative, or deny the transmission line certificate, are described in section 1.6, *Agency Roles, Responsibilities, and Decisions*.

2.8 Alternative B—MMC's Proposed Transmission Line (North Miller Creek Alignment Alternative)

2.8.1 Alignment and Structure Type

The Ramsey Plant Site's electrical service would be 230-kV, 3-phase, 60-cycle, provided by a new, overhead transmission line. MMC would be responsible for funding construction of the transmission line, substation, and loop line that would connect the substation to the Noxon-Libby 230-kV transmission line. MMC's proposed transmission line alignment would be in the watersheds of the Fisher River, Miller Creek, an unnamed tributary to Miller Creek, Midas Creek, Libby Creek, and Ramsey Creek (Figure 41). The proposed alignment would head northwest from the substation for about 1 mile paralleling US 2, and then follow the Fisher River and US 2 north 3.3 miles. The alignment would then turn west and generally follow the Miller Creek drainage for 2.5 miles, and then turn northwest and traverse up a tributary to Miller Creek. The alignment would then cross into the upper Midas Creek drainage, and then down to Libby Creek. The alignment would cross the low ridge between Libby Creek and Ramsey Creek, and then generally follow Ramsey Creek to the Ramsey Plant Site. The maximum annual energy consumed by the project is estimated at 406,000 megawatts, using a peak demand of 50 megawatts.

The characteristics of MMC's proposed North Miller Creek Alignment Alternative and the lead agencies' three other transmission line alignment alternatives are summarized in Table 36. A comparison of the mitigation and modifications the agencies made to MMC's proposal is presented in Table 37. MMC's proposed alignment (Alternative B) would end at a substation at the Ramsey Plant Site; the lead agencies' alternatives (Alternatives C-R, D-R, and E-R) would end at a substation at the Libby Plant Site. Alternative B, and the other three transmission line alternatives, would require a KFP amendment. This required amendment is discussed in section 2.12*, Forest Plan Amendment.*

Estimated transmission line construction costs range from $7.3 million for Alternative B to $5.5 million for Alternative C-R. Cost estimates are based on preliminary design and material costs in 2012 (Table 36). High steel costs would make the steel monopoles proposed in Alternative B considerably more expensive than the wooden H-frame structures proposed in the other alternatives. The lower cost of wooden H-frame structures in Alternatives C-R, D-R, and E-R would offset the cost of helicopters to set structures and clear timber in these alternatives. Estimated mitigation costs of the agencies' alternatives are about $11 million.

2.8.2 Substation Equipment and Location

Two substations would be required. One substation would be used to tap the Noxon-Libby 230-kV transmission line and supply power to the mine site over a new 230-kV transmission line. BPA's proposed Sedlak Park Substation Site at the Noxon-Libby 230-kV transmission line is in an area known locally as Sedlak Park, 30 miles southeast of Libby on US 2 (Figure 42). At the Ramsey Plant Site, a second, 150-foot by 300-foot substation would be built (Figure 5) to distribute electricity through lower voltage lines to equipment in various locations at the Ramsey Plant Site, the Libby Adit Site, the Little Cherry Creek Tailings Impoundment site, and within the underground mine.

Table 36. Characteristics of Transmission Line Alignment Alternatives.

Characteristic	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
Length (miles)[†]				
Steel Monopole	16.4	0.0	0.0	0.0
Wooden monopole	0.0	0.0	0.0	0.5
Wooden H-frame	0.0	13.1	13.7	14.6
Total	16.4	13.1	13.7	15.1
Number of structures[‡]	108	80	91	104
Average span length (ft.)	799	862	793	767
Helicopter use				
Structure placement	Contractor's discretion	26 structures, primarily in Miller Creek and Midas Creek drainages	16 structures, primarily in Miller Creek and Howard Creek drainages	31 structures, primarily in West Fisher Creek and Howard Creek drainages
Vegetation clearing	Contractor's discretion	4.8 miles at selected locations; see Figure 44	2.5 miles at selected locations; see Figure 44	4.3 miles at selected locations; see Figure 44
Line stringing	Contractor's discretion	Yes, entire line	Yes, entire line	Yes, entire line
Annual inspection	Yes	Yes	Yes	Yes
Estimated cost in millions $[§]				
Construction	$7.3	$5.4	$5.4	$6.6
Mitigation	$3.9	$10.8	$10.8	$10.8

[†]Length is based on line termination at the Ramsey Plant Site in Alternative B and the Libby Plant Site in the other three alternatives.
[‡]Number and location of structures based on preliminary design and may change during final design. The lead agencies' analysis of MMC's preliminary design and structure locations indicates additional structures and access may be needed to avoid long spans.
[§]Estimated cost used reasonable assumptions regarding costs of construction materials, clearing, land acquisition, and engineering. Final cost could vary from those shown. Estimated construction cost by HDR Engineering, Inc. 2012; estimated mitigation cost by KNF (2015).

Table 37. Comparison of Mitigation in Transmission Line Alternatives.

Feature/Resource	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
		New Access Road Management		
New roads on National Forest System Lands	Soiled and reseeded after construction; used as necessary for maintenance; decommissioned at closure	Placed in intermittent stored service after construction; used as necessary for maintenance; decommissioned at closure	Same as Alternative C-R	Same as Alternative C-R
New roads on Plum Creek lands	Soiled and reseeded after construction; gated and used as necessary for maintenance	Same as Alternative B	Same as Alternative B	Same as Alternative B
New roads on other private land	None	Soiled and reseeded after construction; gated and used as necessary for maintenance	Same as Alternative C-R	Same as Alternative C-R
		Vegetation Management		
Right of Way Width	100 feet; danger trees outside the right-of-way removed as necessary; analysis assumed 150-foot clearing width	150 feet; danger trees outside the right-of-way removed as necessary; analysis assumed 200-foot clearing width	Same as Alternative C-R	Same as Alternative C-R except for short section of monopoles with a 100-foot right-of-way
Vegetation Clearing	Vegetation removed	Prepare and implement Vegetation Clearing and Removal Plan; minimize heavy equipment use in RHCAs	Same as Alternative C-R	Same as Alternative C-R
Helicopter Use for Vegetation Clearing	At contractor's discretion	In areas adjacent to core grizzly bear habitat (4.8 miles)	Same as Alternative C-R (2.5 miles)	Same as Alternative C-R (4.3 miles)

Feature/Resource	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
Seed Mixes	Interim and permanent seed mixes with native and introduced species	Permanent seed mix with native species only, if commercially available	Same as Alternative C-R	Same as Alternative C-R
Timber Production on Lands Covered by FWP Conservation Easement	Not proposed	Convey title or a conservation easement to FWP to 91 acres of private land adjacent to the easement; acquired lands or easements would be added to the existing conservation easement	Same as Alternative C-R	Same as Alternative C-R on 94 acres
Wildlife see Table 8 for additional mitigation for the mine				
Old Growth	Not specified	Designate 29 acres of effective or replacement old growth on National Forest System lands	Designate 12 acres of effective or replacement old growth on National Forest System lands	Designate 6 acres of effective or replacement old growth on National Forest System lands
Snags (Cavity Habitat)	Not specified	Leave snags in clearing area, unless required to be removed for safety reasons	Same as Alternative C-R	Same as Alternative C-R
Down Wood Habitat	Not specified	Leave up to 30 tons per acre of coarse woody debris within clearing area on National Forest System lands and State lands	Same as Alternative C-R	Same as Alternative C-R

Feature/Resource	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
Big Game Security	Construction would not occur during winter on big-game winter range (assumed to be December 1 and April 30)	See proposed road access changes in Table 8. No transmission line construction or decommissioning in elk, white-tailed deer, or moose winter range between December 1 and April 30 unless approved by the agencies. No waiver of winter range timing restrictions would be approved on National Forest System or State trust lands where the grizzly bear mitigations would apply.	Same as Alternative C-R	Same as Alternative C-R
Bald Eagle	Not specified	Either not clear vegetation or conduct construction activities during breeding season in bald eagle habitat or fund or conduct surveys to locate active nests in appropriate habitat. Follow timing restrictions in the Montana Bald Eagle Management Plan for any identified active nests. Construct transmission line according to recommendations outlined in Reducing Avian Collisions with Power Lines (APLIC 2012) and Suggested Practices for Raptor Protection on Power Lines (APLIC 2006)	Same as Alternative C-R	Same as Alternative C-R
Western Toad	Not specified	Retain shrub habitat in wetlands and riparian areas	Same as Alternative C-R	Same as Alternative C-R

Feature/Resource	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
Migratory Birds	Not specified	Fund or conduct monitoring of landbird populations annually on two, standard Region One monitoring transects within the Crazy and Silverfish PSUs. Construct transmission line according to recommendations outlined in Reducing Avian Collisions with Power Lines (APLIC 2012) and Suggested Practices for Raptor Protection on Power Lines (APLIC 2006)	Same as Alternative C-R	Same as Alternative C-R
Grizzly Bear				
Road and Trail Access changes	See proposed road access changes in Table 8	See proposed road access changes in Table 8	Same as Alternative C-R	Same as Alternative C-R
Land Acquisition for Physical Disturbance	Acquire 68 acres; part of land acquisition described in Table 8	Secure or protect replacement grizzly bear habitat of 26 acres in the CYE	Secure or protect replacement grizzly bear habitat of 40 acres in the CYE	Secure or protect replacement grizzly bear habitat of 30 acres in the CYE
Timing Restriction for Short-term Displacement Effects on the Grizzly Bear	No motorized activity associated with construction from April 1 to June 15 within bear habitat in the Miller Creek and Midas Creek drainages	All activities on National Forest System and State trust lands for both construction seasons and during decommissioning of the transmission line between June 16 and October 14	Same as Alternative C-R	Same as Alternative C-R

The BPA would design, construct, own, operate, and maintain the Sedlak Park Substation and loop line. The BPA is prohibited by law from directly serving the mine; Flathead Electrical Cooperative would be the retailer of power to the mine project. MMC would be responsible for funding construction of the transmission line, substation, and loop line that would connect the substation to the Noxon-Libby 230-kV transmission line. The proposed location of Sedlak Park Substation is common to the four transmission line alternatives. Sedlak Park Substation construction would require disturbing 2 acres. The substation would be near US 2 and require a short access road from US 2 (Figure 42). The access road from US 2 would be designed and constructed to MDT standards.

The substation site would be fenced. The area surrounding the substation would be graveled and kept free of vegetation. No water would be required at the Sedlak Park Substation site, and toilet facilities would be self-contained. The Sedlak Park Substation would be designed to exclusively serve the mine. No additional lines have been proposed to enter or leave the Sedlak Park Substation.

2.8.3 Line and Road Construction Methods

The construction of the proposed transmission line would follow the sequence of: 1) centerline surveyed and staked; 2) right-of-way cleared and access roads built; 3) work areas cleared and leveled as needed; 4) foundations installed, and transmission line structures erected and installed; 5) ground wire, conductors, and ground rods installed, and 6) the site would be cleaned up and reclaimed. Construction of the line is expected to take 2 years.

2.8.3.1 Surveying

Construction survey work would consist of establishing a centerline location, specific pole locations, right-of-way boundaries, work area boundaries, and access roads to work areas. The specified right-of-way boundaries, work areas, access roads, and other features would be marked with painted laths or flags. Markers would be maintained until final cleanup and/or reclamation was completed, after which they would be removed.

2.8.3.2 Access Road Construction and Use

Where possible, roads currently open year-round would be used for construction access. Roads currently closed either seasonally or year-round would only be opened for construction access where necessary. Where seasonally closed roads would be used, efforts would be made to minimize their use during the periods when these roads would otherwise be closed. Alternative B would require the use of roads currently closed with a barrier with no administrative use. Table 38 lists those roads with a change in road status in Alternative B.

Roads opened or constructed for transmission line access on National Forest System lands would be closed after the transmission line was built. The road surface would be reseeded as an interim reclamation activity designed to stabilize the surface. Where soil had been salvaged from new roads, the road surface would be covered with soil and then reseeded. The prism of new roads would remain during mine operations. Management of newly constructed roads on Plum Creek land would depend on the easement agreement between Plum Creek and MMC. For purposes of analysis, the lead agencies assumed newly constructed roads on Plum Creek land would be gated after line construction to allow Plum Creek or State access.

Table 38. Proposed Change in Road Status for Roads used in Alternative B.

Road #	Road Name	Location	Existing Status	Length (miles)
14403	Lower Ramsey	Between Libby and Ramsey creeks	Barriered year-long to motor vehicles, open to snow vehicles December 1 through March 30	0.5
4725	North Fork Miller Creek	Miller Creek Tributary	Gated year-long to motor vehicles, including snow vehicles	4.2
4773	Howard Midas Creek	East of Howard Lake	Barriered year-long to motor vehicles, open to snow vehicles December 1 through March 30	1.1
4777	Lower Midas - Howard Lake	East of Howard Lake	Barriered year-long to motor vehicles, open to snow vehicles December 1 through March 30	0.8
4778	Midas Howard Creek	Midas Creek	Barriered year-long to motor vehicles, including snow vehicles	0.7
4778P	Midas Howard Creek P	Between Midas Creek and Howard Lake	Barriered year-long to motor vehicles, including snow vehicles	0.3
4781	Ramsey Creek	Ramsey Creek	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	2.4
6210	Libby Ramsey	Libby Creek	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	1.0

Existing roads would be used for construction access where possible and new roads or spurs would be built only where necessary (Figure 41). New roads would be 12 feet wide and cleared of all trees and shrubs. In the agencies' analysis in Chapter 3, total roadway width, including cuts and fills, was assumed to be 25 feet. Wood refuse and cleared shrubs would be placed on the downhill edge of the road for erosion control. A road within the right-of-way would be required for line stringing operations across side slopes greater than 10 percent. MMC anticipates that no drainage would be provided for the new roads, but would follow the agencies' guidance if installation of culverts were required. No motorized activity associated with transmission line construction would occur from April 1 to June 15 within bear habitat in the Miller Creek and Midas Creek drainages. Construction would not occur during the winter in big-game winter range areas, which the agencies assumed to be December 1 through April 30. Estimated access road lengths required for each alternative are shown in Table 39.

Improvement of existing roads would be required in some areas to allow access of construction equipment into the transmission line corridor. Upgrades could include widening, lengthening of culverts, placing fill on or near stream banks, clearing, and regrading. Final design plans detailing the location of work areas and new and existing access roads would be submitted to the lead agencies for approval before construction.

MMC identified four possible stream crossing methods in constructing and upgrading roads: fords, culverts, arches, and bridges. MMC anticipates that culverts would be the most commonly used crossing method. BMPs outlined in "Water Quality BMPs for Montana Forests" (Logan 2001) would be followed. Erosion-control BMPs, such as the installation of water bars and dips would be implemented during construction and improvement of access roads. Special

Table 39. Miles of Open, Closed, and New Access Roads Required for Transmission Line Construction.

Road Type	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
Open road	20.6	21.9	16.8	12.8
Closed road	11.1	14.2	10.4	13.4
Extensive upgrade required	0.3	0.0	0.0	0.7
Other closed roads	10.8	14.2	10.4	12.7
New road	9.9	3.1	5.1	3.2
Total	42.0	38.6	31.5	28.6

Source: GIS analysis by ERO Resources Corp. using MMC and HDR Engineering data.

considerations could occur in the design and installation of culverts in waters that contain fish or support fisheries habitat. Based on a preliminary design, MMC anticipates requiring new stream crossings of new access roads at six locations: five in an unnamed tributary of Miller Creek, and one in Ramsey Creek. Additional stream crossings may be needed during timber clearing, and line stringing, if a helicopter were not used. Disturbance on active floodplains would be minimized to reduce sedimentation of streams during annual runoff. Construction activities would be restricted or curtailed during heavy rains or high winds to prevent erosion and soil loss. MMC's proposed Environmental Specifications for the 230-kV transmission line (MMI 2005b) contain additional measures to minimize effects of transmission line and access road construction.

2.8.3.3 Vegetation Clearing

Before any vegetation clearing at the substation site, the BPA would acquire a Montana general stormwater permit from the DEQ. The BPA would clear all trees at the Sedlak Park Substation Site, which would include the 2-acre substation and short access road from US 2 to the substation. Trees within the up to 300-foot right-of-way of the loop line also would be cleared. The BPA would conduct a noxious weed survey at the proposed Sedlak Park Substation Site before and after construction of the substation. It also would revegetate all disturbed areas outside of the access road prism and substation yard.

For the new 230-kV transmission line to the mine, most construction activity would be contained in the 100-foot right-of-way for steel monopole structures (Figure 43) with major exceptions being access road construction and conductor pulling and stringing. General right-of-way clearing would be governed by safety, reliability, environmental, and cost considerations. A 100-foot right-of-way would be cleared as necessary and additional tree clearing outside the 100-foot right-of-way would be necessary to prevent trees from falling into the line, or fires from flashovers where trees were too close to the conductor. For analysis purposes, the lead agencies have assumed the proposed line would require a maximum of 150 feet of clearing along the entire alignment (Figure 43). Some areas within the 150-foot clearing area would not require clearing, such as within high spans across valleys. Actual acreage cleared would be less and would depend on tree height, slope and line clearance above the ground. Clearing would produce a "feathered" edge on the right-of-way clearing, with the width of right-of-way clearing varying along the line. Trees within the right-of-way would be removed to provide a minimum of 18 feet clearance between the vegetation and the conductor. Trees that would extend within 18 feet of the conductors within 5 years also would be removed. Other trees on or off the right-of-way that could fall into the line would be removed. In some areas, such as steep drainages, trees beneath the line would not be cleared if sufficient clearance existed between the line and the tree. Merchantable timber would be measured, purchased from the KNF, and then salvaged from the right-of-way; cleared smaller trees and brush would be burned or chipped. Non-merchantable trees and slash would be piled into windrows (using a brush blade to minimize soil accumulation) and burned. MMC did not specify the type of vegetation clearing that would be used. For analysis purposes, the lead agencies assumed all vegetation clearing would be completed conventionally without the use of a helicopter.

2.8.3.4 Foundation Installation

Excavations for foundations would be made with power auger equipment. Where the soil allowed, a vehicle-mounted power auger would be used. The foundation excavation and installation requires equipment access to the foundation sites. If rocky areas were encountered, foundations may require blasting. The foundation excavation and installation would require access to the site by a power auger or drill, a crane, material trucks, and ready-mix trucks. Concrete for use in constructing foundations would be obtained from commercial sources or from a remote batch plant on private land, depending on contractor needs.

Foundation holes left open or unguarded would be covered and/or fenced where practical to protect the public and wildlife. Soil removed from foundation holes would be stockpiled on the work area and used to backfill holes. All remaining soil not needed for backfilling would be spread on the work area. Concrete trucks would wash their chute debris into a depression in the permanent disturbance area at the pole site and soil from the foundation excavation would be used to cover the chute debris.

Where bedrock was encountered while excavating structure holes, a rock drill and compressor would be used to drill the rock. A hole would be blasted using explosives. Blasting would not expand the area needed for operations around the hole, but would increase the amount and duration of associated construction activity. It also would slightly affect the sequence and schedule of operations around those holes, extending the amount of time that the structures remain at the site before they can be set.

2.8.3.5 Structure Installation

MMC would use steel monopole structures a maximum of 95 feet high along the 100-foot right-of-way (Figure 43; Table 40). The distance between structures would vary from less than 200 feet to more than 2,000 feet, depending on the alignment selected and terrain crossed (Figure 41; Table 40). The lead agencies' analysis of MMC's preliminary design and structure locations indicates additional structures and access may be needed to avoid long spans and to achieve the proposed structure height. The cor-ten steel structures would be built to provide low reflectivity and long life. Cor-ten steel develops a stable rust-like appearance if exposed to the weather for several years. Tree clearing also would vary depending on span length and tree and structure height. MMC would work with the lead agencies to optimize structure height and span length to

Table 40. Comparison of H-frame and Monopole Structures.

Design Element	H-Frame	Monopole
Right-of-Way Width (ft)	150	100
Estimated Clearing Width (ft)	200	150
Peak current loading (amps)	125	125
Nominal Voltage (volts)	230,000 (230-kV)	230,000 (230-kV)
Conductor Size	795 kcmil Drake	795 kcmil Drake
Conductor Type	ACSR	ACSR
Overhead Ground Wire (Approximate)	1 3/8-inch-dia galvanized and 1 Optical ground wire	Optical ground wire (diameter of <0.433 inches)
Electric field at edge of right-of-way at 3 ft above ground level (kV/m)	0.52	0.62
Magnetic field at edge of right-of-way (mG)	3.2	1-conductor side: 4.0 2-conductor side: 4.2
Typical Structure Height above Ground (ft)	74.5	83.5[†]
Minimum Ground Clearance of Conductor (ft at 212º F)[‡]	25	25
Typical Structure Base Dimensions	2 poles, 2 foot x 2 foot	1 pole, 17.33 inch diameter
Total land temporarily disturbed for conductor reel and pole storage yards (acres)	Similar to monopole	Up to 3.5

[†]Additional structures and access may be needed to avoid long spans and to achieve the proposed structure height.
[‡]Minimum ground clearance used in developing preliminary plan and profiles; actual ground clearance would vary.
ACSR = aluminum core steel reinforced; Kcmil = 1,000 circular mils; kV = Kilovolts;
kV/m = kilovolts per meter; mG = milligauss
Source: MMI 2005b; Power Engineers 2005; HDR Engineering, Inc. 2007.

minimize concerns over tree clearing and visual considerations along any approved alignment and centerline.

Ground disturbance necessary for some pulling and tensioning sites may extend up to 100 feet beyond the right-of-way boundary where the line makes a significant angle. These sites usually require an area up to 40 feet by 150 feet. The proposed alignment would require 13 of these sites.

Structure construction activity is expected to occur within 30 feet of the holes where the structures were installed. Activities conducted outside the 30-foot radius would include pole assembly, framing conductor supports and establishing an operating location for the crane. The optimal crane operating conditions require that the crane be as close to the hole as possible but because of uneven terrain at certain sites, cribbing with timbers under the crane outriggers would be necessary to level the crane. The need for the crane to be outside of the 30-foot radius would probably be the exception. Temporary construction yards may be necessary and would be located on existing disturbed areas or other areas on private lands along the line alignment.

2.8.3.6 Line Stringing

Once structures were in place, a pilot line would be pulled (strung) from structure to structure and threaded through the stringing sheaves on each structure. A larger diameter, stronger line would then be attached to the pilot line. This is called the pulling line, and one pulling line is connected to a conductor or overhead ground wire. Each conductor or ground wire is then pulled through the sheaves in succession and held under tension until connected to the insulators. This process would be repeated until all the ground wires and conductors were pulled through all sheaves. Conductor splicing would be required at the end of a conductor spool or if a conductor were damaged during stringing. The work would occur on work areas for the structures or pulling/tensioning sites. Conductors would be strung using powered pulling equipment at one end and powered braking or tensioning equipment at the other end. For public protection during wire installation, guard structures would be erected over roadways, transmission lines, structures, and other obstacles. Guard structures consist of temporary H-frame structures placed on either side of an obstacle.

Helicopters may be necessary to assist in the construction of the line where ground access was not possible or where the contractor decided it would be cost effective. In such cases, helicopters would be used to bring equipment to structure sites, place transmission structures, and string the conductor. This method of construction would replace the need for small portions of access roads in these locations, and would eliminate vehicle access to the structures to perform maintenance activities. Maintenance in these structure locations would be limited to helicopter access and maintenance or pedestrian access. Ground disturbance associated with the use of helicopter construction would include work areas for each structure site measuring about 15 feet by 15 feet, depending on the topography of the site. All necessary equipment would be lowered from a helicopter to allow foundation installation and structure setting. Vegetation would be removed and the work area would be graded by hand to flatten as needed for the safe operation of equipment and access by work crews. In the lead agencies' analysis of the North Miller Creek Alternative (Alternative B) in Chapter 3, no helicopter use to construct structures was assumed. Helicopter use was assumed for line stringing as helicopter use is expected to be less expensive than conventional ground stringing. Helicopter use for line stringing would take about 10 days.

Three conductors with a horizontal spacing of about 20 feet and a vertical spacing of 6.5 feet are proposed. A fiber optic static wire for protection against lightning strikes and communication would be located at the top of each structure 17 feet above the top conductor.

2.8.4 Operations, Maintenance, and Reclamation

The line would be designed and operated to comply with applicable standards. MMC would adhere to its proposed Environmental Specifications for the 230-kV transmission line regarding construction, operations, maintenance, and decommissioning activities (MMI 2005b). To minimize the potential for bird collisions or electrocution, the line would be constructed according to recommendations outlined in Reducing Avian Collisions with Power Lines (APLIC 2012) and Suggested Practices for Raptor Protection on Power Lines (APLIC 2006).

Following construction, land within the right-of-way and other disturbed areas outside of the right-of-way, such as tensioning sites, that had been rutted, compacted, or disturbed would be reclaimed. Access roads would be regraded, scarified, and seeded. All permanent cut-and-fill slopes on maintenance roads would be seeded, fertilized, and stabilized with hydromulch, netting, or other methods. Drive-through dips, open-top box culverts, waterbars, or crossdrains would be installed on maintenance roads to prevent erosion. Unauthorized traffic would be blocked with appropriate structures.

Monitoring at monthly intervals during the growing season would be conducted along the right-of-way and access roads to detect the invasion of spotted knapweed or other noxious weeds. Spotted knapweed plants found on areas disturbed by the project would be treated by spot spraying individual plants. Herbicides would be carried in tanks mounted on vehicles or in backpack tanks. Herbicide spray would be applied only when wind velocity was less than 8 miles per hour to prevent wind drift. No herbicides would be applied within 25 feet of water bodies. All herbicide applications would comply with all applicable state and federal regulations.

The BPA would pre- and post-construction weed surveys at the Sedlak Park Substation and treat weeds caused by substation construction. The BPA would be responsible for weed control at the substation during operations and decommissioning. All herbicide applications would comply with all applicable state and federal regulations.

Inspection and repair of the line would be conducted by helicopter. Line inspections would be conducted annually to assess structural integrity and to identify maintenance needs; additional inspections may be needed after a fire or ice storm. MMC estimates a line crew would access the line about 5 days per year for maintenance of hardware and removal of trees. MMC would rely on the BPA followed by Flathead Electrical Cooperative and then MMC's own resources for installation, maintenance, repairs, and inspections.

Hazard trees that would interfere with or fall into the transmission line or associated facilities would be identified during routine maintenance inspections. Targeted trees and tall shrubs would be removed in a non-motorized manner. Clearing of danger trees and tall shrubs would continue until the line was decommissioned. Slash would be lopped and scattered evenly throughout the surrounding terrain. Stumps would be cut to less than 1 foot tall, and lopped slash would be left as close to the ground as possible.

Land use in the right-of-way normally would not be restricted except for those activities that interfere with the line operation and maintenance. Line operation would not require any permanent employees, although MMC would have a trained fire crew and would cooperate with the KNF and local fire departments in controlling forest fires in the area.

MMC expects the transmission line facilities would be the last facilities reclaimed following mine closure. Newly constructed roads needed for construction of the transmission line would be soiled and reseeded immediately after construction was completed. Because the access roads would rarely be used following construction, MMC anticipates these roads would have stabilized naturally or by MMC through interim reclamation. The substation at the plant site would be removed. MMC would remove all other transmission line equipment at closure, such as structures, insulators, line, and other hardware from the right-of-way. All concrete foundations/footers would be broken up and buried in place. Poles and other structures would be dismantled and sold, scraped, and/or disposed of off-site. After the transmission line was removed, all newly constructed roads on National Forest System lands would be bladed and recontoured to match existing topography, obliterating the road prism. Management of newly constructed roads on Plum Creek land after the transmission line was removed would depend on the easement agreement between Plum Creek and MMC. Alternative B would not require any road use on State lands. Where culverts were removed, stream banks would be recontoured and reseeded. Native shrubs, such as alder or willow, would be planted on stream banks to reduce bank erosion during high streamflow.

The BPA would dismantle the substation and remove the loop line following mine closure, assuming it had no need for the facilities. The substation and access road would be revegetated after materials had been removed from the site.

2.9 Alternative C-R—Modified North Miller Creek Transmission Line Alternative

2.9.1 Issues Addressed

This alternative includes modifications to MMC's transmission line proposal described in Alternative B. This alternative could be selected with any of the mine alternatives. For analysis purposes, this alternative would terminate at the Libby Plant Site. This alignment was modified between the Draft EIS and the Supplemental Draft EIS, and further modified between the Supplemental Draft EIS and the Final EIS. Both modifications were in response to public comment to reduce effect on private property. The alignment was modified between the Supplemental Draft EIS and the Final EIS so a 2-mile segment would cross the Fisher River about 800 feet north of the alignment presented in the Supplemental Draft EIS.

The agencies developed two primary alignment modifications to MMC's proposed North Miller Creek alignment in Alternative B. One modification would route the line on an east-facing ridge immediately north of the Sedlak Park Substation instead of following the Fisher River. This modification addresses issues associated with water quality and aquatic life (Issues 2 and 3) by reducing the crossing of soils that are highly erosive soils and those with potential for high sediment delivery. This modification also addresses the issue of scenic quality (Issue 4) by reducing the visibility of the line from US 2. Fewer residences would be within 0.5 mile of the line. The other alignment modification, which would use an alignment up and over a ridge between West Fisher Creek and Miller Creek, would increase the use of public land and reduce the use of private land. During final design, MMC would submit a final Vegetation Removal and Disposition Plan for lead agencies' approval. The plan's goal would be to minimize vegetation clearing, particularly in riparian areas.

The agencies modified MMC's proposed Environmental Specifications to incorporate current transmission line construction practices. The agencies' Environmental Specifications, shown in Appendix D, would be implemented to guide line construction, operations, maintenance, and decommissioning activities in all of the agencies' transmission line alternatives. The agencies' Environmental Specifications also include sensitive areas where special measures would be taken to reduce impacts during construction and reclamation activities. Sensitive areas include wetlands; riparian areas; bull trout critical habitat; old growth habitat; core grizzly bear habitat; bald eagle primary use areas; areas with high risk of bird collisions; big game winter range; visually sensitive and high visibility areas; and cultural and paleontological resources. Additional areas for monitoring may be identified following the preconstruction monitoring trip by the agencies or preconstruction surveys by MMC.

BPA's plans for the Sedlak Park Substation Site would be the same as Alternative B.

2.9.2 Preconstruction Surveys

In Alternative C-R, MMC would complete, before any ground-disturbing activities, an intensive cultural resources survey and a jurisdictional wetland delineation on all areas proposed for disturbance for any areas where such surveys have not been completed and that would be disturbed by the alternative. Similarly, MMC would complete a survey for threatened, endangered, or Forest sensitive plant species on National Forest System lands for any areas that would be disturbed by a transmission line alternative where such surveys have not been completed or for any species listed since 2005. MMC also would update surveys in suitable habitat for threatened, endangered, and state-listed plant species potentially occurring on non-National Forest System lands. The survey results would be submitted to the agencies for approval. If wetlands, cultural resources or species of concern were identified and adverse effects could not be avoided, MMC would develop appropriate mitigation plans for the agencies' approval. The mitigation would be implemented before any ground-disturbing activities. To the extent feasible, MMC would make adjustments to structure and road locations, and other disturbing activities to reduce impacts.

2.9.3 Alignment and Structure Type

The substation would be as proposed by BPA at Sedlak Park. From the substation, the alignment would traverse an east-facing ridge immediately north northwest of the substation, and would cross Hunter Creek 2 miles north northwest of the substation. After crossing Hunter Creek, the alignment would head west, crossing US 2, the Fisher River, West Fisher Creek, and NFS road #231 (Libby Creek Road). The alignment then would head northwest, up and over the ridge between West Fisher Creek and Miller Creek. The alignment would then follow an unnamed tributary of Miller Creek and then cross into the upper Midas Creek drainage, and then down into the Libby Creek drainage, ending at a substation at the Libby Plant Site (Figure 44).

MMC would use the same general methods to operate, maintain, and reclaim the line and access roads as Alternative B. Wooden H-frame structures would be used instead of the steel monopoles proposed by MMC in the North Miller Creek Alternative. The lead agencies selected wooden H-frame structures to reduce structure height. H-frame structures also would provide for longer span lengths and consequently would require fewer structures and access roads (Table 36). Using H-frame structures would require more right-of-way and tree clearing (Figure 43). To eliminate the need to use or construct roads that may affect core grizzly bear habitat, 26 structures in the Miller Creek, Midas Creek, and Howard Creek drainages would be constructed using a helicopter (Figure 44).

The centerline of the alignment for Alternative C-R would be near existing or proposed residences at two locations: near the Fisher River and US 2 crossing north of Hunter Creek (Section 32, Township 27N, Range 29 West) and near the Miller Creek crossing (Section 22, Township 27N, Range 30 West). Montana regulations allow the final centerline to vary by up to 250 feet of the centerline (ARM 17.20.301 (21)) unless there is a compelling reason to increase or decrease this distance. During final design, MMC would minimize effects on private land by keeping the centerline at least 200 feet from these residences, unless no practicable alternative existed, to be determined in cooperation with the agencies, and implementing the measures for sensitive areas described in the Environmental Specifications for the 230-kV transmission line (Appendix D).

After a more detailed topographic survey was completed, MMC would complete a detailed visual assessment of the alignment at these locations. Based on the assessment, MMC would locate the transmission line through existing open areas in the forest, where feasible, and incorporate into the Vegetation Removal and Disposition Plan measures to minimize vegetation clearing and clearing visibility from residences through modification of pole height, span length, and vegetation growth factor. The quantity and location of poles to be installed by helicopter would be modified as necessary to minimize access roads visible from private property and Howard Lake.

Based on a preliminary design, four structures would be in a RHCA on National Forest System lands and three structures would be in a riparian area on private lands. During final design, MMC would locate these structures outside of riparian areas if the agencies determined alternative locations were technically and economically feasible.

2.9.4 Line and Road Construction Methods

2.9.4.1 Vegetation Clearing

Vegetation would be cleared in the same manner as Alternative B with the following changes. During final design and submittal of an amended Plan of Operations and permit application before the Construction Phase, MMC would submit a final Vegetation Removal and Disposition Plan for lead agencies' approval (see section 2.5.2.5.2, *Vegetation Removal and Disposition Plan* in the Alternative 3 discussion). The plan would apply to all National Forest System lands covered by the Plan of Operations and all State and private lands covered by the transmission line certificate. It would not apply to private lands affected by the substation and loop line. One of the plan's goals would be to minimize vegetation clearing, particularly in riparian areas. The plan would identify areas where clearing would be avoided, such as deep valleys with high line clearance, and measures that would be implemented to minimize clearing. It would evaluate the use of monopoles to reduce clearing in select areas, such as old growth. The plan also would evaluate the potential uses of vegetation removed from disturbed areas, and describe disposition and storage plans during life of the line. For example, the growth factor used to assess which trees would require clearing could be reduced in sensitive areas, such as RHCAs, from 15 years to 5 to 8 years. Reducing the growth factor could reduce clearing width, but increase maintenance costs. Heavy equipment use in RHCAs would be minimized. Shrubs in RHCAs and in the line of sight between the line and private land would be left in place unless they had to be removed for safety reasons. Vegetation management in riparian areas on private lands would be decided by MMC and the private landowner. Sediment and runoff from all disturbed areas would be minimized through the use of BMPs developed in accordance with the Forest Service's *National Best Management Practices for Water Quality Management on National Forest System Lands* (USDA Forest Service 2012a).

All activities on National Forest System and State trust lands during both construction seasons and decommissioning of the transmission line would occur between June 16 and October 14. The mitigation would not apply to State lands managed by the Montana Department of Transportation.

Most construction activity would be contained in the 150-foot right-of-way with major exceptions being access road construction. For analysis purposes, the lead agencies have assumed the proposed line would require a maximum of 200 feet of clearing along the entire alignment (Figure 43). In areas adjacent to core grizzly bear habitat (4.8 miles), MMC would use a helicopter to clear timber, reducing the need for access roads (Figure 44). A helicopter also may be used to remove timber from steep areas, such as north of West Fisher Creek. As described above, helicopters would be used for structure construction in some segments. Line construction would require up to two construction seasons of helicopter use, but would occur for one season for any particular line segment. The total duration of helicopter use for each line segment would be about 2 months for one construction season. Conventional vegetation clearing techniques would be used in other areas. Merchantable timber would be transported to designated landings or staging areas, and branches and tops would be removed and piled. Helicopter landing sites would generally be on roads (Figure 44). The KNF would be responsible for disposing of the piles. Non-merchantable material would be left within the transmission line clearing area, and would be lopped and scattered. Large woody debris would be left as necessary to comply with the wildlife mitigation described below (see section 2.9.6.1, *Down Wood Habitat*).

Ground disturbance necessary for some pulling and tensioning sites may extend up to 100 feet beyond the right-of-way boundary where the line makes a significant angle. These sites usually require an area up to 40 feet by 150 feet. Alternative C-R would require 18 of these sites.

The FWP holds a conservation easement on some lands owned by Plum Creek where the transmission line may be located. The easement was partially funded by the Forest Legacy Program for the purpose of preventing the land from being converted to non-forest uses. One of the stated purposes of the conservation easement is to "preserve and protect in perpetuity the right to practice commercial forest and resource management." Before the agencies authorize the start of the transmission line construction, MMC would convey title or a conservation easement to FWP to 91 acres of private land adjacent to the FWP conservation easement. Final acquisition requirements would be determined during final design of the transmission line. MMC would follow any FWP requirements for conveyance. Acquired lands or easements would be added to the existing conservation easement.

2.9.4.2 Access Road Construction and Use

New roads would be constructed, and currently gated roads would be upgraded, similar to Alternative B. Estimated access road requirements are shown on Figure 44. A final Road Management Plan described in Alternative 3 (section 2.5.2.3.2, *Plan Development, Updates and Implementation*) would be developed and implemented for Alternatives C-R, D-R, and E-R. Any new, gated, or barriered road used for construction and decommissioning of the transmission line would be restricted from all motorized access with a gate or earthen barrier prior to the general hunting season. If construction access roads onto US 2 were necessary, an encroachment permit would be required before entering MDT right-of-way.

In Alternative C-R, installation of culverts, bridges, or other structures at perennial stream crossings would be specified by the agencies following on-site inspections with DEQ, Forest Service, FWP, landowners, and local conservation districts. Installation of culverts or other structures in a water of the United States would be in accordance with any U.S. Army Corps of Engineers 404 and DEQ 318 permit conditions. Work in streams within the transmission line corridor would be in accordance with MFSA certificate requirements. All culverts would be sized according to Revised Hydraulic Guide (KNF 1990) and Parrett and Johnson (2004). Where new culverts were installed, they would be installed so water velocities or positioning of culverts would not impair fish passage. Stream crossing structures would be able to pass the 100-year flow event without impedance.

In all transmission line alternatives, roads built for the installation of the transmission line would be needed for future reclamation of the line. The KNF would change the status of new transmission line roads on National Forest System lands to intermittent stored service after line installation was completed. Intermittent stored service roads would be closed to motorized traffic and would be treated so they would cause little resource risk if maintenance were not performed on them during the operation period of the mine and before their future need. They would not be used for routine maintenance of the transmission line, but could be used for emergency repairs, such as a damaged insulator. Intermittent stored service roads would require some work to return them to a drivable condition. Intermittent stored service road treatments would include:

- Conducting noxious weed surveys and performing necessary weed treatments before storage activities
- Blocking entrance to road prism
- Removing culverts determined by the KNF to be high-risk for blockage or failure; laying back stream banks at a width and angle to allow flows to pass without scouring or ponding so that revegetation has a strong chance of success
- Installing cross drains so the road surface and inside ditch would not route any intercepted flow to ditch-relief or stream-crossing culverts
- Removing and placing unstable material at a stable location where stored material would not present a future risk to watershed function
- Replacing salvaged soil and revegetating with grasses in treated areas and unstable roadway segments to stabilize reduce erosion potential

New transmission line roads on National Forest System lands would be decommissioned after closure of the mine and removal of the transmission line. Decommissioned roads would be removed from service and would receive a variety of treatments to minimize the effects on other resources. In addition to all the intermittent stored service road treatments, a decommissioned road would be treated by one or more of the following measures:

- Conducting noxious weed surveys and performing necessary weed treatments before decommissioning
- Removing any remaining culverts and removing or bypassing relief pipes as necessary
- Stabilizing fill slopes
- Fully obliterating road prism by restoring natural slope and contour; restoring all watercourses to natural channels and floodplains
- Revegetating road prism
- Installing water bars or outsloping the road prism
- Removing unstable fills

Newly constructed roads on Plum Creek lands would be gated after construction. Road management would depend on the easement agreement between the Plum Creek and MMC. Alternative C-R would not require roads or structures on any other private land other than Plum Creek. Newly constructed roads on State land would be gated after construction and managed in accordance with an easement agreement between the DNRC and MMC. Alternative C-R would require the use of roads currently barriered with no administrative use. Table 41 lists those roads with a change in road status in Alternative C-R.

Table 41. Proposed Change in Road Status for Roads used in Alternative C-R.

Road #	Road Name	Location	Existing Status	Length (miles)
4725	North Fork Miller Creek	Miller Creek Tributary	Gated year-long to motor vehicles, including snow vehicles	4.0
4726	Miller Creek Ridge	South of Miller Creek	Gated year-long to motor vehicles, including snow vehicles	2.3
4726F	Miller Creek Ridge F	South of Miller Creek	Gated year-long to motor vehicles, including snow vehicles	1.3
6210	Libby Ramsey	Libby Creek	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	1.0
8770	4W Ranch (Cactus Wade)	East of Fisher River	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.4
8773	Wade's Back Entry	East of Fisher River	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.2
99760	Brulee-Hunter 99760	Hunter Creek	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	1.1
99806	Wade-Kenelty D 99806	Fisher River	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	3.1
99806D	Wade-Kenelty D 99806D	Fisher River	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.3
99830	West Fisher 99830	West Fisher Creek	Barriered year-long to motor vehicles, including snow vehicles	0.6

2.9.4.3 Line Stringing

A helicopter would be used for line and ground wire stringing in Alternative C-R. Completed segments of the line would be strung at the end of the construction season. The duration of helicopter use for line stringing would be the same as Alternative B (about 10 days).

2.9.5 Operations, Maintenance, and Reclamation

As in Alternative B, annual inspection of the line would be conducted by helicopter in the other transmission line alternatives. Roads placed in intermittent stored service or decommissioned would not be used for routine maintenance of the transmission line, but could be used for emergency repairs, such as a damaged insulator. Increased helicopter use would be required to conduct routine maintenance and line decommissioning. Clearing of danger trees would continue until the line was decommissioned. All vegetation clearing in core grizzly bear habitat would be completed without motorized access.

2.9.6 Wildlife Mitigation Measures

Mitigation common to both the mine and transmission line alternatives is discussed in section 2.5.7, *Mitigation Plans* under Mine Alternative 3. Some monitoring described for Mine Alternative 3 also would apply to transmission line alternatives (see section 2.5.6, *Monitoring Plans*). Except where noted, all wildlife mitigation measures would be implemented during construction of the transmission line.

2.9.6.1 Down Wood Habitat

MMC would leave large woody material for small mammals and other wildlife species within the cleared transmission line corridor on National Forest System and State lands. The mitigation would not apply to State lands managed by the Montana Department of Transportation. Woody material would be scattered and not concentrated within the clearing area. Piece size should exceed 3 inches in diameter, and preference would be for a down "log" to be at least 8 feet in length with a small-end diameter of 6 inches or more. This material would originate from existing logs on site, unused portions of designated cut trees, broken tops, or similar materials. This mitigation would be incorporated into the Vegetation Removal and Disposition Plan. Monitoring of woody material would be implemented through a timber sale contract. The following amounts of coarse woody debris (CWD) would be left:

- Vegetative Response Unit (VRU) 1: leave 5 to 9 tons (6 to 14 logs) per acre of CWD on site after timber clearing
- Vegetative Response Unit (VRU) 2 and 9: leave 10 to 15 tons (15 to 20 logs) per acre of CWD on site after timber clearing
- Vegetative Response Unit (VRU) 3, 4, and 5: leave 15 to 30 tons (23 to 30 logs) per acre of CWD on site after timber clearing

2.9.6.2 Sensitive Species and Other Species of Interest

2.9.6.2.1 Bald Eagle

MMC would either: 1) not clear vegetation or conduct other construction activities during the breeding season (February 1 to August 15) in potential bald eagle nesting habitat or; 2) fund or conduct field and/or aerial reconnaissance surveys to locate any new bald eagle or osprey nests along specific segments of the transmission line corridor in Alternatives C-R, D-R, and E-R. Surveys would be conducted between March 15 and April 30, one nesting season immediately before transmission line construction. The survey could be integrated into the current monitoring of the KNF's Libby Ranger District, or could be contracted by MMC. Transmission line segments to be surveyed by alternative would be:

- Alternative C-R: from Sedlak Park Substation in Section 9, Township 26N, Range 29 West to the western edge of Section 31, Township 27N, Range 29 West in West Fisher Creek
- Alternative D-R: from Sedlak Park Substation in Section 9, Township 26N, Range 29 West to the western edge of Section 31, Township 27N, Range 29 West in West Fisher Creek; and from the northern end of Section 19, Township 27N, Range 30 West to the northern edge of Section 13, Township 27N, Range 31 West, which is the area to the east and northeast of Howard Lake
- Alternative E-R: from Sedlak Park Substation in Section 9, Township 26N, Range 29 West to the western edge of Section 4, Township 26N, Range 30 West in West Fisher Creek; and from the northern end of Section 19, Township 27N, Range 30 West to the northern edge of Section 13, Township 27N, Range 31 West, which is the area to the east and northeast of Howard Lake

If an active nest were found, guidelines from the Montana Bald Eagle Management Plan (Montana Bald Eagle Working Group 2010) would be followed to provide management guidance for the immediate nest site area (Zone 1), the primary use area (Zone 2), and the home range area (Zone 3) as long as they were in effect. This would include delineating a 0.25-mile buffer zone for the nest site area, along with a 0.5-mile buffer zone for the primary use area. High intensity activities, such as heavy equipment use, would not be permitted during the nesting season (February 1 to August 15) within these two zones. The USFWS guidelines would be followed if the Montana Bald Eagle Management Plan guidelines are not in effect.

MMC committed to constructing the transmission line according to recommendations outlined in Reducing Avian Collisions with Power Lines (APLIC 2012) and Suggested Practices for Raptor Protection on Power Lines (APLIC 2006). Specific recommendations that would be implemented are described for migratory birds in section 2.9.6.4, *Migratory Birds*.

The agencies' Environmental Specifications (Appendix D) include additional monitoring and mitigation not described in MMC's Environmental Specifications. As described in Appendix D, areas of high risk for bird collisions where line-marking devices may be needed, such as the Fisher River crossing, and recommendations for type of marking device would be identified through a study conducted by a qualified biologist and funded by MMC.

2.9.6.2.2 Western Toad

In transmission line Alternatives C-R, D-R, or E-R, all shrub habitat would be retained in wetlands and riparian areas crossed by the proposed transmission line. Wetlands avoidance, minimization, and mitigation and avoidance measures also would ensure that impacts on western toad breeding habitat were minimized.

2.9.6.3 Elk, White-tailed Deer, and Moose Winter Habitat

MMC would not conduct transmission line construction or decommissioning activities in elk, white-tailed deer, or moose winter range between December 1 and April 30. These timing restrictions may be waived in mild winters if MMC could demonstrate that snow conditions were not limiting the ability of these species to move freely throughout their range. MMC must receive a written waiver of these timing restrictions from the KNF, DEQ, and FWP before conducting construction or decommissioning activities in elk, white-tailed deer, or moose winter range between December 1 and April 30. Timing restrictions would not apply to substation construction. Grizzly bear mitigations in the agencies' alternatives include restrictions on the timing of transmission line construction and decommissioning. These restrictions would apply to NFS and State trust lands. This grizzly bear mitigation would require that MMC be restricted to June 16 to October 14 for conducting transmission line construction and decommissioning. No waiver of winter range timing restrictions would be approved on National Forest System or State trust lands where the grizzly bear mitigations would apply.

2.9.6.4 Migratory Birds

MMC committed to constructing the transmission line according to recommendations outlined in Reducing Avian Collisions with Power Lines (APLIC 2012) and Suggested Practices for Raptor Protection on Power Lines (APLIC 2006). MMC would ensure the following recommendations would be implemented:

During Construction

- Provide 60-inch minimum horizontal separation between energized conductors and/or energized conductors and grounded hardware.
- Provide 36-inch minimum vertical separation between energized conductors and/or energized conductors and grounded hardware.
- Insulate hardware or conductors against simultaneous contact where adequate spacing not possible. If transformers, cutouts, or other energized or grounded equipment were present on the structure, then jumpers, cutouts, and bushings should be covered to decrease the chance of a bird electrocution.
- Covering conductors may be necessary at times if adequate separation of conductors, or conductors and grounded parts, could not be achieved. On three phase structures, the cover should extend a minimum of 3 feet from the pole top pin insulator.
- Discourage birds from perching in unsafe locations by installing bird perch guards (triangles) or triangles with perches.
- Increase the visibility of conductors or shield wires where necessary to prevent avian collisions. This may include installation of marker balls, bird diverters, or other line visibility devices placed in varying configurations, depending on line design and location. Areas of high risk for bird collisions where such devices may be needed, such as major drainage crossings, and recommendations for type of marking device would be identified through a study conducted by a qualified biologist and funded by MMC.

During Operations

- Replace or modify a structure where there has been a documented problem with a nest site or an avian electrocution. This may include the installation of elevated perches (or nesting platforms in the case of osprey).

2.9.7 Other Modifications and Mitigation

The agencies modifications to MMC's proposed Environmental Specifications, shown in Appendix D, would be implemented to guide line construction, operations, maintenance, and decommissioning activities. Modifications described in Alternative 3 for the mine, such as affording Native American Tribes the opportunity to monitor any ground disturbing activities, revising seed mixtures (Table 26), modifying revegetation success criteria, implementing measures to protect visual resources, and revising weed control, would be implemented in Alternative C-R.

2.10 Alternative D-R—Miller Creek Transmission Line Alternative

2.10.1 Issues Addressed

This alternative includes modifications to MMC's transmission line proposal regarding H-frame structures, helicopter use, vegetation clearing, road construction and post-construction management, line stringing, operations, maintenance, and reclamation, and seed mixtures described in Alternative C-R. This alternative could be selected with any of the mine alternatives. For analysis purposes, this alternative would terminate at the Libby Plant Site. This alignment was modified between the Draft EIS and the Supplemental Draft EIS, and further modified between the Supplemental Draft EIS and the Final EIS. Both modifications were in response to public comment to reduce effect on private property. The alignment was modified between the Supplemental Draft EIS and the Final EIS so a 2-mile segment would cross the Fisher River about 800 feet north of the alignment presented in the Supplemental Draft EIS.

As in the Modified North Miller Creek Alternative (Alternative C-R), this alternative modifies MMC's proposed North Miller Creek alignment by routing the line on an east-facing ridge immediately north of the Sedlak Park Substation (Figure 44). This modification would address issues associated with water quality and aquatic life (Issues 2 and 3) by crossing less area with soils that are highly erosive soils and those with potential for high sediment delivery. The issue of scenic quality (Issue 4) was addressed by this modification by reducing the visibility of the line from US 2. Fewer residences would be within 0.5 mile of the line. Another modification, developed following comment on the Draft EIS, was to use the same alignment as Alternative C-R into the Miller Creek drainage, and then along NFS road #4724 on the south side of Miller Creek. This modification would increase the use of public land and reduce the use of private land. The issue of effects on threatened or endangered wildlife species (Issue 5) was addressed by routing the alignment along Miller Creek and avoiding core grizzly bear and lynx habitat in Miller Creek and the unnamed tributary of Miller Creek. Other alignment modifications, which would use an alignment up and over a ridge between West Fisher Creek and Miller Creek and move the alignment from private land near Howard Lake, would increase the use of public land and reduce the use of private lands.

This alternative would use an alignment about 0.5 mile east of Howard Lake, a popular recreation facility in the project area. In the 1992 Final EIS, a similar alignment was considered, but was eliminated in part because of visual concerns from Howard Lake. The issue of scenic quality from Howard Lake was addressed by using H-frame structures, which would be shorter than steel monopoles. In addition, screening vegetation has grown taller between the lake and the alignment in the intervening 20 years. More detailed engineering was completed for the alternatives analyzed in this EIS, and H-frame structures would be used to minimize the visibility of the line from Howard Lake (Issue 4).

As in Alternative C-R, a helicopter would be used for vegetation clearing and structure construction in some locations. New access roads on National Forest System lands would be managed in the same manner as Alternative C-R. These modifications would address issues associated with water quality, aquatic life, threatened and endangered species, and wildlife (Issues 2, 3, 5, and 6) by reducing clearing and wildlife displacement associated with new access roads. The issues addressed by the modifications and mitigation measures are summarized in Table 42. Chapter 3 contains a more detailed discussion of how the modifications and mitigating measures would reduce or eliminate environmental impacts.

Table 42. Response of Alternative D-R Modifications and Mitigations to Issues.

Key Issue	Alignment	Structure Type	Construction Techniques
Issue 1-Acid Rock Drainage and Metal Leaching			
Issue 2-Water Quality and Quantity	✓	✓	✓
Issue 3-Aquatic Life	✓	✓	✓
Issue 4-Visual Resources	✓	✓	✓
Issue 5-Threatened or Endangered Wildlife Species	✓	✓	✓
Issue 6-Wildlife	✓	✓	✓
Issue 7-Wetlands and Streams			

2.10.2 Alignment and Structure Type

The substation would be as proposed by BPA at Sedlak Park. From the substation, the alignment would follow the same alignment as Alternative C-R until the alignment crossed the ridge between West Fisher Creek and Miller Creek (Figure 44). After departing from the Modified North Miller Creek alignment, this alternative would follow NFS road #4724 (South Fork Miller Creek Road) to a ridge separating Miller Creek from the Standard Creek drainage. The alignment would traverse the ridge into the Howard Creek drainage. The centerline would be about 500 feet east of the northeast corner of a private land parcel about 0.5 mile south of Howard Lake (Figure 44). North of the private land, the alignment would generally parallel Howard Creek and eventually be the same as the Modified North Miller Creek alignment.

The lead agencies selected wooden H-frame structures to reduce structure height. H-frame structures also provide for longer span lengths and consequently fewer structures and access roads (Table 36). Using H-frame structures would require more right-of-way and tree clearing (Figure 43). To minimize the need to use or construct roads that may affect core grizzly bear habitat, a helicopter would be used for structure construction at 16 locations in the Miller Creek and Howard Creek drainages (Figure 44). Other mitigation described in Alternative C-R would be incorporated into Alternative D-R.

The centerline of the alignment for Alternative D-R would be near existing residences at three locations: near the Fisher River and US 2 crossing north of Hunter Creek (Section 32, Township 27N, R. 29 West), in the Standard Creek drainage (Section 29, Township 27N, R. 30 West), and southeast of Howard Lake (Section 19, Township 27N, R. 30 West). Montana regulations allow the final centerline to vary by up to 250 feet of the centerline (ARM 17.20.301 (21)) unless there is a compelling reason to increase or decrease this distance. During final design, MMC would minimize effects on private land by keeping the centerline at least 200 feet from these residences and implementing the measures for sensitive areas described in the Environmental Specifications for the 230-kV transmission line (Appendix D).

After a more detailed topographic survey was completed, MMC would complete a detailed visual assessment of the alignment at these locations, plus at the locations east and southeast of Howard Lake. Based on the assessment, MMC would locate the transmission line through existing open areas in the forest, where feasible, and incorporate into the Vegetation Removal and Disposition

Plan measures to minimize vegetation clearing and clearing and transmission line visibility from residences and Howard Lake through modification of pole height, span length, and vegetation growth factor. The quantity and location of poles to be installed by helicopter would be modified as necessary to minimize access roads visible from private property and Howard Lake.

Based on a preliminary design, six structures would be in a RHCA on National Forest System lands and three structures would be in a riparian area on private lands. During final design, MMC would locate these structures outside of riparian areas if the agencies determined alternative locations were technically and economically feasible.

2.10.3 Line and Road Construction Methods

2.10.3.1 Access Road Construction and Use

New roads would be constructed, and currently gated roads would be upgraded, similar to Alternative B. Estimated access road requirements are shown on Figure 44. MMC would develop and implement a final Road Management Plan. In Alternative D-R, new access roads on National Forest System, State, and Plum Creek lands would be managed in the same manner as Alternative C-R. Alternative D-R would require the use of roads currently barriered with no administrative use. Table 43 lists those roads with a change in road status in Alternative D-R.

2.10.3.2 Vegetation Clearing

Vegetation would be cleared in the same manner as Alternative B with the modifications of Alternative C-R incorporated. A helicopter would be used to remove timber from 2.4 miles of line in core grizzly bear habitat. A helicopter also may be used to remove timber from steep areas, such as north of West Fisher Creek. BPA's plans for the Sedlak Park Substation Site would be the same as Alternative B. Most construction activity would be contained in the 150-foot right-of-way with major exceptions being access road construction. For analysis purposes, the lead agencies have assumed the proposed line would require a maximum of 200 feet of clearing along the entire alignment (Figure 43). In areas adjacent to core grizzly bear habitat, MMC would use a helicopter to clear vegetation, reducing the need for access roads. Helicopter landing sites would generally be on roads (Figure 44).

Ground disturbance necessary for some pulling and tensioning sites may extend up to 100 feet beyond the right-of-way boundary where the line makes a significant angle. These sites usually require an area up to 40 feet by 150 feet. Alternative D-R would require 19 of these sites.

As discussed for Alternative C-R, MMC would convey title or a conservation easement to FWP to 91 acres of private land adjacent to the FWP conservation easement.

Table 43. Proposed Change in Road Status for Roads used in Alternative D-R.

Road #	Road Name	Location	Existing Status	Length (miles)
4724	South Fork Miller Creek	Miller Creek and South Fork Miller Creek	Barriered year-long to motor vehicles, including snow vehicles	0.2
4726	Miller Creek Ridge	South of Miller Creek	Gated year-long to motor vehicles, including snow vehicles	2.3
4726F	Miller Creek Ridge F	South of Miller Creek	Gated year-long to motor vehicles, including snow vehicles through March 31	1.3
6210	Libby Ramsey	Libby Creek	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.9
8770	4W Ranch (Cactus Wade)	East of Fisher River	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.4
8773	Wade's Back Entry	East of Fisher River	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.2
99760	Brulee-Hunter 99760	Hunter Creek	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	1.1
99806	Wade-Kenelty D 99806	Fisher River	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	3.1
99806D	Wade-Kenelty D 99806D	Fisher River	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.3
99830	West Fisher 99830	West Fisher Creek	Barriered year-long to motor vehicles, including snow vehicles	0.8

2.10.4 Other Modifications and Mitigation

Modifications described in Alternative 3 for the mine or Alternative C-R for the transmission line (*e.g.*, conducting cultural resources, wildlife, plant, and wetland surveys; implementing wildlife mitigation; conveying land or conservation easement on lands adjacent to FWP's conservation easement; affording Native American Tribes the opportunity to monitor any ground disturbing activities, revising seed mixtures (Table 26), modifying revegetation success criteria, implementing measures to protect visual resources, and revising weed control) would be implemented in Alternative D-R.

2.11 Alternative E-R—West Fisher Creek Transmission Line Alternative

2.11.1 Issues Addressed

This alternative includes modifications to MMC's transmission line proposal regarding H-frame structures, helicopter use, road construction and post-construction management, line stringing, operations, maintenance, and reclamation, and seed mixtures described in Alternative C-R. Some steel monopoles would be used in the steep section 2 miles west of US 2 (Figure 44). This alternative could be selected with any of the mine alternatives. For analysis purposes, the lead agencies assumed this alternative would terminate at the Libby Plant Site. This alignment was modified between the Draft EIS and the Supplemental Draft EIS, and further modified between the Supplemental Draft EIS and the Final EIS. Both modifications were in response to public comment to reduce effect on private property. The alignment was modified between the Supplemental Draft EIS and the Final EIS so a 2-mile segment would cross the Fisher River about 800 feet north of the alignment presented in the Supplemental Draft EIS.

Like the Modified North Miller Creek Alternative, this alternative modifies MMC's proposed North Miller Creek Alternative by routing the line on an east-facing ridge immediately north of the Sedlak Park Substation. This modification would address issues associated with water quality (Issue 2) by crossing less area with soils that are highly erosive soils and those with potential for high sediment delivery. The issue of scenic quality (Issue 4) was addressed by this modification by reducing the visibility of the line from US 2. Fewer residences would be within 0.5 mile of the line.

The primary difference between the West Fisher Creek Alternative (Alternative E-R) and the North Miller Creek Alternative (Alternative B) is routing the line on the north side of West Fisher Creek and not up the Miller Creek drainage to minimize effects on core grizzly bear habitat. As in Alternative D-R, this alternative would use an alignment about 0.5 mile east of Howard Lake, a popular recreation facility in the project area; H-frame structures would minimize visibility from the lake.

Wooden H-frame structures, which generally allow for longer spans and require fewer structures and access roads, would be used on this alternative in most locations to minimize the visibility of the line from Howard Lake (Issue 4). In some locations, a helicopter would be used for vegetation clearing and structure construction. New access roads on National Forest System lands would be managed in the same manner as Alternative C-R. These modifications would address issues associated with water quality, aquatic life, threatened and endangered species, and wildlife (Issues 2, 3, 5, and 6) by reducing clearing and wildlife displacement associated with new access roads. The issues addressed by the modifications and mitigation measures are summarized in Table 44. Chapter 3 contains a more detailed discussion of how the modifications and mitigating measures would reduce or eliminate environmental impacts.

Table 44. Response of Alternative E-R Modifications and Mitigations to Issues.

Key Issue	Alignment	Structure Type	Construction Techniques
Issue 1-Acid Rock Drainage and Metal Leaching			
Issue 2-Water Quality and Quantity	✓	✓	✓
Issue 3-Aquatic Life	✓	✓	✓
Issue 4-Visual Resources	✓	✓	✓
Issue 5-Threatened or Endangered Wildlife Species	✓	✓	✓
Issue 6-Wildlife	✓	✓	✓
Issue 7-Wetlands and Streams			

2.11.2 Alignment and Structure Type

The substation would be as proposed by BPA at Sedlak Park. From the substation, the alignment would follow the same alignment as Alternative C-R until just north of Hunter Creek (Figure 44). After departing from the Modified North Miller Creek alignment, this alternative would cross the Fisher River and West Fisher Creek and follow West Fisher Creek until its confluence with Standard Creek. It would follow a small tributary to West Fisher Creek, and would eventually be the same as the Miller Creek alignment.

The lead agencies selected wooden H-frame structures to reduce structure height along most of the West Fisher Creek alignment. H-frame structures also provide for longer span lengths and consequently fewer structures and access roads (Table 36). Using H-frame structures would require more right-of-way and tree clearing (Figure 43). Some steel monopoles would be used in steep areas 2 miles west of US 2. To minimize the need to use or construct roads that may affect core grizzly bear habitat, 32 structures along West Fisher Creek would be constructed using a helicopter (Figure 44). Other mitigations described in Alternative C-R would be incorporated into Alternative E-R.

The centerline of the alignment for Alternative E-R would be near existing residences at four locations: near the Fisher River and US 2 crossing north of Hunter Creek (Section 32, Township 27N, R. 29 West), along West Fisher Creek (Section 2, Township 26N, R. 30 West), in the Standard Creek drainage (Section 29, Township 27N, R. 30 West), and southeast of Howard Lake (Section 19, Township 27 N., Range 30 West). Montana regulations allow the final centerline to vary by up to 250 feet of the centerline (ARM 17.20.301 (21)) unless there is a compelling reason to increase or decrease this distance. During final design, MMC would minimize effects on private land by keeping the centerline at least 200 feet from these residences, unless no practicable alternative existed, to be determined in cooperation with the agencies, and implementing the measures for sensitive areas described in the Environmental Specifications for the 230-kV transmission line (Appendix D).

After a more detailed topographic survey was completed, MMC would complete a detailed visual assessment of the alignment at these locations, plus at the locations east and southeast of Howard Lake. Based on the assessment, MMC would locate the transmission line through existing open areas in the forest, where feasible, and incorporate into the Vegetation Removal and Disposition Plan measures to minimize vegetation clearing and clearing visibility from residences and Howard Lake through modification of pole height, span length, and vegetation growth factor. The quantity and location of poles to be installed by helicopter would be modified as necessary to minimize access roads visible from private property and Howard Lake.

Based on a preliminary design, eight structures would be in a RHCA on National Forest System lands and nine structures would be in a riparian area on private or State lands. During final design, MMC would locate these structures outside of riparian areas if the agencies determined alternative locations were technically and economically feasible.

2.11.3 Line and Road Construction Methods

2.11.3.1 Access Road Construction and Use

New roads would be constructed, and currently gated roads would be upgraded, similar to Alternative B. Estimated access road requirements are shown on Figure 44. MMC would develop and implement a final Road Management Plan. New access roads on National Forest System, State, and Plum Creek lands in Alternative E would be managed in the same manner as Alternative C-R. Alternative E-R would require the use of roads currently barriered with no administrative use. Table 45 lists those roads with a change in road status in Alternative E-R.

Table 45. Proposed Change in Road Status for Roads used in Alternative E-R.

Road #	Road Name	Location	Existing Status	Length (miles)
231A	Libby Creek Fisher River A	North of West Fisher Creek	Barriered year-long to motor vehicles, including snow vehicles	0.4
231B	Libby Creek Fisher River B	North of West Fisher Creek	Gated year-long to motor vehicles, including snow vehicles	0.9
4724	South Fork Miller Creek	Miller Creek and South Fork Miller Creek	Barriered year-long to motor vehicles, including snow vehicles	0.2
4782	Standard Creek - Miller Creek	East of Standard Creek	Gated year-long to motor vehicles, including snow vehicles	1.4
4782A	Standard Creek - Miller Creek A	East of Standard Creek	Impassable	0.5
4782A	Standard Creek - Miller Creek A	East of Standard Creek	Gated year-long to motor vehicles, including snow vehicles	0.9
5326	Standard Creek - Miller Creek Oldie	East of Standard Creek	Barriered year-long to motor vehicles, including snow vehicles	0.7
6210	Libby Ramsey	Libby Creek	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.9
8770	4W Ranch (Cactus Wade)	East of Fisher River	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.4
8773	Wade's Back Entry	East of Fisher River	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.2
99760	Brulee-Hunter 99760	Hunter Creek	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	1.1
99806	Wade-Kenelty D 99806	Fisher River	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	3.1
99806D	Wade-Kenelty D 99806D	Fisher River	Gated year-long to motor vehicles, open to snow vehicles 12/1-3/31	0.3
99844	West Fisher 99844	West Fisher Creek	Gated year-long to motor vehicles, including snow vehicles	0.2
99845	West Fisher 99845	West Fisher Creek	Gated year-long to motor vehicles, including snow vehicles	0.2

2.11.3.2 Vegetation Clearing

Vegetation would be cleared in the same manner as Alternative B with the modifications of Alternative C-R incorporated. A helicopter would be used to remove timber from 4.3 miles of line in core grizzly bear habitat. A helicopter also may be used to remove timber from steep areas, such as north of West Fisher Creek. BPA's plans for the Sedlak Park Substation Site would be the same as Alternative B. Most construction activity would be contained in the 150-foot right-of-way with major exceptions being access road construction. For analysis purposes, the lead agencies have assumed the proposed line would require a maximum of 200 feet of clearing along most of the alignment (Figure 43). The right-of-way would be 100 feet and the clearing width would be 150 feet in steep areas 2 miles west of US 2 where steel monopoles would be used. In areas adjacent to core grizzly bear habitat, MMC would use a helicopter to clear timber, reducing the need for access roads (Figure 44). Helicopter landing sites would generally be on roads (Figure 44).

Ground disturbance necessary for some pulling and tensioning sites may extend up to 100 feet beyond the right-of-way boundary where the line makes a significant angle. These sites usually require an area up to 40 feet by 150 feet. Alternative E-R would require 18 of these sites.

As discussed for Alternative C-R, MMC would convey title or a conservation easement to FWP to 94 acres of private land adjacent to the FWP conservation easement.

2.11.3.3 Line Stringing

A helicopter would be used for line stringing in Alternative E-R.

2.11.4 Other Modifications and Mitigation

Modifications described in Alternative 3 for the mine or Alternative C-R for the transmission line (*e.g*., conducting cultural resources, wildlife, plant, and wetland surveys; implementing wildlife mitigation; conveying land or conservation easement on lands adjacent to FWP's conservation easement; affording Native American Tribes the opportunity to monitor any ground disturbing activities, revising seed mixtures (Table 26), modifying revegetation success criteria, implementing measures to protect visual resources, and revising weed control) would be implemented in Alternative E-R.

2.12 Forest Plan Amendment

Each mine and transmission line alternative would require an amendment to the KFP in order for the alternative to be consistent with the KFP. The amendment would reallocate certain areas from one Management Area to another. In transmission line Alternatives B, C-R, D-R, and E-R, the KNF also would amend the KFP by allowing the ORD to exceed the KFP standard in the Crazy PSU during and after the project, and by allowing the ORD to exceed the KFP standard in the Silverfish PSU during transmission line construction. The amendment would be completed in accordance with the regulations governing Forest Plan amendments found in 36 CFR 219 and FSM 1921.03. The analysis disclosed in this EIS satisfies the requirements for an evaluation for the amendment. The amendments are described in the following sections.

2.12.1 Mine Facilities

In the 1993 ROD approving the lead agencies' preferred alternative for NMC's proposed Montanore Project, the KNF amended the KFP and reallocated an area surrounding the Little Cherry Creek Tailings Impoundment Site and the Ramsey Plant Site to Management Area 31 (MA 31). MA 31 is designed to accommodate the activities associated with mineral development on the KNF (USDA Forest Service 1987a). All areas currently proposed for disturbance at the Ramsey Plant Site and the Little Cherry Creek Tailings Impoundment Site were not previously reallocated to MA 31 due to mapping technology and a slight change in the Little Cherry Creek Tailings Impoundment design from that approved in 1993. In mine Alternatives 2, 3, and 4, the KNF would amend the KFP by reallocating to MA 31 all areas within the operating permit areas of the selected plant site, the tailings impoundment, and LAD Areas 1 and 2 that currently are not MA 31. In addition, a proposed road and facility corridor that would cross MA 13 (Designated Old Growth) would be reallocated to MA 31. The KFP amendment also would allow for increased ORD in MA 12, 15, 16, 17, and 18 in the Crazy PSU, where road densities currently exceed KFP standards (see section 3.25.3.3, *White-tailed Deer*). This amendment would apply only to National Forest System lands disturbed by any mine alternative, and would not apply to private lands affected by the mine alternatives. The effects of the amendment are discussed in section 3.15.4, *Environmental Consequences* in the Land Use section. Maps showing existing MAs and the proposed reallocation are available at the KNF.

2.12.2 230-kV Transmission Line

2.12.2.1 Reallocation to and from Management Area 23

In the 1993 ROD approving the lead agencies' preferred alternative for NMC's proposed Montanore Project, the KNF amended the KFP and reallocated areas crossed by the transmission line classified as corridor avoidance areas (224 acres) to Management Area 23 (MA 23). MA 23 is designed to accommodate the activities associated with electrical transmission corridors on the KNF (USDA Forest Service 1987a). All areas currently proposed for disturbance by MMC's proposed transmission line alignment classified as corridor avoidance areas were not reallocated to MA 23 due to mapping technology and slight changes in the North Miller Creek transmission line alignment from that approved in 1993. In transmission line Alternatives B, C-R, D-R, and E-R, the KNF would amend the KFP by reallocating certain areas within a 500-foot corridor of the selected 230-kV transmission line on National Forest System lands as MA 23. This amendment would apply only to certain National Forest System lands currently not MA 23 disturbed by any transmission line alternative, and would not apply to private or State lands crossed by the transmission line alternatives. The effects of the amendment are discussed in section 3.15.4, *Environmental Consequences*, in the *Land Use* section. The amendment would apply to the following MAs if crossed by the transmission line under the conditions described:

- MA 10 and 11 if the proposed corridor was within grizzly bear Management Situation 1 or 2 (see section 3.25.5.2, *Grizzly Bear*)
- MAs 2, 6, 12, 13, and 14

All transmission line alternatives would include the reallocation of MA 12 in a 500-foot corridor along the transmission line to MA 23. Alternatives B, C-R, D-R and E-R would reallocate MA 12 to MA 23 within the Silverfish PSU. Within the Crazy PSU, no MA 12 is located within the 500-foot corridor of Alternatives B or C-R. Alternatives D-R and E-R would reallocate MA 12 to MA 23 within the 500-foot corridor.

2.12.2.2 Amendment to Allow for Increased Open Road Density in Management Areas 12, 15, 16, 17, and 18

In the Silverfish PSU, where new or opened roads associated with the combined mine-transmission line alternatives would be outside the 500-foot transmission line corridor, a KFP amendment to allow for increased ORD in MA 12 would be necessary because road densities currently exceed KFP standards (see section 3.25.2.3, *Elk*). The KFP amendment also would allow for increased ORD in MA 12, 15, 16, 17, and 18 in the Crazy PSU, where road densities currently exceed KFP standards as well (see Section 3.25.3.3, *White-tailed Deer*). KFP amendments for increases in ORD would be needed for Alternatives 2B, 3C-R and 4C-R, 3E-R, and 4E-R during transmission line construction and operations, and for Alternatives 3D-R and 4D-R during transmission line construction.

2.13 Alternatives Analysis and Rationale for Alternatives Considered but Eliminated

2.13.1 Development of Alternatives

The alternatives development process was designed to identify a reasonable range of alternatives for detailed analysis in the EIS. The agencies developed alternatives in accordance with the requirements of NEPA, MEPA, MFSA, and Section 404 of the Clean Water Act. To develop a reasonable range of alternatives, the lead agencies separated the proposed Montanore Project into components. *Components* are discrete activities or facilities (*e.g*., plant site or tailings impoundment) that, when combined with other components, form an alternative. The agencies identified options for each component. An *option* is an alternative way of completing an activity, or an alternative geographic location for a facility (component), such as alternative geographic locations for a tailings impoundment or transmission line, or an alternative method of tailings disposal, such as paste tailings. Options generate the differences among alternatives. An alternative is a complete project that has all the components necessary to fulfill the project purpose and need. The lead agencies considered options for the following project components:

- Underground mine
- Tailings disposal, including backfilling and surface disposal
- Plant site and adits
- LAD Areas
- Access road
- Transmission line

The Corps and the EPA must follow the 404(b)(1) Guidelines (40 CFR 230) (Guidelines) in permitting the discharge of dredged and fill material into wetlands and waters of the U.S. The Montanore mineral deposit itself is not located within regulated waters of the United States. The deposit would be mined by underground mining methods, and the mine would not result in the discharge of dredged or fill material into waters of the U.S. It is the location of the ancillary surface facilities, such as the tailings impoundment, that would result in a regulated discharge. The Corps requested that the lead agencies address the Guidelines in their alternatives analysis. A 404(b)(1) analysis is in Appendix L. MMC is responsible for demonstrating compliance with the Guidelines. An alternative is practicable under the Guidelines if “it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes” [40 CFR 230.3(q), 230.10(a)(2)]. According to the Guidelines, an alternative can be eliminated if it:

1. Does not meet the project purpose and need
2. Is not available
3. Is not capable of being done because of cost

4. Is not capable of being done because of existing technology

5. Is not capable of being done because of logistics

The analysis of underground mine, tailings disposal, and plant site and adit alternatives is described in detail in the *Tailings Disposal Alternatives Analysis* (ERO Resources Corp. 2011a) and summarized in the following sections. Also described in the following sections is the agencies' analysis of LAD Areas, access road, and transmission line options and an evaluation of alternatives consistent with the KFP.

2.13.2 Regulatory Changes

The agencies' analysis of alternative component options incorporated a number of regulatory changes that occurred since the 1992 Montanore Project Final EIS was issued. The KNF also amended the KFP to accommodate the original Montanore Project and other changes to the KFP. The lead agencies' alternatives analysis conducted for MMC's proposal incorporated these changes. The lead agencies evaluated potential sites for a tailings impoundment within a 10-mile radius of a plant site in either Ramsey Creek or Libby Creek. Sites outside a 10-mile radius were not considered practicable because of long tailings transport distances, large elevational differences between the mill and the impoundment, and potential crossing of perennial streams. The resources affected by the regulatory changes within a 10-mile radius of a plant site in either Ramsey Creek or Libby Creek for purposes of siting an impoundment are discussed briefly in the following sections.

2.13.2.1 Inland Native Fish Strategy

In 1995, the KNF amended the KFP to adopt the Inland Native Fish Strategy (INFS) (USDA Forest Service 1995). INFS established stream, wetland, and landslide-prone area protection zones called RHCAs, and set standards and guidelines for managing activities that potentially affect conditions within the RHCAs. Standard widths for defining interim RHCAs were based on four categories of streams. For example, for fish-bearing streams, which comprise nearly all the streams in the Montanore Project analysis area, the interim RHCAs consist of the outer edge of the 100-year floodplain, the outer edge of riparian vegetation, the distance equal to the height of two site-potential trees, or 600 feet, including both sides of the stream channel, whichever is greater. INFS also established RMOs that provide guidance with respect to key habitat variables. Section 3.6, *Aquatic Life and Fisheries* discusses INFS and RHCAs in greater detail. RHCAs in a 10-mile radius of a plant site in either Ramsey Creek or Libby Creek for purposes of siting an impoundment are shown in Figure 45. Although RHCAs were not established when the 1992 Final EIS was completed, both the MAC Report and the 1992 Final EIS analysis considered effects on streams and their associated habitats as important resources in facility siting.

2.13.2.2 Grizzly Bear

The Montanore Project analysis area is within the Cabinet-Yaak Grizzly Bear Recovery Zone. In 2004, the USDA Forest Service issued a ROD on forest plan amendments in the Idaho Panhandle, Kootenai, and Lolo National Forests for motorized access management within the Selkirk and Cabinet-Yaak Grizzly Bear Recovery Zones (Access Amendment) (USDA Forest Service 2004). In 2006, a federal district judge set aside the Access Amendment EIS and ROD. The Forest Service issued a Final Supplemental EIS on the Access Amendment (USDA Forest Service

2011a) and a ROD in 2011 (USDA Forest Service 2011b). The Access Amendment provides motorized access and security guidelines for grizzly bear management within the Selkirk and Cabinet-Yaak recovery zones. Currently, grizzly bear standards are established by the KFP, as amended by the 2011 Access Amendment, and management needs identified by Harms (1990). The 2011 Access Amendment Biological Opinion provided an incidental take statement related to grizzly bears occurring inside the CYE recovery zone and outside of the recovery zone where recurring grizzly bear use has been documented. Specific motorized access and habitat security guidelines and standards applicable to the impact analysis are explained in section 3.25.5, *Threatened and Endangered Species*.

Standards for core grizzly bear habitat were established in the Access Amendment. Core grizzly bear habitat is defined as an area of high quality habitat within a Bear Management Unit that contains no motorized travel routes or high-use trails. Core areas do not include any gated or restricted roads, but may contain roads that are impassable due to vegetation or barriers. All revisions to core grizzly bear habitat have been incorporated into the alternatives analysis. Section 3.25.5.2, *Threatened and Endangered Species* discusses core grizzly bear habitat in greater detail. Core grizzly bear habitat in a 10-mile radius of a plant site in either Ramsey Creek or Libby Creek for the purposes of siting an impoundment was considered during the evaluation of alternatives, along with lynx (Figure 45). Grizzly bear habitat is shown on Figure 92. The USFWS has not designated grizzly bear critical habitat.

2.13.2.3 Lynx

In 2000, the USFWS listed the lynx as a threatened species. The KFP has been amended to incorporate standards and guidelines for lynx management established in the Northern Rockies Lynx Management Direction adopted in 2007 (USDA Forest Service 2007a). The KNF revised lynx habitat mapping after the Draft EIS was issued to better correspond to habitat components identified in the Northern Rockies Lynx Management Direction. Section 3.25.5.3, *Threatened and Endangered Species* discusses lynx habitat in greater detail. Lynx habitat in a 10-mile radius of a plant site in either Ramsey Creek or Libby Creek for the purposes of siting an impoundment was considered during the evaluation of alternatives (Figure 45). Lynx habitat is shown on Figure 95. The analysis area does not contain any lynx critical habitat.

2.13.2.4 Bull Trout

In 1998, the USFWS listed the bull trout as a threatened species and in 2005 designated critical habitat in five streams in the project area: Libby Creek, Poorman Creek, Ramsey Creek, Rock Creek, and West Fisher Creek. In 2010, the USFWS designated as critical bull trout habitat additional segments of Libby Creek, Rock Creek, and West Fisher Creek, and designated some segments of Bear Creek, East Fork Bull River, and Fisher River. The 2010 designation removed the short segments of critical habitat in Ramsey Creek and Poorman Creek designated in 2005. Segments in Libby Creek, West Fisher Creek, and Fisher River covered by the Plum Creek Native Fish Habitat Conservation Plan are considered essential excluded habitat. Section 3.6*, Aquatic Life and Fisheries* discusses bull trout in greater detail. Bull trout are found in Libby, Ramsey, Poorman, Midas, Bear, East Fork Rock, and Rock creeks and East Fork Bull River in the mine area, and in the Fisher River and West Fisher and Standard creeks along the transmission line alternative corridors (Figure 45).

2.13.2.5 Roadless Areas

Inventoried roadless areas (IRAs) have attributes similar to designated wilderness, such as natural integrity and appearance, opportunities for solitude, and primitive recreation opportunities. IRAs are areas identified in a set of inventoried roadless area maps, contained in the Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000, and any subsequent update or revision of those maps through the land management planning process. The 2000 Roadless Area Conservation Final EIS identified the Barren Peak Inventoried Roadless Area, which is within a 10-mile radius of a plant site in either Ramsey Creek or Libby Creek for purposes of siting an impoundment. Inventoried roadless areas are discussed in section 3.24.2, *Roadless Areas*. Other land use restrictions in the Montanore Project analysis area are CMW and the Cabinet Face East Roadless Area (Figure 45), which were considered in the 1992 analysis.

2.13.2.6 Old Growth Ecosystems

Old growth habitat is recognized for its unique ecological characteristics that serve as important habitat for both wildlife and some species of rare plants on the KNF. Old growth stands in the Crazy and Silverfish Planning Subunits were field-verified and finalized after the Draft EIS was issued. Old growth habitat in the analysis area is described in section 3.22.2*, Old Growth Ecosystems*.

2.13.3 Alternative Mine Location or Combined Mine Operations

2.13.3.1 Mine Location

To address 404(b)(1) Guidelines, the Corps requested that the lead agencies consider alternative locations that could reasonably be obtained for the underground mine not presently owned by MMC. The location of the underground mine is determined by the location of mineralized copper-silver resources. The lead agencies' evaluation of alternative copper-silver resources in northwest Montana, consistent with the Corps' purpose and need described in Chapter 1, is summarized in the following paragraphs.

The U.S. Geological Survey (USGS) recently completed a review of copper-silver deposits in western Montana and eastern Idaho (Boleneus *et al*. 2005). A stratabound deposit is a mineral deposit that occurs within a specific stratigraphic bed or horizon, but which does not comprise the entire bed. Worldwide, stratabound copper-silver deposits contain 23 percent of all known copper resources and are the second most important source of the metal. These deposits typically consist of disseminated copper sulfide minerals restricted to a narrow range of mineralized layers within a sedimentary sequence. The Rock Creek, Montanore, and Troy deposits, which are currently the most significant undeveloped resources identified in the western Montana copper belt, are also among the largest stratabound copper-silver deposits in North America and contain about 15 percent of the copper in such deposits in North America (Boleneus *et al*. 2005).

The USGS used the term "world class deposit" to provide the relationship of the Rock Creek and Montanore deposits to other known stratabound copper-silver deposits in North America. World-class deposits are significant because production from any of them would affect the world's supply-demand relation for the metal. World-class deposits are those that exceed the 90^{th} percentile of discovered metal, and contain more than 2.2 million tons of copper. Only three world-class stratabound copper-silver deposits are found in North America: the Rock Creek and Montanore deposit; the Kona deposit and the White Pine deposit in Michigan (Boleneus *et al*. 2005).

According to Boleneus *et al*. (2005), mineral deposits in the Revett Formation are unusual because they are also rich in silver, a characteristic that sets them apart from many other strata-bound copper deposits. Individually, the Rock Creek and Montanore deposits are considered world-class silver deposits, and collectively they contain 680 million troy ounces of silver. Such deposits represent a “supergiant” silver deposit, which Singer (1995 as cited in Boleneus *et al*. 2005) defined as the largest 1 percent of the world’s silver deposits. The right to mine the Rock Creek deposit is owned by another mining company, and could not be reasonably obtained, used, or managed by MMC. Consequently, the lead agencies did not identify any alternative mineralized resources in northwest Montana that MMC could reasonably obtain.

2.13.3.2 Combined Mining Operations (Rock Creek Project and Montanore Project)

In the 1992 Montanore Project Final EIS, the agencies evaluated a potential alternative of combining the Rock Creek Project with the Montanore Project (USDA Forest Service *et al*. 1992). A similar analysis was conducted and disclosed in the Rock Creek Project Final EIS (USDA Forest Service and DEQ 2001). In 1992, the Rock Creek Project was proposed by ASARCO, Inc.; it is now proposed by RCR.

2.13.3.2.1 Rock Creek Project Final EIS Analysis of Joint Operation

The agencies’ analysis of joint operation in the Rock Creek Project Final EIS was based on Sterling (now RC Resources, Inc.) and NMC (now MMC) operating their projects essentially as a joint venture, using one operator, and using those elements of the Montanore Project that were permitted in 1993. The agencies also would use elements of the Rock Creek proposal that would be necessary to make a logical and efficient mine operation. The agencies assumed that the two companies would mine their ore bodies through the then-approved Montanore adits and use the Montanore plant site in the Ramsey Creek drainage. The analysis focused on two scenarios for combined Rock Creek and Montanore operations: 1) the companies would either mine the two ore deposits sequentially, thus extending the mine life over a 45-year period, or 2) they would mine the two ore bodies simultaneously over a 15- to 30-year life. In the Rock Creek Project Final EIS, the agencies indicated that potential disadvantages of a joint operation outweighed the potential advantages. Under both scenarios, a second tailings impoundment (assumed to be in Midas Creek in the Rock Creek Project Final EIS) would be necessary. Simultaneous joint operation would require two additional adits and an additional or expanded mill to achieve the proposed production rates. Sequential joint operations would impact about 80 more acres than two separate operations, would require two diversion channels at the Midas Creek impoundment, and affect significantly more old growth ecosystem. In the Rock Creek Project Final EIS (USDA Forest Service and DEQ 2001), the agencies determined that simultaneous joint operations would not offer any significant environmental advantages over the agencies’ preferred alternative and would have more impacts than those under the sequential operation alternative. In addition to the environmental and engineering reasons for dismissing a combined operations alternative, significant timing and legal issues are associated with requiring two corporations to work together. For these reasons, the combined operations alternative was dismissed from detailed analysis in the Rock Creek Project Final EIS.

2.13.3.2.2 KNF's Supplemental Information Report

In 2006, MMI, MMC's parent company, provided the KNF with three internal mining company reports that evaluated the possibility of forming a joint venture to combine the Rock Creek and Montanore projects. In accordance with NEPA and Forest Service policy, the KNF conducted a review of the information in the reports to determine its importance and whether a correction, supplement, or revision to the Rock Creek Project Final EIS was necessary, or if the ROD needed to be amended. The KNF prepared a Supplemental Information Report that described its review (KNF 2007b).

The reports focused primarily on the financial advantages and disadvantages to the companies involved should they decide to enter into a joint venture and combine the projects, not on the environmental impacts of the projects or their combination. Due perhaps to the reports' preliminary nature, they provided little or no foundation for many of the assumptions and estimations regarding the design and engineering of a combined operation. The Supplemental Information Report concluded the reports provided by MMI did not provide any new information that proved the analysis disclosed in the Rock Creek Project Final EIS to be in error or incomplete in analyzing the combination of the Rock Creek and Montanore projects. The range of alternatives in the Rock Creek Project Final EIS adequately considered the issues and information included in the three internal industry reports and they did not affect the disclosure of environmental impacts on resources in the Rock Creek area.

2.13.3.2.3 Montanore Project EIS Analysis of Joint Operation

Both MMI and RCR would have to develop a joint operating agreement before the agencies could consider a joint operation. Such an agreement has not been developed jointly by MMI and RCR. The agencies determined that they did not have authority to require RCR and MMI to join their proposals into one operation, and joint operation is not a reasonable alternative.

2.13.4 Tailings Backfill Options

Backfilling at Montanore was considered primarily because of the potential reduction of the surface tailings disposal area. The placement of backfill underground would, at a placement rate of 6,000 tpd, reduce the volume of tailings requiring surface disposal by 33 percent to 40 percent. Backfill methods considered were dry placement, pneumatic placement, hydraulic placement, and thick slurry or paste placement. These backfill placement methods and their requirements are described in the *Tailings Disposal Alternatives Analysis* (ERO Resources Corp. 2011a). Room-and-pillar mining with delayed paste backfill is the only technically feasible method of underground tailings disposal at Montanore. An above-ground paste plant, outside the CMW, is the only feasible backfill plant location.

If the volume of tailings requiring surface disposal could be reduced by 33 to 40 percent, effects on wetlands and streams would be reduced. The use of thickened tailings at the Poorman site would affect 8.3 acres of wetlands. Backfilling 40 percent of the tailings along with paste tailings would reduce impacts on wetlands by an estimated 1.8 acres (Table 46). Based on a preliminary, assessment-level economic analysis, which could vary by more than 30 percent, the agencies' analysis found that backfilling at Montanore would result in significantly greater capital and operating costs than would normally be associated with room-and-pillar mining projects.

Table 46. Estimated Wetlands Effects within the Footprint of Various Conceptual Impoundment Layouts at the Poorman Site.

Conceptual Poorman Impoundment Tailings Density and Additive Scenario	Jurisdictional Wetlands (acres)	Streams (linear feet)	Non-Jurisdictional Wetlands (acres)
Thickened Tailings	8.3	11,110	1.1
Paste Tailings	8.1	10,370	0.5
Paste Tailings with Additive	8.1	10,170	0.4
Paste Tailings, 40% Backfill	6.5	9,940	0.4
Paste Tailings with Additive, 40% Backfill	3.0	8,210	0.2

The jurisdictional status of the wetlands and streams is preliminary and impacts may change during the 404 permitting process.
Source: GIS analysis by ERO Resources Corp.

2.13.5 Tailings Impoundment Location Options

2.13.5.1 Analysis Overview

In the 1992 Montanore Project Final EIS, the agencies reviewed NMC's alternatives analysis and completed an analysis independent of NMC's. The agencies considered numerous engineering factors, such as impoundment capacity, dam volume and height, surface water control, pipeline considerations, and environmental resources, such as fisheries, wetlands and streams, diversion of perennial streams, and threatened and endangered species. In the 1992 Final EIS, impoundment sites in Midas Creek, Standard Creek, and Little Cherry Creek were evaluated. The agencies did not identify an alternative tailings impoundment site that would avoid discharge of dredged or fill materials into waters of the U.S. Considering both environmental and engineering factors, the agencies determined that the Little Cherry Creek site was the preferred impoundment alternative. The Corps issued a 404 permit to NMC in 1993 for the Little Cherry Creek site.

During an interdisciplinary team meeting for the Montanore Project EIS in 2006, the agencies identified the possibility of locating the impoundment north of Poorman Creek to avoid diversion of Little Cherry Creek, a perennial stream. To evaluate this option, the agencies developed six options for an impoundment site between Little Cherry Creek and Poorman Creek (Poulter 2007). Three Poorman Creek options were eliminated because the dam was sited on private land that was not owned by MMC, and that could not be reasonably obtained. Two options were eliminated because they did not have adequate capacity or required large dam volumes, and one option was retained for further analysis. During the preparation of the Draft EIS, the agencies modified MMC's proposed Little Cherry Creek impoundment to reduce resource impacts; this option was also retained for detailed analysis in the Supplemental Draft and Final EISs.

After a preliminary review of the Little Cherry Creek and Poorman impoundment options, the Corps requested the agencies re-evaluate the impoundment sites evaluated in prior alternatives analyses in accordance with the 404(b)(1) Guidelines. Evaluation criteria differed among the prior analyses and did not address all current issues associated with regulatory changes. To address the 404(b)(1) Guidelines, the agencies completed an alternatives analysis of all impoundment sites previously evaluated in KNF's Mineral Activity Coordination (MAC) Report (KNF 1986), analyses conducted by prior project owners during project planning (Morrison-Knudsen

Engineers, Inc. 1988; 1989a, 1989b; NMC 1989), the 1992 Montanore Project Final EIS analysis (USDA Forest Service *et al*. 1992), and the 2001 Rock Creek Project Final EIS analysis (USDA Forest Service and DEQ 2001). The agency-modified Little Cherry Creek site and the Poorman option developed by the agencies were included in the analysis.

The agencies used three successive levels of screening to narrow the range of tailings impoundment options analyzed in detail in the EIS: Level I screening eliminated projects based on availability and logistical criteria described below in section 2.13.5.2*, Level I Screening*. Alternatives remaining after Level I screening were further evaluated in Level II screening based on environmental criteria described in section 2.13.5.3*, Level II Screening*. A third, more detailed level of screening (Level III screening) was conducted on remaining alternatives based on engineering, geotechnical, and environmental criteria. Level I, II, and II screening analyses are described in the following subsections.

2.13.5.2 Level I Screening

The impoundment sites evaluated in the Level I screening analysis were the conceptual layouts developed for the Poorman and agency modified Little Cherry Creek impoundment sites and 20 impoundment sites developed for the MAC Report or the Morrison-Knudsen Engineers analysis (Figure 46). The disturbance area for the agencies' proposed Little Cherry Creek and Poorman impoundments, which include ancillary facilities, is between 1,500 and 2,000 acres. To standardize disturbance areas for the impoundment sites during screening, the area around each impoundment footprint developed for the MAC Report or the Morrison-Knudsen Engineers analysis except the Little Cherry Creek and Poorman sites was enlarged by 2,000 feet. The disturbance area around Little Cherry Creek and Poorman sites was not enlarged during the screening because the agencies had already expanded the area around the impoundment at the time of the screening analysis. Morrison-Knudsen Engineers' Little Cherry site was replaced by the agency-modified Little Cherry Creek impoundment for the alternatives analysis, due to considerable overlap between the two sites. For the same reason, Morrison-Knudsen Engineers' Poorman site and Site 19 from the MAC Report were replaced with the agencies' Poorman tailings impoundment option for the alternatives screening analysis.

Tailings impoundment site evaluations in prior alternatives analyses were completed using lower impoundment capacity requirements than currently necessary for the Montanore Project. For Level I screening, the agencies used a capacity requirement of 120 million tons. At the current project life of 16 years, the Little Cherry Creek Tailings Impoundment has an excess capacity of an additional 3 years of mine production, or 22 million tons. Tailings impoundment capacity at each potential site was determined on a preliminary basis based on capacities provided in the MAC report (KNF 1986) or Morrison-Knudsen Engineers (1988) and potential for expansion. A more detailed evaluation of tailings storage capacity was conducted during Level III screening.

Site availability was used as criterion to comply with the 404(b)(1) Guidelines. The Guidelines indicate if a site is otherwise a practicable alternative, an area not presently owned by the applicant that could reasonably be obtained, utilized, expanded, or managed in order to fulfill the basic purpose of the proposed activity may be considered (40 CFR 230.10(a)(2)). At some sites, private land was owned by RCR on the west side of the Cabinet Mountains, or by Plum Creek on the east of the mountains. Based on correspondence from RCR available in the project record regarding the Montanore Project, private land owned by RCR could not be reasonably obtained for tailings disposal for the Montanore Project.

All but five sites were retained for Level II analysis. Two sites near the confluence of Rock Creek and the Clark Fork River were eliminated because they are owned by RCR and MMC could not reasonably obtain, utilize, expand, or manage them for tailings disposal purposes. Three other sites were eliminated because they did not have sufficient tailings storage capacity, would need excessive borrow material for dam construction, and would not fulfill the project's purpose and need.

2.13.5.3 Level II Screening

Level II screening focused on potential effects of impoundment alternatives on environmental resources. Criteria used in the Level II screening analysis were impacts on RHCAs, occupied bull trout habitat, grizzly bear core habitat, lynx habitat, IRAs, old growth, and grizzly bear habitat security; the amount of perennial stream that would be filled; and watershed area. Criteria were considered in the following order of priority: aquatic resource criteria, grizzly bear and lynx habitat, old growth, and IRAs. The same disturbance areas used for Level I screening were used for the Level II screening analysis.

Sites in Lower Hoodoo, Cable, Libby, Lower Bear, Lower Midas, Lower Standard, Ramsey, Upper Bear, and Upper Standard creeks would affect occupied bull trout habitat and were eliminated from further consideration because sites that would not affect such habitat were available. In addition, all sites that would affect occupied bull trout habitat would have a watershed area of over 2,100 acres, requiring large diversion structures, and would fill over 1.1 miles of perennial stream. Three sites in Upper Midas and Smearl creeks and near the confluence of Libby and Howard creeks were eliminated because of effects on grizzly bear habitat (grizzly bear core habitat and secure habitat) and reasonable alternatives with less effect on grizzly bear were available. The McKay Creek site was eliminated because it would affect 854 acres of secure grizzly bear habitat, require diversion of two perennial streams, fill 2.4 miles of perennial streams, and affect at least 43 acres of wetlands, based on information from the Rock Creek Final EIS (USDA Forest Service and DEQ 2001).

2.13.5.4 Level III Screening

The agencies analyzed in greater detail four impoundment sites after the Level II screening: the agency-modified Little Cherry Creek, Poorman, Crazyman Creek, and Upper Hoodoo Creek sites (Figure 47). The agencies developed conceptual impoundment layouts for the Crazyman and Upper Hoodoo creek sites based on a 120-million-ton tailings storage capacity.

For the Level III screening analysis, engineering and geotechnical factors were considered in addition to environmental resources. The six engineering and geotechnical criteria were: impoundment and dam area, dam height, dam crest length, watershed area, stream crossings by tailings pipelines, and tailings pipeline length. Five criteria were used to evaluate effects on aquatic resources: impacts on RHCAs, perennial stream diverted, perennial stream filled, impacts on bull trout habitat, and impacts on designated critical bull trout habitat. Effects on wildlife were evaluated by considering important grizzly bear habitat, lynx habitat, and old growth forest. Effects on IRAs were also considered.

The agencies retained the Little Cherry Creek and Poorman sites for detailed analysis, and eliminated the Crazyman and Upper Hoodoo creek sites. The Crazyman and Upper Hoodoo creek sites would have a greater effect on perennial streams than the Poorman site and would require more stream crossings by longer tailings pipelines than the Poorman and Little Cherry Creek sites. Also, the Crazyman Creek and Upper Hoodoo Creek dams would be nearly twice as high as the Poorman or Little Cherry Creek dams, potentially posing design and construction problems that could be avoided by better siting (Environmental Protection Agency 1994a). Overall, the Crazyman Creek and Upper Hoodoo Creek sites would have substantially greater impacts on aquatic resources than the Poorman site and would not offer environmental advantages over the Poorman site.

2.13.5.5 MMC Analyses

MMC submitted a Section 404 permit application to the Corps for the agencies' preferred alternatives (Mine Alternative 3 and Transmission Line Alternative D-R) in 2011 (MMC 2011a). MMC prepared several reports on tailings disposal to assist the Corps in a 404(b)(1) compliance determination on MMC's 404 permit application for the Montanore Project (MMC 2012b, 2012c, 2012d). The analyses were not intended to represent the Corps' conclusions or their final 404(b)(1) determination. MMC's analyses considered cost, logistics, existing technology, and environmental consequences. MMC's analysis indicated the Poorman site had the least effect on waters of the U.S., which was consistent with the agencies' analysis described in the previous section and in the agencies' 404(b)(1) analysis.

2.13.6 Plant Site and Adit Location Options

2.13.6.1 Prior Analyses

The agencies reviewed prior analyses of plant and adit sites, specifically KNF's MAC Report, analyses conducted by prior project owners (Morrison-Knudsen Engineers, Inc. 1988; Morrison-Knudsen Engineers, Inc. 1989b; NMC 1989), the 1992 Montanore Project Final EIS analysis, and the 2001 Rock Creek Project Final EIS analysis. Methods, criteria, and conclusions of prior analyses are summarized in section 5.3.1 of the *Tailings Disposal Alternatives Analysis* (ERO Resources Corp. 2011a).

2.13.6.2 Updated Agencies' Analysis

The agencies used an iterative process to evaluate plant site and adit options. The agencies focused on plant sites on the east side of the Cabinet Mountains. Following their evaluation of prior alternatives analyses, the agencies concluded that plant sites on the west side of Cabinet Mountains were not available, or did not offer any environmental advantages over plant sites on the east side of Cabinet Mountains. In addition, plant sites on the west side of the Cabinet Mountains were eliminated because they would be over ten miles from the Little Cherry Creek and Poorman Impoundment Sites selected for detailed analysis in the EIS. MMC's proposed plant site location is in upper Ramsey Creek near the CMW boundary. The agencies considered seven sites along Libby Creek upstream of the confluence of Libby and Howard creeks: 1) one site on private land at the existing Libby Adit Site, 2) two sites upstream of the Libby Adit Site on National Forest System land but outside of the CMW, 3) two sites adjacent to the Libby Adit Site on the north and south sides of Libby Creek and 4) two sites downstream of the Libby Adit Site on National Forest System land (Figure 48). Six sites were eliminated because they did not provide sufficient room to locate the required plant facilities; would affect old growth, wetlands and RHCAs, or IRAs; or were within several avalanche paths. One site downstream of the Libby Adit Site was retained for detailed analysis because it would accommodate all necessary facilities and would not affect wetlands, RHCAs or an IRA. The agencies' analysis is described in a letter report by Agapito Associates, Inc. (2007a) and summarized in section 5.3.2 of the *Tailings Disposal Alternatives Analysis* (ERO Resources Corp. 2011a).

2.13.7 Surface Tailings Disposal Method Options

The agencies' analysis of surface tailings deposition methods is described in section 6.0 of the *Tailings Disposal Alternatives Analysis* (ERO Resources Corp. 2011a) and summarized below.

2.13.7.1 Overview of Deposition Methods

In mining projects that use milling to separate metals from rock, as proposed at Montanore, tailings are discharged from a mill as slurry, which is a mixture of water and solids. The amount of solids in the slurry, referred to as the slurry density, is reported as the percentage of the dry weight of solids (tailings) to the total weight of the slurry (dry weight of tailings plus the water weight) as follows:

Slurry density (%) = (dry weight of tailings)/(dry weight of tailings + weight of water)
Example: 100 lbs. tailings/(100 lbs. tailings + 81.8 lbs. water) = 55% slurry density
The mining industry has adopted descriptive categories, based on the consistency of the tailings slurry, that characterize the slurry over typical ranges of densities. The descriptive categories common to surface tailings deposition are slurry, thickened, paste, and filter or cake tailings deposition. Below is general description of each deposition "method" (or type of slurry) and typical slurry density values associated with each one.

2.13.7.1.1 Slurry Deposition

Slurry deposition occurs when the water content is sufficiently high such that the water component of the slurry mix controls the behavior of the tailings. Slurry densities are typically 55 percent or less in this category but can be as high as 60 percent for some tailings. The high water content results in little or no internal strength and solid particles segregate out from the slurry upon deposition. Tailings surfaces under these conditions generally have an average slope of about 1 percent, but can be as flat as 0.5 percent. In areas near the discharge location, sand-size particles tend to segregate out first and create slightly steeper tailings surfaces (1 to 2 percent), depending upon the sand content and flow velocity at the discharge location.

2.13.7.1.2 Thickened Deposition

Thickened tailings represent an intermediate step between the slurry tailings with high water content and the more viscous paste tailings. What differentiates this category from the others are the water content and deposition behavior of the tailings mass. The slurry density range is typically 60 percent to 75 percent. Thickened tailings can be transported with centrifugal pumps for the lower slurry densities but require positive displacement pumps as the slurry density increases. The slurry density is sufficiently thick such that the solid particles behave in a paste-like manner and do not segregate upon deposition. There is sufficient excess water in the slurry mix that upon deposition the tailings solids readily flow out from the discharge location and any excess water separates to create a water pool. Surface slopes from thickened tailings deposition tend to be slightly steeper (3 percent to 4 percent on average) than slurry tailings.

2.13.7.1.3 Paste Deposition

Paste deposition occurs when the water content is sufficiently low such that the slurry mass exhibits some internal strength and the tailings solid does not segregate out of the slurry upon deposition or as the tailings mass flows away from the discharge location. The slurry flows as a thick heavy fluid and exhibits a consistency varying from soft toothpaste to a thick stiff paste. Typical paste tailings require transport using positive displacement pumps, although the lower range of slurry densities may be pumped using centrifugal pumps. The range of slurry density for paste tailings is about 60 percent to 85 percent. Paste tailings with lower slurry densities would exhibit a bleed-off of excess water and, in sufficient quantity, form a small pool of water. These paste tailings are often categorized as thickened or highly thickened tailings. As the slurry density increases in paste tailings, the bleed-off water discharge is reduced to little or no discharge flow. In the higher range of slurry density for paste tailings, the water content is relatively low and the behavior and flow characteristics are like a stiff plastic material. This range of paste tailings is sometimes referred to as dewatered tailings.

2.13.7.1.4 Filter or Cake Deposition

Filter or cake tailings occur once the slurry density is sufficiently high (*i.e.* low water content) that the mix begins to behave as a semi-solid material. The slurry mass exhibits soil-like characteristics and requires mechanical means, such as belts, to transport for discharge and distribution. The slurry density is typically greater than 85 percent.

Deposition of tailings slurries at thicker densities can offer several advantages over slurry tailings at 55 percent or less. The primary advantage is that water recovery increases as part of the process in preparing the thicker slurry densities, thus reducing make-up water requirements and the amount of excess water stored in the impoundment. In addition, high-density tailings and dewatered/filter tailings are generally more dense at deposition, consolidate to a higher density more rapidly than slurry tailings, and can be used to create a more stable tailings embankment. As a result of the lower water content and increased density, the shear strength generally increases over slurry tailings. Tailings surface slopes are generally steeper and more stable than the slurry tailings. In some cases, this allows for the tailings to be deposited from up gradient slopes at an elevation above the level surface of the tailings. Depending upon the native ground slope, and the impoundment geometry, high-density to dewatered and filtered tailings can be discharged from a higher elevation to create a slope of tailings above the normal impoundment level. Such deposition along with increased density in the placed tailings can be used to develop a deposition plan to reduce the required impoundment capacity, lower the dam crest, and possibly reduce the impoundment footprint.

2.13.7.2 Analysis of Alternative Deposition Methods

In comparing the different methods for use at a project, slurry deposition is often the preferred method with respect to infrastructure, operation, and capital cost. The description and evaluation of slurry deposition was the basis for comparison of the other methods of tailings deposition. Based on the agencies' conceptual impoundment layout at the Poorman site, the agencies found that slurry deposition was not a preferred method to store 120 million tons of tailings, primarily because of the projected shortage of cyclone sand available for dam construction. Effects on wetlands from a slurry deposition impoundment at the Poorman site were not specifically determined, but they would be similar to effects from an impoundment using of thickened tailings deposition (Table 46). Based on conceptual studies completed by the agencies to evaluate the feasibility of developing the Poorman site for tailings disposal, thickened tailings deposition is likely necessary at the Poorman tailings impoundment site to achieve the design capacity for the disposal of 120 million tons of tailings. Compared to thickened tailings deposition, paste or filter tailings deposition would not likely reduce the impoundment footprint enough to substantially decrease the acreage of wetlands affected at the site (Table 46). Reductions in the volume of tailings deposited at the surface due to the use of paste or filter tailings would not be directly proportional to reductions in the required surface area, due to the convex topography at the Poorman site.

2.13.8 LAD Areas

MMC's proposal in Alternative 2 is to have two LAD Areas, one along the north side of Ramsey Creek (LAD Area 1) and another between Ramsey and Poorman creeks (LAD Area 2) (Figure 7). In Alternatives 3 and 4, all mine and adit water would be treated and discharged at the Water Treatment Plant and LAD Areas would not be used.

2.13.9 Access Road

In the 1992 Montanore Project Final EIS, the lead agencies eliminated NFS road #231 from detailed analysis because it would have more stream crossings and have steeper grades than NFS road #278. MMC is proposing to use NFS road #278 for access and to convey concentrate to the Libby Loadout. Four routes are possible to provide access to the Libby Creek and Ramsey Creek drainages: NFS road #278 south from US 2 about 10 miles along Big Cherry Creek, NFS road #231 (Libby Creek Road) west from US 2 about 12 miles along West Fisher Creek, NFS road #231 along Libby Creek, and NFS roads #385, #4724, #4780, and #231 up Miller Creek and then into the Libby Creek drainage. The lead agencies eliminated NFS road #231 west from US 2 along West Fisher Creek because it had more stream crossings and would be much longer than the proposed alignment. NFS road #231 along Libby Creek would have more stream crossings and steeper grades than NFS road #278. Greater disturbance than that needed on NFS road #278 would be necessary to make NFS road #231 suitable for access. In addition, two major bridges spanning Libby Creek along NFS road #231 would have to be rebuilt and widened. A segment of this road was moved out of the Libby Creek floodplain several years ago and placed on a steep hillside to prevent the road from flooding and bridges from being washed out. Widening NFS road #231 to accommodate traffic on the steep hillside would cause a major surface disturbance. The steep hillside alignment has only recently started to stabilize and currently experiences large amounts of rock fall and soil movement during storm events. The use of NFS roads #385, #4724, #4780, and #231 was eliminated because of the length and steep slopes that NFS roads #4724 and #4780 traverse.

2.13.10 Transmission Line Alignment Options

The agencies' alternatives analysis included the evaluation of several transmission line alignments. The following sections summarize the 1992 Montanore Project Final EIS analysis, MMC's MFSA analysis, and the updated agencies' analysis of transmission line alignment alternatives. In addition, the agencies analyzed constructing the line underground and reducing the transmission line voltage.

2.13.10.1 Prior Analyses

2.13.10.1.1 1992 Montanore Project Final EIS

In 1992, the KNF and the DNRC considered several sources of power and different transmission line designs, construction methods, and locations. Two alternatives were eliminated from consideration initially due to their excessive costs and infeasibility. Four other alternatives were evaluated further by the lead agencies, but were ultimately eliminated because they were more costly and did not offer any environmental advantages over the alternatives analyzed in detail in the 1992 Final EIS. In 1992, as well as currently, the laws governing siting a major facility such as the proposed 230-kV transmission line allowed the consideration of cost in assessing impacts (75-20-301(1)(c)).

The KNF and the DNRC eliminated on-site generation because of high capital costs and the likelihood of additional costs to address environmental concerns, such as air quality. The agencies' estimate the capital cost of on-site generation to be $37 million. It would increase concentrations of priority air pollutants, such as nitrogen and sulfur oxides. Although on-site generation was not modeled, it is uncertain that on-site generation could comply with the Clear Air Act or the Montana Clean Air Act. Once the power was available from a transmission line (either the buried 34.5-kV line or the overhead 230-kV line), the operation of emergency generators at the mill would be limited to 16 hours during any rolling 12-month period.

Several power sources on the east side of the Cabinet Mountains were considered to serve the mine. One source would require a new 230-kV line to the mine from an existing substation located just north of the town of Libby. The KNF and the DNRC eliminated the Libby Creek alignment from detailed analysis. The major disadvantages of the Libby Creek alignment were that construction costs would be nearly twice that of several other alignments, operating costs would be substantially higher than several other alignments, and all potential alignments would pass through or adjacent to a much higher population density, affecting substantially more private land than other alignments.

The KNF and the DNRC evaluated a number of options for tapping the area's 230-kV system (USDA Forest Service *et al*. 1992). The lead agencies considered a tap on BPA's Noxon-Libby 230-kV transmission line 7 miles southwest of Pleasant Valley, Montana. This alternative, referred to as Trail Creek, would have required a substation tap on the BPA line in a remote area near the junction of Iron Meadow Creek and the Silver Butte Fisher River. In 1992, this option was not retained by the lead agencies for further detailed study because of its remote location, and environmental concerns about crossing an unroaded area.

The KNF and DNRC evaluated alternatives for the proposed transmission line from a proposed tap site on BPA's Noxon-Libby 230-kV transmission line at Sedlak Park west of Pleasant Valley. Three alignments, Miller Creek, North Miller Creek, and Swamp Creek, were analyzed in detail in the 1992 Final EIS. Two additional alternatives, the West Fisher Creek and Miller Creek/Midas Creek options, were eliminated from detailed consideration in 1992 because they offered no advantages in cost or environmental impact over the alternatives carried forward for detailed analysis.

The West Fisher Creek alignment was eliminated from detailed study because it would be longer than other alignments. The West Fisher Creek alternative would affect more private landowners than other 230-kV alternatives analyzed in detail in the 1992 Final EIS. It also would affect more recreational users due to its location along a major forest access road. The Miller Creek/Midas Creek alignment was eliminated from detailed study because of its greater length and the lack of environmental advantages over other alternatives. In the 1992 Final EIS, the KNF and the DNRC recommended the North Miller Creek alternative as providing the best balance for an alignment, considering the factors used in the 1992 analysis (USDA Forest Service *et al*. 1992).

In the 1992 analysis, the lead agencies considered the use of helicopters to erect the transmission line structures as an alternative to conventional construction methods (USDA Forest Service *et al*.

1992). The lead agencies determined that general use of helicopters in line construction would have little environmental advantage because conventional equipment, such as augers, would be required to excavate foundations for the transmission line structures. Disturbance associated with the access required to move this equipment to each pole location could not be avoided unless more expensive and time-consuming methods (such as hand digging of pole foundation holes) were done. Line maintenance costs also would be increased without ground access to each tower. For these reasons, the lead agencies dismissed this method as a recommended line construction alternative.

2.13.10.1.2 Major Facility Siting Analysis by MMC

In 2005, MMC submitted an application to the DEQ (DNRC's successor under the MFSA) for a MFSA certificate to construct a 230-kV transmission line using the North Miller Creek alignment approved in 1993 by DNRC. A transmission line alignment analysis was conducted (Power Engineers 2005b). The alignment analysis report discussed all the alternatives considered in the 1992 Final EIS, those analyzed in detail and those eliminated from detailed analysis. The alignment analysis report updated the comparison of the three alignments that were carried forward for detailed analysis: North Miller Creek, Miller Creek, and Swamp Creek. Twenty criteria in six broad categories were used in the comparison of these three alternatives. As discussed in MMC's alignment analysis report, MMC considered the North Miller Creek alternative to be the best of the three alternatives using the report's evaluation criteria. Additional discussion of MMC's evaluation criteria and the alternatives comparison is found in the alignment analysis report (Power Engineers 2005b).

2.13.10.2 Updated Agencies' Analysis

The KNF and the DEQ eliminated on-site generation because of high capital costs and the likelihood of other environmental concerns, such as air quality. The agencies' estimate the capital cost of on-site generation to be $37 million. It would increase concentrations of priority air pollutants, such as nitrogen and sulfur oxides. Although on-site generation was not modeled, it is uncertain that on-site generation could comply with the Clear Air Act or the Montana Clean Air Act. A condition of DEQ's draft permit is that once the power was available from a transmission line (either the buried 34.5-kV line or the overhead 230-kV line), operation of emergency generators at the mill would be limited to 16 hours during any rolling 12-month period. The analysis of underground installation is discussed in the next section.

The KNF and the DEQ used an iterative process to develop alternative alignments for the transmission line and to define the criteria with which to evaluate the alternatives. As part of the initial process, the lead agencies mapped and reviewed numerous transmission line alignments. The alignments reviewed were those identified by MMC, modifications of alignments analyzed by MMC, as well as new alignments identified by the lead agencies. The lead agencies also developed criteria with which to evaluate each alternative.

The lead agencies began the screening analysis with the three alignments analyzed in the 1992 Final EIS, as well as the West Fisher Creek alignment. Subsequently, the alignments were slightly modified to improve the alignment. In response to public scoping comments, the lead agencies identified an alternative alignment of a segment immediately north of the proposed Sedlak Park Substation through Plum Creek land. The alignment would locate the line east of MMC's proposed alignment to address visibility of the line from US 2 and area residences, create a buffer between residences and the line, create a buffer between the Fisher River and the line, and establish a more direct alignment north of the Sedlak Park Substation. The lead agencies also considered two alternatives that avoided Plum Creek lands along US 2 encumbered by a conservation easement held by the FWP. The following alternatives were evaluated using a number of technical and environmental criteria (Figure 49):

- North Miller Creek (MMC’s Proposal)
- Modified North Miller Creek
- Modified Miller Creek
- Modified West Fisher Creek-1
- Modified Swamp Creek
- Olson Creek
- Porcupine Creek
- Modified West Fisher Creek-2

The Modified Swamp Creek alternative was eliminated due to the greater effects on old growth, and the unavailability of replacement old growth in the area. The Modified West Fisher Creek 1 was eliminated because it would be longer and would cross more old growth. Because one MFSA siting criterion prefers the use of public lands over private lands the crossing of more private land by this alignment was also a factor. Although the Olson Creek and Porcupine Creek alternatives would be shorter and cross less private land, these two alternatives were eliminated because they would cross the Barren Peak IRA. The remaining four alternatives were retained for detailed analysis in the Draft EIS. The lead agencies’ analysis of possible transmission line alternatives is described in greater detail in the *Transmission Line Screening Report* (ERO Resources Corp. 2006b).

In 2009, the lead agencies released a Draft EIS for public comment. Several owners of private land potentially affected by one or more of the transmission line alignments submitted comments. The lead agencies met with the property owners in the summer 2009. Based on public comment, the agencies alternative alignments, Alternatives C-R, D-R, and E-R, were modified to reduce effects on private land. One of MFSA’s requirements is that the DEQ determine that the use of public lands for location of the facility was evaluated and public lands were selected whenever their use is as economically practicable as the use of private lands. The most substantial change in alignment was in Alternatives C-R and D-R. In the Draft EIS, the alignment for Alternatives C and D would traverse an east-facing ridge immediately north-northwest of the Sedlak Park Substation, and would cross Hunter Creek 2 miles north northwest of the substation. The alignment would continue north northwest for 2.5 miles and head west to cross the Fisher River and US 2 a few hundred feet north of MMC’s proposed alignment. The alignment would then turn west, generally following the Miller Creek drainage for 2.5 miles, and then traverse up a tributary to Miller Creek. About 7 miles of the alignment was on private land owned by one property owner.

2.13.11 Analysis of Underground Installation of Transmission Line

The lead agencies considered locating the transmission line underground. Underground transmission lines typically have less clearing and do not have the visual impact of the transmission lines and structures. Underground transmission lines typically have significantly fewer faults, fewer voltage sags, and fewer short- and long-duration interruptions. Traditional overhead circuits typically fault about 90 times per 100 miles per year; underground circuits fail less than 10 or 20 times per 100 miles per year. Because overhead circuits have more faults, they cause more voltage sags, more momentary interruptions, and more long-duration interruptions (Electric Power Research Institute 2006).

The agencies reconsidered underground installation after modifying transmission line Alternatives C, D, and E. Locating the line underground would require proximity to an access road for the entire length of the line. Consequently, the agencies based their analysis of underground line installation on the route of Alternative E-R, West Fisher Creek. The underground line would not follow the overhead line route exactly, but would be adjacent to US 2 and NFS road #231. This alignment would allow easy access for construction and maintenance. The line would start at the Sedlak Park Substation.

Two voltages would be feasible for an underground line, 230 kV and 115 kV. Both voltages would be solid dielectric, cross-linked polyethylene, insulated cable in duct banks encased in concrete. Multiple underground cable splicing vaults with access manholes would be required along the route. Generally, the vaults would be required every 1,000 feet. Aboveground to overhead line termination points would be necessary at the Sedlak Park Substation and at the Plant Site Substation. The duct bank would have four 5-inch to 8-inch conduits with a cable in each conduit. One conduit would be a spare conduit and cable for reliability of service in case of a cable failure.

Considerable disturbance would be necessary for construction due to the size of the cable trench and the cable splicing vaults. Trenches are 5 feet deep and vaults are 8 feet high, 10 feet wide, and 20 to 30 feet long. The line length would be about 20 miles.

For the 230-kV option, the proposed BPA Sedlak Substation would stay essentially the same except for the addition of a cable termination system. This could increase the substation cost by 15 percent. The construction cost for the installation would be $3 million per mile or $60 million total. For the 115-kV option, the proposed BPA Sedlak Substation would require a voltage step-down transformer, which would increase the substation construction area and require additional facilities and equipment. It also would require a termination system. The substation costs would increase by about 60 percent for the 115-kV cable option. The construction cost for the cable installation would be $2 million per mile or $40 million total. The agencies eliminated underground installation as a reasonable alternative because of the cost.

2.13.12 Analysis of Change in Transmission Line Voltage

The proposed transmission line voltage to the mine facilities is 230 kV, since the existing voltage of the BPA transmission line being accessed is 230-kV. The substation size is about 2 acres and is located in a narrow land area between US 2 and a wetland area. Any voltage other than 230 kV would require a voltage step down transformer at the substation. A substation with a transformer would require a larger construction area of an additional 1 to 2 acres, which may not be achievable due the land constraints of the area. The cost would also increase between $2,000,000 and $3,000,000 over the proposed substation cost due to the additional facilities and equipment required.

Energy losses would increase with this voltage transformation, both in the transformer and in the lower voltage transmission line to the mine facilities. For example, if the line current is 125 amps at 230-kV, the line current would be 250 amps at 115-kV. Decreasing the line voltage by half would double the amperage of the line current. Power losses on a transmission line are expressed as the current squared times the resistance of the conductor. Doubling of the line current quadruples the line power loss (because 2 squared equals 4).

Based on the 2009 average cost of power for industrial customers from Flathead Electric Cooperative, Inc., the annual transmission line losses at 230 kV would cost $49,000 and the annual transmission line losses at 115 kV would cost $199,000, which is an annual difference of $150,000. If the transmission line were in operation between 20 and 30 years, total increased cost would be $3,000,000 to $4,500,000.

The proposed transmission line conductor size is 795 Drake ACSR, which has a maximum load current rating of five times the anticipated load current for a 50-megawatt power requirement at the mine. This conductor was chosen for the 230-kV line because it is the generally accepted minimum size to be installed on a 230-kV line. This conductor meets the required voltage drop and conductor loss requirements to serve the mine facilities adequately. The 795 Drake ACSR conductor also has the strength requirements needed for the span lengths being proposed. As the conductor size is reduced, the resistance is increased, which increases voltage drop to the mine facilities and increases transmission line losses. Reducing conductor size also would decrease strength, which would reduce the desired span lengths that could be achieved.

If the voltage were 115 kV for the transmission line, the conductor would remain the same due to the increased losses previously discussed, similar span lengths being desired, and to meet the voltage drop requirements for the mine facility 50-megawatt power load. Additional studies would be required to verify the 795 Drake ACSR conductor size was adequate at 115 kV.

The construction cost difference between 230-kV transmission and 115-kV transmission would be minimal because structure heights would be almost identical and additional 115-kV structures would be required in the long span areas to meet the design requirements. In general, additional 115-kV structures would be required throughout the length of the line because of the reduced span length allowed due to reduced structure strength. Increased costs would be incurred for access roads to these additional structures and/or increased costs for additional structures required to be helicopter constructed. Right-of-way clearing widths would be reduced only slightly since the conductor blowout condition would dictate the clearing width.

Reliability of a 230-kV system would be superior to a 115-kV system. The basic design strength of 115-kV structures would be less than the design strength of the 230-kV structures. Any other voltage other than 230 kV or 115 kV would not be sufficient to serve the proposed mine facility power requirement. The lead agencies eliminated a 115-kV system because of increased disturbance and cost, and decreased reliability.

2.13.13 Forest Plan Consistency

2.13.13.1 Mine Facilities

As discussed in section 2.2*, Development of Alternatives,* the lead agencies did not identify an alternative that would comply with all KFP standards. For mine facilities, the operating permit areas of the plant site, the tailings impoundment, and LAD Areas 1 and 2 that currently are not MA 31 would be reallocated to MA 31. In addition, a proposed road and facility corridor that would cross MA 13 would be reallocated to MA 31. Although the KFP was amended in 1992 to accommodate the Montanore Project as then approved, all areas proposed for disturbance at the Ramsey Plant Site and the Little Cherry Creek Impoundment Site were not reallocated to MA 31 due to mapping technology and a slight change in the Little Cherry Creek Tailings Impoundment design from that approved in 1993. The lead agencies did not identify alternative locations for mine facilities that would avoid amending the KFP to accommodate the proposed operating permit areas of plant site and the tailings impoundment.

One of the issues discussed in section 2.13.2, *Regulatory Changes* is the KNF's adoption of the INFS standards. One of the INFS standards, Minerals Management 3 (MM3), prohibits solid and sanitary waste facilities in RHCAs, unless no alternative exists. Section 2.13.5*, Tailings Impoundment Location Options* and section 2.13.7*, Surface Tailings Disposal Method Options* discuss the lead agencies' analysis of alternative tailings disposal methods and locations. Compliance with INFS was a key criterion in the alternatives analysis. To be consistent with INFS standard MM-3, the lead agencies developed Alternatives 3 and 4 to minimize the extent to which RHCAs would be affected. Alternatives that would eliminate all effects on RHCAs were not practicable.

2.13.13.2 Transmission Line Facilities

In the 1992 Final EIS, on-site generation of power was considered in lieu of a transmission line. On-site generation would avoid the need to amend the KFP to accommodate the transmission line. The lead agencies eliminated on-site generation because of high capital costs and the likelihood of additional costs to address environmental concerns, such as air quality (USDA Forest Service *et al.* 1992). On-site generation was eliminated in the current alternatives analysis for the same reasons. The agencies' estimate the capital cost of on-site generation to be $37 million. It would increase concentrations of priority air pollutants, such as nitrogen and sulfur oxides. Although on-site generation was not modeled, it is uncertain that on-site generation could comply with the Clear Air Act or the Montana Clean Air Act. A condition of DEQ's draft permit is that once the power was available from a transmission line (either the buried 34.5-kV line or the overhead 230-kV line), operation of emergency generators at the mill would be limited to 16 hours during any rolling 12-month period.

Other alternatives that would involve the construction and operation of a transmission line would all cross MAs designated as corridor avoidance areas. The lead agencies did not identify any reasonable transmission line alternative that would provide power from the BPA's Noxon-Libby 230-kV transmission line that could avoid MAs designated as corridor avoidance areas.

The lead agencies considered a power source other than BPA's Noxon-Libby 230-kV transmission line. One source would require a new line to the mine from a substation located just north of the town of Libby. The primary advantage of the Libby Creek alignment was that it would follow existing transportation and transmission line corridors over much of its length. The major disadvantages of the Libby Creek alignment were that construction costs would be nearly twice that of several other alignments; operating costs would be substantially higher than several other alignments; and all potential alignments would pass through and adjacent to a much higher population density, affecting substantially more private land than other alignments. It also require amending the KFP where it would cross MAs designated as corridor avoidance areas.

2.14 Comparison of Alternatives

The alternatives analyzed in this EIS were developed in response to the significant issues identified during scoping. The lead agencies identified seven significant environmental issues to drive development of alternatives and evaluation of impacts (see section 2.1.2, *Issues*). These alternatives are described in detail in this chapter. A detailed discussion of the alternatives' impacts is contained in Chapter 3. The effects of the alternatives are summarized in the *Summary* section of this EIS.

2.15 Rationale for Preferred Alternatives

The KNF Supervisor and DEQ Director have identified Mine Alternative 3 (the Agency Mitigated Poorman Impoundment Alternative) and Transmission Line Alternative D-R (the Miller Creek Transmission Line Alternative) as the preferred mine and transmission line alternatives. Both the KNF and DEQ decisions would be set forth in agency-specific Records of Decision (RODs). The KNF Supervisor and DEQ Director based their preferred alternatives on a thorough review of the effects analysis in the EIS, review of public and agency concerns received on this project, consultation with cooperating and regulatory agencies, consultation with interested tribes, and the project record.

Mine Alternative 3 and Transmission Line Alternative D-R are the most environmentally preferable of the action alternatives and fulfill the project's purpose, need, and benefit (Section 1.5, *Purpose and Need*). Both alternatives comply with federal and state laws and/or regulation and policy mandates (Section 1.6, *Agency Roles, Responsibilities, and Decisions*). As discussed below, Mine Alternative 3 and Transmission Line Alternative D-R address the seven key issues identified during scoping (Section 2.1.2, *Issues*).

2.15.1 Preferred Mine Alternative

Alternative 3, which would use the Poorman Tailings Impoundment Site instead of the Little Cherry Creek Tailings Impoundment Site, would avoid the diversion of a perennial stream, which would have been necessary under both Alternative 2 (Proposed Action) and Alternative 4 (Issue 2). Mine Alternative 3 also would modify MMC's proposed water management plan to address the uncertainties about the quality of the mine and adit inflows, the effectiveness of LAD for primary treatment (LAD would not be used), the quantity of water that the LAD Areas would be capable of receiving, and the effect on surface water and groundwater quality.

Alternative 3 would incorporate additional feasible and practicable measures to minimize adverse environmental impacts on groundwater and surface water resources. The measures include refining the three-dimensional groundwater model to assess effects, increasing mining buffer zones, installing multiple adit plugs at closure, grouting, and (if necessary) leaving mine void barriers. Using thickened tailings would reduce MMC's appropriation from the Libby Creek and minimize effects on Libby Creek streamflow. To avoid adversely affecting senior water rights, MMC would cease diversions from Libby Creek and discharge treated water to Libby Creek from the Water Treatment Plant during low flows. Discharges to Ramsey Creek from the Water Treatment Plant at low flows also may be needed for the same reason. All discharges of wastewater would be subject to MPDES permitted effluent limits.

Alternative 3 would minimize wetland effects by using the Poorman Impoundment Site, rather than the Little Cherry Creek Impoundment Site (Alternatives 2 and 4) (Issue 7). All unavoidable effects to wetlands (jurisdictional and isolated) would be mitigated through implementation of the alternative's mitigation measures, which would more effectively replace lost functions than the Alternative 2 Wetland Mitigation Plan.

Alternative 3 would address the need for more comprehensive analyses of metals, at appropriate detection limits, through the development and implementation of a Geochemical Sampling and

Analysis Plan (Issue 1). The alternative also would avoid the use of waste rock in plant site construction, require that waste rock be stored either at the Libby Adit Site or within the footprint of the Poorman Impoundment Site before use, and mandate that any waste rock not used in construction would be either placed back underground or used in regrading the tailings impoundment at the end of operations.

Alternative 3 would minimize effects on core grizzly bear habitat and lynx by concentrating disturbance from plant facilities and adits in the Libby Creek drainage (Issue 5). Alternative 3 would require MMC to secure or protect replacement grizzly bear habitat on about 5,500 acres of private lands in the CYE to be managed in perpetuity for the grizzly bear. As compared to other action alternatives, Alternative 3 would incorporate additional feasible and practicable measures to minimize adverse environmental impacts on wildlife habitat that benefit sensitive species and management indicator species (Issue 6). The mitigation and monitoring requirements of the alternative would minimize impacts on wildlife and their habitats. The grizzly bear lands may improve connectivity for wildlife and provide additional habitat for all wildlife species and their prey.

By locating the mine plant (mill and other mine facilities) between Libby and Ramsey creeks (the Libby Plant Site) rather than in the upper Ramsey Creek drainage (the Proposed Action), Mine Alternative 3 would minimize effects on RHCAs (Issue 3). This alternative also would minimize effects on bull trout and sensitive species and includes a bull trout mitigation plan. Mine Alternative 3 would minimize visual effects by reducing the acres that would be disturbed (1,542 acres) and includes a number of measures to harmonize operations with scenic values, such as requiring vegetation clearing methods that maintain scenic quality, painting of structures, and modifying the reclamation plan for the tailings impoundment (Issue 4).

2.15.2 Preferred Transmission Line Alternative

Transmission Line Alternative D-R would avoid an alignment near the Fisher River (Proposed Action) and would minimize the crossing of areas with highly erosive soils and those that are subject to high sediment deliver (Issues 2 and 3). This alternative also would use a helicopter for vegetation clearing and structure construction in some locations, reducing the number and length of new access roads that would be needed. A Vegetation Removal and Disposition Plan would minimize vegetation clearing, particularly in riparian areas.

Transmission Line Alternative D-R would reduce the visibility of the transmission line from US 2 and the CMW, and fewer residences would be within 0.5 mile of the line than under the Proposed Action (Issue 4). Although the alignment would be visible from Howard Lake, the use of H-frame structures, which are shorter than steel monopoles, would mitigate some of these visual impacts above the tree line.

Transmission Line Alternative D-R would minimize effects on threatened or endangered species by routing the alignment along Miller Creek to avoid core grizzly bear and lynx habitat in Miller Creek and the unnamed tributary of Miller Creek (Issue 5). Use of a helicopter for vegetation clearing and structure construction (reducing the number of access roads and displacement effects), as well as limiting construction to between June 16 and October 14 would also mitigate effects on threatened or endangered species and other wildlife species (Issue 6). The mitigation and monitoring requirements of Transmission Line Alternative D-R minimize effects on wildlife and their habitats (Issues 5 and 6). Road closures for wildlife mitigation are maximized in

Transmission Line Alternative D-R (as compared to other action alternatives), and the alternative incorporates additional feasible and practicable measures to minimize adverse environmental impacts on wildlife habitat that benefit sensitive species and management indicator species (Issue 6).

Transmission Line Alternative D-R would minimize effects to wetlands (jurisdictional and isolated) and other waters of the U.S. (Issue 7). Direct effects to wetlands would be avoided by the placement of transmission line facilities and roads, and indirect effects would be minimized through BMPs and appropriate stream crossings.

Chapter 3. Affected Environment and Environmental Consequences

This chapter describes the environment (including its human elements) in the analysis area and discusses the environmental consequences by resource that may result from implementation of each alternative. It provides the scientific and analytic basis for the comparison of alternatives presented in the *Summary* section of this EIS.

3.1 Terms Used in this EIS

3.1.1 Direct, Indirect, and Cumulative Effects

Environmental effects can be direct, indirect, or cumulative and long or short in duration. Direct effects are those that are caused by the action and occur at the same time and place. Indirect effects are those that are caused by the action and are later in time or further removed in distance, but are still reasonably foreseeable (40 CFR 1508.8). The short-term impacts and uses for the mining related aspects of the project are those that would occur during the life of the project. Short-term impacts associated with the transmission line are those that would occur during construction and the 5 years that the DEQ would hold the bond for reclamation of transmission line construction-related disturbances. The KNF and the DEQ would hold a separate bond for transmission line decommissioning. Long-term impacts of the project are those that would persist beyond mine closure and final reclamation.

The project would consist of five main phases – evaluation, construction, operations, closure and post-closure. In general, the Evaluation Phase is estimated at 2 years, Construction Phase at 3 years and potentially up through a fourth year, Operations Phase from 16 to 20 years, and the mine Closure and Post-Closure Phases up to 20 years (or longer if water quality monitoring still indicated a need for treatment). An Operations Phase of 16 to 20 years is predicated on recovering 120 million tons of ore using production rates shown in Table 15, which are of up to 20,000 tons per day. MMC's Preliminary Economic Assessment used a recoverable resource of 58.8 million tons and a production rate of 12,500 tons per day in the assessment (Mine and Quarry Engineering Services 2011). A recoverable resource of 58.8 million tons at a production rate of 12,500 tons per day would take 13 years to mine. A recoverable resource of 120 million tons at a production rate of 12,500 tons per day would take 26 years to mine. Because the recoverable resource and production rate are estimates, the agencies used a 20-year duration for operations in their analyses. The duration of any particular phase may vary and be longer or shorter from that analyzed. A change in production rate would reduce mill water requirements, water appropriations, and wastewater discharges and associated effects on surface water and aquatic resources. A change in project duration would not affect the severity or geographical scope of other effects.

After mining and milling operations ceased, reclamation and closure activities would consist generally of two phases. The first phase would involve the removal of underground and surface facilities, closure of underground workings, and reclamation of surface disturbances in accordance with the approved operating plan. Included in this would be the dewatering and capping of the tailings impoundment as described in section 2.4.3.1.6, *Tailings Impoundment and*

Borrow Areas. The agencies estimate that the dewatering of the tailings impoundment may last from 5 to 20 years, and this timeframe is assessed in the impact analysis that follows in this chapter.

The second phase would involve long-term operations and maintenance of specific facilities, such as the Water Treatment Plant or the seepage collection system at the tailings impoundment. MMC would maintain and operate these facilities until BHES Order limits or applicable nondegradation criteria were met in all receiving waters from any specific discharge. MMC also would continue water monitoring as long as the MPDES permit was in effect. As long as post-closure water treatment operated, the agencies would require a bond for the operation and maintenance of the Water Treatment Plant. The level of human activity associated with facility operation, maintenance, and monitoring is unknown, but has the potential of being a daily requirement and year-round in duration. The length of time that the second phase of closure activities would occur is not known, but may be decades or more.

Cumulative effects are those that result from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions (40 CFR 1508.7). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Past and current activities and natural events have contributed to creating the existing conditions and trends. The agencies used scoping to determine whether, and to what extent, information about the effects of a past action was useful for the effects analysis of the Montanore Project. The agencies conducted the cumulative effects analysis by focusing on the current aggregate effects of past actions (Council on Environmental Quality 2005), as described in the *Affected Environment* sections of this chapter. Additionally, some of these activities may continue to produce environmental effects on issues or resources relevant to the proposal. The list of activities considered in the cumulative effects analysis was taken from the KNF's Schedule of Proposed Actions and from KNF program managers. Figure 50 shows activities considered in the cumulative effects analysis.

Activities on public and private lands have been considered in the cumulative effects analysis and are described in the cumulative effects section for each resource. Data on private lands are the best available information derived from landowners and field verification, and are generally more limited than data on public lands. The types of actions (past and current or reasonably foreseeable) analyzed in the cumulative effects analysis are grouped into four categories:

- Mining Activities
- KNF Land Management Activities
- Private Land Activities
- Other Government Agency Activities

3.1.2 Irreversible or Irretrievable Commitment of Resources

As required by NEPA, this section also includes a discussion by resource of any irreversible or irretrievable commitment of resources that would result from implementing the alternatives. An irreversible commitment of resources means that non-renewable resources are consumed or destroyed. These resources are permanently lost due to project implementation. An irretrievable commitment of resources is the loss of resources or resource production, or use of renewable resources, during project construction and during the period of time that the project is in place.

3.2 Past and Current Actions

3.2.1 Mining Activities

3.2.1.1 Troy Mine

ASARCO leased the Troy Project from Kennecott in 1973 with plans to build a mine. Underground production began in 1981 and lasted for a period of 12 years ending in 1993. The mine was subsequently in care and maintenance status. Revett Mining Co., Inc. (Revett) acquired the Troy Mine, operated by Troy Mine, Inc., a wholly owned subsidiary of Revett in 1999. In late 2004, the Troy Mine was brought back into production. In December 2012, Revett suspended all underground mining activities following back and pillar failures in both the north and south ore bodies in the Middle Quartzite of the Revett Formation that manifested as surface cracking and shallow subsidence (Call & Nicholas 2014). As part of planned development, Revett attempted to gain access to a lower part of the mine through two separate drifts. Revett announced in late 2013 that both drifts exhibited structural instability and did not meet the standards of safety for further development.

Revett’s current plans include accessing two new areas—the I Beds and C Beds. Since commencing the I Bed development drift in early November 2013, Revett has advanced 4,700 feet in total as of July 1, 2014. Revett will install a borehole that will serve as secondary egress and ventilation for development and production of the C Beds. Development will continue until reaching the North C Bed, which is anticipated to be in the third quarter of 2014. Continued development to access the I Beds requires a decline with an accompanying borehole for secondary egress and ventilation. This development is expected to take 6 to 9 months after the North C Bed ore body has been accessed. The mill is scheduled to be restarted for limited commercial production in the fourth quarter of 2014. As of December 31, 2013, the Troy Mine has a proven reserve of 2.18 million ounces of silver and 21.45 million pounds of copper and has probable reserves of 14.99 million ounces of silver and 99.48 million pounds of copper suggesting a 12-year life of mine (Revett 2014). Revett also continues to explore ore bodies that may extend mining activity beyond the currently projected 12 years.

After completion of the mining, the mine area will be reclaimed. In 1978, the KNF and the DSL issued a Draft and Final EIS that addressed potential impacts from both the operation and reclamation of the Troy Mine. In 1999, the agencies initiated a review of the Troy Mine reclamation bond. The agencies notified the mining company that the approved 1978 Reclamation Plan needed to be revised and a substantial bond increase would be required, as the approved 1978 Reclamation Plan does not meet state or federal requirements for mine water discharge. In 2006, Troy Mine, Inc. submitted a revised reclamation plan to the agencies for approval that updates the approved 1978 plan in anticipation of future mine reclamation. The agencies issued a Final EIS and a ROD on the revised reclamation plan in 2012. Depending on project timing, permitting, and other financial considerations, employees from the Troy Mine could be phased into the Rock Creek Project.

The KNF submitted a BA on the revised reclamation plan and a request for concurrence to the USFWS on February 28, 2012. The USFWS reviewed the BA and, on March 21, 2012, concurred that the preferred alternative (Alternative V) would not likely adversely affect the threatened grizzly bear or the threatened Canada lynx. On May 15, 2012, the USFWS also concurred that the action would not likely adversely affect the threatened bull trout or bull trout critical habitat.

3.2.1.2 Other Minerals Activities

Numerous placer and lode mining claims exist within the Treasure, Crazy, Silverfish, and Rock PSUs. Some of these claims are the site of active mines, and several plans of operations have been approved for in-stream suction dredging and exploratory digging in these PSUs. Other claims show evidence of having been mined in the past, and are currently inactive. In some cases the mines are abandoned and the mineral rights are not currently under claim. Closure of abandoned mines, and in some cases inactive mines, for safety purposes is ongoing on the Forest. Use of grates, which allow bat ingress and egress, are the most common and preferred closure type. Common variety type mineral material resources include numerous gravel pits on National Forest System lands which provide mineral material for Forest Service road projects.

3.2.2 KNF Management Activities

Past and current KNF management actions are listed in Appendix E. One outfitter holds a permit for hunting and trail rides within the Silverfish PSU. A hunting camp is permitted near but outside the CMW. This camp is accessed by a trail using foot or saddle and pack stock.

3.2.3 Private Land Activities

3.2.3.1 Libby Creek Placer Timber Harvest

Libby Creek Placer Company has removed 50,000 to 100,000 board feet of timber annually (except in 2007) on the Libby Placer property. About 20 loads or less were removed from the property per year for 3 years beginning in 2007.

3.2.3.2 Avista-funded Bull Trout Recovery Activities

Avista Corp. is funding ongoing fish trapping/monitoring activities in Rock Creek and East Fork Bull River. Both drainages have screw traps and weirs for capturing out-migrating juvenile trout. In addition, adult bull trout are being captured below Cabinet Gorge Dam, and based on their genetic assignment are transported above and afforded access to both Rock Creek and East Fork Bull River. In the East Fork Bull River, Avista and FWP are implementing a non-native suppression program that involves active and passive methods to remove and exclude non-native fish from the river. Fish greater than 151 mm in length are being moved to other areas of the Bull River. In cooperation with FWP, annual bull trout spawning surveys are conducted annually, and overall fish population surveys are conducted on a predetermined schedule. The most recent channel restoration in the East Fork Bull River occurred in 2007. Avista and others funded the KNF to complete 1,100 feet of channel restoration to route the stream back into a historical channel to avoid a newly created chronic sediment source. Most of the work occurred on National Forest System land.

3.2.4 Other Government Agency Activities

3.2.4.1 DNRC Habitat Conservation Plan

The DNRC Trust Land Management Division developed a voluntary multi-species habitat conservation plan (HCP) with technical assistance from the USFWS (DNRC 2011). The HCP intends to sustain DNRC management practices over time while conserving habitat for five fish and wildlife species, three of which are listed under the ESA. The HCP was prepared to meet regulatory compliance with Section 10(a)(1)(B) of the ESA. Section 10 provides a regulatory mechanism to allow for the incidental take of federally endangered and threatened species of wildlife by private interests and non-federal government agencies during lawful land practices. The HCP permit period extends 50 years and covers forest management activities on classified forested State trust lands that provide habitat for species currently listed or having the potential to be listed under the ESA. Those species are: grizzly bear, Canada lynx, bull trout, westslope cutthroat trout, and redband trout. Activities covered by the HCP are timber management activities, road construction, reconstruction, maintenance, and use and associated gravel quarrying for forest road surface materials, and grazing. One State land parcel subject to the HCP is found along the agencies' transmission line alternatives. Another State land parcel subject to the HCP is along Libby Creek Road.

3.2.4.2 FWP-Plum Creek Conservation Easement

In 2003, Plum Creek initiated a 7-year transaction to sell a conservation easement to the FWP on 142,000 acres in northwest Montana. The Plum Creek Conservation Easement in the analysis area is discussed in section 3.15*, Land Use* and shown on Figure 78.

3.3 Reasonably Foreseeable Future Actions or Conditions

3.3.1 Climate Change

Climate change is not a reasonably foreseeable future action, but may represent a reasonably foreseeable future affected environment. Information on the effects of the project on greenhouse gas emissions is discussed in section 3.4, *Air Quality.* The potential project effects associated with climate change are described in section 3.6, *Aquatic Life and Fisheries,* section 3.10, *Groundwater Hydrology*, section 3.11, *Surface Water Hydrology*, section 3.13, *Water Quality*, and, for those wildlife species potentially affected, in section 3.25, *Wildlife.*

The USDA Forest Service issued the Kootenai-Idaho Panhandle Plan Revision Zone (KIPZ) Climate Change Report in 2010 (USDA Forest Service 2010a). The report was prepared for revision of the forest plans of the Kootenai and Idaho Panhandle National Forests and provided a synthesis of the best available scientific information on climate change and its potential impacts on the resources and ecosystems of northern Idaho and northwest Montana. It summarized available information on climate changes that have been observed over the last 100 years and the amount of change projected in the coming decades. Global climate models are the principal tool for evaluating future changes and trends in climate. Models are run with different scenarios of global socioeconomic change. The different scenarios lead to different levels of greenhouse gas and sulfate emissions. The KIPZ Climate Change Report provided an evaluation of the potential implications for those trends for resources and ecosystems of the Kootenai and Idaho Panhandle National Forests. It described key areas of uncertainty associated with climate change trends and model results.

The Department of the Interior, Bureau of Reclamation issued three reports on climate change in 2011 (Reclamation 2011a, 2011b, 2011c). One report (Reclamation 2011a) provided a region-specific summary of recent literature on the past and projected effects of climate change on hydrology and water resources and then summarized implications for key resources in the 17 Western States. The report's narratives were meant for potential use in environmental documents, such as EISs and BAs (Reclamation 2011a). A second report (Reclamation 2011b) described Reclamation's assessments that involved developing hydrologic projections associated with a large collection of global climate projections featured in the Intergovernmental Panel on Climate Change Fourth Assessment (Intergovernmental Panel on Climate Change 2007) and developed as part of the World Climate Research Program's Coupled Model Intercomparison Project phase 3 (CMIP3). CMIP3 projections are regarded as the best available information for describing future global climate possibilities (Reclamation 2011b). A third report (Reclamation 2011c) summarized Reclamation's analysis in a report to the U.S. Congress. The following discussion is based on these reports, and focuses on the Pacific Northwest. Where available, this discussion includes projections for northern and eastern subbasins in which the Montanore Project area occurs. Two of the cited reports (Reclamation 2011b, 2011c) describe the uncertainties associated with the projections in detail, such as uncertainties about future greenhouse emissions pathways and physical processes that affect climate. The Bureau of Reclamation (2011c) stated that "the projected changes have geographic variation; they vary through time, and the progression of change through time varies among climate projection ensemble members" and that "some geographic complexities of climate change emerge over the Columbia River Basin when climate projections are inspected location by location."

3.3.2 Mining Activities

3.3.2.1 Rock Creek Project

The Rock Creek Project is a proposed underground copper and silver mine and mill/concentrator complex near Noxon, in Sanders County, Montana. RCR would be the mine operator. The KNF and the DEQ issued a joint ROD on the project in 2001 (USDA Forest Service and DEQ 2001) and the KNF issued a new ROD in 2003 (USDA Forest Service 2003a) following a revised USFWS Biological Opinion (USFWS 2003a). The Final Biological Opinion on the project was issued in 2006 (USFWS 2006). A supplement to the Final Biological Opinion was issued in 2007 (USFWS 2007a). The Forest Service is responding to the United States District Court Opinion in Rock Creek Alliance *et al*. v. USDA Forest Service that found deficiencies in the 2001 Rock Creek Project Final EIS. The court, in an earlier decision dated April 29, 2010, vacated the Forest Service's ROD) to approve the Rock Creek Project, and remanded the 2001 Final EIS to the Forest Service for further action consistent with the Court's Opinion. Based on the court ruling, the Forest Service will issue a Supplemental EIS and a new ROD.

The Rock Creek Project is approved by the DEQ. RCR has not posted a reclamation bond for the operating permit and the DEQ has not issued an operating permit. The DEQ issued Exploration License 00663 in 2009 for construction of an evaluation adit. RCR initiated activities approved on private land. RCR posted a portion of a reclamation bond with the DEQ before implementing approved activities.

The Rock Creek Project would include relocation of the lower portion of NFS road #150, and the construction of a mill/concentrator for ore processing, mine waste disposal facilities, various pipelines and access roads, a 230-kV transmission line and associated substation, a rail loading area for transportation of concentrate, and water treatment facilities. The operating permit area for the agencies' preferred alternative identified in the 2001 RODs (Alternative V) would be 1,560 acres (749 acres of private and 811 acres of National Forest System lands). The project would disturb 482 acres, of which 140 acres would be National Forest System lands, and reduce grizzly bear habitat effectiveness on an estimated 7,044 acres during construction and 6,428 acres during operations. The life of the Rock Creek Project is anticipated to be 35 years. The Rock Creek ore deposit is located beneath and adjacent to the CMW. The ore deposit, mill, and other facilities would be located in the Kaniksu National Forest, which is administered by the KNF in Montana. Access to the proposed project site would be via MT 200 and NFS road #150, or the Rock Creek Road.

An evaluation adit would be constructed above the West Fork Rock Creek off of NFS road #2741 near the CMW to gather additional data and to provide ventilation during mining. Support facilities would be constructed, including a wastewater treatment facility to handle water from the evaluation adit before discharge to infiltration ponds on private land in the proposed tailings storage facility.

The underground mining operation would use a room-and-pillar mining method. The mineralized zone under the CMW would be accessed through twin adits driven from outside the CMW. A fourth adit may be constructed for ventilation intake with a portal in the CMW if needed. Ore concentrate produced during the milling process would be transported from the mill to the rail loading area via pipeline and then shipped to a smelter by rail. The tailings would be deposited as a paste in an impoundment behind an embankment.

Mine water would be stored seasonally in underground workings; excess water would be discharged to the Clark Fork River after treatment. The water treatment system would include semi-passive biotreatment and a reverse osmosis system. At the end of operations, all remaining surface area disturbances and facilities except for the Water Treatment Plant and associated pipelines would be reclaimed. Water treatment of mine water and tailings seepage would continue as long as necessary until each water source met appropriate water quality standards or limits without treatment. The mine adits would either be a) plugged with concrete bulkheads and sealed once the mine water met groundwater or surface water quality standards, and the mine workings flooded with mine water, or b) sealed against unauthorized access and the mine water drained or pumped, after treatment, if necessary, to the Clark Fork River in perpetuity.

Development of the evaluation adit would take 18 to 24 months. Work would start with 23 employees in the first quarter and increase to a maximum of 73 workers in the fourth quarter. Mine construction might immediately follow the adit work, or a period of inactivity could last months, or even years, between the two phases. Mine construction and production startup would take about 3.5 years. During the initial phase of mine construction, the entire workforce would consist of an estimated 72 employees, then it is estimated 275 contract construction personnel would be brought onto the project for 18 months. Employment of company and contract workers would peak at 348 during mine construction, with the minimum employment of 180 mine workers following this peak at about year 4 of construction. Permanent operating employment is projected to stabilize at 340. The project would operate 24 hours per day, 7 days per week, and 354 days per year. At the end of production, there would be a 2-year shutdown and reclamation period employing 35 workers. Limited employment would continue as long as water treatment was necessary.

Project mitigation would include the following grizzly bear mitigation measures:

- RCR would acquire perpetual conservation easements or purchase replacement grizzly bear habitat (2,350 acres). Of this, 53 acres would be acquired before evaluation adit construction, an additional 1,721 acres before mine construction, 10 acres before the air-intake ventilation adit, and 566 acres before mine operation.

- RCR would secure or protect from development and use 100 acres of replacement habitat.
- The KNF would place an earthen barrier on NFS road #4784 within 1 year of issuing approval for the evaluation adit.
- Before construction, the KNF would place a barrier on 1.6 miles of NFS road #2285, 0.18 miles of NFS road #2741X, and gate 0.5 mile of NFS road #2741A and 2.92 miles of NFS road #150 year-long.
- RCR would fund two local FWP grizzly bear management specialist positions (with focus on public information and education) and a local FWP law enforcement position.
- RCR would defer the construction phase of the mine until at least six female grizzly bears have been augmented into the Cabinet Mountains portion of the Recovery Zone (south of US 2); this requirement has been fulfilled.

Among the monitoring and mitigation measures implemented by RCR are completing a collection agreement with FWP for grizzly bear mitigation, providing $468,603 to FWP toward funding of the grizzly bear management specialist and initial funding of other grizzly bear mitigation items, and acquiring 928 acres of grizzly bear habitat to be conveyed to the Forest Service or placed in a permanent conservation easement.

3.3.2.2 Libby Creek Ventures Drilling Plan

Libby Creek Ventures proposed the drilling of three borings adjacent to the Upper Libby Creek Road (NFS road #2316) on its two claims located in Section 15, Township 27N, Range 31 West. A 20-ton rotary-hammer type truck-mounted drill rig with a trailer and two pick-up trucks will be used to drill the holes and the active drilling will take place during 3 days. Mobilization and equipment maintenance may increase the total active time to 1 week. The KNF's approved Plan of Operations expired on October 18, 2011 (USDA Forest Service 2007b). To date, Libby Creek Ventures has not implemented the project, but it is reasonably foreseeable that the action will occur. About 1 acre of surface disturbance would be associated with the drilling project.

3.3.3 KNF Management Activities

3.3.3.1 Wayup Mine/Fourth of July Road Access

The KNF completed an EIS and issued a ROD for the Wayup Mine and Fourth of July Road Access. The proposed action will permit access across National Forest System lands to private property located in the upper West Fisher Creek drainage. The Wayup Mine is located in the headwaters of West Fisher Creek and the Fourth of July is located near Lower Geiger Lake (USDA Forest Service 2000a, 2000b). The Wayup Mine proposal will involve reconstruction, maintenance, spot reconstruction, and use of two existing roads. These roads will provide the proponent access across National Forest System lands to about 40 acres of private property known as the Wayup Mine. The first road is an existing non-system road and the second road is NFS road #6746. The Fourth of July proposal will involve reconstruction of 0.72 mile of road and will begin at the end of NFS road #6748 at the Lake Creek trailhead and proceed southwest on the non-system Irish Boy Mine road to a proposed bridge site on Lake Creek. Reconstruction will consist of clearing trees, brush, and stumps from the existing road corridor. It will also include removing slumps, outsloping and installing surface drainage structures, and slash disposal. New construction of 1.8 miles of road would begin at the proposed bridge site and extend to the Fourth of July parcel. Construction would consist of clearing trees, brush, and stumps for a road corridor up to 60 feet wide on steep slopes, earthmoving to create a 12- to 16-foot surface, installation of road surface drainage structures and culverts, construction of one bridge, and slash disposal. USFWS consultation would be necessary before implementation of the Wayup Mine/Fourth of July Road Access project, along with possible further analysis and public involvement.

3.3.3.2 Miller-West Fisher Vegetation Management Project

The KNF prepared an EIS to disclose the environmental effects of vegetation management through commercial timber harvest, precommercial thinning, and prescribed fire; access management changes; trail construction and improvement; treatment of fuels in campgrounds; and watershed rehabilitation activities. The project area is 20 miles south of Libby, Montana in the Silverfish PSU on the KNF's Libby Ranger District and contains Miller, West Fisher, and Silver Butte watersheds. A ROD was signed in 2009. Alternative 6-Modified of the Miller-West Fisher Vegetation Management Project EIS was the KNF's selected alternative and is used in the cumulative effects analysis. This decision was remanded to the KNF by the Montana District Court. Additional analysis for the project was required. During this additional analysis, the KNF dropped helicopter logging from the project due to long-term economic infeasibility. These changes are detailed in the Miller-West Fisher Supplemental EIS and modified ROD. With these changes, the project would consist of:

- Vegetation treatments on about 1,898 acres, including commercial timber harvest and associated fuel treatments including 1,206 acres of intermediate harvest and regeneration harvest on 692 acres, precommercial thinning on 351 acres, and prescribed burning without associated timber harvest on 2,830 acres.
- Road and access management, including access changes on 1.92 miles of road; 3.29 miles of new temporary road construction, and 19.2 miles of road storage, and 1.43 miles of road decommissioning; improvement, construction, and reconstruction of 5.9 miles of trail tread.
- Fuels and hazardous tree removal in Lake Creek Campground.
- Watershed condition improvement in the form of BMP implementation, including installation of ditch relief culverts, culvert replacement, surface water deflectors, and cleaning ditches is proposed for all haul routes. Additional BMP work on roads not used for timber removal is proposed and will be performed as funding becomes available.
- Trail and trailhead improvements.
- Creation of in-stream pools in Miller Creek and stabilization of stream banks in West Fisher Creek.
- Design features and mitigations to maintain and protect resource values.

Alternative 6-Modified activities would occur in two sequential phases (Phase I and Phase II) to maintain current levels of grizzly bear core habitat. In Phase I, vegetation would be treated in the North Fork Miller Creek. After North Fork Miller Creek vegetation treatments were complete, NFS road #4725 would be barriered and placed into intermittent stored service, creating core habitat. During Phase II, vegetation would be treated in the Teeters Peak area, which currently provides grizzly bear core habitat. To access the Teeters Peak area, the earthen barrier on the currently closed NFS road #6743 would be replaced with a gate that would remain closed during temporary road construction, logging, and road storage work. The gate on NFS road #6743 would be replaced by a new earthen barrier when activities in the Teeters Peak area were complete.

Mitigation for the Montanore Project also includes replacing the existing gate on NFS road #4725 with an earthen barrier to restrict motorized access year round and create grizzly bear core habitat. Because the access change on NFS road #4725 was first proposed for the Montanore Project, the Montanore Project Final EIS analysis assumes the road would be barriered before initiation of the Construction Phase as part of the Montanore Project mitigation.

3.3.3.3 Flower Creek Vegetation Management Project

The KNF prepared an EIS to disclose the environmental effects of vegetation management on 990 acres. The project area is 3 miles south of Libby, Montana in the Flower Creek watershed, which is the municipal water source for Libby. Vegetation treatments will include commercial timber harvest and associated fuel reduction, fuel reduction in stands that are not economically viable for commercial harvest, pre-commercial thinning, yarding tops to the landing in commercial harvest units, grinding landing piles and spot fuel grinding or mastication with and without associated timber harvest. The project also will include 1.81 miles of road storage, 1 mile of temporary road construction, and 0.23 miles of trail construction.

3.3.3.4 Bear Lakes Access

In the decision issued following an EA, the KNF allowed the owners of the Bear Lakes Ranch reasonable access to a cabin on Bear Lakes Ranch. The action permits the owners to use either the Bear Lakes Trail #178 or the Divide Cut-off Trail #63 via the Iron Meadow Trail #113 for horse and pack stock access to the cabin on Bear Lakes Ranch. Through a special use permit, the owners of the ranch may use a portion of the non-system trail into Big Bear Lake Basin and construct a new trail to the cabin as designated by the KNF. About 1,000 feet of new trail will be constructed to access the private land. The new construction will involve a limited amount of blasting (*i.e.*, one day involving four to six blasts) and will occur in the CMW (USDA Forest Service 2005a).

3.3.3.5 Other Projects

Other projects include the KNF’s Libby Ranger District granting of an easement for access to private land on Allen Peak using NFS road #2301. Access currently occurs, and would continue to occur on a limited basis using this road. No road construction or reconstruction is planned.

The Coyote Improvement vegetation management project, currently in the planning stage, is on the KNF’s Libby Ranger District in Sections 13 and 18, Township 27N, Range 30 West. The proposed project involves harvest of 240 acres to increase stand resiliency to mountain pine beetles. No new road construction is planned.

A communication site, consisting of a small utility building, and towers not to exceed 80 feet in height, within and area of less than 1 acre, is planned for Horse Mountain on the KNF’s Libby Ranger District. The proposed site is within the Crazy PSU, outside of the BMU. No new road construction is planned. A site would be administered under a Special Use permit.

The KNF’s Libby Ranger District is conducting an environmental analysis on the Silverbutte Bugs project in the area of the Miller-West Fisher Vegetation Management Project.

3.3.4 Private Lands Activities

3.3.4.1 Poker Hill Rock Quarry

Plum Creek permitted a quarry called the Poker Hill site located in sections 3, 4, 9, and 10 in Township 28N, Range 30 West. The quarry site has a 123-acre permit area and will disturb up to 38 acres for the quarry and staging area. The quarry will produce decorative rock used for landscaping, retaining walls, and masonry. Riprap and gravel may be used for road BMP upgrades and maintenance. Rock tumblers, splitters, crushers, and blasting may be used on the quarry site to help create the desired products. The quarry and associated glacial deposits may also be used as a source for US 2 aggregates for future highway improvements.

Reclamation will include recontouring slopes where needed, grass seeding, weed spraying, reshaping high walls and pit areas where possible as described in the general plan of operations. All access roads, which are needed for future timber management, will be left unreclaimed and maintained up to forestry BMP standards. Access to the quarry will use existing Plum Creek roads. The access road to US 2 would be realigned for safety if a major highway construction contract is awarded that would use the aggregates from the quarry.

3.3.4.2 MDT Road Projects

MDT has multiple projects within the area of US 2 that may be affected by traffic or construction of the power line or roadway improvements for the Montanore Mine. One MDT roadway and one wetland project are currently under construction and two additional roadway construction projects are anticipated for the next 5 years.

3.3.4.3 Other Actions on Private Lands

Continued development of private lands within the analysis area is expected. Development is expected to include commercial timber harvest, land clearing, home construction, road construction, septic field installation, water well drilling, livestock grazing, and stabilization of stream banks.

3.4 Air Quality

3.4.1 Regulatory Framework

3.4.1.1 Clean Air Act and Clean Air Act of Montana

Under the federal Clean Air Act, the EPA sets National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The EPA has set NAAQS for six principal pollutants: carbon monoxide (CO); lead; nitrogen oxides (NO_2); particulate matter with an aerodynamic diameter equal to or less than 10 and 2.5 microns (PM_{10} and $PM_{2.5}$, respectively); ozone; and sulfur dioxide (SO_2). These pollutants are referred to as criteria pollutants. The federal Clean Air Act established two types of standards for criteria pollutants. Primary standards set limits to protect public health, including the health of sensitive populations, such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings (Environmental Protection Agency 2006a). In 2010, the EPA established a new 1-hour standard for nitrogen dioxide (NO_2) at a concentration of 100 parts per billion (ppb) (188.679 micrograms per cubic meter ($\mu g/m^3$)), expressed as the 3-year average of the 98th percentile (8th highest) of the yearly distribution of 1-hour daily maximum concentrations. The new standard supplements the existing annual standard. The EPA also established in 2010 a new 1-hour SO_2 standard of 75 ppb (195 $\mu g/m^3$), which is based on the 99th percentile (4th highest) of the annual distribution of the maximum daily 1-hour SO_2 concentration. Under Montana's implementation of the Clean Air Act, Montana established Montana Ambient Air Quality Standards (MAAQS) for criteria and other ambient air pollutants. NAAQS and MAAQS are presented in Table 47. In 2012, the EPA reduced the annual $PM_{2.5}$ standard to 12 $\mu g/m^3$. Unlike

Table 47. National and Montana Ambient Air Quality Standards.

Pollutant	Averaging Period	MAAQS ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
PM_{10}	Annual	50	Revoked
	24-Hour†	150	150
$PM_{2.5}$	Annual	—	12
	24-Hour†	—	35
NO_x	Annual‡	94	100
	1-Hour§	564	188.679
SO_2	Annual	52	80
	24-Hour†	262	365
	3-Hour†	—	1,300
	1-Hour†	1,300	195
Lead	Quarterly*	—	1.5
	90-day*	0.15	—

†Concentrations are high second-high values. Certain ambient air quality standards are "not to be exceeded more than once per year." DEQ looks at the highest second high value for maximum modeled concentrations.
*The 1-month average concentration is used for compliance demonstration.
$\mu g/m^3$ = microgram per cubic meter.
Source: DEQ 2011a.

most new NAAQS, the EPA allowed grandfathering of pending preconstruction permitting applications if the application was deemed complete by December 14, 2012. This grandfathering would apply to the Montanore Project, and MMC would not need to demonstrate compliance with the new annual $PM_{2.5}$ standard.

An area is designated as attainment when existing concentrations of all regulated pollutants are below the NAAQS and MAAQS. Likewise, an area is designated as nonattainment when existing concentrations of one or more regulated pollutants are above the NAAQS and MAAQS. The Montanore mine production and processing facilities would be in an area designated as "attainment" for all regulated pollutants. The city of Libby and surrounding area has been designated a nonattainment area for both $PM_{2.5}$ and PM_{10}. The closest boundary of the PM_{10} nonattainment area is 8.9 miles north of the proposed Little Cherry Creek Tailings Impoundment. The closest boundary of the $PM_{2.5}$ nonattainment area is 1.5 miles north of the tailings impoundment. The Libby Loadout and segments of the Bear Creek access road would be within the Libby PM_{10} and $PM_{2.5}$ nonattainment areas.

The Montanore Project would be required to obtain a Montana Air Quality Permit (MAQP) because the facility has the potential to emit more than 25 tons per year (tpy) of one or more criteria air pollutants. The mine and mill (plant) facility would be considered a minor source under the Title V and Prevention of Significant Deterioration (PSD) regulations because total potential emissions from point sources underground and on the surface would be less than 250 tpy for any criteria pollutants. The Project would be considered a minor source and would not require a Title V operating permit under ARM 17.8.1204 because the potential emissions are less than 100 tpy for any pollutant, less than 10 tpy for any single hazardous air pollutant (HAP), and less than 25 tpy for total HAPs (TRC Environmental Corp. 2006a).

The PSD program is implemented primarily through the use of pollutant increments and area classifications. An increment is the maximum increase (above a baseline concentration) in the ambient concentration of PM_{10}, $PM_{2.5}$, SO_2 and NO_2 that would be allowed in an area. The area classification scheme establishes three classes of geographic areas and applies more stringent increments to those areas recognized as having higher air quality values. Class I areas are accorded the highest level of protection by allowing the smallest incremental pollutant increase. Under PSD regulations, the mine facilities would be located in an area designated as Class II and the CMW is designated as Class I. Mine adits, which would be the source of emissions, would be about 0.5 mile from the CMW boundary in Mine Alternatives 2, 3, and 4.

The USDA Forest Service, National Park Service, and U.S. Fish and Wildlife Service, collectively called the Federal Land Managers (FLMs) issued interagency guidance for nitrogen and sulfur deposition analysis in 2011 summarizing current and emerging deposition analysis tools applicable to Class I and Class II areas for evaluating the effect of increased nitrogen or sulfur deposition on air quality related values (AQRVs) (USDA Forest Service *et al*. 2011). The FLMs established deposition analysis thresholds to use as screening level values for the additional modeled amount of sulfur and nitrogen deposition within areas from new or modified major sources. A deposition analysis threshold is defined as the additional amount of nitrogen or sulfur deposition within an area, below which estimated impacts from a proposed new or modified source are considered negligible. The deposition analysis threshold established for both nitrogen and sulfur in the KNF and CMW is 0.005 kilograms/hectare/year (USDA Forest Service *et al*. 2011). Under the Clean Air Act, the FLM formal "affirmative responsibility" role in the permitting process is limited to the extent a proposed new or modified major source may affect AQRVs in a Class I area. The Montanore Project is not a major source.

The Forest Service provides guidance to evaluate the potential impact of sulfur (S) and nitrogen (N) deposition, calculated from sources of SO_2 and NO_x operating during Montanore Mine production. The Forest Service resource concern thresholds for CMW lakes with different acid-neutralizing capability (ANC) are (USDA Forest Service 2013d):

10%:	Lakes with ANC 10-100 microequivalents/liter (μeq/L)
No change:	Lakes with ANC < 10 μeq/L

3.4.1.2 Other Federal Requirements

3.4.1.2.1 Organic Administration Act and Forest Service Locatable Minerals Regulations

The Organic Administration Act authorizes the Forest Service to regulate the occupancy and use of National Forest System lands. The Forest Service's locatable minerals regulations are promulgated at 36 CFR 228, Subpart A. The regulations apply to operations conducted under the U.S. mining laws as they affect surface resources on National Forest System lands under the jurisdiction of the Secretary of Agriculture. One of these regulations (36 CFR 228.8) requires that mining activity be conducted, where feasible, to minimize adverse environmental impacts on National Forest surface resources. 36 CFR 228.8(a) also requires that mining operators comply with applicable state and federal air quality standards including the Clean Air Act. 36 CFR 228.8(h) states that "certification or other approval issued by state agencies or other federal agencies of compliance with laws and regulations relating to mining operations will be accepted as compliance with similar or parallel requirements of these regulations."

3.4.1.2.2 Wilderness Act

The Wilderness Act allows mineral exploration and development under the General Mining Law to occur in wilderness to the same extent as before the Wilderness Act until December 31, 1983, when the Wilderness Act withdrew the CMW from mineral entry, subject to valid and existing rights. 36 CFR 228.15 provides direction for operations within the National Forest Wilderness. Holders of validly existing mining claims within the National Forest Wilderness are accorded the rights provided by the U.S. mining laws and must comply with the Forest Service Locatable Minerals Regulations (36 CFR 228, Subpart A). Mineral operations in the National Forest Wilderness are to be conducted to protect the surface resources in accordance with the general purpose of maintaining the wilderness unimpaired for future use and enjoyment as wilderness and to preserve the wilderness character consistent with the use of the land for mineral development and production.

3.4.1.2.3 Kootenai Forest Plan

The 1987 KFP established management areas within the forest with different goals and objectives based on the capabilities of lands within the analysis area (USDA Forest Service 1987a). The KFP contains goals, objectives, and standards. The KNF will cooperate with the DEQ in meeting the State Implementation Plan and the Smoke Management Plan.

3.4.2 Analysis Area and Methods

The analysis area is an area around project facilities where air emissions would occur. The facilities are the Ramsey and Libby Plant sites, the Ramsey and Libby Adit sites, the Little Cherry Creek and Poorman tailings impoundment areas, LAD Areas, all access roads, alternate transmission line alignments, Sedlak Park Substation, and the Libby Loadout. The Libby Loadout is included in the analysis area because the loadout would be covered by DEQ's Operating Permit.

3.4.2.1 Methods

3.4.2.1.1 Existing Conditions

Meteorological conditions and air quality parameters were monitored between July 1, 1988 and June 30, 1989 at two sites—the Ramsey Creek Air Monitoring Site in the upper Ramsey Creek drainage at the Ramsey Plant Site and the Little Cherry Creek Air Monitoring Site south of the Little Cherry Creek Tailings Impoundment (meteorological data only) (Woodward-Clyde Consultants 1989b). The monitoring locations are shown on Figure 2.3 in the MAQP Application (TRC Environmental Corp. 2006a). The monitoring results were used in the air quality and visibility analyses for both the 1992 EIS (USDA Forest Service *et al*. 1992) and this EIS. Only data from the Ramsey Creek Air Monitoring Site were used because the data recovery at the Little Cherry Creek Air Monitoring Site was not as complete and because Ramsey Creek Air Monitoring Site meteorological data are more representative of the conditions where a majority of pollutant emissions would be emitted (the Ramsey and Libby adits). The Ramsey Creek Air Monitoring Site meteorological data were combined with twice-daily upper air mixing height data from Spokane, Washington, the closest upper air meteorological site to the mine area (TRC Environmental Corp. 2006a). The baseline meteorological and air quality measurements made during the 1988-1989 baseline year are considered to be representative of one year at this site, with the exception of precipitation, which was much lower than normal during this period (see *Affected Environment* section below).

Maximum hourly and/or daily and annual average emission rates of PM_{10}, $PM_{2.5}$, total suspended particulates (TSP), NO_x, CO, SO_2, and trace metals including antimony, arsenic, cadmium, chromium, and lead were calculated for all sources and regulated pollutants. Copper and silver were not included because they are not regulated in air. This differentiation between short-term (hourly and daily) and long-term averages applies most specifically to emission sources for which annual operating limits are proposed, but have the potential to operate at maximum load on an hourly and/or 24-hour basis. For modeling purposes, it was assumed mine construction would commence and the mine would phase in production, reaching full production in operating year 4. Operations for year 4, the first year of maximum production, were considered the worst-case production emissions scenario and were used for emission calculations (TRC Environmental Corp. 2006a).

Ambient air quality background concentrations were established using monitoring and other available data. Background concentrations were added to modeled concentrations predicted to be emitted from the Montanore Mine to obtain total concentrations for comparison to NAAQS and MAAQS. Modeled annual NO_x concentrations were adjusted using the Ambient Ratio Method. Hourly NO_x concentrations were adjusted using the Ozone Limiting Method (OLM) as described in the Draft Montana Modeling Guideline for Air Quality Permit Applications (DEQ 2007). The ozone ambient standard of 196 micrograms per cubic meter (μg/m^3) was assumed to be ambient background for the OLM calculation (TRC Environmental Corp. 2006a).

3.4.2.1.2 Air Modeling

MMC submitted an application for a MAQP in 2006 (TRC Environmental Corp. 2006a). The application was revised and resubmitted later in 2006 to incorporate additional information and analyses requested by the DEQ ARMB, and the application was deemed complete in 2006. The application included an air dispersion modeling analysis updated from the 1992 EIS analysis, which was conducted to demonstrate compliance with ambient air quality standards following guidance in the Draft Montana Modeling Guideline for Air Quality Permits (DEQ 2007) and in accordance with EPA guidance. The analysis quantified PM_{10}, $PM_{2.5}$, NO_2, SO_2, and lead emissions and their impacts. MMC and the DEQ completed new dispersion modeling in 2011. The modeling included the locations for project components described in Alternative 3. All sources remained as permitted and at the same emission rates and stack parameters, and all model settings were identical to the 2007 AERMOD analysis, with some minor exceptions, primarily the use of up to two generators that would meet the equivalent of the EPA Tier 3 nitrogen oxides (NO_x) emission standard for engines 750 horsepower or less (Carter Lake Consulting, LLC 2011). The DEQ issued a Supplemental Preliminary Determination that incorporated the new modeling (DEQ 2011a).

Although not required by current regulations and permit requirements, the DEQ requested that MMC conduct additional modeling, including:

- An analysis of impacts on air quality related values (AQRV) in the CMW Class I Area
- Assessment of impacts on Libby PM_{10} and $PM_{2.5}$ nonattainment areas
- Determination of potential effects of terrain-induced downwash (a sudden drop in terrain causing turbulence on the downwind side which results in mixing and dispersion of air pollutants)
- Potential impacts on ambient air quality from construction activities (TRC Environmental Corp. 2006a)

MMC also submitted modeling of the impacts from trace metals released during ore, tailings, and concentration mining handling and processing. Montana does not have air toxics impact regulations and MMC is not required to assess human health risks from metals emissions. MMC provided a screening-type human health risk assessment for trace metals classified as HAPs to provide a full disclosure of potential HAP impacts (DEQ 2011a).

None of the modeling done for the 1992 EIS was used in this Draft EIS. All modeling and analyses are new. The most current up-to-date models were used and the new data generated by the modeling have been analyzed in this EIS.

For Alternatives 3 and 4, the Libby Plant Site would be northeast of the Libby Adit Site, and two adits would be constructed at the Libby Adit Site and one adit at the Upper Libby Adit Site. For the AERMOD modeling of these alternatives, the four plant area emission sources and the emergency generator source were located at the Libby Plant Site. Two ventilation scenarios were modeled for the adits. One modeled scenario assumed all underground emissions exited through one of the two Libby Adits. In this scenario, the Upper Libby Adit would be used for intake.

Libby Adit dimensions were assumed to be the same in all alternatives. All other mine emissions sources were modeled as they were for Alternative 2 (Sage Environmental Consulting 2007).

In another modeled scenario (Alternatives 3 and 4), the assumptions were the same as the first scenario except underground emissions would be split between one of the two Libby Adits and the Upper Libby Upper Adit. The other Libby Adit would be used for intake (Sage Environmental Consulting 2007).

Visibility Analysis – Plume Impairment

Potential plume impairment was evaluated generally following guidance established by the Federal Land Managers' Air Quality Related Values Workgroup (FLAG) (FLAG 2000). This guidance was updated in 2010, and uses essentially the same approach (USDA Forest Service, National Park Service, and U.S. Fish and Wildlife Service 2011). In 2011, the USDA Forest Service, National Park Service, and U.S. Fish and Wildlife Service issued supplemental guidance that addresses the use of deposition analysis thresholds and critical loads when evaluating deposition impacts (USDA Forest Service, National Park Service, and U.S. Fish and Wildlife Service 2011). The mine would be located within 7,000 feet of the CMW, and as prescribed in the FLAG document, visibility analyses were limited to plume impairment. Potential plume impairment from the largest mine sources were modeled following FLAG guidance. The FLAG guidance describes three levels of analysis for plume impairment assessments. Levels one and two are screening level analyses that use the VISCREEN model for assessing plume impairment impacts, and level three is a refined analysis using the PLUVUE II model. (Citations for all models mentioned in this section are available from the DEQ-ARMB.) If a screening analysis demonstrates that visibility impacts from plume impairment are below threshold values, then no further analysis is required.

For the Montanore mine emission sources, screening level impacts using VISCREEN were predicted to be greater than threshold values. As a next step, the PLUVUE II model was used for plume impairment analyses (TRC Environmental Corp. 2006b).The PLUVUE II model estimates plume perceptibility in terms of change in color difference (ΔE) and contrast ($|C|$). The threshold values for plume perceptibility are contrast ($|C| = 0.02$) and change in color difference ($\Delta E = 1.0$) (USDA Forest Service, National Park Service, and U.S. Fish and Wildlife Service 2011).

The PLUVUE II analysis was performed for the largest Montanore mine emissions sources that have the potential to form discrete plumes and impact the CMW. These sources would be the Ramsey portal, the Libby portal, and the emergency generator. The Ramsey and Libby portal emissions included all fugitive and mobile source emissions that would occur within the underground mine. The Ramsey and Libby portals and the emergency generator would be located within about 1 mile of the CMW. An individual PLUVUE II analysis was performed for each of these three sources separately because their distinct, separated locations limit the potential to form one contiguous plume that would impact the CMW. Because once the electric transmission line (either the 34.5-kV underground line or the 230-kV overhead line) was operational at the mine site and the emergency generator at the mill would operate only 16 hours per year, meteorological conditions are less likely to occur that would create a contiguous plume from the generator and portal combined. A single viewpoint, or observer location, for each analyzed source was selected by determining the location with the most viewing angles from within the Class I area that an observer could see a plume generated by each source. Each viewpoint was evaluated for views for each wind direction sector, which could advect a plume toward the CMW.

Nitrogen and Sulfur Deposition Analysis

The interagency guidance on nitrogen and sulfur deposition analysis (USDA Forest Service *et al.* 2011) provides a four-step process to determine if a deposition impact analysis is needed and, if so, to determine if the predicted impacts are potentially adverse.

Step 1: Are the source's impacts negligible? A source located greater than 50 km from an FLM area is considered to have negligible impacts for AQRVs if its total annual emissions of SO_2, NO_x, PM10, and H_2SO_4 (in tons/year) divided by the distance (Q/D) is 10 or less. If that is the case, no further AQRV analysis is needed.

Step 2: If Q/D is more than 10, is the source's predicted contribution to deposition less than the deposition analysis threshold of 0.005 kilogram/hectare/year? If so, the source's impacts on AQRV are considered to be negligible.

Step 3: Does the refined/contextual analysis alleviate concerns? Does the analysis show that the source's impacts would not cause harm to an AQRV? If so, the impacts are considered to be not adverse.

Step 4: Are there mitigation strategies that could reduce the potential adverse impact?

Maximum S and N deposition predicted for Alternative 2 at three sensitive water bodies, Lower Libby Lake, Upper Libby Lake, and Rock Lake, were calculated from sources of SO_2 and NO_x operating during Montanore Mine production using emission estimates from the 2006 modeling (TRC Environmental Corp. 2006). The CALPUFF model was used to model all emission sources in Alternative 2. Nitrogen dioxide (NO_2) 1-hour AERMOD modeling completed in 2011 using NOx emission sources and rates was used for the analysis of Alternatives 3 and 4. Results were reported as NO_2. In 2013, nitric acid (HNO_3) 1-hour AERMOD modeling was completed using the same assumptions as the nitrogen dioxide modeling. Results were reported as N. The emissions from the operation of the emergency generator during the Operations Phase at 16 hours per year were modeled using an annualized rate (Klepfer Mining Services 2013a, 2013b). The assumptions associated with the modeling nitrogen and sulfur deposition rates are described in the modeling report (TRC Environmental Corp. 2006a, 2006b; Klepfer Mining Services 2013a, 2013b) and the Montana DEQ's Supplemental Preliminary Determination on MMC's air quality permit application (DEQ 2011a).

3.4.3 Affected Environment

3.4.3.1 Climate

3.4.3.1.1 Regional Climate

The region has a "modified continental maritime" type of climate. The regional climate is influenced and modified by Pacific Ocean maritime air masses. Summers are warm and dry, and winters are cold. The Pacific Ocean influences development of coastal storms, which occasionally track across the State of Washington, and east into northern Idaho and Montana. The relatively high mountain ranges to the west and north tend to reduce the effects of these storms, so that more rain or snow occurs on the west or north side of the Cabinet Mountains than the south or east sides. In winter, cold Canadian air masses can cause periods of extremely cold temperatures. Cold air movement into the region forms temperature conditions that may trap pollutants near the land surface. More frequently, dry continental air masses from Canada or the east influence the region. In summer, these air masses create conditions of warm temperatures and low humidity.

3.4.3.1.2 Analysis Area Climate

Although similar to the regional climate, the climate of the analysis area is highly influenced by local terrain and elevation. The analysis area's mountainous terrain produces significant precipitation and temperature variations. Analysis area elevations range from 2,600 feet along US 2 to almost 8,000 feet at Elephant Peak in the Cabinet Mountains. Elevation in the City of Libby is 2,062 feet. The terrain in the immediate vicinity of the proposed facilities is mountainous with large changes in elevation over short distances (Mines Management, Inc. 2005a).

Wind velocities vary according to terrain features, with higher wind speeds at ridge tops and lower wind speeds in protected valleys. The upper level winds above 10,000 feet come predominantly from the northwest, and surface winds follow topographic relief (valley flow) in times of stable weather activity. Based on wind data collected in 1988-1989, over 50 percent of the winds at the Ramsey Creek Air Monitoring Site and nearly 90 percent of the winds at the Little Cherry Creek Air Monitoring Site were less than 3.5 miles per hour (mph). The average wind speed at Ramsey Creek was 5 mph. The highest wind speed recorded was 28.4 mph at the Ramsey Creek Air Monitoring Site. Wind speed averaged 2.4 mph at the Little Cherry Creek Air Monitoring Site (Woodward-Clyde Consultants 1989b).

Predominant wind directions are from the southwest-to-southeast sectors (Woodward-Clyde Consultants, Inc. 1989b). The measured predominant wind direction at the Ramsey Creek Air Monitoring Site is south-southeast. Maximum wind speeds are also associated with south-southeast winds. This is in contrast to the tendency for upper level winds to be from the northwest. The predominant wind direction is also inconsistent with the orientation of the creek drainage (southwest-to-northeast), although winds from the southwest and south-southwest were measured about 30 percent of the time. Maximum wind speeds at the Ramsey Creek Air Monitoring Site were associated with south-southeast winds, and with south-southwest winds at the Little Cherry Creek Air Monitoring Site. Valleys in western Montana have a strong potential for the formation of temperature inversions (stable atmospheric conditions with little air mixing).

According to the National Weather Service (2011), "normal" precipitation is derived from PRISM climate data, which uses a 4 km by 4 km grid size. The PRISM gridded climate maps are considered the most detailed, highest-quality spatial climate datasets currently available (National Weather Service 2011). The 30- year PRISM normal from 1971-2000 was used for precipitation analysis. Available precipitation estimates are discussed in more detailed in section 3.8.3.1, *Definitions and Comparisons of Peak Flow, Annual Flow, Baseflow and 7Q2 and 7Q10 Flows.* Based on PRISM estimates, average annual precipitation at the impoundment sites is 30 inches. The estimated average annual precipitation at the Libby Plant Site is 35 inches and 68 inches at the Ramsey Plant Site. Precipitation data for the project area are available from a monitoring site in upper Poorman Creek, about 1 mile north of the proposed Ramsey Plant Site. Precipitation increases with increasing elevation, and can reach 90 inches in the highest Cabinet Mountains. About 35 percent of precipitation is snow that generally falls between October and May. Rain-on-snow also may occur in mid-winter and early spring, which can result in large runoff events (Geomatrix 2006b). Temperatures in the analysis area are cold in the winter and mild in the summer. The annual average temperature is about 41°F with a range between -26°F and 95°F (hourly average).

3.4.3.2 Particulate Matter and Gaseous Ambient Air Pollutants

3.4.3.2.1 Airborne Particulate Matter

Concentrations of TSP and PM_{10} are typical of remote, mountainous sites. At the Ramsey Creek Air Monitoring Site, the annual average PM_{10} was 14 μg/m^3 and the maximum 24-hour concentration was 35 μg/m^3 (Table 48). PM_{10} concentrations are in compliance with the MAAQS and NAAQS (Table 51). MAAQS and NAAQS for TSP have been rescinded since the time the data were collected. The maximum measured PM_{10} and TSP values each exceeded their respective standards on one occasion in the fall of 1988, likely due to the numerous forest fires in the region, and do not represent normal background conditions. At the Little Cherry Monitoring Site, the arithmetic mean PM_{10} concentration was 14 μg/m^3 and the geometric mean for the TSP sampler was 33 μg/m^3 (Woodward-Clyde Consultants Inc. 1989a).

Table 48 lists modeling background concentration values for $PM_{2.5}$, PM_{10}, NO_2, SO_2, CO, and lead. The $PM_{2.5}$ background values were obtained from the Forest Service IMPROVE site, about 3 miles south of the CMW southern boundary. The PM_{10} and lead concentrations were collected during 1988-1989 at MMC's air monitoring sites, which the DEQ determined to be representative of PM_{10} concentrations at the mine site. Site conditions since 1989 that would affect 1988-1989 PM_{10} concentrations have not changed. The NO_2, SO_2, and CO values are typical values provided by DEQ for use in permit modeling analyses. The TSP filters at the Little Cherry Creek Air Monitoring Site were analyzed for trace metals including lead.

Table 48. Measured or DEQ Default Background Concentrations Used in the Air Quality Modeling.

Pollutant	Averaging Period			
	Annual	24-Hour	3-Hour	1-Hour
PM_{10}	14	35	NA	NA
$PM_{2.5}$	3.5	10.4	NA	NA
NO_2	6	NA	NA	40 (NAAQS) 75 (MAAQS)
SO_2	3	11	26	35
CO	NA	1,150	NA	1,725
Lead	0.006	NA	NA	NA

All concentrations are in micrograms per cubic meter (μg/m^3).
NA = Not applicable.
Source: DEQ 2011a.

Trace metal concentrations measured in the total suspended particulate matter samples were low. None of the monthly values exceed any federal ambient standard or Montana guideline concentration (TRC Environmental Corp. 2006a).

In 2011, the EPA determined the Libby nonattainment area for the 24-hour PM_{10} standard attained the standard as of December 31, 1994. In 2008, EPA designated parts of Lincoln County as a nonattainment area for $PM_{2.5}$. The nonattainment area for $PM_{2.5}$ extends south of Libby to about 2 miles north of the Little Cherry Creek Impoundment Site. The area includes about 6 miles of the Bear Creek access road and the Libby Loadout facility.

3.4.3.2.2 Gaseous Pollutants

No measurements of other criteria pollutants and their precursors, such as CO, SO_2, ozone, NO_x, or hydrocarbons, were made in the analysis area. Given the remoteness of the analysis area and the lack of air pollution sources and minimal human impact, low background concentrations are expected (Table 48).

3.4.3.3 Visibility and Deposition

Visibility is usually high, except during times of forest fires or controlled burning. In the CMW, the average annual natural standard visual range is 259 kilometers (161 miles) and the annual average 2000-2004 baseline standard visual range is 167 kilometers (104 miles).

The closest atmospheric deposition site to the analysis area is the Priest River Experimental Forest, 61 miles west of the analysis area. Between 2004 and 2013, total annual sulfate deposition averaged 1.74 kg/ha and total annual inorganic nitrogen deposition averaged 1.58 kg/ha. Another atmospheric deposition site is in Glacier National Park, 78 miles northeast of the analysis area. Between 2004 and 2013, total annual sulfate deposition averaged 1.90 kg/ha and total annual inorganic nitrogen deposition averaged 1.38 kg/ha. (National Atmospheric Deposition Program 2014).

3.4.3.4 Acid-neutralizing Capability of Mine Area Lakes

Two types of acidification affect lakes and streams. One is a year-round condition when a lake is acidic all year long, referred to as chronically or critically acidic. The other is seasonal or episodic acidification associated with spring melt and/or rain storm events. A lake is considered insensitive when it is not acidified during any time of the year. Lakes with ANC values below 0 μeq/L are considered to be chronically acidic. Lakes with ANC values between 0 and 50 μeq/L are considered susceptible to episodic acidification (Driscoll *et al.* 2001). In the analysis area, Libby Lakes are the most susceptible to acidification. Samples from the Upper Libby Lake shore had an average ANC value of 4.7 μeq/L and a range of -4.9 μeq/L to 10.54 μeq/L between 1991 and 2009. The ANC of Lower Libby Lake's outlet averaged 18.2 μeq/L and a range of 6.0 μeq/L to 36.5 μeq/L between 1991 and 2009 (Grenon and Story 2009, McMurray, pers. comm. 2013). Rock Lake's ANC ranged from 54.2 to 59.5 μeq/L in two sample events in 1991 and one sample event in 1992 (VIEWS 2013). Concentrations of sulfate decreased in Lower Libby Lake. No significant trends were observed in other Lower Libby Lake measured parameter, or any measured parameter in Upper Libby Lake (Grenon and Story 2009). Gurrieri and Furniss (2004) reported an average ANC of 44 μeq/L in Rock Lake from samples collected after snowmelt runoff (7/22/99 to 10/22/99). In 1991, St. Paul Lake's ANC was 168.4 μeq/L and Wanless Lake's ANC was 73.1 μeq/L (VIEWS 2013).

3.4.4 Environmental Consequences

3.4.4.1 Alternative 1 – No Mine

The increased air emissions from mine construction and operation described under the mine alternatives would not occur. The ambient air quality and visibility in the CMW would not be affected by the proposed mine. Existing trends in air quality of the analysis area would continue.

3.4.4.2 Alternative 2 – MMC's Proposed Mine

3.4.4.2.1 Particulate Matter and Gaseous Pollutants

Modeled Concentrations

Pollutants emitted by the proposed project would be from fugitive sources such as haul roads, from mobile sources such as earth moving equipment, and from point sources such as propane heaters. PM_{10}, CO, and NO_x would be the primary pollutants. The emission inventory shown in Table 49 was used in the 2006 modeling results shown in Table 51, Table 53, Table 54, and Table 55. The emission inventory shown in Table 50 was used in the 2011 modeling results shown in Table 52, Table 57, Table 59, and Table 60. The basis for the differences between the 2006 and 2011 emission inventories is described in the updated air quality permit application (Carter Lake Consulting, LLC 2011). The increase in PM_{10} is due to the addition of three enclosed transfer points on the proposed overland conveyor between the Libby Adit and the Libby Plant Site.

Dispersion model results were compared to applicable ambient standards. Ambient background concentrations were added to modeled concentrations to obtain total concentrations for comparison to the NAAQS and MAAQS. The 2006 model results for the pollutants shown in Table 51 would comply with all NAAQS and MAAQS. Concentrations of 1-hour NO_2 and SO_2 were modeled in 2006 and were in compliance with standards applicable in 2006. The 1-hour NO_2 and SO_2 modeling was updated in 2011 to demonstrated compliance with the standards promulgated in 2011; the updated results are shown in Table 52. The modeling analysis and results (TRC Environmental Corp. 2006b) are incorporated by reference.

Table 49. 2006 Air Emissions Inventory.

Pollutant	Point Source Emissions (tpy)	Fugitive Emissions (tpy)	Mobile Source Emissions (tpy)
PM_{10}	12.7	137.56	5.07
$PM_{2.5}$	2.62	20.55	5.07
NO_x	3.60	1.33	163
SO_2	0.01	0.14	6.32
CO	0.47	64.7	56.6
Volatile organic compounds	0.13	0.00	9.01
Lead	0.0007	0.0014	<0.0001

tpy = tons per year.
Source: DEQ 2011a.

Table 50. 2011 Air Emissions Inventory.

Pollutant	Point Source Emissions (tpy)	Fugitive Emissions (tpy)	Mobile Source Emissions (tpy)
PM_{10}	16.88	137.56	1.49
$PM_{2.5}$	3.46	20.55	1.49
NO_x	3.49	1.33	64.74
SO_x	0.036	0.14	5.48
CO	0.53	64.66	49.99
Volatile organic compounds	0.125	0.00	4.21
Lead	0.00086	0.0014	<0.0001

tpy = tons per year.
Source: DEQ 2011a.

MMC would continue to use the unpaved Libby Creek Road (NFS road #231) and the Upper Libby Creek Road (NFS road #2316) year-round during the 2-year evaluation program and the 1-year period during reconstruction of the Bear Creek Road. The continued and increased use of these two roads for Evaluation Phase and Construction Phase traffic would increase fugitive dust from them. Fugitive dust from mine haul roads typically decreases to background levels within 100 feet of the road. Most of the dust is greater than PM_{10} (Organiscak and Reed 2004).

The Libby Loadout would be completely enclosed; no particulate emissions would occur from transfer, storage, or loading activities at this site (Figure 12). The transfer and loading of concentrate onto rail cars would be conducted within the pressurized load-out building. The concentrate would possess a high moisture content (16 percent to 20 percent), which would inherently control particulate emissions. Any product loss from trucks outside the load-out facility would be swept promptly. The complete enclosure of the handling and transfer operations within the pressurized building, combined with the other product loss control methods, is estimated to completely control emissions from the transfer and loading operations. Loaded rail cars waiting for consolidation into a unit train would be covered to prevent wind losses and water pollution.

Model results from the 2011 analysis for the 8^{th} highest daily maximum 1-hour NO_2 concentration and 4^{th} highest daily maximum 1-hour SO_2 concentration are shown in Table 52. Adding an ambient background value of 35 $\mu g/m^3$ for SO_2 and 40 $\mu g/m^3$ for NO_2, total concentrations are predicted to be less than 1-hour ambient air quality standards. The maximum NO_2 concentrations would occur in the Construction Phase and the maximum SO_2 concentration would occur during the Operations Phase. The modeling analysis and results (DEQ 2011a) are incorporated by reference.

Table 51. 2006 Modeled Maximum Concentrations During Operations, Alternative 2.

Pollutant	Averaging Period	Maximum Modeled Concentration (µg/m³)	Pollutant Background (µg/m³)	Total Concentration (Modeled + Background) (µg/m³)	MAAQS (µg/m³)	% of MAAQS	NAAQS (µg/m³)	% of NAAQS
PM_{10}	Annual	4.09	14	18.09	50	36.2	Revoked	—
	24-Hour†	21.66	35	56.66	150	37.8	150	37.8
$PM_{2.5}$	Annual	2.1	3.5	5.60	—	—	12	46.6
	24-Hour†	13.97	10.4	24.37	—	—	35	69.6
NO_x	Annual‡	19.8	6	25.8	94	27.5	100	25.8
	1-Hour§	364	75	439	564	77.8	—	—
SO_2	Annual	1.92	3	4.92	52	9.5	80	6.2
	24-Hour†	12.25	11	23.25	262	8.9	365	6.4
	3-Hour†	42.15	26	68.15	—	—	1,300	5.2
	1-Hour†	51.42	35	86.42	1,300	6.7	—	—
Lead	Quarterly*	0.00026	NA	0.00026	—	—	1.5	0.02
	90-day*	0.00026	NA	0.00026	1.5	0.02	—	—

†Concentrations are high second-high values. Certain ambient air quality standards are “not to be exceeded more than once per year.” DEQ looks at the highest second high value for maximum modeled concentrations.
‡The ambient ratio method has been applied to this result.
§The ozone limiting method has been applied to this result.
*The 1-month average concentration is used for compliance demonstration.
NA = Not available.
µg/m³ = microgram per cubic meter.
Source: DEQ 2011a.

Table 52. 2011 Maximum Modeled 1-Hour NO_2 and SO_2 Concentrations, Alternative 2.

Pollutant and Averaging Period	Modeled Concentration ($\mu g/m^3$)	Tier 2 Ambient Ratio	Background Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
NO_2[†]	91.3	0.80	40	113.0	188.679
SO_2[§]	21.2		35	56.2	195

[†]8th highest daily maximum 1-hour concentration.
[§]4th highest daily maximum 1-hour concentration.
Source: Carter Lake Consulting LLC 2011.

Greenhouse Gas Emissions

Anticipated emissions of greenhouse gas emissions (GHGs) from Montanore Project combustion sources are 32,500 metric tons per year CO_2-equivalent, including 250 tons/year from methane (CH_4) and nitrous oxide (N_2O) (combined), and the remainder from CO_2. Forty-one percent of the total GHG emissions would be generated by diesel-fired underground equipment, and 43 percent would be generated by diesel-fired surface mine equipment. Contractor highway haul trucks carrying ore account for 7 percent, and propane-fired mine air heaters 9 percent (Bridges Unlimited 2010). GHG emissions from the mine would substantially decrease when underground mining ceased and would end after the adits were plugged.

The EPA's Region 8 Climate Change Strategic Plan provides details of the 2007 GHG emission inventories in five EPA Region 8 states (Environmental Protection Agency 2008). The inventories are based on the region's consumption of electricity, and do not include electricity that is produced for export outside the region. Based on these, and an evaluation of the emissions from North Dakota, the EPA determined:

- The states in EPA Region 8 were responsible for 5.3 percent of the nation's greenhouse gas emissions in 2005 totaling 362.39 million metric tons of CO_2
- The principal sources of the region's emissions vary by state, but include energy use, transportation, the fossil fuel industry, and agriculture

A key objective of EPA's plan includes mitigation, including identifying and implementing goals and prioritized activities that have the highest potential to reduce greenhouse gas emissions. In particular, GHG-emitting projects subject to NEPA should disclose relevant information about the project's GHG emissions.

Anticipated emissions of GHGs from MMC would represent 0.009 percent of 2005 EPA Region 8 emissions. A typical coal-burning power plant emits several million tons of carbon dioxide a year. The 32,500-ton emission level is comparable to the emissions from burning 170 rail cars of coal or the annual energy use of about 2,860 homes. MMC's proposed mitigation measures to minimize GHG emissions are discussed in section 3.4.4.2.8, *Best Available Control Technology Analysis,* DEQ's Supplemental Preliminary Determination (DEQ 2011a), and MMC's air quality permit application (TRC Environmental Corp. 2006a). The DEQ does not have the authority to regulate GHG emissions in minor source permits.

3.4.4.2.2 Clean Air Act General Conformity Analysis

The agencies completed an assessment of all potential PM air emissions within the PM_{10} and the $PM_{2.5}$ nonattainment areas to determine if a general conformity analysis required by 40 CFR 93.153 would be required. A conformity determination is required for each criteria pollutant or precursor where the total of direct and indirect emissions of the criteria pollutant or precursor in a nonattainment or maintenance area caused by a Federal action would equal or exceed any of the rates in paragraphs (b)(1) or (2) of 40 CFR 93.153. The specific activities that may contribute to particulate matter emissions in the PM_{10} and $PM_{2.5}$ nonattainment areas are discussed in the following sections. The only project facilities in the PM_{10} and $PM_{2.5}$ nonattainment areas, including the 10-km buffer to the PM_{10} nonattainment area would be the Libby Loadout and the access road (US 2 and some segments of the NFS road #278 (Bear Creek Road)).

Initial Construction Traffic and Building Construction

Construction of a simple steel building at the Libby Loadout would be short in duration, and would result in negligible air emissions from construction crew light vehicle traffic and limited heavy construction vehicle traffic to the site on existing paved roads. The loadout building would be built on an existing concrete pad. The construction period is expected to last less than two months. Temporary dust emissions would be negligible.

Truck Traffic

At peak production, about 420 tons of concentrate, or 21 trucks, would be trucked daily via NFS road #4781, a new access road (the Ramsey Plant Site Access Road), NFS road #278 (Bear Creek Road), reconstructed sections of NFS road #278, and US 2 to Libby, and then to a road accessing the Kootenai Business Park to a loadout facility.

The DEQ extends the designated PM_{10} nonattainment area with an additional 10-kilometer buffer. If that additional distance is added to each concentrate truck trip, the maximum potential PM_{10} emissions from truck traffic on the paved road in the PM_{10} nonattainment area plus the buffer zone is 81.8 tons per year (Bridges Unlimited 2010). Potential $PM_{2.5}$ and PM_{10} emission would be well below the 100 tons per year rates of PM_{10} and $PM_{2.5}$ emission that would require a general conformity analysis.

Loadout Activities

Minimal PM emissions would result from loadout activities. Concentrates would be stored at the loadout inside an enclosed building with rail access at the Kootenai Business Park. The facility would be covered to eliminate any precipitation, runoff, or fugitive emission issues. The concentrate would be moist, so minimal fugitive PM emissions are anticipated. The Supplemental Preliminary Determination contains several conditions associated with loadout activities, which would be effective in minimizing emissions.

Rail Service

Rail cars loaded with ore would be consolidated into an existing unit train that was already traveling on the rail route. There would be no additional rail service.

3.4.4.2.3 New Source Performance Standards

The Montanore Mine is subject to 40 CFR 60, Subpart LL, "Standards of Performance for Metallic Mineral Processing Plants." This subpart limits the emission rate of particulate matter from "affected facilities" at metallic mineral processing plants. Affected facilities are defined as each crusher and screen in open-pit mines; each crusher, screen, bucket elevator, conveyor belt transfer point, thermal dryer, product packaging station, storage bin, enclosed storage area, truck loading station, truck unloading station, railcar loading station, and railcar unloading station at the mill or concentrator. All facilities located underground are exempt from this subpart.

The DEQ's Supplemental Preliminary Determination includes the following conditions that identify sources subject to New Source Performance Standards:

- Emissions from the baghouses used to control emissions from the surface ore handling activities at the SAG mill and at the Libby Loadout facility. The Supplemental Preliminary Determination limits emissions to 0.05 grams per dry standard cubic meter (g/dscm) or 0.020 grains/dscm.
- Emissions from the wet Venturi scrubber used to control emissions from the coarse ore stockpile transfer to the apron feeders. The Supplemental Preliminary Determination limits emissions to 0.05 g/dscm or 0.020 grains/dscm.
- The Supplemental Preliminary Determination prohibits stack emissions that exhibit 7% opacity or greater averaged over 6 consecutive minutes from the baghouse.
- The Supplemental Preliminary Determination prohibits any fugitive emissions from process equipment that exhibit 10% opacity or greater averaged over 6 consecutive.

3.4.4.2.4 Hazardous Air Pollutant Impact Assessment

Various metals would be present in ore, tailings, waste rock, concentrate, and road dust. Some of the metals are considered hazardous air pollutants (HAPs). The Montanore Mine is not explicitly required by Montana air quality regulations (ARM 17.8 Sub-Chapter 7) to assess human health risks from HAP emissions. A human health risk assessment was performed for the trace metals classified as HAPs to provide a full disclosure of potential HAP impacts (TRC Environmental Corp. 2006a).

The analysis predicted concentrations of arsenic, antimony, cadmium, chromium, and lead. No Montana risk assessment guidance exists for this source type; as a result, maximum modeled concentrations were used to calculate carcinogenic risk based on currently established unit risk factors for lifetime exposure as defined in the Integrated Risk Information System (IRIS) database (IRIS 2005).

The Montanore Mine proposed life is 19 years. The total combined cancer risk from three metals (arsenic, cadmium, and chromium) was determined by summing the cancer risk of each metal using a 20-year exposure period and was found to be 1 in 1,300,000, above the acceptable total lifetime risk level of 1 in 1,000,000. Predicted concentrations also were compared to EPA's concentrations for screening risk assessments. Predicted concentrations of all HAPs were below EPA risk screening levels (Table 53). MMC would begin air monitoring arsenic, cadmium, chromium, and lead at the commencement of mill facilities or the tailings impoundment and continue air monitoring for at least 1 year after normal production was achieved. MMC would analyze for metals shown in Table 17 on the PM_{10} filters once the mill facilities and tailings impoundment were operational. At that time, the DEQ would review the air monitoring data and determine if continued monitoring or additional monitoring were warranted. The DEQ may require continued air monitoring to track long-term impacts of emissions and cancer risk, or require additional ambient air monitoring or analyses if any changes took place regarding quality and/or quantity of emissions or the area of impact from the emissions.

Table 53. 2006 Modeled HAP Concentrations.

Pollutant	EPA weight-of-evidence for carcinogenicity‡	Averaging Period	Maximum Modeled Concentration ($\mu g/m^3$)§	IRIS Lifetime Cancer Risk Factor (per $\mu g/m^3$)	Lifetime Exposure Cancer Risk	Chronic Inhalation, Cancer ($\mu g/m^3$)‡	Imminently Dangerous to Life and Health ($\mu g/m^3$)†
Arsenic	A - Human carcinogen	Annual	0.00053	0.0043	0.00000070	0.0043	500
Cadmium	B1 - probable carcinogen, limited human evidence	Annual	0.00005	0.0018	0.00000003	0.0018	900
Chromium	Chromium VI compounds: carcinogenic to humans	Annual	0.00008	0.0120	0.00000030	0.0120	1,500
Antimony		Annual	0.00005	None	—	NA	5,000
Lead	B2 - probably carcinogen, sufficient evidence in animals	Monthly	0.00026	None	—	NA	10,000
Total lifetime cancer risk					0.0000013		

$\mu g/m^3$ = microgram per cubic meter.
Source: ‡EPA 2007b; §TRC Environmental Corp. 2006a; †EPA 2007a.

3.4.4.2.5 Construction Emissions

Construction activities would be temporary and would precede full production, which for modeling purposes, was assumed to be in year 4. During the first phase of construction, underground construction activities would begin, no major surface construction activities would occur, and one 1,622 horsepower diesel electric generator (with one identical co-located unit on standby) would operate continuously at the Libby Adit to provide electrical power. The generator would operate until line power becomes available, which MMC expected to be less than 1 year from commencement of construction activities. After the Bear Creek Road underground electric line was installed, the generator would operate as an emergency backup only.

Dispersion modeling was performed for the first phase of construction, the only portion of construction during which a generator would operate continuously, to determine whether that construction activities would comply with ambient air quality standards. The maximum-modeled 1-hour NO_2 concentration was 364 $\mu g/m^3$, less than the MAAQS of 564. The maximum-modeled annual NO_2 concentration was 19.8 $\mu g/m^3$, less than the MAAQS of 94 $\mu g/m^3$ and the NAAQS of 100 $\mu g/m^3$ (TRC Environmental Corp. 2006a).

3.4.4.2.6 Nonattainment Area Boundary Impact Assessment

Minimal PM emissions would result from loadout activities, which would occur in the Libby nonattainment area. The Supplemental Preliminary Determination contains several conditions associated with loadout activities, which would be effective in minimizing emissions. In 2011, the EPA determined the Libby nonattainment area met the 24-hour PM_{10} standard as of December 1994 and has not had an exceedance of the standard since then. Modeled concentrations of $PM_{2.5}$ from mine operations were calculated in 2006 at receptors placed at regular intervals along the nonattainment area boundary (Table 54).

Table 54. 2006 Modeled Nonattainment Area Concentrations to PSD Class II Significance Levels, Alternative 2.

Nonattainment Area	Pollutant and Averaging Period	Maximum Modeled Concentration ($\mu g/m^3$)	PSD Class II Significance Level ($\mu g/m^3$)†
Libby, MT $PM_{2.5}$	$PM_{2.5}$ Annual	0.44	0.3
	$PM_{2.5}$ 24-Hour	1.75	1.2

$\mu g/m^3$ = microgram per cubic meter.
†Not established in 2006.
Source: DEQ 2011a.

3.4.4.2.7 Cabinet Mountain Wilderness Impact Assessment

An analysis of air quality impacts at and within the PSD Class I Area boundary was completed, and concentrations were compared to PSD Class I Increments that exist for PM_{10}, NO_2, and SO_2. Modeled concentrations were predicted to be less than PSD Class I Increments at all locations at and within the Class I Area boundary (Table 55).

The Air Quality Related Values analysis included dispersion modeling to determine visibility impacts, and nitrogen and sulfur deposition impacts on CMW from mine operations (TRC Environmental Corp. 2006b).

Table 55. 2006 Modeled Concentrations in the CMW Compared to PSD Class I Increments, Alternative 2.

Pollutant	Averaging Period	Maximum Modeled Concentration ($\mu g/m^3$)	Class I Increment ($\mu g/m^3$)	% of Class I Increment
PM_{10}	Annual	0.25	4	6.4
	24-Hour	4.18	8	52
NO_2	Annual	1.62	2.5	65
SO_2	Annual	0.10	2	5.0
	24-Hour	2.24	5	45
	3-Hour	7.97	25	32

$\mu g/m^3$ = microgram per cubic meter.
Source: TRC Environmental Corp. 2006a.

Visibility Impact

Out of 1 year of PLUVUE II analysis hourly analyses, only 3 hours of potential plume impairment were found for each of the Ramsey Plant Site portal and the emergency generator at the Libby Adit. The emergency generator was modeled at maximum hourly emission rates year-round, although it is expected to be permitted to operate a maximum of 16 hours per year. The potential plume impairment hours would be just over the thresholds for color difference.

Contrast parameters were computed to be less than threshold values, indicating that there would be no perceptible contrast change or general haze in the CMW due to the mine. The reduction in visual range also was predicted to be below perceptible levels. Infrequent, episodic events, such as high winds causing erosion of the tailings impoundment surface, may cause minor, short-term visual impacts from dust plumes that could be visible from the CMW and other areas. The results of the FLAG PLUVUE analysis indicated that impacts on visibility at the CMW from mine sources would be minor, precluding the need for any further analyses.

Nitrogen and Sulfur Deposition

Modeled maximum nitrogen deposition rates from the mine were 7 to 10 times greater than the FLM deposition analysis thresholds at Upper Libby Lake, Lower Libby Lake and Rock Lake; maximum sulfur deposition impacts were less than the deposition analysis thresholds at Lower Libby Lake and Rock Lake and greater than the deposition thresholds at Upper Libby Lake (Table 56). Nitrogen and sulfur emissions from the mine would substantially decrease when underground mining ceased and would end after the adits were plugged.

3.4.4.2.8 Best Available Control Technology Analysis

Emission controls to be used at the proposed mine would constitute Best Available Control Technology (BACT), as required by ARM 17.8.752(1)(a). MMC would operate all equipment to provide for maximum air pollution control for which it was designed (TRC Environmental Corp. 2006a). Dust emissions from ore handling activities would be controlled with water sprays, wet Venturi scrubbers, baghouses, and enclosures. Ore grinding operations at the Semi-Autogenous Grinding (SAG) mill would be fully enclosed and wet, with water pumped into the SAG mill at a rate of 7,780 gpm; therefore, the mill would not be a source of air emissions. Water sprays would

Table 56. Maximum Predicted Nitrogen and Sulfur Deposition, Alternative 2.

Pollutant	Site	Deposition Impact (kilograms/ hectare/year)	Deposition Analysis Threshold (kilograms/ hectare/year)
Nitrogen	Lower Libby Lake	0.0498	0.005
	Upper Libby Lake	0.0544	
	Rock Lake	0.0367	
Sulfur	Lower Libby Lake	0.0048	0.005
	Upper Libby Lake	0.0052	
	Rock Lake	0.0036	

Source: TRC Environmental Corp. 2006b.

be used, as needed, to prevent excess fugitive dust at the Little Cherry Creek Tailings Impoundment. Other proposed controls would comply with BACT (DEQ 2011a).

3.4.4.2.9 Odor and Noise

Odor and noise are not regulated in the ARM. Odor is a potential nuisance, but the project is not expected to increase odors. Noise is discussed in the subsequent *Sound, Electrical and Magnetic Fields, Radio and TV Effect* section.

3.4.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

3.4.4.3.1 Particulate Matter and Gaseous Ambient Pollutants

Modeled Concentrations

In 2011, the DEQ modeled daily and annual $PM_{2.5}$ and PM_{10} emissions were using Alternative 3 facility locations. These pollutants were selected because the 2006 modeling analyses (Table 51) showed these emissions had the greatest impacts on their respective NAAQS. The maximum $PM_{2.5}$ and PM_{10} emission rates did not exceed any standard (Table 57). Based on these results that were lower than the corresponding 2006 results, the emission rates of CO, lead, NO_2, and SO_2 would be below applicable standards.

The DEQ also modeled NO_2 and SO_2 concentrations using Alternative 3 facility locations (Table 58). Adding an ambient background value of 35 $\mu g/m^3$ for SO_2 and 40 $\mu g/m^3$ for NO_2, maximum concentrations would be less than 1-hour ambient air quality standards (DEQ 2011a). The maximum NO_2 concentrations would occur in the Construction Phase and the maximum SO_2 concentration would occur during the Operations Phase.

Table 57. 2011 Modeled Maximum $PM_{2.5}$ and PM_{10} Concentrations During Operations, Alternative 3.

Pollutant	Averaging Period	Maximum Modeled Concentration† (µg/m³)	Pollutant Background (µg/m³)	Total Concentration (Modeled + Background) (µg/m³)	MAAQS (µg/m³)	% of MAAQS	NAAQS (µg/m³)	% of NAAQS
PM_{10}	Annual	6.4	14	20.4	50	40.8	Revoked	—
	24-Hour	45.3	35	80.3	150	53.5	150	53
$PM_{2.5}$	Annual	1.2	3.5	4.7	—	—	15	31.3
	24-Hour	9.7	10.4	20.1	—	—	35	57.4

†Concentrations are high second-high values.

µg/m³ = microgram per cubic meter.

The current NAAQS for annual $PM_{2.5}$ is 12 µg/m³. The EPA allowed grandfathering of pending preconstruction permitting applications if the application was deemed complete by December 14, 2012; this grandfathering would apply to the Montanore Project, and MMC would not need to demonstrate compliance with the new annual PM¬2.5 standard.

Source: DEQ 2011a.

Table 58. 2011 Maximum Modeled 1-Hour NO_2 and SO_2 Concentrations, Alternative 3.

Pollutant and Averaging Period	Modeled Concentration (µg/m³)	Tier 2 Ambient Ratio	Background Concentration (µg/m³)	Total Concentration (µg/m³)	NAAQS (µg/m³)
NO_2†	87.07	0.80	40	109.656	188.679
SO_2§	17.82		35	52.82	195

†8th highest daily maximum 1-hour concentration.

§4th highest daily maximum 1-hour concentration.

Source: DEQ 2011a.

The Poorman Tailings Impoundment Site is about 1 mile south of the Little Cherry Creek Tailings Impoundment Site. The agencies' modified MMC's tailings dust control measures. The DEQ's Supplement Preliminary Determination (DEQ 2011a) has specific requirements for tailings dust management. Spigots distributing wet tailings material and water would cover about one-half of the total tailings at any time. The spigots would be moved regularly and would cause wetting of all non-submerged portions of the tailings impoundment to occur each day. This wetting would be supplemented by sprinklers as necessary when weather conditions could exist to cause fugitive dust. MMC would develop a general operating plan for the tailings impoundment site including a final fugitive dust control plan to control wind erosion from the tailings impoundment site. Effects of the Poorman Tailings Impoundment would be less than Alternative 2. Construction emissions and effects on Libby air quality would be the same as Alternative 2.

The DEQ's Supplemental Preliminary Determination on MMC's air quality permit (DEQ 2011a) contains a number of limitations on air emissions summarized in Chapter 2, beginning on p. 157. MMC would treat all unpaved portions of the haul roads, access roads, parking lots, or the general plant area with water, as necessary, to maintain compliance with the reasonable precautions limitations of the draft permit. These limitations would ensure actual concentrations would be equal to or less than modeled concentrations.

Greenhouse Gas Emissions

GHG emissions in Alternative 3 would be similar to Alternative 2. The agencies' mitigation, such as limiting generator use at the mill after power was available from a transmission line to 16 hours during any rolling 12-month time period and using Tier 4 engines and ultra-low diesel fuel in underground mobile equipment, would substantially reduce nitrogen emissions compared to Alternative 2. Nitrogen and sulfur emissions from the mine would substantially decrease when underground mining ceased and would end after the adits were plugged.

3.4.4.3.2 Nonattainment Area Boundary Impact Assessment

Modeled concentrations of $PM_{2.5}$ from mine operations were calculated at model receptors located at regular intervals along the nonattainment area boundary, and were compared to EPA's PSD Class II significance levels for $PM_{2.5}$ Modeled concentrations were predicted to be less than the significance levels, indicating that mine operations would not significantly affect $PM_{2.5}$ concentrations within Libby's nonattainment area (Table 59).

Table 59. 2011 Modeled Nonattainment Area Concentrations to PSD Class II Significance Levels, Alternative 3.

Nonattainment Area	Pollutant and Averaging Period	Maximum Modeled Concentration ($\mu g/m^3$)	PSD Class II Significance Level ($\mu g/m^3$)
Libby, MT $PM_{2.5}$	$PM_{2.5}$ Annual	0.02	0.3
Libby, MT $PM_{2.5}$	$PM_{2.5}$ 24-Hour	0.36	1.2

$\mu g/m^3$ = microgram per cubic meter.
Source: DEQ 2011a.

The 2006 modeling showed no Class I PSD increment was consumed. Because the greatest increase in the emissions occurred in the NO_x emissions (Table 49 and Table 55), a PSD Class I increment modeling analysis was conducted. Because there is no short-term NO_2 PSD Class I increment, the annual NO_x emissions were modeled and compared to the correspond PSD Class I increment (Table 60). The PSD Class I annual NO_2 increment would not be consumed by the NO_x emissions.

Table 60. 2011 Modeled NO_2 Concentrations in the CMW Compared to PSD Class I Increments, Alternative 3.

Pollutant	Averaging Period	Maximum Modeled Concentration (μg/m³)	Class I Increment (μg/m³)	% of Class I Increment
NO_2	Annual	0.04	2.5	1.6

μg/m³ = microgram per cubic meter.
Source: DEQ 2011a.

3.4.4.3.3 Cabinet Mountain Wilderness Impact Assessment

Modeled maximum nitrogen deposition rates from the mine were less than the FLM deposition analysis threshold at Upper Libby Lake, Lower Libby Lake and Rock Lake. Modeled rates were highest at Rock Lake, at 0.0011 kilograms/hectare/year (Table 61). Modeled deposition for sulfur dioxide (SO_2) used emissions based on a fuel sulfur content of 50 ppm (0.005%). Since those calculations were performed, federal regulations (40 CFR 80 Subpart I) have become effective that require the use of ultra-low sulfur diesel fuel with the equivalent of 15 ppm S (0.0015%). Using ultra-low sulfur diesel in the modeling, SO_2 emissions from diesel combustion would be 70 percent less than calculated for Alternative 2. Sulfur deposition rates would have a corresponding reduction because 97 percent of SO_2 at the mine would be emitted from diesel fuel combustion sources. Sulfur deposition rates is expected to be below the sulfur deposition analysis threshold (Klepfer Mining Services 2013a). The agencies' mitigation, such as limiting generator use at the mill after power was available from a transmission line to 16 hours during any rolling 12-month time period and using Tier 4 engines and ultra-low diesel fuel in underground mobile equipment, would substantially reduce nitrogen and sulfur emissions compared to Alternative 2. Nitrogen and sulfur emissions from the mine would substantially decrease when underground mining ceased and would end after the adits were plugged.

Table 61. Maximum Predicted Nitrogen Deposition, Alternatives 3 and 4.

Pollutant	Site	Deposition Impact (kilograms/ hectare/year)	Deposition Analysis Threshold (kilograms/ hectare/year)
Nitrogen (as NO_2)	Lower Libby Lake	0.0006	0.005
	Upper Libby Lake	0.0006	
	Rock Lake	0.0011	

Source: Klepfer Mining Services 2013b.

In Alternatives 3 and 4, MMC would monitor nitrogen and sulfur emissions at the Libby Adit for a minimum of 2 years. Using the monitoring data, MMC would update the nitrogen and sulfur deposition analysis and compare the updated model results to the current FLM deposition analysis thresholds. MMC would also assess potential effects on lake ANC if appropriate methods were available. If modeled results using the Libby Adit monitoring data were greater than current FLM deposition analysis thresholds, MMC would develop a plan for agencies' review that evaluated all available control technologies to reduce pollutant emissions.

3.4.4.3.4 Effectiveness of Agencies' Proposed Mitigation

The DEQ's Supplemental Preliminary Determination on MMC's air quality permit (DEQ 2011a) contains a number of limitations on air emissions described in Chapter 2, beginning on p. 157. These limitations would be effective in ensuring actual concentrations would be equal to or less than modeled concentrations.

The reporting requirements described in Appendix C, along with the conditions and reporting requirements in DEQ's Supplemental Preliminary Determination (DEQ 2011a) would be adequate to control emissions. Proposed controls would comply with BACT (see section 3.4.4.2.8, *Best Available Control Technology Analysis*). As a condition of the air quality permit, MMC would develop a general operating plan for the tailings impoundment site including a fugitive dust control plan to control wind erosion from the tailings impoundment site. The plan would include, at a minimum, the embankment and cell (if any) configurations, a general sprinkler arrangement, and a narrative description of the operation, including tonnage rates, initial area, and timing of future enlargement. Should these measures not be adequate to control wind erosion from the impoundment, MMC would submit a revised plan to the agencies for approval, incorporating alternative measures, such as a temporary vegetation cover. These measures would be effective in minimizing wind-blown tailings at the tailings impoundment site.

The required use of Tier 4 engines on underground mobile equipment and emergency generators and use of ultra-low sulfur diesel fuel in those engines beginning in the Construction Phase would be effective in minimizing nitrogen and sulfur deposition on wilderness resources.

3.4.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would have essentially the same air emissions associated with underground exhaust and milling operations as Alternative 3 (Table 50). Concentrations of all pollutants would be below applicable standards. Effects from the tailings impoundment, road construction, and concentrate shipment would be the same as Alternative 2.

3.4.4.5 Alternative A— No Transmission Line

Air quality would not be directly affected if a transmission line was not built. However, if the transmission line was not constructed, generators would be used to meet the electrical power requirements of the mine. The operation of generators at the site would result in increased air pollutant emissions and subsequent ambient air quality impacts greater than those quantified for Alternative 2 or Alternative 3. MMC would revise its air quality permit application to quantify the effects of the generators.

3.4.4.6 Effects Common to Transmission Line Alternatives B, C-R, D-R, and E-R

Construction of all transmission line alternatives, including BPA's construction and maintenance of the Sedlak Park Substation and loop line, would result in short-term increases in gaseous and particulate emissions. Similar, but lower, emissions would occur at the end of operations when the transmission line is removed. The agencies' transmission line alternatives (Alternatives C-R, D-R, and E-R) would comply with the Environmental Specifications (Appendix D) regarding dust control and slash burning.

3.4.4.7 Cumulative Effects

3.4.4.7.1 Past Actions

With the exception of the Libby Loadout, past actions in the analysis area have had little effect on ambient air quality in the analysis area. Wood burning and other human activity at the Libby Loadout have increased concentrations of particulate matter and other gaseous pollutants. The EPA has designated the area around the proposed Libby Loadout, formerly a mill site industrial area, and currently the Kootenai Business Park, as Operable Unit 5 of the Libby Asbestos National Priorities List Site. EPA sampling and assessment of Operable Unit 5 has indicated that disturbance of wood chips stored on site would not result in detectable fiber emissions. EPA determined that there was no potential human exposure to Libby asbestos at Operable Unit 5 (CDM Smith 2012).

3.4.4.7.2 Rock Creek Project

All action alternatives for the transmission line would have similar cumulative impacts. Of the reasonably foreseeable actions, the proposed Rock Creek Project on the west side of the Cabinet Mountains in the Rock Creek drainage would contribute to the cumulative effect on air quality. The Rock Creek Mine would have similar emissions sources associated with the plant site, tailings impoundment, and other surface disturbances as the Montanore Mine. The project would use diesel equipment in the mine and vent mine exhaust northeast of the plant site. Although Montanore's intake ventilation adit would be located in the CMW, it would not be a source of emissions.

The impact analyses conducted for the Montanore Mine predicted compliance with the Class I and Class II increments at the CMW boundary. The Montanore and Rock Creek projects have been analyzed and found to have a potential minor impact on ambient air quality. The geographic areas of impact for each project do not overlap and would not be additive.

According to the 1992 Montanore Project Final EIS (USDA Forest Service *et al.* 1992), "NO_x and SO_2 increment consumption would occur from both projects (Rock Creek and Montanore), but the analysis indicates that there would not be a combined or overlapping increment consumption." This means that a small portion of the allowable increase in ambient air pollution concentrations under PSD Class 1 designations would occur as a result of each project. The increase would not be in the same geographic areas and would not be additive.

The Forest Service has monitored Libby Lakes for many years because of their high quality waters and sensitivity to change. There is concern that emissions from regional mining projects could increase acid deposition to the lakes, with acidification of the lake watershed and lake chemistry and associated adverse aquatic effects. The Forest Service conducted a MAGIC (Model of Acidification of Groundwater in Catchments) model screen analysis for CMW watersheds to determine the risk of both projects on Libby Lakes (Story 1997). The modeling results concluded the estimated changes in acid anions and base cations are not sufficient to project any changes in pH or alkalinity in Libby Lakes from either project directly, and cumulatively.

3.4.4.7.3 Other Projects

Timber harvesting, thinning, and prescribed burning associated with the proposed Miller-West Fisher Project on unpaved roads would increase particulate emissions for a short duration. Concentrations of criteria pollutants would be well below the NAAQS and MAAQS. The cumulative effects of the two projects would not exceed the NAAQS and MAAQS. Other reasonably foreseeable actions in the area may be expected to contribute localized, short-term, and transient emissions of fugitive dust. The limited term nature of these potential emissions makes it unlikely that they would add measurably to emissions from the Montanore Project.

3.4.4.8 Regulatory/Forest Plan Consistency

All mine alternatives would implement emission controls at the proposed mine that would constitute BACT, as required by ARM 17.8.752(1)(a). 36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources; and comply with applicable state and federal air quality standards including the Clean Air Act. Although Mine Alternative 2 and Transmission Line Alternative B would implement BACT, these alternatives would not fully comply with 36 CFR 228.8. In these alternatives, MMC did not propose to implement feasible measures to minimize air emissions. The agencies' alternatives (Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R) would incorporate additional feasible measures to minimize adverse environmental impacts on National Forest surface resources and to comply with applicable state and federal air quality standards. These measures, which would include limiting generator use at the mill to after power was available from a transmission line 16 hours during any rolling 12-month time period, and using Tier 4 engines and ultra-low sulfur diesel fuel in underground mobile equipment, would substantially reduce emissions. Other conditions and limitations on air emissions are described in DEQ's Supplemental Preliminary Determination (DEQ 2011a). MMC would develop a general operating plan for the tailings impoundment site including a final fugitive dust control plan to control wind erosion from the tailings impoundment site. Spigots distributing wet tailings material and water would cover about one-half of the total tailings at any time. The spigots would be moved regularly and would cause wetting of all non-submerged portions of the tailings impoundment to occur each day. This wetting would be supplemented by sprinklers as necessary when weather conditions could exist to cause fugitive dust. These measures would minimize wind-blown tailings at the tailings impoundment.

All mine alternatives have the potential to indirectly affect wilderness qualities. Mitigation measures identified in Chapter 2 for Alternatives 3 and 4 and monitoring required for Alternatives 3 and 4 (Appendix C) would be implemented to minimize changes in wilderness character. In Alternative 3 and 4, potential air quality indirect impacts on wilderness lakes and wilderness character would be minimized by mitigation measures such as limiting generator use, and using tier 4 engines and low sulfur diesel fuel in underground mobile equipment by reducing emissions as compared to Alternative 2. Mitigation measures and monitoring requirements in Alternatives 3 and 4 are reasonable stipulations for protection of the wilderness character and are consistent with the use of the land for mineral development. Alternatives 3 and 4 would be conducted to protect the surface resources in accordance with the general purpose of maintaining the wilderness unimpaired for future use and enjoyment as wilderness, and to preserve the wilderness character consistent with the use of the land for mineral development and production in compliance with 36 CFR 228.15 and the Wilderness Act. The agencies' mine and transmission line alternatives would comply with the Wilderness Act. Alternatives 3 and 4 would minimize adverse environmental impacts on surface resources within the wilderness, and thereby comply with the regulations (36 CFR 228, Subpart A) for locatable mineral operations on National Forest System lands.

All mine and transmission line alternatives would comply with 36 CFR 228.8(a), the KFP and the Montana Clean Air Act because construction activities and facility operations in all alternatives would not result in exceedances of any NAAQS or MAAQS. The DEQ's Supplemental Preliminary Determination (DEQ 2011a) discusses compliance with the Montana Clean Air Act in detail. Mine operations would not significantly affect $PM_{2.5}$ concentrations within Libby's nonattainment area and would comply with the State Implementation Plan. 36 CFR 228.8(h) states that "certification or other approval issued by state agencies or other federal agencies of compliance with laws and regulations relating to mining operations will be accepted as compliance with similar or parallel requirements of these regulations." DEQ's permit decision and conditions on the air quality permit would constitute compliance with Clean Air Act requirements.

3.4.4.9 Irreversible and Irretrievable Commitments

During construction and operation of the mine, air pollutant concentrations would be higher throughout the analysis area and in the CMW than current levels, but below applicable air quality standards. Following mine closure and successful reclamation, pollutant concentrations would return to pre-mining levels. There would be no long-term irreversible or irretrievable commitment of resources.

3.4.4.10 Short-term Uses and Long-term Productivity

During construction and operation of the mine, air pollutant concentrations would be higher throughout the analysis area and in the CMW than current levels, but below applicable air quality standards. Once mining and reclamation are completed, the pollutant concentrations would return to pre-mining levels, assuming adequate revegetation success.

3.4.4.11 Unavoidable Adverse Environmental Effects

All action alternatives would temporarily increase air pollutant concentrations in the CMW and the analysis area. Standard control practices would minimize emissions.

3.5 American Indian Consultation

Federal laws, regulations, and treaties direct the Forest Service to consult with federally-recognized tribes who may have concerns about federal actions that may affect religious practice, traditional cultural uses, and cultural resource sites and remains associated with American Indian ancestors. The analysis area lies within the aboriginal territory of the Kootenai Tribe. The Confederated Salish and Kootenai Tribes (CSKT) and the Kootenai Tribe of Idaho (KTOI) are the federally-recognized tribes representing the modern members of the Kootenai Tribe.

3.5.1 Regulatory Framework

The Forest Service has a government-to-government responsibility to all federally-recognized tribes, as outlined in the Guide to USDA Programs for American Indians and Alaska Natives (USDA 1997a). American Indian tribes are afforded consideration under the National Historic Preservation Act (Section 2) (NHPA), NEPA, the Native American Graves Protection and Repatriation Act, the American Indian Religious Freedom Act, and the Religious Freedom Restoration Act, among other Executive orders and policy. Federal guidelines direct federal agencies to consult with representatives and traditionalists from federally recognized American Indian tribal who may have concerns regarding federal actions potentially affecting religious practices, and other traditional cultural uses. Consultation also may involve cultural resource sites and remains associated with American Indian heritage. Any tribe whose aboriginal territory falls within a analysis area is afforded the opportunity to voice concerns for issues governed by NHPA, Native American Graves Protection and Repatriation Act, American Indian Religious Freedom Act, and Religious Freedom Restoration Act.

The American Indian Religious Freedom Act protects the "inherent right of the freedom to believe, express, and exercise their traditional religions." These concerns include, but are not limited to, access to sites, use and possession of sacred objects, and the freedom to practice sacred ceremonies. The Religious Freedom Restoration Act establishes a higher standard for justifying government actions that may impact religious liberties.

Executive Order 13175 requires federal agencies to consult with American Indian tribal representatives and traditionalists on a government-to-government basis. Executive Order 13007 requires federal agencies to consult with tribes on Indian sacred sites. Tribes are also covered by Executive Order 12898 regarding environmental justice, discussed under section 3.26.1, *Environmental Justice*.

3.5.2 Treaty Rights

The analysis area is located within lands encompassed by the Hellgate Treaty of 1855. The Hellgate Treaty was signed between the United States and the Flathead, Upper Pend d'Oreilles, and the Kootenai Tribes, and the federal government has consultation responsibilities to ensure that the Tribes' reserved rights are protected. The treaty-reserved rights include the "right of taking fish at all usual and accustomed places, in common with citizens of the Territory, and of erecting temporary buildings for curing; together with the privilege of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land". The KNF's Libby Ranger District fits the description of "usual and accustomed places," and lies within the aboriginal territory of the Kootenai and the Salish (Flathead). Ongoing consultation with the CSKT ensures that tribal treaty rights are protected.

3.5.3 Analysis Area and Methods

The analysis area surrounds all mine facilities and the transmission line alternatives. Consultation with the KTOI and the CSKT has taken place from 1989 until present. In addition, the Coeur d'Alene and Kalispel Tribes were notified and an offer made for discussion about the project. The KTOI responded to the request, and met for discussion. The Kalispel Tribe responded that due to the project being on the east side of the Cabinets, it was well outside of Kalispel aboriginal territory. They wanted to continue to receive correspondence about the project. The early consultation from 1989 to 1992 was conducted during the NEPA work associated with the original Montanore Project. While this Montanore Project EIS updates the NEPA analysis, the 1992 Montanore Project Final EIS initially outlined the analysis area and therefore early consultation is relevant. The Montanore Project consultation resumed and extends from January of 2005 until present. The primary limitation of this analysis is dependent on the response received from the tribes. If the tribes decline to comment, then the information available for analysis is limited.

3.5.4 Affected Environment

3.5.4.1 Historical Tribal Distributions

Historically, the Kootenai Tribe was made up of seven bands, with four in Canada and three in the U.S. The three historic U.S. bands are: the Tobacco Plains Band, located around present-day Eureka, Montana; the Jennings Band, located around the confluence of the Kootenai and Fisher Rivers, and the Bonners Ferry Band, located around present-day Bonners Ferry, Idaho. The aboriginal territory of the bands of the Kootenai is an irregularly shaped parcel. The territory is bounded by a southeast-northwest line extending along the Continental Divide to the west side of Kootenay Lake in Canada. The boundary continues north of present-day Golden, British Columbia southward to the Clark Fork River, then follows eastward to the confluence of the Flathead and North Fork of the Flathead Rivers. In 1855, after U.S. negotiations with the Flathead (Salish), Upper Pend d'Oreilles, and the Kootenai Tribes, the Jennings and Tobacco Plains bands were moved to the Flathead Reservation and became known as the CSKT. The Bonners Ferry Kootenai did not sign the Hellgate Treaty and it was not until 1974 that the Tribe was deeded 12.5 acres of land north of Bonners Ferry, Idaho.

3.5.4.2 Consultation with Interested Tribes

Consultation with tribes was initiated during scoping for NMC's Montanore Project. The CSKT indicated an interest in the project and on December 8, 1989, the cultural resource inventory report was sent to the CSKT for review (Historical Research Associates 1989a and 1989b). In 1990, the CSKT and KTOI responded by outlining general concerns. The KTOI referenced treaty rights associated with huckleberry gathering, big game hunting, and stream fishing (December 6, 1990). The CSKT also referenced treaty rights including water quality issues, fish habitat, and more specifically copper contaminant effects on sturgeon (December 11, 1990). Information addressing these issues was relayed by the Forest Service with continued correspondence through 1991. Tribal consultation resumed under MMC's Montanore Project, with letters to the Tribal Chairmen for the CSKT, KTOI, the Kalispel and Coeur d'Alene Tribes dated July 18, 2005. The Kalispel Tribe responded that the project was outside of their aboriginal territory and therefore did not request further consultation (September 17, 2005). The Coeur d'Alene Tribe did not respond with interest in the project. Numerous meetings with the CSKT and KTOI took place to answer tribal questions and requests for information sent by the Forest Service. Written correspondence from the CSKT requesting that no mining be permitted was received on July 5, 2006 and July 9, 2007. Detailed correspondence is located in either the project record for Mines Management's or NMC's Montanore Projects. Both project records are located in the KNF Supervisor's Office.

According to oral history and consultation, known Native American traditional use areas are on the uplands adjacent to the proposed Swamp Creek wetlands mitigation site and within the private land boundary. These upland sites adjacent to the wetlands have been used traditionally for camping by the Kootenai Tribe as they travelled through what is now the US 2 corridor on a seasonal basis for hunting and gathering purposes.

3.5.5 Environmental Consequences

The lead agencies identified three scoping issues for tribal consultation: 1) rights under the Hellgate Treaty; 2) sacred places and access to those places for the exercise of religion; and 3) burials. The thresholds indicated by the three issues could not be measured, as the tribes have declined to provide the baseline data necessary to conduct effects analysis.

3.5.5.1 Alternative 1 – No Mine and Alternative A – No Transmission Line

In this alternative, no actions are proposed, and any previously recorded or as yet undiscovered cultural sites with Tribal affiliation would remain undisturbed. The CSKT letter dated July 5, 2006 conveyed the tribal perspective on the Montanore Project, "Throughout the consultation process the Kootenai Elders have expressed a general desire to see no mining permitted on the KNF. The Elders remain concerned with the potential impacts (both direct and indirect) to water quality, fisheries, wildlife, plant life, and non-renewable cultural resources. The Kootenai people have traditional stories, place names, and cultural history throughout the area of impact. The Elders have also noted the influx of mine employees, equipment, and other mine related activity could have an impact on Tribal use of this area." This position was affirmed in another memo dated July 11, 2006.

3.5.5.2 Effects Common to All Mine and Transmission Line Action Alternatives

While the tribes were afforded the opportunity to provide comments on all alternatives, they declined, stating that their opposition to the mine negated the need to determine which alternatives were more preferable to them. The tribes also declined to comment on the proposed Sedlak Park Substation site.

After the Swamp wetland mitigation site on private land was protected by a conservation easement, or conveyed to the Forest Service, the upland areas would be managed to protect and provide for future traditional cultural uses. Developed recreational use would not be encouraged.

3.5.5.3 Cumulative Effects

The CSKT considered the effects of the Montanore Project and the Rock Creek Project as one. The CSKT submitted the following comment regarding the Montanore Project: "The expansion of the Montanore Mine has the potential to impact Tribal ancestral sites, including trails, fishing and gathering areas, as well as occupation sites. Both mines have the potential to degrade water quality, thus impacting aquatic habitats that provide Tribal members with traditional plants and medicines. The degradation of the surrounding watershed should have far-reaching impacts on culturally significant fish and wildlife, including the endangered bull trout and white sturgeon" (July 11, 2006). Because the CSKT have chosen not to identify specific effects, the agencies cannot address specific direct or indirect impacts on these undisclosed resources. Analysis of cumulative effects described in other resource sections indicates that increased access to the general project area could increase the use of resources by the general public as well as tribal members. Vegetation removal as a result of construction of the proposed project or other permitted activities within the Libby Creek watershed could impact areas with plant species associated with tribal use. These potential effects on resources identified by CSKT are outlined in the various resource sections in this document.

3.5.5.4 Regulatory/Forest Plan Consistency

The consultation process for this project is consistent with direction in the KFP, and all other laws regulations, and Executive Orders described in the section 3.5.1, *Regulatory Framework*. The KNF has consulted with tribes when management activities may impact treaty rights and/or cultural sites and cultural use.

3.5.5.5 Irreversible and Irretrievable Commitments

The CSKT have stated their position that there would be irreversible and irretrievable impacts on non-renewable cultural resources. The specific resources referred to have not been disclosed to date.

3.6 Aquatic Life and Fisheries

This section describes changes to aquatic life and fisheries that may occur from the construction, operations, and reclamation of the Montanore Project. Existing conditions described in section 3.6.3, *Affected Environment* were determined through surveys and review of existing data sources and used to develop effects analysis for the aquatic resources in each watershed. Effects on fish and other aquatic populations were assessed based on effects on habitat.

3.6.1 Regulatory Framework

3.6.1.1 Organic Administration Act and Forest Service Locatable Minerals Regulations

The Organic Administration Act authorizes the Forest Service to regulate the occupancy and use of National Forest System lands. The Forest Service's locatable minerals regulations are promulgated at 36 CFR 228, Subpart A. The regulations apply to operations conducted under the U.S. mining laws as they affect surface resources on National Forest System lands under the jurisdiction of the Secretary of Agriculture. One of these regulations (36 CFR 228.8) requires that mining activity be conducted, where feasible, to minimize adverse environmental impacts on National Forest surface resources. 36 CFR 228.8 also requires that mining operators comply with applicable state and federal water quality standards including the Clean Water Act; take all practicable measures to maintain and protect fisheries and wildlife habitat which may be affected by the operations; and construct and maintain all roads so as to assure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water, and other resource values.

3.6.1.2 Endangered Species Act

The KNF is required by the ESA to ensure that any actions it approves will not jeopardize the continued existence of a T&E species or result in the destruction or adverse modification of critical habitat. agencies are also required to develop and carry out conservation programs for these species. The KNF prepared a BA for aquatic resources that evaluates the potential effect of the proposed project on T&E aquatic species, including measures the KNF believes are needed to minimize or compensate for effects. The KNF submitted the BA to the USFWS for review and consultation in 2011, and revised it in 2013 (USDA Forest Service 2013a) to provide additional information about the project and to make it consistent with current regulatory requirements. The USFWS (2014c) then issued a Biological Opinion on the project in 2014. Section 1.6.1.2, *U.S. Fish and Wildlife Service* provides more information on the Biological Opinion.

Bull trout (*Salvelinus confluentus*) is currently listed as threatened under the ESA and occurs within the analysis area. The USFWS has designated bull trout critical habitat in the analysis area. Bull trout is discussed in section 3.6.3.9, *Threatened and Endangered Fish Species.*

White sturgeon (*Acipenser transmontanus*) is currently listed as endangered and occurs in the Kootenai River. The white sturgeon is restricted to 168 miles of the Kootenai River between Cora Linn Dam in Canada and Kootenai Falls in Montana. All proposed activities are upstream of Kootenai Falls. The proposed Libby Loadout in a disturbed area of the Kootenai Business Park east of Libby is the closest project facility to the Kootenai Falls. The proposed activities would not affect white sturgeon or its habitat, and effects on this species are not discussed further.

3.6.1.3 Wilderness Act

The Wilderness Act allows mineral exploration and development under the General Mining Law to occur in wilderness to the same extent as before the Wilderness Act until December 31, 1983, when the Wilderness Act withdrew the CMW from mineral entry, subject to valid and existing rights. 36 CFR 228.15 provides direction for operations within the National Forest Wilderness. Holders of validly existing mining claims within the National Forest Wilderness are accorded the rights provided by the U.S. mining laws and must comply with the Forest Service Locatable Minerals Regulations (36 CFR 228, Subpart A). Mineral operations in the National Forest Wilderness are to be conducted to protect the surface resources in accordance with the general purpose of maintaining the wilderness unimpaired for future use and enjoyment as wilderness and to preserve the wilderness character consistent with the use of the land for mineral development and production.

3.6.1.4 Tribal Treaty Rights

The Hellgate Treaty of 1855 reserved for the Kootenai Nation, among other rights, “the right to fish at all usual and accustomed places….on open and unclaimed lands.” The KFP recognizes these treaty rights, and allows the Flathead/Kootenai-Salish Indian tribes to fish within the KNF. Additionally, the American Indian Religious Freedom Act allows Native Americans access to sites within the KNF that are still in use. Section 3.5*, American Indian Consultation* discusses American Indian rights.

3.6.1.5 Major Facility Siting Act

The Major Facility Siting Act directs the DEQ to approve a facility if, in conjunction with other findings, DEQ finds and determines that the facility minimizes adverse environmental impacts, considering the state of available technology and the nature and economics of the various alternatives.

3.6.1.6 Montana Water Quality Act

The Water Quality Act is the primary statute for water quality protection in the State of Montana. The DEQ enforces the Act, and the Act also provides authority for the establishment of surface water standards protective of aquatic life, mixing zone rules, and nondegradation rules. This act is described in more detail in section 3.13.1.2.2 of the *Water Quality* section.

3.6.1.7 National Forest Management Act

The National Forest Management Act requires the Secretary of Agriculture to promulgate regulations specifying guidelines for land management plans that “provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives…” The “specific land area” (scale) for providing diversity is established in the framework as the area covered by the Forest Plan, or the entire KNF. One of the KFP goals is to “maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species… and in sufficient quality and quantity to maintain habitat diversity representative of existing conditions” (II-1 #7).

Sensitive species are designated by the Regional Forester (FSM 2670.5). FSM 2672.42 directs the Forest Service to conduct a biological evaluation (BE) to analyze impacts on sensitive species. The sensitive species analysis in this document meets the requirements for a BE as outlined in

FSM 2672.42. FSM 2670.22 requires that the Forest Service develop and implement management practices to ensure that sensitive species do not become threatened or endangered because of Forest Service actions and maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands. Any decision on the Montanore Project cannot result in loss of sensitive species viability or create significant trends toward federal listing (FSM 2670.32). Sensitive fish species identified within the analysis area are the interior redband trout (*Oncorhynchus mykiss gairdneri*) and the westslope cutthroat trout (*Oncorhynchus clarki lewisi*). The western pearlshell mussel (*Margaritifera falcata*) is also a species of concern in Montana (MNHP 2014). Torrent sculpin (*Cottus rhotheus*) is a species of concern in Montana, but no longer listed by Region 1 USDA Forest Service.

The KNF provides habitat for more than 300 different species of fish and wildlife (USDA Forest Service 2003b), many of which occur on the Libby Ranger District and within the Montanore Project analysis area. The presence or absence of these fish and wildlife species in part depends on the amount, distribution, and quality of each species' preferred habitat. In addition to habitat changes, many of these are impacted by fishing, hunting or trapping. FWP regulates fish and game populations in the analysis area. The Forest Service and the FWP work together to ensure that an appropriate balance is maintained between habitat capability and population numbers. The Forest Service also works closely with the USFWS to assist in the recovery of species listed under the ESA. Proposed federal projects that have the potential to impact species protected by the ESA require consultation with the USFWS.

3.6.1.8 Kootenai Forest Plan

The KFP established management areas within the forest with different goals and objectives based on the capabilities of lands within this area (USDA Forest Service 1987a). In 1995, the Inland Native Fish Strategy (INFS) amended the 1987 KFP (USDA Forest Service 1995). As part of this strategy, the Regional Foresters designated a network of priority watersheds, which are drainages that still contain excellent habitat or assemblages of native fish, provide for objectives of stable or increasing fish populations, or have excellent potential for restoration. The priority watersheds in the analysis area are Rock Creek, Bull River, West Fisher Creek, and Libby Creek upstream of US 2.

INFS also established stream, wetland and landslide-prone area protection zones called Riparian Habitat Conservation Areas (RHCAs). INFS standards apply only to National Forest System lands. RHCAs are portions of watersheds where riparian-dependent resources receive primary emphasis. INFS sets standards and guidelines for managing activities that potentially affect conditions within the RHCAs, and for activities outside of RHCAs that potentially degrade RHCAs. These standards and guidelines are in addition to existing standards and guidelines in the KFP. RHCAs are defined for four categories of streams or water bodies, depending on flow conditions and presence of fish, with different RHCA widths for each category (Table 63). The widths shown in Table 63 are minimum default widths. For fish-bearing streams, default RHCA buffers extend from the edge of both sides of the active stream channel to the outer edges of the 100-year floodplain, to the outer edge of the riparian vegetation, to a distance equal to the height of two site-potential trees, or 300 feet slope distance (600 feet, including both sides of the stream channel), whichever is greatest. Widths of RHCA buffers are based on current scientific literature that documents them to be adequate to protect streams from non-channelized sediment inputs (sediment produced from overland flow) and provide for other riparian functions. These riparian functions include delivery of organic matter, large woody debris recruitment, and stream shading. All four categories are represented by streams and water bodies in the analysis area.

Table 62. RHCA Categories and Standard Widths.

Stream or Water Body Category	Standard Width
Fish-bearing streams	Minimum 300 feet each side of the stream
Perennial, non-fish bearing streams	Minimum 150 feet each side of stream
Ponds, lakes, and wetlands greater than 1 acre	Minimum 150 feet from maximum pool elevation
Intermittent and seasonally flowing streams, wetlands less than 1 acre, landslides and landslide-prone areas	Minimum 100 feet from edge (except in non-priority watersheds, where the minimum is 50 feet)

Source: USDA Forest Service 1995.

In addition, INFS identifies riparian management objectives (RMOs) that guide management of key habitat variables for good fish habitat on National Forest System lands. The RMOs for stream channel conditions provide the criteria against which attainment or progress toward attainment of riparian goals is measured. RMOs, as established by INFS standards for forested systems, include pool frequency, large woody debris (LWD) frequency, and width/depth ratio (Table 63). Actions that retard attainment of these RMOs, whether existing conditions are better or worse than objective values, are considered to be inconsistent with INFS and therefore not in compliance with the KFP.

Table 63. Habitat Measures Associated with Riparian Management Objectives Standards.

Habitat Measure		Riparian Management Objectives Standard	
Bankfull Width (ft.)	Pools per Foot	Large Woody Debris per Foot (>BFW)	Width/Depth Ratio
<10	1 per 55	1 per 264	<10
10-20	1 per 94	1 per 264	<10
20-25	1 per 112	1 per 264	<10
25-50	1 per 203	1 per 264	<10

BFW = Bankfull width.
Source: USDA Forest Service 1995.

INFS included project- and site-specific standards and guidelines that apply to all RHCAs on National Forest System lands and to projects and activities outside RHCAs on National Forest System lands that have the potential to degrade RHCAs. Some of the standards and guidelines require that activities not retard or prevent the attainment of the RMOs. "For the purposes of analysis, to 'retard' would mean to slow the rate of recovery below the near natural rate of recovery if no additional human-caused disturbance was placed on the system. This obviously will require professional judgment and should be based on watershed analysis of local conditions" (USDA Forest Service 1995). Section 3.6.4.11, *Regulatory/Forest Plan Consistency* discusses compliance with the following RHCA standards and guidelines:

- Timber management (TM-1)
- Roads management (RF-2 through RF-5)

- Minerals management (MM-1, MM-2, MM-3, and MM-6)
- Lands (LH-3)
- General riparian area management (RA-2 through RA-4)
- Watershed and habitat restoration (WR-1)
- Fisheries and wildlife restoration (FW-1)

3.6.2 Analysis Area and Methods

3.6.2.1 Analysis Area

The analysis area includes areas where aquatic resources may be affected either by mine construction, operations, and closure or by construction, maintenance, and decommissioning of the transmission line. Mine alternatives may affect the named and unnamed streams in the East Fork Bull River, Rock Creek, Ramsey Creek, Poorman Creek, Little Cherry Creek, Bear Creek, Cable Creek, Big Cherry Creek, and Libby Creek watersheds and any other areas where roads would be closed. The transmission line corridor area is drained by the Fisher River and its tributaries: Hunter Creek, Sedlak Creek, Miller and North Fork Miller creeks, Standard Creek, and West Fisher Creek; and by Libby Creek and its tributaries: Howard Creek, Midas Creek, and Ramsey Creek, all perennial streams. Numerous unnamed ephemeral streams also drain the analysis area. Short segments of the Miller Creek (Alternative D-R) and West Fisher Creek (Alternative E-R) transmission line alternatives would be within the Standard Creek watershed, but the line and any associated access roads would be located more than 1 mile from the creek and not within any RHCA. No effects on Standard Creek are expected, and it is not discussed further.

The existing aquatic habitat and populations of additional streams are discussed that would not be affected by mine or transmission line alternatives but would be part of the bull trout mitigation plan. These streams include West Fork Rock Creek, Copper Gulch, and Flower Creek. Of these, West Fork Rock Creek is a tributary to Rock Creek, Flower Creek is a tributary to the Kootenai River, and Copper Gulch is a tributary to the Bull River. The mainstem of Rock Creek and the reach of Libby Creek upstream of Libby Falls were also identified as potential mitigation sites. Additionally, Swamp Creek, a tributary to Libby Creek, may be used as part of the wetland mitigation plan. A second stream named Swamp Creek that is a tributary to the Clark Fork River is also outside the area of predicted effects from mining, but sites on this stream are proposed for use as benchmark monitoring sites. Proposed activity in other watersheds would be minimal and would have no potential for adverse effects on fish species and other aquatic organisms; these watersheds are not discussed further in this section.

Lakes included in the analysis area are Rock Lake, St. Paul Lake, Howard Lake, Ramsey Lake, Upper Libby Lake, and Lower Libby Lake (Figure 53). Ramsey Lake (not shown on Figure 53) does not provide aquatic habitat and the Libby Lakes and Howard Lake are not expected to be affected by the proposed project; these lakes are not discussed further.

3.6.2.2 Baseline Data Collection

3.6.2.2.1 Data Sources

The FWP's Montana Fisheries Information System (MFISH) database (FWP 2012) and the 1992 Montanore Project Final EIS (USDA Forest Service *et al.* 1992) were the primary sources used to determine fish distribution in the analysis area. The 1992 Final EIS also provided data on benthic macroinvertebrate and periphyton populations, as did additional surveys that were conducted at a limited number of sites in 1990 through 1994 as part of an interim monitoring program (Western Technology and Engineering 1992, 1993, 1994; Western Technology and Engineering and Phycologic 1995). Fish distribution surveys, fish genetic analyses, and habitat surveys have also been performed from before the initial baseline study in 1988 up through 2012, mainly by the FWP. Results of many of these surveys were summarized by Kline Environmental Research (2004). Additional data were used from habitat and/or fish surveys conducted on the East Fork Bull River and Rock Creek between 1992 and 1994 (Washington Water Power Company 1996), and on the East Fork Bull River in 1999 (Chadwick Ecological Consultants, Inc. 2000). Annual data on fish distribution, abundance, spawning surveys, and aquatic habitat surveys have also been gathered by Avista Corporation. (Avista) in East Fork Bull River and Rock Creek drainages from 1999 to 2011 for their hydropower relicensing agreement (GEI 2005; Hintz and Lockard 2007; Moran 2007; Horn and Tholl 2008; Lockard *et al.* 2008; Storaasli and Moran 2008; Avista 2011; Storaasli and Moran 2012). Descriptions and data for the Rock Creek watershed from the Rock Creek Project Final EIS and supplemental aquatic resources surveys were used (USDA Forest Service and DEQ 2001; Salmon Environmental Services 2012).

Some of the most recent aquatic resources data used were from surveys conducted in 2005 to supplement the existing data and in 2006 through 2008 as part of MMC's monitoring plan to address the aquatic biology and habitat monitoring requirements included as part of their MPDES permit. These data focused on fish distribution, habitat quality, location and navigability of culverts and other barriers, composition of spawning gravel, stream temperature, and the comparison of fish habitat quality in Little Cherry Creek and in the proposed drainage diversion (Kline Environmental Research 2005a, 2005b, 2008, 2009; Kline Environmental Research and Watershed Consulting 2005a, 2005b; Kline Environmental Research *et al.* 2005; Watershed Consulting and Kline Environmental Research 2005). Invertebrate and periphyton population data and fish tissues were also collected as part of the 2006 through 2008 sampling (Kline Environmental Research 2008, 2009). Additional surveys of the fish populations, macroinvertebrate populations, periphyton populations, and/or aquatic habitat were conducted in 2012 on the East Fork Bull River, Rock Creek, East Fork Rock Creek, West Fork Rock Creek, Big Cherry Creek, Poorman Creek, Ramsey Creek, Flower Creek, Cooper Gulch, and Swamp Creek (the Libby Creek tributary) by the USFWS, the USDA Forest Service, or MMC to either provide further baseline data for the impact assessment or to investigate the mitigation potential of these streams (Kline and Savor 2012; Kline Environmental Research and NewFields 2012).

3.6.2.2.2 Habitat Data

During the 1988 baseline study, physical habitat was evaluated at 18 stream reaches located on Libby, Little Cherry, Ramsey, Poorman, Bear, and East Fork Rock creeks. The habitat surveys classified stream reaches using the USDA Forest Service General Aquatic Wildlife System Level III assessment, which incorporates the Rosgen (1985) channel-typing system. This system categorizes reaches based on various measurements of entrenchment, width-to-depth ratio, sinuosity, substrate, and stream slope. The Forest Service also used this method to characterize a more limited number of reaches in these streams in 1997, 1998, 2002, 2004, and 2005 (Kline Environmental Research 2004; USDA Forest Service 2005a).

Stream habitat surveys also were conducted in the Libby Creek watershed in July and August 2005 during low flow conditions at most sites shown in Figure 52. Site LC4 was not surveyed because it had only isolated, shallow pools as habitat. Survey protocols followed USDA Forest Service Level III Region 1/Region 4 fish habitat inventory procedures (Overton *et al.* 1997), and are described by Watershed Consulting and Kline Environmental Research (2005). Habitat units at each site were identified, with various measures such as length, width, average and maximum depths, number of pools, pool type, substrate composition, percent stable and undercut banks, and amount of large, woody debris existing in the stream channel recorded for each unit. Some of these sites were also surveyed in 2006 through 2008, with a more limited number of habitat parameters recorded (Kline Environmental Research 2008, 2009). GIS and aerial imagery data were used to determine slope, canopy cover, amount of large woody debris, and types of habitat present in Poorman Creek, Ramsey Creek, a tributary to Ramsey Creek, and Libby Creek in 2012 (Kline Environmental Research and NewFields 2012).

A more extensive habitat survey was conducted in May and June 2005 for Little Cherry Creek and Drainages 10 and 5, the channels that are proposed to receive the flows from the diverted Little Cherry Creek in Alternatives 2 and 4. Methods used to collect the data were generally based on Bain and Stevenson (1999), with aspects of the USDA Forest Service methods incorporated to address the biological and physical variables determined to be essential for bull trout (USFWS 1998). This survey documented distance, elevation, macrohabitat type, pool dimensions, large woody debris, substrate, valley slope and width, and riparian characteristics continuously along the entire length of the creek. The five habitat characteristics that could be documented in Drainages 10 and 5 (channel gradient, valley side gradient, flood prone width, riparian type, and large, woody debris) also were surveyed to allow for comparisons between what currently exists in Little Cherry Creek and what could be predicted to develop in the two channels (Kline Environmental Research 2005a).

Surveys of drainages within the disturbance boundary of the Poorman Impoundment Site were conducted in 2011 (Kline Environmental Research 2012). This study included the assessment of four headwater drainages between Poorman Creek and Little Cherry Creek. The duration of flow and presence or absence of a surface water connection to Libby Creek was determined for each drainage, and water depths and widths were measured, along with other habitat parameters.

Separate surveys were conducted that documented culverts and potential fish barriers in Libby Creek upstream of NFS road #231 (Libby Creek Road), and the full length of Little Cherry Creek, Poorman Creek, and Ramsey Creek (Kline Environmental Research 2005b; Kline Environmental Research *et al.* 2005). Culverts were surveyed and analyzed for their potential to block upstream passage of fish. All other fish barriers were photographed, described, and measured for breadth, height, and plunge pool depth. Once a permanent barrier to all fish under all flow conditions was identified on each tributary, the survey effort was discontinued. Kline Environmental Research (2005b) describes the methods used to characterize the barriers.

Stream gravel samples were collected from 15 sites on Libby, Little Cherry, Poorman, Bear, and Ramsey creeks using a McNeil core sampler (Kline Environmental Research and Watershed Consulting 2005b). Samples were collected in July and August 2005 from all locations shown in August 2005, day and night snorkel surveys were conducted at most 2005 sample sites shown in Figure 52, except for sites Be2, LC4, and L9. The sites on Bear Creek and Libby Creek were not sampled at that time because McNeil core samples had recently been collected in 2004 and 2005 by the FWP or USDA Forest Service at or near those locations (Wegner, pers. comm. 2006a). The upstream Little Cherry Creek site was not sampled for gravel because only isolated, shallow pools for fish were present at the site, and no fish were observed at the site immediately downstream. When sufficient quantities of gravel were present, ten core samples were collected from each reach with the McNeil sampler. A more complete description of methods used to collect and process the gravel samples is given by Kline Environmental Research and Watershed Consulting (2005b).

The Fisher River was surveyed in 2003, West Fisher Creek was surveyed in 1996, and Miller Creek was surveyed in 1998 and 2005 by the KNF (USDA Forest Service 2005a). All reaches surveyed on the Fisher River were downstream of the analysis area. The surveys of Miller Creek and West Fisher Creek provided information on Rosgen channel type, gradient, width/depth ratio, and substrate composition.

Habitat surveys were conducted on Rock Creek and the East Fork Bull River between 1992 and 1994 (Washington Water Power Company 1996) as part of a survey of the lower Clark Fork River tributaries. Various habitat variables were recorded, including average widths, average depths, maximum pool depths, bank stability, substrate composition, amount of large woody debris, and percentage of surface fines. Temperature at the time of sampling was recorded and the spawning area substrate composition and spawning habitat availability were evaluated. The Lower Clark Fork Habitat Problem Assessment (GEI 2005) summarized habitat surveys in the East Fork Bull River from 1993 to 2003 and habitat work in Rock Creek. The Rock Creek Project Final EIS used these data and also summarized similar habitat data from additional sources (USDA Forest Service and DEQ 2001). Surface fines and spawning substrate were evaluated by Salmon Environmental Services, LLC (2012) in 2011 and 2012 for the Rock Creek project as well. In addition, extensive habitat and large, woody debris surveys of the Rock Creek mainstem, East Fork Rock Creek, West Fork Rock Creek, and the East Fork Bull River were conducted in 2012 by USDA Forest Service or MMC personnel (Kline and Savor 2012). Habitat measurements included wetted widths, maximum and average water depths, number of pools per mile, and large, woody debris counts, as well as other parameters. GIS and aerial survey data were used to determine the slope, amount of large woody debris, canopy cover, and habitat types within reaches of East Fork Rock Creek (both upstream and downstream of Rock Lake), the Rock Creek mainstem, the East Fork Bull River, and tributaries of the East Fork Bull River and St. Paul Lake (Kline Environmental Research and NewFields 2012).

3.6.2.2.3 Periphyton Population Data

Periphyton populations were sampled in analysis area streams during August 1988, October 1988, and April 1989. Interim monitoring continued during 1990 and 1991 at all locations in the analysis area, and during 1993 and 1994 at Libby Creek sites only. The objective of the continued monitoring was to assess possible impacts of exploration activities during 1991 and elevated concentrations of nitrate in Libby Creek. Additionally, the periphyton assemblages at sites on Libby Creek were sampled multiple times from 2006 through 2008 as part of the monitoring included with the MPDES permit, and sites on Ramsey Creek, Poorman Creek, Little Cherry Creek, and Bear Creek were added to this monitoring effort in 2007 and 2008. Periphyton samples were collected from four headwater drainages located within the disturbance boundary of the Poorman Impoundment Site in 2011 (Kline Environmental Research 2012). Periphyton samples were also collected in 2012 from a site on East Fork Rock Creek and from two tributaries to St. Paul Lake within the East Fork Bull River watershed (Kline Environmental Research and NewFields 2012).

Collection of the samples involved scraping algae from a variety of substrates and combining those scrapings to compose one sample per site. Non-diatom algae were identified to genus, with relative abundances of each taxon estimated as rare, common, very common, abundant, or very abundant. Diatoms were identified to species, with percent relative abundances calculated when possible. The sampling conducted in 2006 through 2008 focused on determining the taxonomic composition of the periphyton assemblages in the Libby Creek watershed. Full descriptions of methods used for each sampling event are documented by Western Resource Development Corp. (1989a),Western Technology and Engineering (1992, 1993, 1994),Western Technology and Engineering and Phycologic (1995), Kline Environmental Research (2008, 2009, 2012), and Kline Environmental Research and NewFields (2012).

3.6.2.2.4 Aquatic Macroinvertebrate Population Data

Stream macroinvertebrates were collected from over 30 locations in analysis area streams between 1986 and 2012 (Western Resource Development Corp. 1989a; USDA Forest Service and DEQ 2001; Western Technology and Engineering 1991, 1992, 1993, 1994; Western Technology and Engineering and Phycologic 1995; Hoffman *et al.* 2002; Dunnigan *et al.* 2004; USDA Forest Service 2006b; Kline Environmental Research 2008, 2009; Kline Environmental Research and NewFields 2012). Some reaches were sampled over 20 times during that time period.

Sampling began in 1988 in Libby Creek, Bear Creek, Little Cherry Creek, Poorman Creek, Ramsey Creek, and East Fork Rock Creek. Interim sampling continued through 1994 at a more limited number of reaches in these streams to assess possible impacts of mining activities that occurred during 1991. Additional macroinvertebrate data were collected from a single reach in Libby Creek in 2000 and 2003 in order to evaluate the effects of a restoration project that was completed during that time period (Hoffman *et al.* 2002; Dunnigan *et al.* 2004). The KNF conducted sampling annually at three to six reaches on Libby Creek, Bear Creek, West Fisher Creek, and the Fisher River from 1998 through 2004 (USDA Forest Service 2006b). Additionally, multiple sites on Libby Creek were sampled as part of the monitoring required under the MPDES permit for the Libby Adit in 2006 through 2008, with one site each on Ramsey Creek, Poorman Creek, Little Cherry Creek, and Bear Creek also sampled as part of this effort in 2007 and 2008 (Kline Environmental Research 2008, 2009). The macroinvertebrate assemblages within four headwater drainages located within the disturbance boundary of the Poorman Impoundment Site were sampled in 2011 as well (Kline Environmental Research 2012). Macroinvertebrate sampling in East Fork Rock Creek occurred in 1986 through 1988 as part of the Rock Creek Project permitting (USDA Forest Service and DEQ 2001). East Fork Rock Creek was sampled again in 2005 and 2012, with samples also collected from two tributaries to St. Paul Lake in the East Fork Bull River watershed in 2012 (Kline Environmental Research and NewFields 2012).

Sampling methods differed over this time period in number of samples taken per site, type of equipment used to collect and process samples, and level of identification used for certain macroinvertebrate families. The differences in methods used complicate the ability to interpret any changes in population parameters over time.

3.6.2.2.5 Fish Population Data

During August and September 1988, fish populations at 13 sites on Libby Creek, Ramsey Creek, Poorman Creek, Little Cherry Creek, and the East Fork Rock Creek were sampled using backpack electrofishing equipment. Additionally, Rock Lake was sampled using gill nets and hook and line, and Rock Creek Meadows, a large wetland on East Fork Rock Creek below Rock Lake, was sampled using an electrofishing boat and hook and line. Sites were generally between 330 to about 1,000 feet in length. Each fish collected was identified, weighed, and measured, and scales were taken from most fish to provide estimates of age and growth. Spawning was assessed from electrofishing results and from visual searches along Libby, Ramsey, and Poorman creeks conducted in October 1989.

Additional surveys have been conducted on analysis area streams and lakes by the FWP and others. The results of most of these surveys within the Libby Creek watershed are summarized by Kline Environmental Research (2004, 2007a), with additional survey results listed in the MFISH database (FWP 2012). As part of the mitigation efforts for the construction and operation of Libby Dam, fish population surveys also were conducted on Libby Creek from 2000 through 2009 (Dunnigan *et al*. 2004, 2005, 2011). Spawning surveys were conducted annually on Bear Creek and West Fisher Creek from 1995 through 2009 as part of the same project. During July and August 2005, day and night snorkel surveys were conducted at most 2005 sample sites shown in Figure 52. Site LC4 was not surveyed because only shallow, isolated pools were present at that location, and no fish were observed downstream at site LC3. Sites Be2, L9, L10, and L11 were not surveyed because fish surveys have been conducted near these reaches during 2003, 2004, or 2005 by government agencies (Kline Environmental Research and Watershed Consulting 2005a). Two of the Little Cherry Creek sites, sites LC1 and LC3, were too shallow for snorkeling, and were instead surveyed visually from the banks. For each macrohabitat type within each stream reach, counts of fish, species identifications, and lengths were documented to the extent practical without capturing fish. Kline Environmental Research and Watershed Consulting (2005a) provide a more complete description of methods used. In 2012, reaches of Big Cherry Creek, Poorman Creek, and Swamp Creek were surveyed via electrofishing by MMC to provide further baseline data or to investigate mitigation potential (Kline and Savor 2012). Three reaches of Flower Creek, a tributary to the Kootenai River, were also surveyed to assess its mitigation potential.

Fish population surveys also were conducted on the East Fork Bull River and Rock Creek between 1992 and 1994 (Washington Water Power Company 1996), and on the East Fork Bull River in 1999 (Chadwick Ecological Consultants, Inc. 2000) as part of projects surveying the lower Clark Fork River tributaries and the Bull River drainage. Results of fish surveys conducted in Rock Creek from 1985 through 1996 and the results from metals analyses of trout tissue collected from Rock Creek in 1985 are summarized in the Rock Creek Project Final EIS (USDA Forest Service and DEQ 2001). From 2000 through 2010, fish population monitoring surveys were completed annually during all or most years on the East Fork Bull River and East Fork Rock Creek by Avista (Horn and Tholl 2008, 2011; Avista 2011). One to two reaches of Rock Creek, East Fork Rock Creek, and West Fork Rock Creek were surveyed by FWP personnel in 2012 to evaluate the fish populations to either provide further baseline data or, in the case of West Fork Rock Creek, to investigate the mitigation potential (Kline and Savor 2012). Copper Gulch, which is also within the Lower Clark Fork drainage, was also surveyed by MMC or FWP personnel for mitigation purposes as well.

3.6.2.2.6 Metals in Fish Tissue

Metals analyses of redband trout tissues collected from the most downstream site on Libby Creek were conducted at Montana State University, Bozeman, and the Department of Health and Environmental Sciences, Helena, Montana (Western Resource Development Corp. 1989a). Analyses of cadmium, lead, and mercury concentrations in rainbow trout tissues (identified only as Oncorhynchus sp.) were also conducted for one or more sites on Libby Creek in 2006 through 2008, and at a site on Bear Creek in 2007 and 2008 (Kline Environmental Research 2008, 2009).

3.6.2.2.7 Riparian Habitat Conservation Areas and Other Riparian Areas

The KNF maintains a map of RHCAs for the Libby Ranger District, which is available in the agencies' project record. Most streams within the analysis area are considered fish-bearing streams under INFS. RHCAs also are found around wetlands (Table 63). Wetlands in the analysis area were "buffered" by the standard widths shown in Table 63 to generate a final RHCA and other riparian area map (Figure 53). Similar habitat is found on private land in the analysis area. Such habitat is described as "other riparian areas" in the impact assessment.

3.6.2.3 Impact Analysis Methods

The impact analysis methods focused on assessing the effects on fish, fish habitat, and other aquatic populations from the predicted changes in sedimentation rates, water quantity, water quality (nutrients, metals, and temperature), fish passage, and fish losses. Additionally, the effects of these changes on sensitive species, including threatened species, Forest Service sensitive species, and Montana species of concern, were assessed.

3.6.2.3.1 Sediment

Mine construction, mine activities, and transmission line construction may result in increased sediment in streams. Possible sources of sediment related to the proposed project were identified for the Evaluation, Construction, Operations, Closure, and Post-Closure Phases of mine activities for existing conditions and Alternatives 2, 3, and 4, as described in section 3.13, *Water Quality.* The agencies analyzed the potential effects of the project on erosion and sedimentation both qualitatively and quantitatively (KNF 2013c), and results of these analyses were used to qualitatively assess the effects of sedimentation on stream habitat for each alternative. The possible changes to stream habitat that may occur from increases in sediment delivery rates to streams were then evaluated as to their possible effect on fish and other aquatic populations within the analysis area. The uncertainty and limitations associated with the water quality analysis and the Water Erosion Prediction Project (WEPP) analysis used to estimate sediment delivery from roads and the transmission line were discussed in KNF's WEPP analysis (2013c) and section 3.13.4.5, *Uncertainties Associated with Water Quality Analysis*. While the model results are expected to be representative of what would occur as a result of the project, the uncertainty and limitations of the modeling could potentially affect the qualitative interpretation of the effects of any changes in sediment delivery to streams as a result of the project on the aquatic habitat.

3.6.2.3.2 Water Quantity

The water bodies in the analysis area include first-order headwater streams and larger streams, as well as glacial lakes whose water sources are snowmelt, rainfall, and groundwater (shallow and deep). Streamflows are described in section 3.11, *Surface Water Hydrology*.

Multiple activities related to the mine operations may induce changes in surface water flows and lake levels and thus result in impacts on aquatic resources. Section 3.10, *Groundwater Hydrology* describes how mine and adit inflows and the pumpback wells are predicted to result in groundwater drawdown that may reduce stream baseflows and lake levels within the analysis area. In addition, discharges to Libby Creek from the Water Treatment Plant are predicted to increase flows downstream of the Libby Adit during all mine project phases, as described in section 3.11, *Surface Water Hydrology*. Streamflows would also potentially be impacted through infiltration from the LAD Areas (used in Alternative 2 only), interception of precipitation and runoff by the impoundment, stormwater runoff from other mine facilities, and the increases in runoff resulting from vegetation clearing. The transmission line alternatives would not affect streamflow in most cases; the exceptions to this are discussed in section 3.6.4.6.2, *Peak Streamflow*.

Three-dimensional (3D) hydrogeological models of the analysis area were used (Geomatrix 2011a) to estimate the range of effects predicted to occur to baseflows as a result of the project, as described in section 3.11.4, *Surface Water Hydrology*. Effects on streamflows focused on the evaluation of predicted impacts on low flows, peak flows, and average annual flows for eight selected sites over the various phases of the project, with one or more sites each located on East Fork Rock Creek, Rock Creek, East Fork Bull River, Ramsey Creek, Poorman Creek, Little Cherry Creek, and Libby Creek (Figure 52). Baseflow reductions were predicted to be negligible in other analysis area streams. In addition, predicted low flow changes and the associated changes in wetted perimeters for three additional sites were estimated for the Operations and Post-Closure Phases. These additional impact assessment sites included one site each on Libby Creek, East Fork Rock Creek, and East Fork Bull River (Figure 76).

Assessment of the resulting impacts on fisheries habitat and other aquatic resources from changes in streamflows was mainly based on the changes predicted to occur to low flows as represented by the percent changes to $7Q_{10}$ flows provided in section 3.11.4, *Surface Water Hydrology*. Changes to these flows represent the maximum effects that would occur to aquatic populations during the periods of the year when groundwater inflows comprise most or all of the flow in headwater reaches. Potential flow conditions during other times of the year were evaluated on a case-by-case basis, depending upon the available data and the magnitude of effects.

The effects on streamflow were quantified using the 3D model results for Alternative 3 only, but the effects under Alternatives 2 and 4 on east side streams would be similar to those that occur under Alternative 3. Without mitigation, effects on west side streams would be the same for all three alternatives. The time period and extent to which baseflow conditions persist in the stream reaches in the area varies from year to year based on the amount of precipitation, runoff, and other factors, but typically occurs during mid-August to October and then again from late December through March. The 3D model assumes that stream baseflows originate mainly from regional groundwater sources that would be affected by the dewatering that would occur as a result of the project; it may be difficult to separate the effects from natural stream flow variability (USDA Forest Service 2013a).

The uncertainty associated with the 3D model predictions is discussed in section 3.10.4.3.5, *Groundwater Model Uncertainty*. Uncertainty in the predicted changes to baseflow also results in uncertainty in the assessment of impacts on fisheries habitat and other aquatic resources. The 3D model results are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. Both 3D groundwater flow models would be refined and rerun after data from the Evaluation Phase were incorporated into the models. Following additional data collection and modeling, the predicted impacts on surface water resources in the analysis area may change and the model uncertainty would decrease.

The three additional sites at which streamflow effects from mine inflows were modeled in 2012 were chosen to provide additional information for stream reaches where impacts on bull trout habitat may occur. The Libby Creek site (LB-2) is 1 mile upstream of Little Cherry Creek within a stream reach that would be affected by operation of the pumpback wells system (Figure 76). The East Fork Rock Creek site (RC-3) is located about 1 mile upstream of the confluence with West Fork Rock Creek, and the East Fork Bull River site (EFBR-2) is located at the confluence with Isabella Creek within the CMW. Both locations on the west side streams were chosen because data indicate bull trout are relatively abundant in these areas and use them for spawning. KNF hydrologists collected stream cross-section data in late summer and early fall 2012 at these three sites. The data were used to develop a relationship between wetted cross section area and discharge during the low flow period in these stream reaches (ERO Resources Corp. 2012b). Changes in the wetted cross-sectional area of the streams at these sites were then estimated for the project alternatives during the Operations and Post-Closure Phases, and are further discussed in section 3.11, *Surface Water Hydrology*.

The quantitative analysis of flow-related habitat effects from the project alternatives focuses on impacts on aquatic habitat for bull trout, the federally threatened species that occurs in the analysis area. Effects to other sensitive species (westslope cutthroat trout, interior redband trout, and western pearlshells), species of concern (torrent sculpin), and macroinvertebrate communities are qualitatively assessed.

The quantitative analysis of effects on bull trout habitat is based on the methods used and described in the BA prepared for the Montanore Project (USDA Forest Service 2013a). These methods use the estimated changes in baseflow from the 3D models for those stream reaches in which bull trout occur, and evaluate the effect these reductions in low flows would have with regard to the potential to affect adult migratory bull trout passage. Impacts on bull trout passage in the analysis area streams was based on USGS bull trout passage data from studies in central Idaho (Maret *et al*. 2005, 2006; Sutton and Morris 2004, 2005) and channel widths, depths, and habitat types present in the stream reaches of interest in the analysis area. Impacts on habitat availability for adult, juvenile, and spawning bull trout were also evaluated using relationships developed from these USGS studies, which assessed habitat availability for the various bull trout life stages using Physical Habitat Simulation System (PHABSIM) model data.

The USGS studies determined that a minimum stream depth of 0.6 feet was necessary for migratory adult bull trout passage (Maret *et al*. 2005, 2006; Sutton and Morris 2004, 2005), and this depth must be present over at least 25 percent of the total stream width and must be continuous for at least 10 percent of this width at a representative transect. In the BA, the KNF (USDA Forest Service 2013a) indicated that this should be considered a conservative criterion as passage at depths less than 0.6 feet has been recorded. Further details of how the passage criterion was used and applied to analysis area streams to determine passage is provided in the BA.

The use of PHABSIM to evaluate habitat availability for fish is based on the preferences of a species and life stage for water depth, velocity, substrate, and cover, which can vary at different flows. PHABSIM and other related methods have been widely used to predict impacts (Reiser *et al*. 1989), but there are some concerns about its use (Orth and Maughan 1982, 1986; Mathur *et al*. 1985, 1986; Scott and Shirvall 1987; Armour and Taylor 1991; Bovee *et al*. 1994). These types of methods have been used to quantitatively link changes in habitat availability to effects on fish populations in several studies (Nehring and Anderson 1993; Baran *et al*. 1995; Jowett 1992), and they provide a way to estimate the magnitude of effects that might occur to aquatic resources based on differences in flow between existing conditions and the alternatives.

For the assessment of any habitat availability changes that would potentially occur for bull trout as a result of changes in low flows resulting from the project, the KNF (2013a) developed relationships between these parameters based on the USGS studies that indicated that for every 1 percent decrease in low flows, a corresponding 0.4 percent, 0.5 percent, and 1 percent decrease could be predicted to occur in adult, juvenile, and spawning bull trout habitat, respectively. While these relationships were not established using data specifically from analysis area streams, they were determined to be the best available method for the evaluation of aquatic habitat impacts on bull trout populations based on the information currently available.

The relationship between habitat availability and bull trout abundance is complex and reach specific (Al-Chokhachy *et al*. 2010), and factors such as substrate composition, species interactions, food availability, groundwater inputs, channel morphology, and stream temperatures can also significantly affect bull trout survival and reproduction (Montana Bull Trout Restoration Team 2000), but are not directly accounted for using these relationships. Based on this and a lack of studies supporting a direct linear relationship between bull trout abundance and habitat availability as estimated using PHABSIM or other related methods, the relationships derived in the BA were used to estimate the amount of habitat that would be predicted to be available under existing conditions compared to Alternative 3 rather than estimating direct loss of bull trout. The reductions in wetted cross-sectional area predicted to occur as a result of the project based on the data collected in 2012 from LB-2, RC-3, and EFBR-2 (Figure 76, Table 109) were also assessed in the BA (USDA Forest Service 2013a) to determine if they indicated the same general trends in changes to habitat availability and passage as these relationships developed using the USGS data.

The impact assessment assumed that lower or higher habitat availability in Alternative 3 compared to existing conditions would result in adverse or beneficial impacts, respectively, to bull trout populations, and that a greater magnitude of change in habitat availability would result in correspondingly greater impact on the populations. Additionally, while changes to habitat availability were not quantified for redband trout, westslope cutthroat trout, and other fish species within the analysis area, lower flows were assumed to result in lower habitat availability for these species as well. The success of the various mitigations proposed for any impacts were not determined based on these estimations of changes to habitat availability due to the uncertainty and complexity of estimating the effects on aquatic populations as a result of the project. Instead, mitigation success would be determined directly by use of monitoring data that would continue to be collected throughout the mine phases (USDA Forest Service 2013a). Collection of these data would allow for an adaptive approach to mitigation strategies that takes into account the actual progress made toward the bull trout mitigation objectives in the Lower Clark Fork and Kootenai Core areas.

Impacts on macroinvertebrate populations from changes in water quantity resulting from the project were also evaluated qualitatively based on the modeled changes to low flows and the general assumption that lower flows would result in less wetted surface area available to support these assemblages. The response of macroinvertebrate populations to decreases in flow may be less predictable than that of fish populations. Dewson *et al*. (2007) and Poff and Zimmerman (2010) reviewed literature reports of responses of macroinvertebrate diversity and abundance to alterations in flow magnitude, and found that while these parameters generally declined, there were some cases in which abundance or diversity increased even with large (greater than 70 percent) changes in flow. Poff and Zimmerman (2010) were not able to determine a quantitative relationship between the magnitude of the flow changes and any observed changes in the macroinvertebrate populations, nor could they identify an ecological threshold, due to the lack of data available for situations in which flows changed by less than 50 percent.

3.6.2.3.3 Water Quality

Projected changes in water quality during low flow conditions in the Evaluation, Construction, Operations, Closure, and Post-Closure Phases were compared to existing mean water quality concentrations for sites in Ramsey Creek, Poorman Creek, and Libby Creek in section 3.13,4, *Environmental Consequences* in the *Water Quality* section. Methods used in the mass balance calculations for prediction of water quality changes are discussed in section 3.13.2.2.2, *Impact Analysis*. Information from these sections was used to qualitatively predict the effect of any such changes on the aquatic assemblages and habitat. The uncertainty and limitations associated with the water quality analysis were discussed in section 3.13.4.5, *Uncertainties Associated with Water Quality Analysis*. While the analysis results are expected to be representative of what would occur as a result of the project, the uncertainty in the predicted changes to water quality also results in uncertainty in the qualitative interpretation of the effects of any changes in stream water quality on aquatic resources as a result of the project. As discussed in Section 3.13.4.2.3, *Environmental Consequences* in the *Water Quality* section, if mine void water flowed to the East Fork Bull River or East Fork Rock Creek after mine closure, it is not likely that changes in water quality in the river would be detectable. Mitigation would be designed to minimize post-mining changes in the East Fork Bull River and East Fork Rock Creek streamflow and water quality.

Surface water quality in the project area may be affected by reductions in groundwater contribution to streams, which could result in lower dissolved solids concentrations in these streams and lakes . If such a water quality change occurred, it would be detectable only during low flow periods when bedrock groundwater is the major source of supply to surface water. Even at low flows, the changes in water quality may be difficult to measure.

Nutrients

In 1992, the BHES issued an Order authorizing degradation and establishing allowable changes in surface water and groundwater quality adjacent to the Montanore Project for discharges from the project (BHES 1992). The Order established a limit for total inorganic nitrogen (TIN) as 1.0 mg/L (Table 75). The Order remains in effect for the operational life of the mine and as long as necessary thereafter. In issuing the Order, the BHES determined that a limit of 1 mg/L TIN would be protective of all beneficial uses (BHES 1992). In 1992, the DHES (now DEQ) determined that land treatment would provide adequate secondary treatment of nitrate (80 percent removal). The Order requires the DEQ to review design criteria and final engineering plans to determine that at least 80 percent removal of nitrogen would be achieved and the TIN concentration in Libby, Ramsey, or Poorman creeks would not exceed 1 mg/L. The Order also adopted the modifications developed in Alternative 3, Option C, of the Final EIS (1992), addressing surface water and groundwater monitoring, fish tissue analysis, and instream biological monitoring. In all alternatives, the agencies assumed TIN concentrations could increase up to 1 mg/L.

In 2014, the DEQ developed numeric standards for total phosphorus and total nitrogen for wadeable streams in Montana Ecoregions (DEQ 2014a). Wadeable streams are perennial or intermittent streams in which most of the wetted channel is safely wadeable by a person during baseflow conditions; this includes all streams in the analysis area. The analysis area is in the Northern Rockies Ecoregion; all wadeable streams have a seasonal total phosphorus standard of 0.025 mg/L and a seasonal total nitrogen standard of 0.275 mg/L between July 1 to September 30. During October 1 to June 30, the narrative standard for nutrients applies, which is that surface waters must be free of substances that will create conditions that produce undesirable aquatic life (ARM 17.30.637). Because the numeric nutrient standards are stringent and may be difficult for

MPDES permit holders to meet in the short term, Montana's Legislature adopted a law (75-5-313, MCA) allowing for the achievement of the standards over time via variance procedures found in Circular DEQ-12B (DEQ 2014b). A MPDES permit holder may apply for a general variance for either total phosphorus or total nitrogen, or both. The general variance may be established for a period not to exceed 20 years. The DEQ must review the general variance treatment requirements every three years to assure that the justification for their adoption remains valid. The review may not take place before June 1, 2016, and must occur triennially thereafter. If MMC received a general variance from the base nitrogen and phosphorus standards, the total phosphorus end-of-pipe discharge limit would be 1 mg/L (DEQ 2014b). For total nitrogen, the limit would be 10 mg/L. Because nitrate would be the dominant nitrogen form, the analysis assumed that the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes.

Circular DEQ-12B indicates that cases will arise in which a permittee is or will be discharging effluent with nitrogen and/or phosphorus concentrations lower than (i.e., better than) the minimum requirements of a general variance, but the resulting concentrations outside of the mixing zone still exceed the base numeric nutrient standards, such as those established by the BHES Order. Such permitted discharges are still within the scope of the general variance, because the statute contemplates that a general variance is allowable if the permittee treats the discharge to, at a minimum, the concentrations indicated by 75-5-313(5)(b)(i)and (ii), MCA. Thus, permitted discharges better than those at 75-5-313(5)(b)(i)and (ii), MCA, are not precluded from falling under a general variance.

Montana law also allows for the granting of nutrient standards variances based on the particular economic and financial situation of a permittee (75-5-313(1), MCA). Individual nutrient standards variances may be granted on a case-by-case basis because the attainment of the base numeric nutrient standards is precluded due to economic impacts, limits of technology, or both (DEQ 2104b).

The greatest ecological effect of increased nutrient concentrations would be an increase in primary production, potentially resulting in nuisance algal blooms either in the channel or downstream of the discharge. This analysis examined changes in nitrogen concentrations in the Libby Creek watershed, although nitrogen is only one of the factors that could influence production in the stream. Phosphorus is often a limiting factor to production and data indicate generally low phosphorus concentrations exist in analysis area streams. Predicted phosphorus concentrations in Libby Creek below the Water Treatment Plant effluent discharge point are provided for Alternative 3 in Table 127 in section 3.13.4.3.2, *Water Quality*. Phosphorus concentrations are predicted to increase above ambient concentrations, but would remain below the total phosphorus standard of 0.025 mg/L, and well below a general variance treatment requirement of 1 mg/L (DEQ 2014b). Other factors, such as carbon availability, shading, stream velocity, and substrate composition can also limit algal production.

Ammonia is the only nutrient with known toxicity to aquatic life and, therefore, has a Montana aquatic life standards (ALS). Chronic criteria for ammonia are modified by ambient pH and temperature, and take into consideration the presence of sensitive early life stage fish. The presence of early life stage fish requires a more restrictive standard. Higher temperature and/or pH also result in a more restrictive standard. For the effects evaluation, projected changes in ammonia concentrations were compared to the chronic early life stage present criterion at the ambient pH and a stream temperature of 14˚C. Only minor differences in nutrient concentrations is expected during the all phases of the project; predicted impacts are discussed collectively.

Metals

Metal concentrations are generally low within analysis area streams, with a high percentage of values below detection limits. Existing baseline concentrations and estimated changes in concentrations due to the project are provided in Section 3.13.4 for metals, including antimony, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, silver, and zinc. The uncertainties associated with projected instream concentrations resulting from discharges are discussed in section 3.13.4.5, *Uncertainties Associated with the Water Quality Assessment*, and these uncertainties would also impact the evaluation of potential impacts on aquatic life. Water quality monitoring would be required for a full suite of metals (see Appendix C).

The impact assessment for aquatic life focuses on the effects from any metals that would be predicted to increase to concentrations greater than chronic or acute aquatic life standards (ALS) or BHES Order limits in surface water as a result of the project alternatives (Table 118, p. 663). BHES Order limits were established for chromium, copper, iron, manganese, and zinc concentrations. Existing and predicted metal concentrations are presented as total recoverable metals, and were compared to total recoverable metal standards when available. Because the effects of changes in metal concentrations would be similar during each phase, predicted impacts are discussed collectively.

Montana ALS for cadmium, copper, chromium (III), lead, nickel, silver, and zinc are stream hardness-modified concentrations (DEQ 2012a). Because the toxicity-hardness relationship is uncertain at hardness concentrations of less than 25 mg/L, a hardness concentration of 25 mg/L as $CaCO_3$ is used to calculate metals standards when ambient hardness is less than this value. Ambient hardness is less than 10 mg/L in many of the water quality monitoring locations, creating uncertainty for the analysis of effects of metals on fish.

The BHES Order limit of 0.05 mg/L for manganese in surface water was consistent with the Montana surface water quality standard in effect in 1992. Montana's surface water standard for manganese was designed to protect the beneficial use of surface water as a drinking water source. Manganese in drinking water can have adverse staining and taste characteristics. Montana does not have a surface water quality standard or an ALS for manganese (Table 118). The State of Colorado adopted a hardness-modified chronic manganese standard of 1.04 mg/L at a hardness of 25 mg/L for aquatic life (Colorado Department of Public Health and Environment 2013). Although this aquatic life criterion has not been adopted in Montana and is not being applied to the Montanore Project, it was used to evaluate potential effects of projected manganese concentrations, as it is likely to be a more appropriate indicator of potential adverse effect on aquatic life than the BHES Order limit of 0.05 mg/L.

Temperature

As discussed in section 3.13, *Water Quality*, Montana has surface water ALSs for temperature that restrict substantial increases or decreases in stream temperature, dependent on the naturally occurring range of temperatures within the stream (Table 118, p. 663). For bull trout, water temperatures ranging from 36° to 59°F are needed, with adequate thermal refugia available for temperatures at the upper end of this range. Other fish and invertebrate species within the analysis area also have specific temperature range needs that could be affected by any changes resulting from the project.

Direct solar radiation is the primary contributor to daily fluctuations in stream temperature, but stream temperature is influenced by other factors as well: air temperature, topography, weather, shade, streambed substrate (bedrock versus gravel or sandy bottoms), stream morphology, the amount of subsurface streamflow, and groundwater inflows (USDA Pacific Northwest Research Station 2005). Potential effects to stream temperature due to the project are discussed in section 3.13.2.2.2. Given all of the factors that may affect stream temperature (both natural and due to the project), as well as the constantly changing stream temperature regime, it is difficult to predict how mine project effects may alter stream temperature, to what extent stream temperatures may be changed, or whether effects due to the mine would be separable from natural effects. Changes in stream temperature as a result of the mine project are evaluated qualitatively with respect to their effects on aquatic populations and habitat.

3.6.2.3.4 Metals in Fish

Metal concentrations in fish tissues were determined from redband trout samples collected from Libby Creek downstream of the Little Cherry Creek confluence in 1988, as well as from one or more sites on Libby Creek in 2006 through 2008 and one site each on Bear Creek in 2007 and 2008 (Western Resource Development Corp. 1989a; Kline Environmental Research 2008, 2009). Metals measured in 1988 included cobalt, copper, lead, mercury, and zinc in fish ranging from 3 inches to greater than 7 inches. Cadmium, lead, and mercury concentrations were measured in the trout collected from 2006 through 2008. Results from metals analyses of trout tissue collected from Rock Creek in 1985 are summarized in the Rock Creek Project Final EIS (USDA Forest Service and DEQ 2001). All reported concentrations were assumed to be reported as wet weight unless otherwise stated. Potential changes in tissue concentrations for each alternative were not calculated due to the lack of information needed to determine site-specific bioaccumulation and bioconcentration factors. Effects due to an increase in metal tissue concentrations were evaluated through projected changes for instream metal concentrations.

3.6.2.3.5 Fish Passage and Fish Loss

Mine activities have the potential for altering stream habitat by the creation of barriers to fish passage. If fish passage is restricted, habitat may be fragmented, migratory corridors may be eliminated, and fish subpopulations can become isolated from the remainder of the population. If a fish population becomes isolated, neighboring populations may be unable to recolonize and act as a source of gene flow for the isolated population, leaving it more vulnerable to extirpation. In several Montana watersheds, lack of connectivity has been identified as a major threat to bull trout restoration and persistence (Parametrix 2005).

The methods used to determine if barriers to fish passage from decreases in low flows is expected to occur as a result of the project alternatives was discussed in section 3.6.2.3.2, *Water Quantity*, and was based on the analysis presented in the BA (USDA Forest Service 2013a). This analysis used criteria from multiple USGS studies (Maret *et al*. 2005, 2006; Sutton and Morris 2004, 2005) that assessed the channel widths and stream depths necessary to allow for passage of adult migratory bull trout. The likelihood that physical or flow barriers would develop in the analysis area from other project effects and the potential impacts of the development of those barriers on aquatic resources were assessed using best professional judgment. Additionally, mine actions and mitigation plans were evaluated with respect to their potential to cause loss of fish within the analysis area.

3.6.2.3.6 Threatened, Endangered, or Sensitive Species and Species of Concern

As part of the impact analysis, activities during all mine phases were evaluated to determine their potential to alter stream habitat in such a way as to adversely affect sensitive species. Threatened, endangered, or sensitive species include the bull trout, a federally listed threatened species, and interior redband trout, westslope cutthroat trout, and western pearlshell mussels, all of which are Forest Service sensitive species. Additionally, torrent sculpin are a species of concern in Montana. Trout have specific habitat requirements for spawning, egg incubation, and rearing of juvenile fish, and possible effects on habitat must be assessed for all life stages. Best professional judgment was used to determine the potential for any adverse effects of mine activities to occur. An assessment of effects to bull trout from the project was the focus of the BA (USDA Forest Service 2013a), and included assessment of impacts from changes to water quantity, water quality, temperature, riparian areas, non-native fish abundance and presence, and fish passage.

3.6.3 Affected Environment

3.6.3.1 Aquatic Habitat

3.6.3.1.1 Stream Habitat Characteristics

Fish habitat parameters for 15 stream reaches within the analysis area sampled in 2005 are summarized in Table 64, with more detailed data summaries provided by Watershed Consulting and Kline Environmental Research (2005). Additional data from the KNF and other sources on the Libby Creek, Rock Creek, West Fisher Creek, and Miller Creek watersheds are presented in Table 65 through Table 69. The habitat evaluations conducted in Libby Creek, Bear Creek, Little Cherry Creek, Poorman Creek, Ramsey Creek, and East Fork Rock Creek during 1988 and 1989 classified each stream reach using the Rosgen (1985, 1996) system. Figure 54 shows the Rosgen categories assigned to each reach. If the same reach was surveyed for two or more years, then the category assigned to that reach during the most recent survey is given.

Wegner (pers. comm. 2012) also categorized reaches within analysis area streams based on data collected during the Rosgen surveys as one of five stream types: source reaches, stable transport reaches, unstable transport reaches, stable depositional/transport reaches, or unstable depositional reaches (Figure 54). Source reaches are characterized as being steep and deeply entrenched, and typically transport a high amount of debris. Rapids and waterfalls are often present in such reaches, and there is no to low fisheries use. Stable transport reaches are less steep and entrenched than source reaches, and typically have higher fisheries use. Riffles and step-pool complexes are common in these reaches, and banks are typically stable. Unstable transport reaches can serve as a source of sediment, and generally are entrenched with unstable banks. Fish habitat in these reaches is of a lower quality than in the more stable reaches. Stable depositional/transport reaches have a low gradient and level of entrenchment, with stable banks, meandering riffles and pools, and high fisheries use. Unstable depositional reaches typically have braided channels, high bedload, high bank erosion and deposition, and low fisheries use. Such a reach also typically supplies large amounts of sediment.

Three habitat indices also were calculated as part of the 1988-1989 habitat evaluations (Western Resource Development Corp. 1989a). The riparian habitat condition index is calculated based on nine vegetation and substrate measures, with the overall value ranging from 0 to 36. All values above 30 indicate excellent riparian habitat in the analysis area, with values between 22 and 30 indicating good riparian habitat. Based on this index, riparian habitat was good or excellent throughout most stream reaches (Table 66).

The habitat vulnerability index rates sites for potential susceptibility to aquatic habitat degradation based on measures of valley bottom width, stream gradient, upper bank slope, lower bank slope, bank stability, and indications of sediment production. Scores higher than 60, between 45 and 60, and less than 45 indicate high, moderate, and low vulnerability to degradation, respectively. Most streams in the analysis area had a moderate vulnerability (Table 66).

The habitat condition index measures potential fishery habitat. It ranges from 0 to 100, with higher scores indicating higher quality of habitat. Overall, the analysis area scored high on measures such as bank cover and stability, while measures of pool quality and quantity were typically lower, resulting in an overall reduction in stream reach scores (Table 66).

As an additional part of the baseline habitat surveys conducted in 1988 and 1989 (Western Resource Development Corp. 1989a), the percentage of potential spawning and rearing areas for fish was estimated for each reach of East Fork Rock Creek and the streams within the Libby Creek watershed.

The composition of spawning gravel was sampled with a McNeil core sampler from 15 stream reaches in Libby Creek, Little Cherry Creek, Ramsey Creek, Poorman Creek, and Bear Creek in 2005 (Table 67) (Kline Environmental Research and Watershed Consulting 2005b; Wegner, pers. comm. 2006a). Additionally, a single site on East Fork Rock Creek, two sites on West Fork Rock Creek, and three sites on the East Fork Bull River were surveyed between 1992 and 1994 using similar sampling methods (Washington Water Power Company 1996). Samples were collected from sites that appeared most suitable for spawning. In the laboratory, samples were dried and sieved. Imhoff cones were used in the field to estimate fine sediment not accounted for in the McNeil core samples. This aspect of the stream habitat is important as the proportion of fine sediment in spawning gravel can be a limiting factor to the reproductive success of bull trout and other salmonids that deposit eggs in the stream gravel.

Generally, core samples showed that the upstream sites had a higher percentage of fine sediment and a smaller median substrate size in comparison to the downstream sites (Table 67). The most downstream reach on Libby Creek had the lowest percent fine sediment (14.6 percent), while the site sampled on East Fork Rock Creek had the highest percent fine sediment (43.0 percent) (Kline Environmental Research and Watershed Consulting 2005b). The average amount of stream substrate covered by fine sediment in low gradient riffles was also measured eight times from 2006 through 2008 at sites on Libby Creek, Bear Creek, Ramsey Creek, and Poorman Creek (Kline Environmental Research 2008, 2009). Surface fines composed less than 15 percent of the substrate in these areas within all sites except the site on Little Cherry Creek in August and October 2008 and the site on Libby Creek immediately upstream of the falls near LB-300 in October 2008.

Table 64. 2005 Region 1/Region 4 Summary Data for 15 Stream Reaches in the Libby Creek Watershed.

Site	Study Length (ft.)	Gradient (Percent)	Width/ Depth Ratio	Percent Riffle	Percent Run/ Glide	Percent Pool	Pools/ mile	LWD/ mile	Percent Stable Banks	Percent Undercut Banks
					Libby Creek					
L1	997	1.8	50.9	48.3	28.1	28.6	10.3	31.9	100.0	0.0
L2	928	1.5	104.7	52.0	23.2	24.8	4.4	22.8	100.0	0.2
L3	1000	3.5	39.4	64.2	20.2	15.6	12.2	153.0	100.0	2.8
L9	1000	1.5	48.1	56.8	24.3	18.9	10.2	126.8	100.0	0.0
L10	1000	4.0	39.4	70.6	9.8	16.4	12.2	73.9	100.0	0.2
L11	1000	15.0	27.7	69.9	9.5	12.0	10.2	26.4	100.0	0.0
					Ramsey Creek					
Ra2	997	3.0	55.6	67.7	9.0	23.3	20.4	116.3	99.3	2.1
Ra3	1000	9.0	52.5	42.1	3.2	17.9	18.3	131.9	100.0	0.0
Ra4	1000	2.5	52.9	49.8	39.8	10.4	6.1	205.8	100.0	0.0
					Poorman Creek					
Po1	1000	3.0	33.3	56.9	27.5	15.6	10.2	163.6	100.0	0.9
Po2	1000	6.0	42.5	66.3	4.2	27.9	24.5	105.6	100.0	1.3
					Little Cherry Creek					
LC1	902	1.5	32.1	49.2	27.4	23.5	24.9	177.2	100.0	0.1
LC2	971	2.0	28.2	46.1	26.6	27.3	35.7	184.9	99.6	6.3
LC3	984	6.5	31.6	65.7	15.9	18.3	33.1	337.6	100.0	1.3
					Bear Creek					
Be2	1066	2.0	32.9	77.7	6.1	16.2	11.5	153.5	99.7	0.1

LWD = large woody debris.

Source: Watershed Consulting and Kline Environmental Research 2005.

Table 65. Stream Geomorphology Data for Libby Creek and Tributaries.

Site and Year Sampled	Rosgen Type	BFW (ft.)	Pools/ft.	LWD/ft.	Width/ Depth Ratio
7 Libby 2005	D4	277	1/1,110	1/347	120.2
8 Libby 2005	F3	55	1/1,222	1/203	47.8
9 Libby 2005	B3c	39	1/797	1/80	34.7
10 Libby 1997	B3c	50	1/180	1/25	22.7
10 Libby 2004	B3c	37	1/279	1/70	35.1
11 Libby 1997	B3c	45	1/225	1/450	32.9
11.5 Libby 2004	B2a	33	1/223	1/335	76.6
12 Libby 1997	C4	37	1/249	1/23	19.4
12 Libby 2004	C3	28	1/5	1/50	57.0
13 Libby 1997	C3	28	1/141	1/37	19.7
13 Libby 2004	F3	29	1/192	1/36	43.4
14 Libby 1997	B3c	36	1/144	1/23	24.5
15 Libby 1997	F3b	23	1/165	1/247	16.6
15 Libby 2004	B3	24	1/127	1/85	28.2
16 Libby 1997	B3c	35	1/357	1/48	26.1
16 Libby 2004	F4b	24	1/173	1/11	38.3
17 Libby 1997	C3b	32	1/192	1/36	43.4
17 Libby 2004	B3c	22	1/117	1/6	110.4
1 Ramsey 1998	B3	23	1/7	1/16	17.5
1 Ramsey 2005	B3	24	1/153	1/77	18.2
2 Ramsey 1997	B2c	15	1/31	1/22	18.1
2 Ramsey 2005	B3c	24	1/247	1/11	17.2
1 Poorman 1997	B2a	16	1/40	1/108	18.1
1 Poorman 2005	A1a	14	1/13	1/4	25.5
2 Poorman 1997	F3b	24	1/13	1/13	15.3
2 Poorman 2005	B3	14	1/97	1/15	21.6
1 Little Cherry 1997	F4b	11	1/37	1/16	19.8
1 Little Cherry 2005	B4	10	1/39	1/14	15.9
2 Little Cherry 2005	A2	8	1/39	1/54	12.9
1 Bear 1997	B3c	25	1/127	1/63	24.9
1 Bear 2004	B3c	20	1/100	1/19	22.4
2 Bear 1997	F3b	33	1/111	1/21	31.4
2 Bear 2004	F3b	25	1/621	1/44	44.1
3 Bear 1997	F3	33	1/134	1/37	1.4
3 Bear 2004	F3	27	1/50	1/35	15.5
4 Bear 2002	G4c	17	1/121	1/18	1.1
1 Cable 1997	B4	21	1/60	1/45	29.9
1 Cable 2005	B3a	23	1/83	1/22	26.6
1 Howard 1997	B4	15	1/135	1/15	21.0
2 Howard 1997	B3a	11	1/32	1/37	32.4
1 Midas 1998	B4	13	1/50	1/10	14.2
2 Midas 1998	F4b	12	1/34	1/19	18.8
3 Midas 1998	F3b	8	1/31	1/16	17.0
4 Midas 1998	B4	8	1/21	1/15	12.2

Shaded values indicate RMOs or goals not met.

LWD = large woody debris; BFW = bankfull width.

Source: Libby Ranger District files (USDA Forest Service 2005a).

Table 66. Mean Habitat Values for Analysis Streams in 1988-1989.

Site	Mean Riparian Habitat Condition Index	Mean Habitat Vulnerability Index	Mean Habitat Condition Index	Potential Spawning Area (%)	Potential Rearing Area (%)
Libby Creek					
L1	33/Excellent	55.45/Moderate	74.1	44.6	7.7
L2	33/Excellent	55.61/Moderate	75.5	25.0	16.8
L4	18/Fair	48.79/Moderate	55.4	34.2	21.7
L5	29/Good	43.94/Moderate	66.8	26.2	18.2
L8	25/Good	44.70/Moderate	70.1	36.6	39.2
L10	33/Excellent	52.73/Moderate	70.6	26.7	20.6
L11	32/Excellent	55.91/Moderate	80.0	33.8	28.6
Ramsey Creek					
Ra2a	31/Excellent	58.94/Moderate	72.0	29.1	13.3
Ra3	32/Excellent	58.03/Moderate	65.4	18.6	21.9
Ra4	31/Excellent	60.45/High	50.9	4.4	99.0
Poorman Creek					
Po0	32/Excellent	45.76/Moderate	60.4	35.2	8.0
Little Cherry Creek					
LC1	33/Excellent	52.88/Moderate	65.9	25.2	17.8
Bear Creek					
Be1	29/Good	44.55/Moderate	73.2	29.1	25.1
Be2	31/Excellent	57.73/Moderate	78.6	37.6	31.6
Be3	30/Excellent	61.97/High	77.7	22.7	28.4
East Fork Rock Creek					
Ro1	33/Excellent	59.24/Moderate	75.4	5.7	34.2
Ro3	29/Good	63.03/High	60.6	3.6	91.1
Ro4	30/Excellent	53.18/Moderate	61.1	2.3	34.4

Source: Western Resource Development Corp. 1989a.

Libby Creek

The Libby Creek stream reaches surveyed in 2005 were generally dominated by riffle habitat, with stable banks and good cover for fish (Table 64). All reaches were moderate in gradient (≤ 4 percent), except the most upstream reach. The dominant substrate types at all reaches were gravel and cobble (Watershed Consulting and Kline Environmental Research 2005). GIS and aerial imagery data were used to survey the habitat in the upstream 5.6 miles of Libby Creek in 2012 (Kline Environmental Research and NewFields 2012). The average slope in this reach was determined to be 7 percent, with moderate canopy cover and amounts of large woody debris. Pools, glides, riffles, and cascades were present throughout this reach.

All five of the stream types identified within the analysis area were present within Libby Creek (Figure 54). A short reach within the headwaters was categorized as a source reach, which then transitioned into a stable transport reach upstream of the CMW boundary (Wegner, pers. comm., 2012). Stable transport reaches were also identified further downstream in Libby Creek from below the Midas Creek confluence to downstream of the Bear Creek confluence. A lower gradient reach between these reaches was characterized as stable but more depositional. An unstable depositional reach was also identified from the Ramsey Creek confluence extending downstream of the Midas Creek confluence (Figure 54).

RMOs and goals for the amount of large, woody debris and bank stability (Table 63) were generally achieved at the Libby Creek sites within the analysis area, but width/depth ratios were consistently not met (Table 65). Pool frequency was lower than these objectives at some sites also.

The riparian habitat condition index, rated as fair throughout the reach of Libby Creek downstream of the Poorman Creek confluence (Site L4), reflects the physical effects of abandoned placer mining operations. All other reaches were rated excellent or good. The mean habitat vulnerability index was rated moderate for all sites (Western Research Development Corp. 1989a).

The most likely locations for spawning in Libby Creek included the reaches downstream from its confluence with Bear Creek (Site L1), near its confluence with Poorman Creek (Site L4), downstream from Ramsey Creek (Site L5), and downstream from Howard Creek (Site L8). Potential spawning habitat ranged from 25 to 45 percent of the total length of each surveyed reach in Libby Creek, and potential rearing areas ranged from 8 to 39 percent (Table 66). Percent fine sediment ranged from 15 percent to 29 percent in 2005 (Table 67). Sampling conducted in 2006 through 2008 indicated that the percentage of surface fines in low gradient riffle habitat within most surveyed reaches of Libby Creek was less than 10 percent (Kline Environmental Research 2009). The reach of Libby Creek immediately upstream of Libby Falls near LB-300 had a higher percentage of fines than the other reaches during some sampling events in 2007 and 2008, with the percent of fines ranging from 1 percent to 17 percent.

In 2001 through 2006, sections of Libby Creek were restored by the FWP as part of the Libby Creek Demonstration, Upper Cleveland, and Lower Cleveland projects. These projects were implemented because accelerated bank erosion along some meander bends had resulted in a widened, shallow, and unstable stream channel that produced low quality habitat for native trout (Dunnigan *et al.* 2004, 2011). The Libby Creek Demonstration Project focused on 1,700 feet of the stream located above the confluence of Elliot Creek with Libby Creek. Two eroding banks in this area were contributing substantial amounts of sediment to Libby Creek. The project restored this reach of Libby Creek, reduced bank erosion, and increased the quantity and quality of rearing habitat for native salmonids (Dunnigan *et al.* 2005, 2011).

Table 67. Mean Particle Size Distribution of McNeil Core Samples.

Site	Mean Particle Size (mm)	Mean % fine sediment (<6.25 mm)
Libby Creek		
L1	37.6	14.6
L2	26.6	19.6
L3	24.2	25.0
L9†	19.0	29.0
L10	25.8	21.7
L11	23.9	19.7
Ramsey Creek		
Ra2	33.4	14.8
Ra3	23.6	22.2
Ra4	23.0	23.1
Poorman Creek		
Po1	28.0	17.2
Po2	22.8	21.0
Little Cherry Creek		
LC1	24.5	19.5
LC2	18.5	23.9
LC3	35.3	39.4
Bear Creek		
Be2†	25.0	23.0
Rock Creek		
Reach 2	Not Calculated	43.0
West Fork Rock Creek		
Reach 1	Not Calculated	28.0
Reach 2	Not Calculated	24.0
East Fork Bull River		
Reach 1	Not Calculated	25.0
Reach 2	Not Calculated	33.0
Reach 3	Not Calculated	15.0

†Sites were surveyed in 2005 by Libby Ranger District; data from other years also available.
mm = millimeter.
Sources: Kline Environmental Research and Watershed Consulting 2005b; Wegner, pers. comm. 2006a; Washington Water Power Company 1996.

The other restoration projects, designated the Upper and Lower Cleveland restoration projects, focused on restoring stream function to about 6,100 feet of Libby Creek between the confluences of Howard Creek and Midas Creek (Dunnigan *et al*. 2011). The restoration effort was aimed at increasing sinuosity (and thereby stream length), habitat complexity, and the number of pools within the stream channel. The projects additionally added cobble structures, rootwad complexes, and rock vanes to increase gradient control, pool habitat, and bank protection. Various shrubs, willows, and cottonwoods were planted to establish a healthy riparian area (Dunnigan *et al.* 2004). Much of this habitat restoration work in upper Libby Creek was destroyed or damaged during a 2006 rain-on-snow event, but the habitat has continued to recover from this large flood event and has remained better than conditions before the restoration based on monitoring through 2009 (Dunnigan *et al*. 2011). Rain-on-snow events occur with sufficient frequency to make habitat improvements in Libby Creek difficult to maintain.

Ramsey Creek

The stream reaches surveyed in 2005 in Ramsey Creek were dominated by riffle habitat and had stable banks. Gradient ranged from 2.5 to 9.0 percent (Table 64). The dominant substrate types at all reaches were cobble and gravel. The headwaters reach of Ramsey Creek and its tributary were assessed using GIS data and aerial imagery in 2012 (Kline Environmental Research and NewFields 2012). The upstream reach of the mainstem had an average slope of 0.3 percent and was dominated by glide habitat, while the tributary was determined to have an average slope of 43 percent and to be comprised mainly of cascade habitat. The tributary had no large woody debris.

The two downstream reaches on Ramsey Creek had a high amount of pool habitat. The farthest downstream Ramsey Creek reach had the highest amount of fish cover in Ramsey Creek, with larger pools that could offer winter fish habitat and a moderate amount of spawning gravel. The upstream Ramsey Creek reach had the lowest percentage of pool habitat out of all of the project stream reaches (Watershed Consulting and Kline Environmental Research 2005).

The upstream segment of Ramsey Creek near the CMW boundary was categorized as a source reach, with the rest of Ramsey Creek categorized as a stable transport reach (Figure 54) (Wegner, pers. comm. 2012). The RMOs describing the amount of large woody debris and bank stability were met in both Ramsey Creek reaches surveyed (Table 65). RMOs for pool frequency were not met during the 2005 surveys, and the goal for width/depth ratios were not met during any survey in Ramsey Creek, similar to other streams within the analysis area.

The riparian habitat condition index was rated as excellent for all reaches of Ramsey Creek. Based on the mean scores for each reach, the upper reach of Ramsey Creek was rated as having a potentially high vulnerability to degradation (Table 66). The other reaches were rated as having moderate potential vulnerability to degradation (Western Resource Development Corp. 1989a).

Potential spawning habitat ranged from 4 to 29 percent in the surveyed reaches of Ramsey Creek, and potential rearing areas ranged from 13 to 99 percent (Table 66). Percent fine sediment increased slightly in a downstream direction, varying from 15 percent to 23 percent in 2005 (Table 67).The average percentage of fine sediment in low gradient riffle habitat was surveyed within a single reach of Ramsey Creek in 2007 and 2008, and was estimated to be 1 percent or less (Kline Environmental Research 2009).

Poorman Creek

The stream reaches surveyed in 2005 in Poorman Creek were dominated by riffle habitat and had stable banks. Gradient was 3 percent in the upper reach and 6 percent in the lower reach (Table 64). The dominant substrate types at all reaches were cobble and gravel. GIS and aerial imagery data were used to assess the headwaters reach of this stream in 2012; average slope was estimated to be 13 percent, and cascades were the most common habitat type (Kline Environmental Research and NewFields 2012). This reach was also determined to have high solar exposure and no woody debris.

The downstream reach on Poorman Creek was braided, with much of the side channel water going subsurface before re-entering the main channel. The upstream Poorman Creek reach had high quality pocket pool habitat formed by cobble and small boulders that serve as good interstitial habitat for juvenile bull trout. The upstream segment of Poorman Creek was categorized as a source reach, while the downstream segment was categorized as an unstable transport reach (Figure 54) (Wegner, pers. comm. 2012). All RMOs and goals were met except for the objectives for width/depth ratios (Table 65).

The riparian habitat condition index for Poorman Creek was rated as excellent. The habitat vulnerability index was rated as moderate. Potential spawning area was found in the reach of Poorman Creek above its confluence with Libby Creek. Potential spawning habitat was 35 percent in the surveyed reach of Poorman Creek, and potential rearing area was 8 percent (Table 66). Percent fine sediment ranged from 17 percent to 21 percent in the two reaches surveyed in 2005 (Table 67). The average percentage of fine sediment in low gradient riffle habitat within the single reach of Poorman Creek surveyed in 2007 and 2008 was estimated to be 1 percent or less (Kline Environmental Research 2009).

Little Cherry Creek

The stream reaches surveyed in the Little Cherry Creek were dominated by riffle habitat and had stable banks. Gradient was moderate to fairly steep (Table 64). The dominant substrate types at all reaches were cobble and gravel.

The upstream Little Cherry Creek site provided limited winter habitat availability and poor pool habitat. Although a few larger pools did exist in the middle reach of Little Cherry Creek, overall this reach also provided poor pool habitat and little fish cover. The most downstream Little Cherry Creek reach had high habitat diversity, but low water volumes. All reaches of Little Cherry Creek were categorized as stable transport reaches (Figure 54) (Wegner, pers. comm. 2012). RMOs and goals were met for pool frequency, amount of large woody debris, and bank stability during each of the three habitat surveys, but were not met for width/depth ratios (Table 65).

The riparian habitat condition index for Little Cherry Creek was rated as excellent. The habitat vulnerability index was rated as moderate (Table 66). Potential spawning habitat was 25 percent in the surveyed reach of Little Cherry Creek, and potential rearing area was 18 percent (Table 66). Percent fine sediment increased downstream, ranging from 20 percent to 39 percent in 2005 (Table 67). The percentage of fine sediment in low gradient riffle habitat was near 2 percent in 2007 and the first sampling event in 2008. The percentage of sediment was much higher in August 2008 and then further increased up to 95 percent in October 2008, potentially as a result of logging activity nearby (Kline Environmental Research 2009).

Bear Creek

Bear Creek was dominated by riffle habitat and had stable banks, with the gradient at the site surveyed in 2005 being 2.0 percent (Table 64). The dominant substrate types were cobble and gravel. The headwaters reach of Bear Creek within the CMW was categorized as a source reach (Figure 54) (Wegner, pers. comm. 2012). Downstream of the CMW boundary, the stream transitioned into a stable transport reach, with a less stable reach present downstream of the Cable Creek confluence. The RMOs and goals for the amount of large woody debris present and for bank stability were met at each site surveyed, but the width/depth ratios did not meet these goals consistently (Table 65). Width-depth ratios at Cable Creek were also greater than the RMOs, and bank stability was low during the 2005 survey.

The mean riparian habitat condition index for Bear Creek was good in the upper reach and excellent in the two lower reaches. Based on the mean scores for each reach, the upper reach of Bear Creek was rated as having a potentially high vulnerability to degradation (Table 66). Other reaches of Bear Creek were rated as having moderate potential vulnerability to degradation (Western Resource Development Corp. 1989a).

Probable spawning areas include reaches in Bear Creek both downstream and upstream of Bear Creek Road (NFS road #278). Potential spawning habitat ranged from 23 to 38 percent in the surveyed reaches of Bear Creek, and potential rearing areas ranged from 25 to 32 percent (Table 66). The single reach surveyed on Bear Creek in 2005 was noted as having good over-wintering and juvenile salmonid rearing habitat, although it appeared to provide limited spawning habitat. Percent fine sediment at this site was 18 and 23 percent in 2004 and 2005, respectively (Table 67) (Wegner, pers. comm. 2006a), and was 8 percent or lower in the monitoring conducted from 2007 to 2008 (Kline Environmental Research 2009). Percent fine sediment was also measured by in Bear Creek in most years from 2002 through 2010 as part of the mitigation program for Libby Dam; mean percent fine sediment ranged from 16 percent in 2008 to 39 percent in 2005 (Dunnigan *et al*. 2011).

Big Cherry Creek

No habitat data were available for Big Cherry Creek from MFISH (FWP 2012) or the other sources used.

Howard Creek

Howard Creek was not evaluated for riparian condition index or the vulnerability index. Based on habitat data collected in 1997 (Table 65), LWD and bank stability met RMO's, as did the pool frequency at one site. Width/depth ratios and the pool frequency at the remaining site surveyed did not meet the RMOs.

Midas Creek

Midas Creek was not evaluated for riparian habitat condition index or the vulnerability index. Banks were stable and both LWD and pool frequency met RMOs. Width/depth ratios were not being met based on 1998 surveys (Table 65).

Swamp Creek (Libby Creek tributary)

No data were available from the MFISH database (FWP 2012) or the other sources used that described the aquatic habitat within Swamp Creek. This stream would be used as part of the agencies' wetland and other waters of the U.S. mitigation plan.

Headwater Drainages

Habitat within four headwater drainages between Poorman Creek and Little Cherry Creek were surveyed in 2011 (Kline Environmental Research 2012). Three of the four drainages had surface water connections to Libby Creek that were present for between 34 and 117 days during 2011; the remaining drainage had no surface connection to Libby Creek or any other neighboring drainage over this time period. The percentage of the channel that was flowing in May 2011 but dry in September 2011 varied from 1 percent to 67 percent within the four drainages. Channelized segments were interspersed with non-channelized or dry segments in each of the four drainages. An average gradient of 8 percent was documented in the four drainages, and the average bankfull depth was 10 inches. Canopy cover varied widely, ranging from near zero to 100 percent.

Fisher River and Miller Creek Watersheds

The stream reaches surveyed in the mainstem of the Fisher River were downstream of the analysis area, but generally had gradients that were generally less than 1.0 percent (USDA Forest Service 2005a). Miller Creek was sampled in 1998 and 2005, and comparisons between years are shown in Table 68. Overall, gradients were moderate to steep, and mean substrate size ranged from gravel to cobble sizes. RMOs and goals for most of these stream reaches were met for all parameters except for width/depth ratios, but occasionally RMOs and goals for pool frequency, large woody debris frequency, and bank stability were also not met (Table 68). Mean percent fine sediment was measured in West Fisher Creek as part of the Libby Dam mitigation project in 2006, 2008, 2009, and 2010. Mean values ranged from 10 percent in 2008 to 32 percent in 2006 (Dunnigan *et al*. 2011). No habitat data were available for Hunter Creek and Sedlak Creek.

Rock Creek Watershed

Fish habitat was surveyed in two reaches of Rock Creek, two reaches of East Fork Rock Creek, and three reaches of West Fork Rock Creek between 1992 and 1994 as part of a survey of the tributaries of the lower Clark Fork River (Washington Water Power Company 1996). The two East Fork Rock Creek reaches were similar in location to the sites surveyed during the previous baseline surveys conducted in this stream, while the West Fork Rock Creek reaches extended from the confluence with East Fork Rock Creek upstream to West Fork Falls. Rock Creek was described as consisting of mainly run, low gradient riffle, and glide habitat types, with substrate that was predominately rubble, cobble, gravel, and boulder. Other than the low gradient section termed Rock Creek Meadows, East Fork Rock Creek was composed primarily of riffle and cascade habitats, with a higher percentage of larger substrate such as boulder and cobbles present. West Fork Rock Creek was primarily composed of high gradient riffle and pool habitat with rubble and gravel substrate. Surface fines within the Rock Creek drainage ranged from less than 1 to 31 percent, with the highest percentage occurring in the most downstream reach surveyed in West Fork Rock Creek. Generally the downstream reaches on Rock Creek contained lower amounts of large woody debris than the upstream East Fork Rock Creek reaches.

Substantial portions of the Rock Creek mainstem have seasonally intermittent flows, as do the downstream reaches of West Fork Rock Creek. The riparian zone within these two mainstem reaches was also observed to be significantly altered by logging and wildfires. Percent vegetated bank cover was higher in East Fork Rock Creek and West Fork Rock Creek, compared to the mainstem (Washington Water Power Company 1996). The riparian habitat condition index for East Fork Rock Creek was rated as good in the middle reach and excellent in the upstream and downstream reaches (Table 66). The middle reach was rated as having a potentially high vulnerability to degradation. The other reaches were rated as having moderate potential vulnerability to degradation (Western Resource Development Corp. 1989a). The riparian habitat condition index and habitat vulnerability index were not evaluated on any reaches within the mainstem Rock Creek or West Fork Rock Creek.

Table 68. Stream Geomorphology Data for West Fisher and Miller Creeks and Tributaries.

Site and Year	Rosgen Type	BFW (ft.)	Pools/ ft.	LWD/ft.	Width/ Depth Ratio
1 West Fisher Creek 1996	D4	98.0	1/673	1/1009	109.0
3 West Fisher Creek 1996	B3c	18.3	1/324	1/93	32.9
5 West Fisher Creek 1996	C4	19.1	1/96	1/77	25.0
8 West Fisher Creek 1996	B3a	15.2	1/53	1/45	17.8
1 Miller Creek 1998	B3c	12.1	1/115	1/109	15.8
1 Miller Creek 2005	B4	16.4	Dry	1/10	11.5
2 Miller Creek 1998	B4c	10.8	1/34	1/80	14.8
2 Miller Creek 2005	F4	10.9	1/54	1/18	29.0
3 Miller Creek 1998	F4	11.2	1/120	1/243	13.3
3 Miller Creek 2005	E4	13.2	1/270	1/45	10.2
4 Miller Creek 1998	B4c	13.0	1/54	1/39	16.6
4 Miller Creek 2005	B4c	11.3	1/139	1/132	13.0
5 Miller Creek 1998	B3c	9.2	1/193	1/14	16.2
5 Miller Creek 2005	F4b	9.0	1/47	1/38	13.6
6 Miller Creek Trib. 1998	Da4	4.3	Dry	nc	21.5
6 Miller Creek Trib. 2005	Da4	3.8	Dry	1/5	9.9
7 Miller Creek Trib. 1998	B4	6.9	1/46	1/6	9.1
7 Miller Creek Trib. 2005	F4	6.1	Dry	1/98	22.6
8 Miller Creek 1998	B4c	9.8	1/66	1/28	13.2
8 Miller Creek 2005	F4b	11.5	1/5	1/18	25.7
9 South Fork Miller 1998	B4	6.7	1/33	1/98	18.0
9 South Fork Miller 2005	E4b	7.0	1/36	1/72	4.9
10 South Fork Miller 1998	C4b	5.2	1/32	1/8	20.1
10 South Fork Miller 2005	E4b	6.0	1/43	1/6	5.8
11 Miller Creek 1998	F4b	9.7	1/70	1/15	21.0
11 Miller Creek 2005	B4	8.4	1/46	1/11	20.5
12 North Fork Miller 1998	F3b	10.0	1/40	1/9	31.1
12 North Fork Miller 2005	F4b+	8.8	Dry	1/10	32.8
13 Miller Creek 1998	F4b	6.8	1/64	1/128	28.3
13 Miller Creek 2005	F4	5.8	1/39	1/8	17.4
14 Miller Creek 1998	B4a	5.2	1/24	1/8	12.2
14 Miller Creek 2005	G4	5.7	1/28	1/5	15.8
15 Miller Creek 1998	G4	4.8	1/28	1/6	9.8
15 Miller Creek 2005	F4b	3.0	0/10	nc	16.6

Shaded values indicate RMOs or goals not met.
BFW = bank full width; LWD = large woody debris; nc = not calculated.
Source: Libby Ranger District files (USDA Forest Service 2005a).

Potential spawning habitat ranged from 2 to 6 percent in the surveyed reaches of East Fork Rock Creek, and potential rearing areas ranged from 34 to 91 percent (Table 66). While each reach was not evaluated, the potential spawning and rearing areas for the stream as a whole also were estimated for Rock Creek, East Fork Rock Creek, and West Fork Rock Creek in 1992 to 1994

(Washington Water Power Company 1996). The combined percentage of potential spawning habitat in Rock Creek and East Fork Rock Creek was 1.1 percent. The percentage of potential rearing habitat in this stream was 16.1 percent. Within West Fork Rock Creek, the percentage of spawning and rearing habitat was 2.9 and 32.1 percent, respectively. When compared to other tributaries in the lower Clark Fork River, the percentage of potential spawning area was relatively low, while the percentage of rearing habitat in the Rock Creek drainage was similar to other streams. Percent fine sediment in spawning areas was 43 percent at the one reach surveyed in Rock Creek, and ranged from 24 to 28 percent in West Fork Rock Creek (Table 67), (Washington Water Power Company 1996).

The habitat within the mainstem, East Fork, and West Fork of Rock Creek was also evaluated in August 2012 by the KNF (Kline and Savor 2012; Salmon Environmental Services 2012). The entire length of the mainstem was surveyed, and 3.2 miles and 2.1 miles of East Fork Rock Creek and West Fork Rock Creek, respectively, were surveyed as well. The upstream boundary of the surveys on both East Fork Rock Creek and West Fork Rock Creek were at waterfalls that act as barriers to fish migrating upstream. Riffle habitat predominated within all three streams, and small cobble, large cobble, and gravel were the most common substrates observed in these reaches. Average stream widths were more similar in the mainstem of Rock Creek and East Fork Rock Creek, and were narrower in West Fork Rock Creek, while average depths were similar between all three reaches (Table 69). While bank stability was not specifically measured during this study, RMOs were met for the amount of large, woody debris present within the reach. Width/depth ratios were higher than the RMOs and number of pools per foot lower than the RMOs for those parameters (Table 63) for all three streams. Kline and Savor (2012) provided additional information on pool widths and depths. The number of large pools per mile, defined as pools greater than 9.8 feet in width and 3.3 feet in depth at low flow, was low. About 15 and 4 of these types of pools occurred per mile in the mainstem and East Fork Rock Creek. No pools were present meeting the pool criteria in West Fork Rock Creek.

GIS and aerial imagery data were used to assess some habitat features in a reach of the Rock Creek mainstem and reaches of East Fork Rock Creek upstream and downstream of Rock Lake in 2012 (Kline Environmental Research and NewFields 2012). The mainstem reach that was surveyed was located immediately downstream of the confluence of the east and west forks of Rock Creek, in a reach that has perennial flow. It had an average slope of 2 percent, with dense canopy cover and abundant large woody debris. Pools and glides were the most common habitat types. Average slope for the reach upstream of the lake was estimated to be 21 percent, with cascades common. Large woody debris was reported to be almost absent in this reach, but most of the reach was shaded due to narrow stream widths and riparian shrubs. Downstream of the lake, slope decreased and averaged 8 percent, with pools, riffles, rapids, and glide habitat present. Low to moderate canopy cover was present in this reach, and it also had moderate amounts of large woody debris.

Percent fines in the pool crest areas were highest in West Fork Rock Creek in 2012, where fines comprised 41 percent of the substrate on average in these areas (Table 69) (Kline and Savor 2012). Core data were also collected during these surveys from a stream reach 4 miles upstream of the mouth on the mainstem of Rock Creek and from a site immediately upstream of the confluence with the mainstem on West Fork Rock Creek. The average percentage of fines less than 0.25 inches was 17 and 34 percent, respectively (Carlson, pers. comm. 2012).

Table 69. Stream Habitat Parameters for the Rock Creek and East Fork Bull River Drainages in August 2012.

Reach Length (ft.)	Rosgen Channel Type	Average Wetted Width (ft.)	Average Depth (ft.)	Average Percent Fines in Pool Crest	Pools/ft.	Large Woody Debris/ ft.†	Width/ Depth Ratio
Mainstem Rock Creek							
29,077	NM	20	1.2	27	1/282	1/46	22.8
East Fork Rock Creek							
16,376	NM	20	1.1	15	1/455	1/26	21.9
West Fork Rock Creek							
10,775	NM	11	0.9	41	1/177	1/7	13.6
East Fork Bull River							
2,667	B3c	21	1.2	NM	1/205	1/89	20.1
1,684	B3	23	1.0	NM	1/140	1/83	23.6
1,050	A3-A2	21	0.8	NM	1/105	1/55	29.2

NM = parameter not measured.
†Large woody debris counts included those with diameters greater than 6 inches and lengths either greater than the stream width for the Rock Creek watershed and greater than 15 feet in length for the East Fork Bull River watershed.
Shaded values indicate RMOs or goals not met.
Source: Kline and Savor 2012.

Surface fines and spawning substrate were also evaluated in a separate survey in the Rock Creek drainage in 2011 and 2012 (Salmon Environmental Services 2012). This evaluation concluded that most of the smaller substrates present in the Rock Creek drainage were located in channel margins and depositional bars in areas that were frequently dry during the low flow period. Suitable spawning habitat during this period was limited. The percent of surface fines 0.25 inches or less in diameter varied from none present at one of the East Fork Rock Creek sites to 14 percent at a site on the mainstem. Their evaluation of these and previous data determined that the amount of fine surface sediment in the Rock Creek drainage was generally at levels that would function appropriately for bull trout spawning and incubation. Potential sediment sources were also assessed during 2011, and the primary source of new sediment delivery in this watershed was determined to be bank erosion.

The reach of the mainstem Rock Creek immediately downstream of the Orr Creek confluence was dry during the surveys in 2012 (Salmon Environmental Services 2012), as was the most downstream portion of West Fork Rock Creek and the reach of West Fork Rock Creek upstream of the upper Forest Road 150 crossing.

East Fork Bull River Watershed

As part of the fish habitat survey between 1992 and 1994 (Washington Water Power Company 1996), three reaches of the East Fork Bull River were surveyed. The habitat in this stream consists primarily of high gradient riffle and pool habitat types, with mainly cobble and rubble substrate in the high gradient sections and sand and silt in low gradient sections. East Fork Bull River had lower amounts of fine sediment than most of the other lower Clark Fork River tributaries, ranging from 7 to 11 percent surface fines. It had moderately high amounts of large woody debris (Washington Water and Power Company 1996). A project completed in 2001 restored about 1,200 feet of the channel in the lower East Fork Bull River with subsequent work done to reduce sediment and increase fish habitat (Avista 2007).

While each reach was not evaluated, the potential spawning and rearing areas for the stream as a whole also were estimated for the East Fork Bull River in 1992 through 1994 (Washington Water Power Company 1996). The percentage of potential spawning habitat in the East Fork Bull River was 0.6 percent (Table 66). The percentage of potential rearing habitat in this stream was 4.1 percent. When compared to other tributaries to the lower Clark Fork River, these percentages were relatively low. Percent fines in the three reaches surveyed in 1992 through 1994 ranged from 15 percent to 33 percent (Table 66) (Washington Water Power Company 1996).

Stream habitat restoration projects initiated by Avista occurred in 2001 and 2009 in the lower reaches of the East Fork Bull River (Horn and Tholl 2011). The 2001 project involved rechannelization, revegetation, and installment of large, woody debris in a 1,200-foot reach on the lower East Fork Bull River known as the Stein property reach. In spring 2008, flows returned to the historical south channel. A second restoration project was begun in 2008 in a reach of the East Fork Bull River several hundred feet upstream from the Stein property reach called the East Fork Slide Project. This project included rechannelization, sediment source reduction, and habitat enhancement (Horn and Tholl 2008).

The habitat in the East Fork Bull River was surveyed by MMC in August 2012 to provide addition baseline data for this stream (Kline and Savor 2012). The three reaches surveyed were located near the mouth of the stream, between the Snake Creek and Lost Girl Creek confluences, and upstream of the North Fork East Fork confluence. Average wetted stream widths were similar between the three reaches, while average depths decreased in an upstream direction (Table 69). The RMOs were met for the amount of large, woody debris present within the reach and bank stability, but width/depth ratios were higher than the RMOs (Table 63) for all three reaches, and the number of pools present was lower for all but the most upstream reach (Table 69).

Kline and Savor (2012) also reported the number of large pools per mile in the three reaches, defined as the number of pools with average widths greater than 9.8 feet in width and 3.3 feet in depth at low flow. From downstream to upstream, the three reaches had 12, 6, and 5 of these pools per mile, indicating that such large, deep pools are found more frequently in the East Fork Bull River than in the Rock Creek watershed. The dominant substrate classes observed in the East Fork Bull River are cobble or gravel. The Rosgen classifications indicated that the two downstream reaches were stable, moderately entrenched, and had moderate gradients, while the upstream reach surveyed was steeper and more entrenched.

GIS and aerial imagery data were used to assess some additional habitat parameters in the East Fork Bull River watershed in 2012 (Kline Environmental Research and NewFields 2012). Placer Creek, a tributary to the East Fork Bull River, and two tributaries into St. Paul Lake were evaluated, as well as a reach of East Fork Bull River itself. The tributaries had average slopes ranging from 17 to 35 percent, while the upstream East Fork Bull River reach had an average slope of 12 percent. All tributaries were dominated by cascade habitat, and both rapid and cascade habitat were common in the East Fork Bull River reach. The tributaries had little to no large woody debris, but high amounts were noted in the East Fork Bull River reach, which also had denser canopy cover than the tributaries.

Swamp Creek and Wanless Lake

A habitat survey of three reaches of Swamp Creek (the Lower Clark Fork tributary) was conducted in 1992 through 1994 by Washington Water Power Company (1996). Habitat consisted primarily of runs, cascade, and riffles. Gravel and cobble were abundant in Swamp Creek, and surface fines composed on average 13 percent of the substrate composition. Large woody debris was less abundant in Swamp Creek than in many of the streams surveyed concurrently within the Lower Clark Fork River drainage. Spawning and rearing habitat availability were low, and were estimated to be 0.3 percent and 3.4 percent of the total habitat.

Copper Gulch

Habitat surveys of two reaches of Copper Gulch were conducted in 2000 by Land & Water Consulting, Inc. (2001), as summarized in GEI (2005). This stream was described as high gradient, with substrate dominated by gravel and cobble. Riffle habitat comprised 92 percent or more of all habitat surveyed within both reaches. The downstream reach of Copper Gulch was channelized, with flood control berms constructed, and alteration of the riparian zone was evident. These habitat modifications contributed to the degradation of fish habitat and intermittent flows that occur within this reach of the stream. The quantity of large, woody debris was extremely low in the downstream reach. Further upstream, stream habitat was more complex and stable, with deeper pools present and higher amounts of large, woody debris. Suitable spawning habitat was limited in both reaches.

Flower Creek

No habitat data were available for Flower Creek from MFISH (FWP 2012) or the other sources used. Flower Creek may be included as part of the mitigation plan.

3.6.3.1.2 Barriers to Fish Passage

Over the years, as part of the road system on the KNF, culverts have been installed on streams, some of which have created migration barriers to fish. Barriers have been created on tributaries to the main stems of Libby and West Fisher creeks. The KNF replaced one such barrier in 2007 on Midas Creek where the Libby Creek Road (NFS road #231) crosses the stream. Existing barriers that inhibit fish use of Libby Creek or its tributaries include: a large natural waterfall on Libby Creek; a thermal barrier in the lower several miles of the mainstem of Libby Creek near the mouth with the Kootenai River that occurs seasonally in some years; loss of flow in various reaches (in Libby Creek near the US 2 bridge and the lower segment of the stream near the mouth with the Kootenai River); and double pipe culverts on NFS road #14458 on upper Midas Creek. No permanent known man-made barriers are on the mainstem of Libby Creek. The Vaughn and Greenwall ditch, which was constructed in 1900 to provide a water source for mining activities, possibly provided a passage around the falls in Libby Creek. This ditch is no longer functional and upstream movement is no longer available. Bull trout above the falls are currently isolated from the remainder of the population although downstream movement likely occurs.

In September 2005, a search for barriers to fish passage in the analysis area was conducted (Kline Environmental Research 2005b); a survey to determine the fish passage status of culverts existing in the watershed was conducted in July and August 2005 (Kline *et al.* 2005). The only barrier on Libby Creek documented in these reports was the 39-foot waterfall (Libby Falls) located about 6,200 feet upstream of the Howard Creek confluence near LB-300 (Figure 76). The portion of Libby Creek downstream of NFS road #231 and Libby Creek Falls was not searched for barriers due to FWP's restoration efforts within that reach. No culverts exist on Libby Creek within the analysis area.

Permanent barriers to fish passage were found on Ramsey Creek, Little Cherry Creek, and Poorman Creek that appear to cause portions of these tributaries to be inaccessible to fish from Libby Creek. Little Cherry Creek provides the least amount of habitat for fish from Libby Creek, as a subsurface reach exists during low flow conditions immediately at its confluence with Libby Creek. Even during higher flow conditions, about 950 feet or less of the stream is accessible to fish from Libby Creek due to a series of barriers, the most upstream of which was judged to be impassable to all fish (although small populations of redband trout have been found upstream of those barriers, as discussed below). Additionally, two culverts exist on Little Cherry Creek at the crossing of NFS roads #6212 and #278, upstream of the natural barriers. Poorman Creek has a subsurface reach near its confluence with Libby Creek, but during adequate flow conditions about 2.5 miles of lower Poorman Creek are accessible before a barrier impassable to all fish is encountered. Downstream of this barrier at the crossing of NFS road #278, a culvert that acts as a secondary barrier to juvenile trout at all flows and to adult trout at high flows also exists. Ramsey Creek is accessible to Libby Creek for about 2.7 miles before a barrier to most fish occurs, followed by a barrier to all fish about 1.5 miles upstream of that barrier. No culverts exist on Ramsey Creek (Kline Environmental Research 2005a; Kline Environmental Research *et al.* 2005).

A natural fish barrier is present on East Fork Rock Creek 3 miles upstream from the confluence with West Fork Rock Creek. This barrier is located downstream of Rock Creek Meadows and at the outlet of Rock Lake and does not prevent downstream fish passage. A waterfall is also present on West Fork Rock Creek 2 miles upstream of the confluence with East Fork Rock Creek that would be impassable to fish moving upstream. In addition, the culverts associated with MT 200 on the mainstem and NFS road #150 on West Fork Rock Creek may be barriers to fish movement during low flow (Salmon Environmental Services 2012). West Fork Rock Creek has intermittent flow present within the reach upstream of the waterfall and also the reach near the confluence.

GEI (2005) estimated that about 28 percent of Rock Creek is intermittent (GEI 2005), which likely acts as a barrier to migrating bull trout seasonally. The summary of the flow regime in the Rock Creek watershed provided by Salmon Environmental Services (2012) stated that the mainstem flows intermittently during low flow for all but short reaches. Flow is maintained in these short reaches by groundwater and input from Engle Creek and Orr Creek.

A natural barrier is present over 1 mile upstream of the CMW boundary on the East Fork Bull River (USDA Forest Service and DEQ 2001; Washington Water Power Company 1996; Kline and Savor 2012). The barrier was not assessed to determine if they are barriers to all fish or if they are navigable to some fish under some flow conditions, although fish have been documented to be present upstream of this barrier (FWP 2012). This barrier is located downstream of the Isabella Creek confluence.

The mainstem of West Fisher Creek has no known permanent natural or man-made barriers. A partial barrier exists at the confluence of West Fisher Creek and the Fisher River. This barrier occurs because of the high amount of bedload that is transported down West Fisher Creek. In low water years, the stream has multiple shallow channels through which large migratory fish cannot pass. Miller Creek in the lower reaches near the confluence with the Fisher River is dry most of the year. Streamflow goes subsurface for nearly 0.5 mile in the drainage for most of the year. The stream connects with the Fisher River only during spring high flows, or during rain or snow events.

3.6.3.2 Water Quality Characteristics

Overall surface water quality in streams and lakes within the analysis area is excellent. Total suspended solids, total dissolved solids, major ions, and nutrient concentrations are generally low in analysis area streams, and are frequently at or below detection limits. The low concentrations of nutrients and minerals within the analysis area limit the productivity potential for aquatic life. Lakes located in or near the CMW are quite dilute.

Because of very low alkalinities, analysis area streams are poorly buffered. Consequently, surface waters tend to be slightly acidic, with most pH values slightly below 7.0. This acidity has two likely natural sources – organic acids originating from surrounding coniferous forests and dissolved carbon dioxide (CO_2) in surface water and groundwater draining into the area streams. Median water hardness in all sampled streams within the Libby Creek drainage was less than 30 mg/L as calcium carbonate ($CaCO_3$), with several sampling locations with median hardness values under 10 mg/L $CaCO_3$ (Appendix K). Water quality for the streams and lakes in the analysis area are discussed in section 3.13, *Water Quality*.

3.6.3.3 Aquatic Plants and Periphyton

The results of the 1988 and 1989 monitoring show that sparse growths of green algae (Chlorophyta), blue-green algae (Cyanophyta), and diatoms (Bacillariophyta) occur throughout the Libby Creek watershed within the analysis area. In general, the algal taxa found were typical of unpolluted, soft water streams in Montana. The low population densities are common in high-elevation streams and reflect the low nutrient content in the Libby Creek drainage waters. Of the green and blue-green algae taxa found within the analysis area, *Zygnema* and *Oscillatoria* were the most abundant and widespread genera (Western Resource Development Corp. 1989a).

Diatoms were present in all periphyton samples, but were collected at relatively low abundances at most reaches (Western Resource Development Corp. 1989a). Taxa richness also was low in these samples, ranging from 5 taxa to 27 taxa collected over the three sampling events in 1988 and 1989. The most abundant diatom taxon at most stations on most sampling dates was *Achnanthes minutissima* (Western Resource Development Corp. 1989a), which is often the first species to establish itself at a site disturbed by physical abrasion, and is common in mountain streams (Teply and Bahls 2005). When present in the samples, *A. minutissima* composed from 3 to 99 percent of the diatom community in these stream reaches. Relative abundances up to 25 percent of the diatom population indicate a normal level of disturbance, while relative abundances from 25 to 50 percent indicate minor disturbance (Teply and Bahls 2005). Relative abundances greater than 50 percent indicate moderate to high levels of disturbance.

Periphyton sampling continued from 1991 through 1994. Analysis of the samples collected in 1991 and 1992 from Little Cherry Creek showed a relatively high diversity of algae taxa, possibly as a result of nutrient enrichment. Poorman and Ramsey creeks had a more limited algal diversity, signifying low nutrient concentrations (Western Technology and Engineering, Inc. 1992, 1993). Periphyton samples were only collected from Libby Creek sites from 1993 to 1994. Based on diatom association indices (Western Technology Engineering, Inc. 1994, 1995), biological integrity upstream and at the nearest station downstream of the mining activities was good to excellent, and aquatic life was not impaired. The periphyton community did show some effects attributed to the elevated nitrogen concentrations in October 1991 at the site immediately downstream of the Libby Adit. Periphyton communities at this site were strongly dominated by *Ulothrix*, a green algae species that responds favorably to elevated nutrient concentrations. This site also had the highest diatom species richness and diversity values for that year. Biological integrity ratings were not adversely affected in later years (Western Technology Engineering, Inc. 1994, 1995) as the periphyton community was not as strongly dominated by one green algae species in later sampling.

Periphyton sampling was again conducted at three to five sites on Libby Creek during eight sampling events from 2006 to 2008, and at one site each on Bear Creek, Little Cherry Creek, Poorman Creek, and Ramsey Creek during five sampling events from 2007 to 2008 (Kline Environmental Research 2008, 2009). Sampling continued on two reaches of Libby Creek through 2011 (Kline Environmental Research and NewFields 2012). Presence-absence data were generated from the analysis of these samples. Diatoms were present at every site and sampling event, with diatom richness ranging from 16 to 54 taxa. Green and blue-green algae were common, while red algae (Rhodophyta) and yellow-green algae (Xanthophyta) were collected infrequently from sites on Libby Creek, Bear Creek, and Little Cherry Creek. Common taxa included the cyanobacteria genus *Phormidium* and the green algae genera *Zygnema* and *Ulothrix*.

The periphyton assemblages were sampled in May and September 2011 from 12 sites located on headwater drainages within the disturbance boundary of the Poorman Impoundment Site (Kline Environmental Research 2012). The number of diatom taxa present at these sites ranged from 16 to 53 taxa, while the number of other algal taxa ranged from one to seven taxa. Algal cover was sparse in most of these reaches.

Periphyton samples were collected from nine sites in the Rock Creek drainage in 1985, with species composition described as typical of clean, soft waters in the Rock Creek Project Final EIS (USDA Forest Service and DEQ 2001). Diatoms and green, blue-green, and red algae were present. Periphyton accumulation was also monitored in Rock Creek, East Fork Rock Creek, West Fork Rock Creek, and the East Fork Bull River in 1993 (Washington Water Power Company 1996; USDA Forest Service and DEQ 2001). When compared to other tributaries in the lower Clark Fork River, net productivity and chlorophyll content was relatively high in Rock Creek and East Fork Rock Creek, while the chlorophyll content of the samples was relatively low in West Fork Rock Creek and the East Fork Bull River. In August 2012, algal samples were collected from sites on two tributaries to St. Paul Lake in the East Fork Bull River watershed and from a reach of East Fork Rock Creek upstream of Rock Lake (Kline Environmental Research and NewFields 2012). The number of diatom taxa ranged from 19 to 25 at these sites, with from 2 to 8 other algal taxa present. Golden algae (Chrysophyta), green algae, and blue-green algae were present at these sites, in addition to diatoms.

Aquatic plants and mosses also were documented during the 1988 periphyton surveys. Aquatic macrophytes occurred only incidentally within the analysis area, and included sparse numbers of water buttercup (*Ranunculus*) in spring seeps in the Libby Creek floodplain and in Rock Creek Meadows, as well as sedges (*Carex*) in Rock Creek meadows. Byrophytes (mosses) were the predominant vegetation found along many stream reaches. They were particularly abundant in the upstream portions of each stream, but were present wherever stable substrates and dense forest canopies occur. They occurred only sporadically in Libby Creek's middle reaches, if at all (Western Resource Development Corp. 1989a).

Bryophytes were also collected from the four headwater drainages between Poorman Creek and Little Cherry Creek in 2011, and from two tributaries to St. Paul Lake and one reach of the East Fork Rock Creek upstream of Rock Lake in August 2012 (Kline Environmental Research 2011; Kline Environmental Research and NewFields 2012). The multiple sites sampled within the headwater drainages had up to four bryophyte taxa present at each site, but no bryophytes were collected at one site. *Brachythecium velutinum* was the most common bryophyte collected. Each sample from the tributaries of the East Fork Bull River above St. Paul Lake and East Fork Rock Creek consisted of one bryophyte taxa, including *Amblystegium serpens* var. *juratzkanum* and an unidentified liverwort taxon from the tributaries above St. Paul Lake, and *Scouleria aquatica* from the East Fork Rock Creek site.

3.6.3.4 Aquatic Macroinvertebrates

Stream macroinvertebrates were collected from over 30 locations in analysis area streams between 1986 and 2012 (Western Resource Development Corp. 1989a; USDA Forest Service and DEQ 2001; Western Technology and Engineering 1991, 1992, 1993, and 1994; Western Technology and Engineering and Phycologic 1995; Hoffman *et al.* 2002; Dunnigan *et al.* 2004; USDA Forest Service 2006b, Geomatrix 2006d, Kline Environmental Research 2008, 2009, 2012; Kline Environmental Research and NewFields 2012). Data are summarized in Appendix F.

During the initial baseline study (Western Resource Development Corp. 1989a), mean macroinvertebrate densities and total taxa richness were highly variable (Appendix F). Taxa richness refers to the number of species collected at each site for each sampling event. True flies (dipterans) were the most diverse group taxonomically, and had the highest relative abundance at some sites. Other insect groups with high diversity and relative abundances at all sites were mayflies (Ephemeroptera) and stoneflies (Plecoptera). Metal-intolerant macroinvertebrates, such as heptageniid mayflies, were consistently present at sites in each stream. Most of the macroinvertebrates collected are considered intolerant of fine sediments, metals, and organic pollution (Western Resource Development Corp. 1989a).

Calculated indices characterizing macroinvertebrate communities during the initial baseline period indicated diverse macroinvertebrate communities and high water quality exist in analysis area streams. Differences in community characteristics among the stations were generally slight, and were probably due to differences in stream order, microhabitat conditions, and variable sampling efficiencies.

Macroinvertebrate sampling continued from 1990 through 1994 at a limited number of sites. Both higher and lower values for most of the calculated metrics were observed during this period as compared to the baseline monitoring period data. No consistent spatial, temporal, or seasonal trends were apparent (Appendix F).

Macroinvertebrate data have also been collected from several reaches within analysis area streams as part of the MPDES permit requirements for the Libby Creek adit and for other projects. These studies included sampling reaches of the Rock Creek drainage in some years from 1985 through 2005, and sampling reaches of Libby Creek, Bear Creek, Little Cherry Creek, Poorman Creek, Ramsey Creek, West Fisher Creek, and the Fisher River from 1998 through 2004 (USDA Forest Service and DEQ 2001; Hoffman *et al.* 2002; Dunnigan *et al.* 2004; USDA Forest Service 2006b; Geomatrix 2006d). The data are presented in Appendix F.

More recent data for the analysis area are presented in Table 70. Taxa richness has generally been high in recent sampling, with the exception of East Fork Rock Creek in 2005 and 2012, Fisher River in 2002 and 2003, the most downstream Libby Creek site in 2002, the two upstream Libby Creek sites in spring 2007, and the two tributary sites above St. Paul Lake in 2012. Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa can be used as an indicator of water quality, as they are considered sensitive to a wide range of pollutants (Plafkin *et al.* 1989; Wiederholm 1989; Klemm *et al.* 1990; Lenat and Penrose 1996; Wallace *et al.* 1996; Barbour *et al.* 1999; Lydy *et al.* 2000). The EPT index is a ratio of the number of EPT taxa collected compared to the number of total taxa collected. Values for these metrics typically increase with better water quality. The sensitive EPT taxa composed a substantial proportion of the macroinvertebrate community in all reaches sampled, making up 50 percent or more of the total number of taxa in all of the recent sampling events except for the 2005 events on East Fork Rock Creek and one of the sampling events at the downstream Libby Creek site and Bear Creek in 2006 and 2008, respectively (Table 70).

Of the metrics calculated, percent EPT abundance is one of the most informative because it is less sensitive to differences in sampling and identification methods than most of the other metrics calculated. This metric reflects proportional abundances rather than actual numbers of invertebrates collected. A high abundance of EPT organisms indicates good water quality, as these taxa are generally intolerant of pollutants, low oxygen, high sediment loads, and high temperatures. Percent EPTs were generally high at most sites during most sampling events, and few trends between sites, years or seasons were identified (Appendix F).

Evenness ranges from 0 to 1, and is a measure of how well each species is represented within the invertebrate community. The Shannon-Weaver diversity index is recommended by the EPA as a measure of the effects of stress on invertebrate communities (Klemm *et al.* 1990). Shannon-Weaver index values greater than 2.50 are generally indicative of a healthy invertebrate community (Wilhm 1970). Most Shannon-Weaver diversity and evenness values indicated that healthy, well-balanced macroinvertebrate communities exist in the analysis area streams. The lowest diversity values were recorded in East Fork Rock Creek in 2005, with values ranging from 0.69 to 1.53.

Average Montana Multimetric Index scores were calculated for the samples collected in 2006 through 2008 by Kline Environmental Research (2008, 2009). Values for this index ranged from 57 to 81. Index scores greater than 63 indicate that the stream is not impaired. Only the downstream Libby Creek site near the Crazyman creek confluence scored below this threshold during two of the seven sampling events.

These general findings indicate that the macroinvertebrate communities within the analysis area are variable temporally, spatially, and seasonally, and are likely influenced by factors other than water quality. The flow regime may be a major factor affecting macroinvertebrate abundances, with repeated high flow events resetting densities at low levels. The natural flow regime is dictated by drainage basin characteristics and precipitation events.

Table 70. Characteristics of Macroinvertebrate Populations during 2000-2008.

Stream	Sampling Date	Taxa Richness	EPT Taxa Richness	EPT Index	Shannon-Weaver Diversity Index	Evenness	Data Source
Libby Creek Headwaters Reach	Aug-06	33	18	55	3.78	NC	Kline Environmental Research 2008, 2009
	Oct-06	22	11	50	3.05	NC	
	Apr-07	13	10	77	3.38	NC	
	Aug-07	24	14	58	3.38	NC	
	Oct-07	25	16	64	2.90	NC	
	Apr-08	32	19	59	3.66	NC	
	Aug-08	26	NC	NC	NC	NC	
	Oct-08	34	NC	NC	NC	NC	
Libby Creek Reach Immediately Upstream of Falls	Sep-00	24	16	67	2.26	0.5633	USDA Forest Service 2006b
	Aug-01	39	28	72	2.55	0.4860	
	Aug-03	41	28	68	2.47	0.5340	
	Jul-04	30	24	80	2.47	0.5910	
	Aug-06	23	16	70	3.34	NC	Kline Environmental Research 2008, 2009
	Oct-06	31	17	55	3.36	NC	
	Apr-07	12	9	75	2.79	NC	
	Aug-07	32	18	56	4.09	NC	
	Oct-07	32	20	63	3.27	NC	
	Apr-08	30	17	57	3.68	NC	
	Aug-08	24	NC	NC	NC	NC	
	Oct-08	26	NC	NC	NC	NC	
Libby Creek Reach Near Midas Creek Confluence	Sep-00	33	25	76	NC	NC	Dunnigan *et al.* 2004; Hoffman *et al.* 2002
	Aug-03	35	28	80	NC	NC	
	Aug-07	23	16	70	2.96	NC	Kline Environmental Research 2008, 2009
	Oct-07	23	16	70	2.69	NC	
	Apr-08	28	14	50	3.35	NC	
	Aug-08	32	NC	NC	NC	NC	
	Oct-08	37	NC	NC	NC	NC	

Stream	Sampling Date	Taxa Richness	EPT Taxa Richness	EPT Index	Shannon-Weaver Diversity Index	Evenness	Data Source
Libby Creek Reach Near Bear Creek confluence	Jul-04	21	18	86	2.63	0.7720	USDA Forest Service 2006b
	Aug-07	25	13	52	3.02	NC	Kline Environmental Research 2008, 2009
	Oct-07	26	15	58	2.60	NC	
	Apr-08	35	18	51	4.05	NC	
	Aug-08	27	NC	NC	NC	NC	
	Oct-08	33	NC	NC	NC	NC	
Libby Creek Reach Near Crazyman Creek Confluence	Oct-00	29	22	76	2.25	0.5537	USDA Forest Service 2006b
	Aug-01	43	28	65	2.59	0.5370	
	Aug-02	13	11	85	2.25	0.8820	
	Aug-03	34	24	71	3.09	0.7850	
	Jul-04	42	27	64	1.75	0.2790	
	Aug-06	25	11	44	3.35	NC	Kline Environmental Research 2008, 2009
	Oct-06	29	17	59	3.20	NC	
	Apr-07	20	12	60	3.07	NC	
	Aug-07	37	19	51	3.16	NC	
	Oct-07	25	14	56	3.23	NC	
	Apr-08	32	16	50	3.40	NC	
	Aug-08	32	NC	NC	NC	NC	
	Oct-08	30	NC	NC	NC	NC	
Ramsey Creek	Aug-07	22	16	73	3.70	NC	Kline Environmental Research 2008, 2009
	Oct-07	35	21	60	3.69	NC	
	Apr-08	32	16	50	3.94	NC	
	Aug-08	34	NC	NC	NC	NC	
	Oct-08	34	NC	NC	NC	NC	
Poorman Creek	Aug-07	32	19	59	3.85	NC	Kline Environmental Research 2008, 2009
	Oct-07	32	21	66	3.80	NC	
	Apr-08	43	23	53	4.22	NC	
	Aug-08	29	NC	NC	NC	NC	
	Oct-08	34	NC	NC	NC	NC	

Stream	Sampling Date	Taxa Richness	EPT Taxa Richness	EPT Index	Shannon-Weaver Diversity Index	Evenness	Data Source
Little Cherry Creek	Aug-07	26	13	50	3.86	NC	Kline Environmental Research 2008, 2009
	Oct-07	38	19	50	4.11	NC	
	Apr-08	33	18	55	3.96	NC	
	Aug-08	36	NC	NC	NC	NC	
	Oct-08	43	NC	NC	NC	NC	
Bear Creek	Aug-00	32	24	75	2.75	0.6500	USDA Forest Service 2006b
	Aug-01	33	23	70	2.66	0.5710	
	Aug-03	39	29	74	3.01	0.7150	
	Jul-04	28	22	79	2.54	0.6440	
	Aug-07	22	17	77	3.15	NC	Kline Environmental Research 2008, 2009
	Oct-07	29	17	59	3.75	NC	
	Apr-08	43	20	47	4.11	NC	
	Aug-08	34	NC	NC	NC	NC	
	Oct-08	38	NC	NC	NC	NC	
Fisher River at US 2	Aug-01	34	19	56	2.62	0.5910	USDA Forest Service 2006b
	Jul-02	10	7	70	2.02	NC	
	Aug-03	16	9	56	2.10	0.5920	
	Jul-04	37	25	68	1.92	0.4530	
West Fisher Creek	Oct-00	28	17	61	2.26	0.5547	USDA Forest Service 2006b
	Aug-01	39	26	67	2.83	0.5960	
	Jul-02	29	19	66	2.64	0.6210	
	Aug-03	39	23	59	2.79	0.6540	
	Jul-04	27	20	74	2.51	0.5970	
East Fork Rock Creek	Sep-05	9	4	44	1.53	0.4819	Geomatrix 2006d
	Sep-05	7	2	29	1.08	0.3831	
	Sep-05	11	4	36	0.69	0.1986	
	Aug-12	8	7	88	2.75	0.1360	Kline Environmental Research and NewFields 2012
St. Paul Lake Tributaries	Aug-12	1	0	0	NC	NC	Kline Environmental Research and NewFields 2012
	Aug-12	2	1	50	NC	NC	

EPT = Ephemeroptera, Plecoptera, and Trichoptera; NC = not counted

Macroinvertebrate assemblages were also sampled at twelve sites within four headwater drainages located in the disturbance boundary of the proposed Poorman tailings facility planned for use with Alternative 3 in May and September 2011 (Kline Environmental Research 2012). These drainages do not have perennial flow throughout their length, and the composition of their macroinvertebrate communities is expected to reflect the flow conditions present. Lower metric values generally occurred at those sites that had water present during the May sampling event, but were dry in September. The number of taxa present at these sites ranged from one taxa to 27 taxa, with no EPT taxa present at two to three sites during each sampling event. EPT taxa comprised up to 65 percent of the abundance at the other sites. Macroinvertebrate density varied widely within and between the drainages.

3.6.3.5 Fisheries

3.6.3.5.1 Libby Creek Drainage Fish Populations

Electrofishing studies were conducted at 12 sites located on Libby Creek, Poorman Creek, Ramsey Creek, Little Cherry Creek, and East Fork Rock Creek in August and September 1988 (Figure 52 and Table 71). Native salmonid fish species collected within the Libby Creek drainage in 1988 were redband trout and bull trout (Table 71). While no effort was made to collect sculpins (*Cottus* sp.), they were noted as common at some sites. Both torrent sculpin and slimy sculpin inhabit the Libby Creek drainage. Torrent sculpin is a Montana species of concern. Redband trout was the dominant trout species in all analysis area streams in the Libby Creek watershed, ranging from 65 percent of the trout collected in Ramsey Creek to 100 percent of the trout collected in Little Cherry Creek. Bull trout were collected from all analysis area streams except for Little Cherry Creek. Trout densities in all streams within the Libby Creek drainage were low (Table 71), with all streams except for Little Cherry Creek having no more than 8 trout per 100 square meters (1076 square feet).

No trout were collected at the most upstream sites on Libby Creek (L11) or Ramsey Creek (Ra4). Site Ra4 was located above a barrier to all fish. Site L11 also may be located upstream of a barrier to fish passage, but barrier surveys did not extend that far upstream (Kline Environmental Research 2005b). Site L11 is the only site within the CMW in the Libby Creek drainage. Trout scales were analyzed for age and growth during the 1988 baseline survey. Most trout within the analysis area were young (age I, II, and III), as is typical for low productivity mountain headwater streams. Older (age IV) redband trout were found only in Ramsey Creek, while older bull trout (age IV or V) were found at sites on Ramsey and Libby creeks. Growth rates for all age classes were low, likely due to limitations caused by the low nutrient concentrations.

Using external characteristics to differentiate between pure interior redband trout and redband/rainbow, redband/cutthroat trout, and rainbow/cutthroat trout hybrids in the field is not reliable. Because no genetic analyses were performed at the time of the 1988 study, some uncertainty exists as to whether the redband trout collected during this study were pure redband trout or hybrids. Based on the results of genetic analyses conducted after the initial baseline study and described below, hybridization of redband trout with stocked rainbow trout and westslope cutthroat trout does occur in the analysis area streams.

To provide additional baseline data on fish populations in the analysis area, day and night snorkeling surveys were also conducted at ten sites located on Little Cherry Creek, Libby Creek, Poorman Creek, and Ramsey Creek in July and August 2005 (Table 72) (Kline Environmental Research and Watershed Consulting 2005a). Overall, the distribution of fish within the analysis area in 2005 was similar to those reported in the 1988 baseline surveys. Based on the difficulty in accurately differentiating between redband trout, rainbow trout, and their hybrids, these fish were recorded only as *Oncorhynchus* sp. during these surveys. While the brook trout and bull trout surveyed had external characteristics consistent with one or the other species, hybrids between these two species also occur within the analysis area and evidence of hybridization is not always readily apparent. Additionally, both torrent and slimy sculpin are found in analysis area streams. Sculpin were not identified at the species level. Consistent with the 1988 results, the dominant fish species at all sites where fish were observed in 2005 was *Oncorhynchus* sp.

Abundance and number of fish species were greatest in Libby Creek during the 2005 surveys (Table 72). Brook trout, a non-native species, were first collected in Libby Creek within the analysis area in 2004 (Kline Environmental Research 2004). During the 2005 survey, brook trout outnumbered bull trout by a nearly 8 to 1 ratio at the Libby Creek sites. Longnose dace and large-scale suckers were only seen at the most downstream Libby Creek site during the nighttime snorkeling surveys. Sculpin were most abundant at this site, and also were seen in higher numbers during the night surveys (Kline Environmental Research and Watershed Consulting 2005a).

The only fish observed in Little Cherry Creek in the 2005 study were *Oncorhynchus* sp. (Table 72), consistent with the 1988 survey. *Oncorhynchus* sp. was also the only trout species observed in Poorman Creek in the 2005 study, although bull trout were documented in the 1988 surveys. No fish were seen upstream of the first permanent fish barrier in Poorman Creek (Kline Environmental Research and Watershed Consulting 2005a; Kline Environmental Research 2005b). Both bull trout and *Oncorhynchus* sp. were observed in Ramsey Creek. Bull trout were not seen at the upper Ramsey Creek site as was reported in the 1988 baseline survey. No fish were observed in Ramsey Creek upstream of the first permanent barrier to all fish (Kline Environmental Research and Watershed Consulting 2005a; Kline Environmental Research 2005b). Data from the surveys conducted in 1988 and 2005 were combined with data from the MFISH database (FWP 2012) and other sources to provide a more detailed summary of the fish populations within the analysis area streams. A list of the fish species that occur in each stream, as well as any available data on densities or abundances of these species, are included in these summaries. Additionally, if results of any genetic analyses were available, these data are also discussed.

Libby Creek Fish Populations and Genetics

Based on the results of the previously discussed surveys and the MFISH database (FWP 2012), the following fish species occur in the segment of Libby Creek within the analysis area: rainbow trout, interior redband trout, westslope cutthroat trout, bull trout, brook trout (*Salvelinus fontinalis*), slimy sculpin (*Cottus cognatus*), mountain whitefish (*Prosopium williamsoni*), longnose dace (*Rhinichthys cataractae*), largescale suckers (*Catostomus macrocheilus*), and various salmonid hybrids noted above. Results of the specific surveys documented in either the MFISH database (FWP 2012), Kline Environmental Research (2004), or Dunnigan *et al.* (2004, 2005) only record rainbow trout (presumably referring to redband trout, rainbow trout, and their hybrids), brook trout, bull trout, mountain whitefish, longnose dace, and sculpin as having been collected from the segment of Libby Creek within the analysis area downstream of Libby Falls, and only bull trout as having been collected from the segment of Libby Creek upstream of the falls. Occasionally, amphibians were also collected during the fish population surveys; species included the Rocky Mountain tailed frog (*Ascaphus montanus*) and the Columbia spotted frog (*Rana luteiventris*).

Table 71. Redband, Bull, and Westslope Cutthroat Trout Population Characteristics in 1988.

Site/ Stream	Redband Trout			Bull Trout			Westslope Cutthroat Trout		
	Density (fish/100 m^2)	Average Length (cm)	Average Weight (grams)	Density (fish/100 m^2)	Average Length (cm)	Average Weight (grams)	Density (fish/100 m^2)	Average Length (cm)	Average Weight (grams)
Libby Creek									
L2	3	12.4	22.7	<1	12.2	9.1	0	—	—
L8b	0	—	—	2	18.0	59.0	0	—	—
L10	0	—	—	2	19.3	68.0	0	—	—
L11	0	—	—	0	—	—	0	—	—
Little Cherry Creek									
LC1	18	9.1	9.1	0	—	—	0	—	—
LC2	16	9.7	13.6	0	—	—	0	—	—
Poorman Creek									
Po0	8	11.9	22.7	<1	16.8	49.9	0	—	—
Po1a	8	11.7	22.7	0	—	—	0	—	—
Ramsey Creek									
Ra2a	3	12.4	27.2	2	13.7	40.8	0	—	—
Ra3	2	15.7	45.4	1	20.1	77.1	0	—	—
Ra4	0	—	—	0	—	—	0	—	—
East Fork Rock Creek									
East Fork Rock Creek	0	—	—	4	16.0	40.8	10	14.2	36.3
Rock Creek Meadows	0	—	—	0	—	—	ND[†]	22.4	122.5
Rock Lake	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND = Not determined; see section 3.6.3.5.5, *Analysis Area Lakes*, (p. 365) for discussion of available Rock Lake data. Methods used in Rock Creek Meadows did not allow for density determinations.

[†]Westslope cutthroat trout collected at Rock Creek Meadows site are thought to be hybridized with Yellowstone cutthroat trout and rainbow trout.

Source: Western Resource Development Corp. 1989a.

Table 72. Total Fish Counts per 1,000-foot (305 meters) Stream Reach During Day and Night Snorkeling Surveys in 2005.

Site	Time	Fish Species						Young of Year Fish
		Oncorhynchus sp.	Brook Trout	Bull Trout	Sculpin	Longnose Dace	Largescale Sucker	
Libby Creek								
L1	Day	53	12	0	0	0	0	49
	Night	102	8	1	10	35	5	4
L2	Day	53	0	1	1	0	0	14
	Night	96	0	0	1	0	0	13
L3	Day	114	7	0	1	0	0	18
	Night	94	4	2	0	0	0	1
Little Cherry Creek								
LC1	Day	11	0	0	0	0	0	15
	Night	11	0	0	0	0	0	17
LC2	Day	5	0	0	0	0	0	1
	Night	35	0	0	0	0	0	0
LC3	Day	0	0	0	0	0	0	0
	Night	0	0	0	0	0	0	0
Poorman Creek								
Po1	Day	62	0	0	1	0	0	11
	Night	72	0	0	2	0	0	1
Po2	Day	0	0	0	0	0	0	0
	Night	0	0	0	0	0	0	0
Ramsey Creek								
Ra2	Day	28	0	1	0	0	0	1
	Night	24	0	2	0	0	0	0
Ra3	Day	27	0	0	0	0	0	0
	Night	35	0	0	0	0	0	0
Ra4	Day	0	0	0	0	0	0	0
	Night	0	0	0	0	0	0	0

Source: Kline Environmental Research and Watershed Consulting 2005a.

Surveys conducted from 1988 through 2011 show variable trout densities between years and survey sites, ranging from no trout collected during surveys of some reaches to up to 12 to 133 trout/100 meters (328 feet) within a reach (Kline Environmental Research 2004, 2008; Dunnigan *et al*. 2005, 2007, 2011; FWP 2012). Redband trout and/or their hybrids were the dominant trout species at almost all sites downstream of the falls during years sampled. Bull trout were generally collected in low numbers in most reaches downstream of the falls, but were present in surveys conducted near the Libby Placer Mining Company property between the Howard Creek and Midas Creek confluences from 2005 through 2009 (Dunnigan *et al*. 2011; FWP 2012). These data are consistent with the results of the 1988 baseline surveys. Only bull trout were collected during surveys conducted by the FWP from the reach of Libby Creek near Libby Falls from 2005 through 2010. Density estimates were included in some of these surveys, while the number of fish collected was included in others. Bull trout densities reached up to 5.2 bull trout per 100 square meters of stream. Brook trout were first collected in Libby Creek within the analysis area in 2004, but were collected more frequently from Libby Creek sites downstream of the analysis area in earlier years (Kline Environmental Research 2004; Dunnigan *et al.* 2005). One or more brook trout were collected from Libby Creek in multiple surveys conducted within the reach near the Libby Placer Mining Company property from 2005 through 2009 (Dunnigan *et al.* 2011; FWP 2012).

Genetic analyses were performed on rainbow trout tissues collected from sites in Libby Creek within the analysis area in 1991, 1992, 2000, and 2006. The analyses conducted in 1991 and 2000 from Libby Creek between the confluence of Howard Creek and Ramsey Creek (FWP 2012) showed that all fish collected were rainbow trout. Clarification as to the sub-species of rainbow trout was not found for the 1991 analysis in the MFISH database. A memo from Robb Leary (2003) of the University of Montana to Mike Hensler of the FWP stated that the 2000 analyses were characteristic of a pure redband trout population. These results suggest that the 1991 analysis results likely also referred to redband trout. Non-native rainbow trout have been stocked in Howard Lake, potentially allowing these trout to access Libby Creek through Howard Creek.

Trout also were collected for genetic analysis in 1992 from a more downstream segment of Libby Creek between the confluences of Ramsey and Poorman creeks. These trout were shown to be redband trout/rainbow trout hybrids (52.3 percent redband, 45.7 percent rainbow). The trout collected for the 2006 genetic analyses were from a reach of Libby Creek upstream of the Little Cherry Creek confluence. Results indicated that these trout were rainbow trout/westslope cutthroat trout hybrids (98.9 percent rainbow, 1.1 percent westslope cutthroat trout), instead of the redband trout/rainbow trout hybrids that were collected farther upstream in 1992. The subspecies of rainbow trout was not specified in the 2006 analyses (FWP 2012).

Ramsey Creek Fish Populations and Genetics

In addition to the survey conducted in 2005, fish distribution surveys on three reaches of Ramsey Creek were conducted between 1976 and 1988, with bull trout and redband trout collected at total densities ranging from 4 to 26 trout/100 meters (Kline Environmental Research 2004; FWP 2012). Genetic analysis performed on six trout collected from Ramsey Creek in 1991 (FWP 2012) indicated that the rainbow trout population was hybridized with westslope cutthroat trout (98.7 percent rainbow trout, 1.3 percent westslope cutthroat trout). Based on the historical distribution of redband trout throughout this area and the results of subsequent genetic analyses, these hybrids are likely redband trout hybridized with westslope cutthroat trout rather than rainbow trout hybrids. An additional 25 fish were analyzed in 2000. Analysis revealed that 24 of those trout were pure redband trout, and one trout was a redband/westslope cutthroat hybrid. Based on the results of this analysis, the memo from Robb Leary to Mike Hensler (2003) stated that the population could be considered to be redband trout from a management perspective.

Poorman Creek Fish Populations and Genetics

Poorman Creek has been sampled five times between 1982 and 2012, with total trout densities at sites ranging from 5 trout/100 meters to 36 trout/100 meters (Kline Environmental Research 2004; FWP 2012, Kline and Savor 2012). Rainbow trout (no sub-species listed), redband trout, and slimy sculpin are listed as occurring commonly in the creek, with bull trout occurring rarely (FWP 2012). The most recent sampling event was conducted by MMC personnel in August 2012 at two sites located immediately upstream and downstream of the culvert for Forest Service Road

278, which is a mile upstream of the mouth of Poorman Creek (Kline and Savor 2012). Twenty-seven and fourteen rainbow trout (no sub-species listed) were collected from upstream and downstream of the culvert, respectively, with one rainbow trout/cutthroat trout hybrid collected at each site. These numbers indicate that 23 and 21 trout/100 meters of stream were present at that time, respectively, based on the reach lengths surveyed. No bull trout have been collected in surveys of Poorman Creek since a single one was collected 1994 near the confluence with Libby Creek (FWP 2012). Bull trout were also collected at low abundances in 1982 and 1988.

Genetic analyses were conducted on tissues from five trout in 1991 and 25 trout in 2000, and indicated that the trout population in Poorman Creek consists of pure rainbow trout, but does not specify the subspecies of rainbow trout (FWP 2012). The memo from Robb Leary (2003) to Mike Hensler states that the allele frequencies detected during the genetic analyses are actually characteristic of redband trout, not rainbows. The memo also states that while the population should conservatively be considered non-hybridized, the possibility of the population being slightly hybridized with westslope cutthroat trout cannot be ruled out without further data.

Little Cherry Creek Fish Populations and Genetics

The MFISH database (2008a) lists interior redband trout, bull trout, westslope cutthroat trout/rainbow trout hybrids, and redband/rainbow trout hybrids as occurring in Little Cherry Creek. Field data for all surveys summarized in the MFISH database and by Kline Environmental Research (2004) document only the collection of redband or rainbow trout, with no specific data pertaining to the collection of bull trout or any other species. Only one additional survey is documented in MFISH other than the results of the initial baseline study. This survey was conducted from a section of Little Cherry Creek about 1 mile upstream from its confluence with Libby Creek and documents 24 redband trout collected from an unknown length of the stream.

Genetic analyses were performed on trout collected in 1991, 1992, and 2005 from Little Cherry Creek. The earlier results of the genetic analysis conducted on the 25 trout collected in 1991 and the five trout collected in 1992 determined that these trout were redband/westslope cutthroat trout hybrids (1991 analysis) and redband/rainbow trout hybrids (1992 analysis) (Kline Environmental Research 2004; FWP 2012). A recent genetic analysis conducted on 30 trout collected in 2005 from Little Cherry Creek determined that the trout population was composed of non-hybridized pure redband trout (Leary 2006). The 2005 results prompted the re-examination of the 1991 and 1992 results. Re-analysis of the 1991 results determined that what was initially taken to be a small amount of hybridization with westslope cutthroat trout was more likely to be redband trout genetic variation that was indistinguishable from that usually characteristic of westslope cutthroat trout due to the small sample size. The 1992 results also were determined to have erroneously reported that the trout population was hybridized with rainbow trout due to the limited genetic sampling that had occurred throughout the drainage. More recent genetic sampling in the area resulted in those analyses being re-interpreted so as to confirm the presence of a non-hybridized redband trout population in Little Cherry Creek (Leary 2006).

Bear Creek and Cable Creek Fish Populations and Genetics

Bear Creek is north of the Little Cherry Creek Tailings Impoundment Site, and was not surveyed in 1988 but has been surveyed frequently since then. Based on the MFISH database, brook trout, bull trout, redband trout, rainbow trout, and westslope cutthroat trout have been observed in Bear Creek. During most sampling events in Bear Creek that occurred from 1982 through 1995, rainbow (presumably redband and redband hybrid) trout have been the dominant species, ranging from 46 to 100 percent of the trout observed. Bull trout have been observed during almost every sampling event, both in the upstream and downstream portions of the creek, and have ranged from 3 to 100 percent of all fish collected. A single brook trout and a single westslope cutthroat trout (or a hybrid) were observed in a 1994 and 1995 sampling event, respectively.

FWP surveys conducted annually in Bear Creek from 1999 through 2008 estimated bull trout densities in a reach of Bear Creek 4 miles upstream from the mouth to range from 0.4 bull trout/100 square meters in 2008 to 14 bull trout/100 square meters in 2001 (FWP 2012). Bull trout densities in these surveys have been lower since 2004 compared to the earlier years. In other surveys, only the number collected was provided, with up to 125 bull trout observed within a reach in recent sampling events from 2005 through 2011 (FWP 2012).

The MFISH database lists Columbia Basin redband trout and both migratory and resident bull trout as occurring in Cable Creek, a tributary of Bear Creek (FWP 2012). Results from a single survey conducted near the mouth of Cable Creek in 1982 are provided in the database. One bull trout and 19 Columbia Basin redband trout were collected in this snorkeling survey.

Genetic testing has been conducted twice on trout tissues collected from Bear Creek. The results of the analysis of four trout in 1991 indicated that the trout population consisted of rainbow/cutthroat hybrids (98.7 percent rainbow, 1.3 percent cutthroat), but did not indicate whether “rainbow” referred to rainbow or redband trout genes. Based on the analyses conducted in 2000, the trout population in Bear Creek is composed of pure redband trout and redband/westslope cutthroat hybrids, as 29 of the trout analyzed were redbands, with the remaining fish being a redband/cutthroat hybrid. Genetic analysis in 2009 confirmed the presence of hybrid trout in Bear Creek, with the 27 fish collected for analysis determined to westslope/redband/rainbow trout hybrids (FWP 2012).

Big Cherry Creek Fish Populations and Genetics

The MFISH database lists brook trout and westslope cutthroat trout as occurring commonly in Big Cherry Creek, with bull trout, Columbia Basin redband trout, mountain whitefish, and slimy sculpin occurring rarely based largely on professional judgment (FWP 2012). Fish population surveys of this stream were conducted in 1982, 1986, 1994, 2009, and 2012 in one or more reaches (FWP 2012; Kline and Savor 2012). In the surveys from 1982 through 1994, redband trout were generally the dominant species and sometimes the only species collected, with over 300 of these fish collected in a survey conducted in 1982. Density or abundance estimates were not provided for all surveys, but 121 redband trout/100 meters were estimated to be present in 1987. Brook trout were also collected in low numbers in 1982, 1987, and 1994, with a single westslope cutthroat trout collected in 1994 as well. In the two surveys conducted in 2009 at more upstream locations than the earlier surveys, westslope cutthroat trout were the dominant species, with sculpin also present in both surveys and four bull trout present in one of the sites surveyed (FWP 2012).

Three reaches of Big Cherry Creek were surveyed in August 2012 to provide additional data for the baseline assessment (Kline and Savor 2012). The three reaches surveyed were all 10 to 13 miles upstream of the confluence with Libby Creek, with sites surveyed downstream of the Forest Service Road 4785 bridge, upstream of Forest Service 876 bridge, and downstream of the Forest Service Road 876 bridge. Rainbow trout/cutthroat trout hybrids were collected from all three reaches, at abundances estimated to be 6 to 7 trout/100 meters. Additionally, four bull trout were collected at the most upstream location, and a single brook trout was collected from the site located just upstream of the Forest Road 876 bridge. The bull trout ranged in size from 95 mm to 564 mm, with an average of 213 mm, suggesting that multiple age classes were present. The largest bull trout at this site was collected for genetic analysis, which determined that it was likely assigned to either the West Fisher River or Callahan Creek, both of which are tributaries downstream of Libby Dam.

Genetic analysis has also been conducted on over 150 trout collected from multiple locations in Big Cherry Creek in 1994, 2000, and 2006 (FWP 2012). These analyses confirmed that hybridization between Columbia Basin redband trout and westslope cutthroat trout occurs in this stream. The analysis of trout collected from two locations in 1994 indicated that those collected about 10 miles upstream of the confluence with Libby Creek were pure Columbia Basin redband trout, while those collected four miles downstream of that site were hybrid trout described as being 97.3 percent Columbia Basin redband trout and 2.7 percent westslope cutthroat trout. Hybrid trout were also collected from two locations in 2000 and from a single location in 2006.

Midas Creek Fish Populations and Genetics

Based on the MFISH database, bull trout, redband trout, westslope cutthroat trout, and cutthroat/rainbow trout hybrids have been observed or are believed to occur in Midas Creek. Midas Creek was surveyed in 1987 near the confluence with Libby Creek and the catch was comprised of all “rainbow trout” and one bull trout (Marotz *et al*. 1988). Genetic analyses conducted in 1991, 1997, and 2006 indicated that westslope cutthroat trout are hybridized with redband trout in this stream.

Swamp Creek Fish Populations and Genetics

The MFISH database does not include any specific surveys of Swamp Creek (the Libby Creek tributary), but lists westslope cutthroat trout as occurring there based on professional judgment (FWP 2012). Surveys of four reaches of this stream were conducted in July and August 2012 by the FWP and MMC (Kline and Savor 2012). The four reaches were interspersed within the 3.5 mile stretch upstream of the confluence of Swamp Creek and Libby Creek. Brook trout were the most abundant fish within each reach, and were the only species collected in the two downstream reaches. From 10 to 42 brook trout were collected from each site. At the two upstream reaches, rainbow trout/cutthroat trout hybrids were also collected, with four of these trout observed at each site. One of these reaches also had two additional trout collected that were visually identified as pure cutthroat trout rather than hybrids. Genetic analysis of tissues from 18 fish collected in 1999 indicated that the hybrid trout present were 86 percent westslope cutthroat trout and 14 percent rainbow trout (FWP 2012).

3.6.3.5.2 Fisher River Drainage Fish Populations and Genetics

All of the alternative transmission line alignments would follow or cross streams within the Fisher River watershed. Brook trout, bull trout, rainbow trout, mountain whitefish, largescale suckers, longnose dace, longnose suckers (*Catostomus catostomus*), redside shiners (*Richardsonius balteatus*), northern pikeminnow (*Ptychocheilus oregonensis)*, and sculpin are listed as residing in this reach of the Fisher River (FWP 2012). Genetic surveys conducted on 90 rainbow trout collected from three locations in the upstream portion of the Fisher River in 2005 indicate these are pure interior redband trout, although the presence of westslope/rainbow trout hybrids in reaches further downstream was verified through genetic analyses in earlier years.

Additionally, one or more of the transmission line alternatives follow and/or cross West Fisher Creek, Miller Creek, Hunter Creek, and Sedlak Creek, all of which are within the Fisher River watershed. The MFISH database (FWP 2012) lists brook trout, bull trout, redband trout, westslope cutthroat trout, mountain whitefish, rainbow trout, sculpin, and longnose dace as occurring in West Fisher Creek, and Rocky Mountain tailed frogs were also collected in some fish population surveys. Brook/bull trout hybrids were also reported as being collected from reach near the mouth of this stream in 2009 and 2010. Surveys of one or more reaches of this stream were conducted in 1987, 1993, and 2002 through 2010. Most surveys conducted near the confluence of West Fisher Creek and the Fisher River indicated that rainbow trout were the dominant species, although bull trout were collected in similar or greater numbers in 2005 and 2006. Bull trout densities were estimated from surveys conducted about 3.7 miles upstream of the confluence, and varied from 0.1 to 1.6 bull trout/100 square meters. Tissues from 25 trout collected in 2000 from West Fisher Creek from a reach 6 miles upstream of the mouth underwent genetic analysis and were determined to be westslope/rainbow trout hybrids. Analysis of 30 fish from further upstream in 2006 indicated all were pure westslope cutthroat trout. Analysis of 49 bull trout and brook trout collected in 2007 included 36 pure bull trout, 12 pure brook trout, and a single brook trout/bull trout hybrid.

Miller Creek, a tributary to the Fisher River, is reported to contain brook trout, redband trout, westslope cutthroat trout, redband/cutthroat trout hybrids, slimy sculpin, and torrent sculpin. Brook trout have been the most abundant species in surveys conducted since 2002. Genetic analyses conducted in 1997 and 2000 indicated that the westslope cutthroat trout were 100 percent pure in a reach 3 miles upstream of the confluence with the Fisher River, but were hybridized with rainbow trout further downstream (FWP 2012). Rocky Mountain tailed frogs were collected from Miller Creek during fish population surveys as well. No surveys were listed for Sedlak Creek or Hunter Creek within the MFISH database (FWP 2012), but westslope cutthroat trout were noted as occurring in Sedlak Creek based on professional judgment.

3.6.3.5.3 Lower Clark Fork River Drainage Fish Populations

Rock Creek Watershed Fish Populations and Genetics

During the initial baseline surveys in 1988, westslope cutthroat trout were the dominant trout species in East Fork Rock Creek, comprising 71 percent of all trout collected and having a density of 10 trout/100 square meters (Table 71). Many of the westslope cutthroat trout collected from the Rock Creek Meadows site near the outlet of Rock Lake were thought to be hybridized with Yellowstone cutthroat trout and rainbow trout. Bull trout also were collected during these surveys at densities of 4 trout/100 square meters. The trout scales analyzed for age and growth during the 1988 baseline survey indicated that most trout within the analysis area were young (age I, II, and III), as is typical for low productivity mountain headwater streams, as older fish reside in larger downstream areas. Older bull trout and westslope cutthroat trout (age IV and/or V) also were found in East Fork Rock Creek and Rock Creek Meadows, respectively. As in the Libby Creek drainage streams, growth rates for all age classes were low, likely due to limitations caused by the low nutrient concentrations and harsh environmental conditions.

In addition to the bull trout and westslope cutthroat trout observed in East Fork Rock Creek during the initial baseline survey, brook trout, brown trout (*Salmo trutta*), Yellowstone cutthroat trout, rainbow trout, westslope/Yellowstone/rainbow trout hybrids, and slimy sculpin also occur in the Rock Creek drainage (FWP 2012). Rocky Mountain tailed frogs were also collected from the Rock Creek watershed during some fish population surveys. Fish populations from one or more sites in East Fork Rock Creek, West Fork Rock Creek, and Rock Creek were surveyed in 1985, 1986, 1988, 1993, 1994, 1996, and 2001 through2012 (Washington Water Power Company

1996; USDA Forest Service and DEQ 2001; FWP 2012; Horn and Tholl 2011; Kline and Savor 2012). While only presence-absence data or counts were recorded for many of these earlier surveys, total trout densities recorded from surveys in East Fork Rock Creek as summarized by the USDA Forest Service and Montana Department of Environmental Quality (2001) ranged from 13 to 36 trout/100 square meters, with westslope cutthroat trout comprising from 69 to 93 percent of the total trout collected during the 1985 to 2000 period. Bull trout were the only other trout species collected in these surveys, and they were collected at densities up to 11 trout/100 square meters during this time period.

Since 2000, sites on East Fork Rock Creek have been surveyed annually during almost all years from 2001 through 2012 by Avista, FWP, or Forest Service personnel (Horn and Tholl 2011, FWP 2012; Kline and Savor 2012). Only westslope cutthroat trout and bull trout were present within these reaches, with the exception of a few westslope cutthroat/rainbow trout hybrids collected in 2007 and 2010 within the upstream reaches of East Fork Rock Creek near Rock Lake. Bull trout densities were stable or had gradual increasing trends observed at these sites, with densities ranging from 2 to 28 trout/100 meters over that time period (Horn and Tholl 2008; FWP 2012; Kline and Savor 2012). Radio tagging and genetic studies indicate that both migratory and resident bull trout occur in the Rock Creek drainage (Avista 2011; Salmon Environmental Services 2012). Westslope cutthroat trout densities were more variable from 2001 through 2012, with population estimates ranging from 12 to 106 trout/100 meters. The westslope cutthroat trout population appears to be composed of mostly resident fish, although one radio-tagged trout was tracked from the Cabinet Gorge Reservoir in 2002 (Avista 2011).

In the mainstem of Rock Creek, total trout densities were generally lower than in the East Fork Rock Creek, but reached up to 32 trout/100 square meters, with westslope cutthroat trout also dominating the fish populations in most surveys (as summarized in USDA Forest Service and DEQ 2001). Brook trout were the dominant species in downstream reaches during two surveys in 1993 and 1996. Based on these surveys and the surveys documented in the MFISH database (FWP 2012), brook trout appear to mainly inhabit the downstream reaches of Rock Creek. The seasonally dewatered reach may have prevented this species from colonizing the upstream reaches (Horn and Tholl 2011). Bull trout were collected in some surveys in the mainstem Rock Creek, but generally were collected less frequently and in lower densities than in East Fork Rock Creek (USDA Forest Service and DEQ 2001). The most recent survey of Rock Creek was conducted in September 2012 by the FWP at a reach downstream of the Engle Creek confluence (Kline and Savor 2012). Brook trout and cutthroat trout were collected in similar numbers, with 47 trout collected within the 100-meter reach.

As summarized in USDA Forest Service and DEQ (2001), bull trout were the most abundant species collected from reaches of West Fork Rock Creek in surveys that occurred in 1985, 1986, and 1993, but only westslope cutthroat were collected in surveys conducted at several sites in 1996. When present, bull trout densities ranged up to 13 trout/100 square meters, and westslope cutthroat trout densities reached up to 22 trout/100 square meters. Fish densities were generally higher in the upstream reaches of West Fork Rock Creek than in the downstream reach that has intermittent flows. Bull trout were not collected in the two additional surveys listed in the MFISH database and conducted in July 2007 and August 2009 (FWP 2012), but six bull trout, as well as 42 westslope cutthroat trout, were collected in a more recent survey conducted in August 2012 by the KNF within a reach near the mouth of West Fork Rock Creek (Kline and Savor 2012; Salmon Environmental Services 2012). The 2007 survey was conducted by Avista personnel and was located within two reaches in the downstream 0.7 miles of the stream, and reported that 78 and 1 westslope cutthroat trout were collected from these reaches, respectively. The 2009 survey reach was just upstream of the 2007 reaches, and resulted in the collection of 33 westslope cutthroat trout by Forest Service personnel.

The 1988 study discusses results of genetic analyses from fish thought to be westslope cutthroat trout collected in 1984 (Western Resource Development Corp. 1989a; FWP 2012) from near the mouth of Rock Creek and on East Fork Rock Creek near the Rock Creek Meadows site. Based on the results of these analyses, the westslope cutthroat population at the mouth of Rock Creek was considered pure, but subject to genetic invasion, while the Rock Creek Meadows population was considered to be hybridized (92.8 percent westslope cutthroat trout, 5.2 percent Yellowstone cutthroat trout, and 2 percent rainbow trout) (Western Resource Development Corp. 1989a). Past stocking activities in Rock Lake or Rock Creek Meadows are responsible for this hybridization. East Fork Rock Creek has barriers to upstream fish movement in Rock Creek Meadows and at the outlet of Rock Lake, but these barriers do not prevent downstream fish passage. Hybridized cutthroat trout have access into areas occupied by pure strains (USDA Forest Service and DEQ 2001; Washington Water Power Company 1996). In addition, during the 2010 survey conducted by Avista (Horn and Tholl 2011), a single westslope cutthroat trout/rainbow trout hybrid was collected from a reach of East Fork Rock Creek several kilometers upstream of the West Fork Rock Creek confluence. The identity of this fish was genetically confirmed. This was the first occurrence of a non-native salmonid in this reach of East Fork Rock Creek, although westslope cutthroat trout hybrids have been collected from the mainstem Rock Creek in previous years (FWP 2012).

While fish that were thought to be brook/bull trout hybrids have been observed in the Rock Creek watershed, genetic analyses have indicated no evidence of hybridization of this trout population. These analyses further indicate that the bull trout population in the Rock Creek watershed is genetically distinct from neighboring populations based on a summary of the data by Avista personnel (Salmon Environmental Services 2012).

As part of Avista's monitoring of bull trout in the Rock Creek drainage, 10 radio tagged bull trout were detected between 2003 and 2007 moving into Rock Creek, including one fish that was detected in the drainage two years in a row. Observations of these radio tagged fish along with capture of migratory sized adult bull trout in weir traps installed in Rock Creek indicate low, but stable, bull trout numbers over the years. From 2004 to 2011, a total of 12 migratory bull trout were captured below the Cabinet Gorge Dam that were genetically assigned to Rock Creek; these fish were thus transported and released back into Rock Creek (Avista 2011). Of these twelve, two fish were recaptures of juveniles that had been previously collected in fish traps located in Rock Creek. Additional information about Avista's monitoring is reported in Lockard *et al.* 2003; Lockard and Hintz 2005; Lockard *et al.* 2005; Hintz and Lockard 2006, 2007; Lockard *et al.* 2008; Bernall and Lockard 2008; Moran *et al*. 2009; Avista 2011.

East Fork Bull River Fish Populations and Genetics

The East Fork Bull River was not surveyed as part of the 1988 study, but one or more sites were surveyed between 1992 and 1994 and from 1999 to 2011 (Washington Water Power Company 1996; Chadwick Ecological Consultants, Inc. 2000; Horn and Tholl 2008, 2011; FWP 2012). Results from these surveys indicate that brook trout, brown trout, bull trout, westslope cutthroat trout, mountain whitefish, rainbow trout, sculpin, and northern pike minnow are present in the East Fork Bull River. Rocky Mountain tailed frogs were also collected during some of the fish population surveys. The 1992 through 1994 surveys indicated that fish densities were high for cutthroat trout and brown trout, with average densities of 64 fish/100 meters and 21 fish/100 meters, respectively. Densities were lower for bull and brook trout, which had average densities of 8 fish/100 meters and 7 fish/100 meters, respectively (Washington Water Power Company 1996). Surveys included in the MFISH database (FWP 2012) suggest that fish populations are present in about 7 miles of the East Fork Bull River, up to near the confluence with Placer Creek. No surveys of Placer Creek were documented in the database, but bull trout could be present in this tributary as well.

Fish densities were estimated from snorkeling surveys within four reaches of the East Fork Bull River in 1999 (Chadwick Ecological Consultants, Inc. 2000). Westslope cutthroat trout and bull trout were found in all four reaches of the East Fork Bull River, while brown trout, brook trout, and mountain whitefish were observed in one or both of the two downstream reaches and sculpin were observed in all but the most upstream reach. Westslope cutthroat trout were the dominant species throughout the reaches surveyed, with densities up to 2 trout/100 square meters. Based on these estimates, the East Fork Bull River had about 2,600 westslope cutthroat trout present throughout its length. Bull trout were collected at considerably lower densities than westslope cutthroat trout in the East Fork Bull River in 1999, with all reaches having less than 1 trout/100 square meters. Generally, bull trout densities were highest in the upstream reaches of this stream. The East Fork Bull River was estimated to have about 200 bull trout present throughout its length. Surveys of reaches in other streams within the Bull River drainage in 1999 indicated that the majority of the bull trout in this watershed are found in the East Fork, with 85 percent of these trout collected from all sites within the Bull River watershed being collected from this stream.

Subsequent sampling in the East Fork Bull River since 2000 has continued to indicate that higher densities of bull trout exist in the upstream reaches. From 2000 through 2010, bull trout densities have ranged from 1.3 trout/100 meters at a downstream site in 2006 to as high as 43 bull trout/100 meters in more upstream reaches in 2005 (Horn and Tholl 2008, 2011; FWP 2012). Estimates of westslope cutthroat trout abundance from surveys conducted during this same time periods in the East Fork Bull River ranged up to 52 trout/100 meters (Horn and Tholl 2011; FWP 2012). The additional surveys recorded in the MFISH database (FWP 2012) only gave the number of fish collected, but these numbers indicated that trout density is relatively high in the East Fork Bull River, particularly near the confluence with the Bull River. Brown trout was the dominant fish species in many of the surveys, but westslope cutthroat, brook trout, and mountain whitefish were also frequently collected in high numbers. Sampling by Avista found similar results, with brown trout generally being the most abundant species in the lower reaches but bull trout, brook trout, mountain whitefish, and westslope cutthroat trout also being present (Horn and Tholl 2008, 2011). In upstream reaches near or within the CMW, westslope cutthroat trout or bull trout were the dominant fish species, with brown trout and brook trout present in lower numbers if at all. Northern pike minnows and sculpins were collected more rarely and generally in low numbers (Chadwick Ecological Consultants, Inc. 2000; FWP 2012).

Avista initiated a non-native salmonid suppression program in 2007, with non-native fish removed from the lower 2 miles of the East Fork Bull River from 2007 through 2009 using electrofishing methods (Horn and Tholl 2011). While brown trout and other non-native fish were still present in the lower reaches following this effort, monitoring in 2009 and 2010 indicated a shift towards native species was occurring in this reach. Westslope cutthroat trout was the most abundant species in these two years. While brown trout remained more abundant than bull trout, numbers of bull trout collected were higher than in all previous years of this study since 2000.

This shift could also have resulted in part from the reactivation of the historical channel that occurred within this reach in 2008 due to a natural avulsion that occurred upstream.

Length-frequency data and scale analysis conducted during the 1999 survey suggest that the migratory life form of bull trout exists in the East Fork Bull River drainage. Resident bull trout also likely exist in the drainage, as some younger trout within the size range expected for resident trout were observed. The absence of “resident” fish past age III raises uncertainties about the existence of a true resident population (Chadwick Ecological Consultants, Inc. 2000). Research has shown radio tagged bull trout transported from Lake Pend Orielle moving to the East Fork Bull River. The genetic information, sampling surveys, and telemetry indicated that this population is primarily a migratory population (Katzman and Hintz 2003, Moran and Storassli 2008).

Genetic analysis of bull trout tissues collected in 1993 from three locations on the East Fork Bull River indicated that the bull trout populations were pure. A single bull trout/brook trout hybrid was listed as captured from the weir trap in 2007 and 2010 (Moran and Storaasli 2008; FWP 2012). No documentation was provided that suggests that these fish were genetically analyzed. Bull trout/brook trout hybrids were collected in other locations within the Bull River watershed in 2005, 2006, and 2007 (Moran *et al*. 2009; Horn and Tholl 2011). Genetic analyses conducted on westslope cutthroat trout tissues in 1983, 1984, and 2004 also determined that these populations were pure (FWP 2012). Population surveys conducted in 2002, 2009, and 2011 reported the collection of small numbers of westslope cutthroat/rainbow trout hybrids from the East Fork Bull River, generally from the most downstream reach of the river (FWP 2012). These trout may have been visually identified and not necessarily confirmed via genetic analyses.

Swamp Creek Fish Populations and Genetics

Brook trout, brown trout, bull trout, westslope cutthroat trout, sculpin, largescale sucker, mountain whitefish, brook/bull trout hybrids, and westslope/rainbow trout hybrids have been collected in Swamp Creek (tributary to the Lower Clark Fork River) between 1992 to 2010 (Washington Water Power Company 1996, Chadwick Ecological Consultants 2002; GEI 2005, FWP 2012). Fish population surveys were conducted in Swamp Creek by Washington Water Power Company (1996) in 1992 through 1994. The most downstream reach of Swamp Creek was dry at this time, but brook trout, westslope cutthroat trout, and brown trout were collected upstream of this reach. Brook trout were the most abundant species collected, with densities up to 85 fish/100 meters. Westslope cutthroat trout were found in both reaches surveyed in Swamp Creek at densities that ranged from 10 fish/100 meters to 47 fish/100 meters. Brown trout were only collected in one of the two reaches surveyed that had water present, and were collected at densities of 13 fish/100 meters.

Chadwick Ecological Consultants (2002) surveyed multiple reaches of Swamp Creek and its tributaries in 2001, with bull trout, brown trout, brook trout, westslope cutthroat trout, largescale suckers, and sculpins collected. Westslope cutthroat trout were the most abundant species collected in most reaches, and bull trout were collected from the mainstem Swamp Creek in low numbers. Surveys of various reaches of Swamp Creek conducted by Avista in 2006, 2007, and 2010 indicated that brook trout were frequently the most abundant species present during this time period, although westslope cutthroat trout and bull trout were occasionally more numerous (FWP 2012). These surveys did not provide density data, but documented the number of each species collected. While bull trout were absent during the 1992 to 1994 surveys, they were present in one or more surveys conducted in 2006, 2007, and 2010. A single hybrid brook/bull trout was collected in 2007, although no data were provided to determine if it was identified as a hybrid based on visual observations or genetic analysis (FWP 2012).

The MFISH database (FWP 2012) indicated that a single westslope cutthroat/rainbow trout hybrid was collected from the mid-reaches of Swamp Creek in 2007. This fish was likely identified visually, as results of genetic analyses conducted in that year are not included. Earlier analyses were conducted between 1984 and 1994 (FWP 2012, Washington Water Power Company 1996). Most analyses indicated that the westslope cutthroat trout population was pure, but Washington Water Power Company (1996) states that trout collected in 1994 from a reach near the CMW boundary were hybridized westslope/Yellowstone cutthroat trout. Additionally, 30 trout collected for genetic analysis from Wanless Lake in the headwaters of Swamp Creek in 1987 were determined to be westslope/Yellowstone cutthroat trout hybrids (FWP 2012).

Bull trout were collected for genetic analyses from Swamp Creek and other streams in 1997 through 1999 (Neraas and Spruell 2001). Of the 17 bull trout collected, three of these were determined to be hybridized with brook trout. A survey was conducted in 2004 by Avista specifically for the purpose of conducted genetic analyses on any bull trout that were collected, but none were observed in that year (GEI 2005).

Copper Gulch Fish Populations and Genetics

The MFISH database (FWP 2012) lists resident bull trout and westslope cutthroat trout as occurring rarely in Copper Gulch based on professional judgment. The summary of fish populations provided in GEI (2005) indicates that mountain whitefish, hybrid westslope cutthroat trout, brook trout, and brown trout may also be present. Two reaches of Copper Gulch were surveyed in August 2012 by the FWP to investigate the mitigation potential of this stream (Kline and Savor 2012). One reach was located immediately upstream of the confluence with the Bull River, while the other reach was located almost 2 miles upstream of the confluence. Brook trout, brown trout, and rainbow trout/cutthroat trout hybrid were collected from the downstream site, with brook trout comprising 62 percent of the trout collected. At the upstream reach, 57 cutthroat trout were collected, with no other species present. These trout were visually identified as pure. Twenty-three trout were collected for genetic analysis in 1992 from a reach of Copper Gulch 1 mile upstream of the mouth, and were determined to be pure westslope cutthroat trout.

3.6.3.5.4 Flower Creek Fish Populations and Genetics

The MFISH database (FWP 2012) lists westslope cutthroat trout and brook trout as common or abundant in reaches of Flower Creek, with bull trout, rainbow trout, slimy sculpin, and torrent sculpin listed as occurring rarely. Data provided include results from surveys in 1960 and 2009, with an additional report attached that included results of a survey conducted in 1959 (Opheim 1960). In 1959 and 1960, westslope cutthroat trout were the most abundant species, and brook trout and bull trout were also present. Westslope cutthroat trout were estimated to have been collected at densities between 23 and 43 fish/100 meters in the 1960 survey, with bull trout and brook trout densities estimated at 4 and 10 fish/100 meters, respectively. Three reaches of Flower Creek were surveyed in 2009, with brook trout, sculpin, and westslope cutthroat trout collected. No density estimates were provided from these surveys, but a total of 167 westslope cutthroat trout were collected, and this was the only species present in the most upstream reach sampled. Eleven brook trout and 16 sculpin were also collected in addition to the westslope cutthroat trout in the other two reaches. Twenty fish were collected for genetic analysis in 1994; these trout were westslope cutthroat/rainbow trout hybrids (FWP 2012).

Additional surveys of three reaches of this stream were conducted by MMC in August 2012 (Kline and Savor 2012). These reaches were between 3 and 6 miles upstream of the confluence of Flower Creek and the Kootenai River, with a reach surveyed a mile upstream of the upper reservoir, immediately upstream of the lower reservoir, and immediately downstream of the lower reservoir. Rainbow trout/cutthroat trout hybrids were the most abundant species collected from all three sites, at abundances estimated to range from 6 to 20 trout/100 meters. Brook trout were also common at the two downstream sites, and four cutthroat trout visually identified to be pure were collected from downstream of the lower reservoir. In addition, a single bull trout/brook trout hybrid was collected from both the upstream site and the site downstream of the lower reservoir. These fish were collected for genetic analysis, and the hybridization was verified.

3.6.3.5.5 Analysis Area Lakes

Rock Lake, St. Paul Lake, Howard Lake, Ramsey Lake, Upper Libby Lake, and Lower Libby Lake are within the analysis area. While no fish population data were available for Ramsey Lake, St. Paul Lake or the Libby Lakes, the MFISH database (FWP 2012) indicates that Yellowstone cutthroat/westslope cutthroat trout hybrids inhabit Rock Lake. Nineteen fish were collected in Rock Lake in 1988, with some thought to be pure westslope cutthroat trout and other hybrids (Western Resource Development Corp. 1989). Genetic analyses were conducted on trout from this lake in 1985 and 1993. Results of both analyses were similar, and indicated that the fish are hybridized in Rock Lake, containing between 79 percent and 82 percent westslope cutthroat trout genes, and between 18 percent and 21 percent Yellowstone cutthroat trout genes. In Howard Lake, non-native rainbow trout are considered abundant and are also stocked annually by FWP (FWP 2012).

3.6.3.6 Spawning Surveys

In October 1989, about 22 miles of Libby, Ramsey, and Poorman creeks were surveyed for bull trout redds (spawning nest made by trout) as part of the initial baseline study. Two spawning areas made by large, apparently migratory bull trout were found downstream of the project. Above the falls, ten small bull trout redds also were found, which were the product of resident fish. No bull trout spawning activity was observed in Ramsey Creek or Poorman Creek. Also, no spawning or spent bull trout or mountain whitefish were observed in the 11-mile portion of Libby Creek surveyed during the November 1988 mountain whitefish survey (Western Resource Development Corp. 1989a; Kline Environmental Research 2004).

Redd surveys also were conducted in October 1995 and 1996 in Libby, Ramsey, Poorman, and Little Cherry creeks. Four possible redds were noted, one on Libby Creek upstream of its confluence with Little Cherry Creek, and three on Ramsey Creek. The three redds identified on Ramsey Creek were noted as possibly being brook trout redds (Kline Environmental Research 2004), but are more likely to have been bull trout redds because surveys have not reported brook trout as occurring in Ramsey Creek. As part of the mitigation efforts for the construction and operation of Libby Dam, redd surveys were conducted on Bear Creek annually from 1995 through 2009. About 4 miles were surveyed on each occasion, with the number of bull trout redds observed ranging from three in 2005 to 36 in 1999 (Dunnigan *et al.* 2004, 2005, 2011). Three sites on Libby Creek were surveyed for bull trout redds in 2006, and these three sites, an additional Libby Creek site, and a single site each on Bear Creek, Little Cherry Creek, Poorman Creek, and Ramsey Creek were surveyed in 2007 and 2008 as part of the monitoring requirements for the Libby Creek adit permit (Kline Environmental Research 2008, 2009). No redds were observed during these surveys.

Redd surveys also have been conducted by the FWP and KNF within the Fisher River, East Fork Bull River, Rock Creek, and Swamp Creek (tributary to the Clark Fork River) watersheds. The Fisher River watershed was surveyed for redds in 1993, with one suspected bull trout redd observed in the Fisher River, and 12 redds observed within other tributaries in the drainage (Kootenai Tribe of Idaho and FWP 2004). Additionally, between 6 and 10 miles of West Fisher Creek have been surveyed for bull trout redds from 1995 through 2009; redd counts have ranged from none found in 1997 to 27 observed in 2005 (Dunnigan *et al*. 2011).

The East Fork Bull River has been surveyed for both brown and bull trout redds (Washington Water Power Company 1996; Moran 2007, Storaasli and Moran 2012). Brown trout redds were surveyed from 1980 through 1982, with an average of 33 redds observed each year. Surveys for bull trout redds were begun in 1992, with 12 redds observed. Both bull trout and brown trout redd surveys were conducted in 1993, 1994, and 1995. Three brown trout redds were observed in 1993, but no bull trout redds were found. Accurate redd counts were not possible in 1994 and 1995 due to high flows (Washington Water Power Company 1996). Bull and brown trout redd surveys also were conducted on the East Fork Bull River from 2001 to 2011 by Avista (Storaasli and Moran 2008, 2012). The number of bull trout redds in the East Fork Bull River ranged from four in 2008 to a high of 32 in 2002. Brown trout redd surveys during this same time period for East Fork Bull River ranged from five in 2006 to 46 in 2002 (Storaasli and Moran 2008, 2012). Brown trout redds were generally excavated as part of the Avista's non-native fish suppression program.

Washington Water Power Company (1996) and Avista (Storaasli and Moran 2012) also conducted redd surveys on Rock Creek and Swamp Creek between 1993 and 2011. As in the East Fork Bull River, the redd surveys in 1994 and 1995 did not result in accurate counts due to high flow conditions in Rock Creek and prevented redd counts from occurring in Swamp Creek. Only a single bull trout redd was found in Rock Creek during the 1993 survey (Washington Water Power Company 1996). In the Avista surveys conducted from 2004 through 2011 in East Fork Rock Creek, bull trout redds ranged from one redd observed in 2005, 2008, and 2010 to six in 2004 and 2009 (Storaasli and Moran 2008, 2012; Salmon Environmental Services 2012). Brown trout redd surveys were not conducted in Rock Creek or Swamp Creek at this time. The redd survey conducted in Swamp Creek in 1993 located three bull trout redds in October, and four older redds thought to be bull trout redds in December during a brown trout redd survey (Washington Water Power Company 1996). No bull trout redds were observed in Swamp Creek in 2001 through 2004, and in 2009. The highest number of redds observed during the Avista surveys was ten redds observed in 2011 (Storaasli and Moran 2012).

3.6.3.7 Metal Concentrations in Fish Tissues

Concentrations of copper, lead, mercury, zinc, and cobalt in redband trout tissues collected from Libby Creek in 1988 are shown in Table 73. Mercury concentrations were measured in muscle tissue, while all other metal concentrations (*e.g.*, copper, lead, and zinc) were measured in liver tissue (Western Resource Development Corp. 1989). The current water quality criteria level for methylmercury in fish tissues for the protection of human health is 0.3 mg/kg whole body wet weight (Environmental Protection Agency 2001). The initial baseline study report (Western Resource Development Corp. 1989a) does not specifically state if the results listed in Table 73 were based on wet weight or dry weight, although it does mention that "it was difficult to weigh the frozen samples due to loss of moisture." Based on this, the best assumption is that the samples were intended to be weighed as wet weight. All mean concentrations of mercury in the sampled fish were below the level set by the EPA, although the maximum mercury concentration was slightly above this level. Regulatory criteria for metal concentrations in fish tissues have not been established for the remaining metals.

Table 73. Metal Concentrations in Redband Trout in Libby Creek.

Metal	Minimum Metal Concentration (mg/kg)	Maximum Metal Concentration (mg/kg)	Average Metal Concentration (mg/kg)
Cobalt	0.1	12.4	1.9
Copper	2.4	29.4	6.5
Lead	<0.1	<1.4	<0.5
Mercury	0.1	0.4	0.19
Zinc	22.3	62.8	30.1

mg/kg = milligram per kilogram.
Note: Mercury concentrations were measured in muscle tissue, while all other metal concentrations were measured in liver tissue. Results given were not specified as wet weight or dry weight measurements, but are presumed to be based on wet weight.
Source: Western Resource Development Corp. 1989a.

Additionally, ten trout identified as *Oncorhynchus* sp. were collected for tissue analysis from a reach of Libby Creek downstream of the Crazyman Creek confluence in 2006, and an additional ten trout each were collected from this site, a site on Libby Creek downstream of the Midas Creek confluence, and a site on Bear Creek in 2007 and 2008 (Kline Environmental Research 2008, 2009). Whole-body tissue concentrations of cadmium, lead, and mercury were analyzed in these fish. Concentrations for all three metals were below minimum detection levels at some sites and years, and mercury concentrations were below the detection level in slightly over half the samples. The highest mercury concentration recorded was 0.16 mg/kg dry weight within a fish collected at the downstream Libby Creek site in 2006. While the necessary data to convert the dry weight concentration into wet weight was not provided, these concentrations would be less than the human health criterion threshold based on a typical moisture content of 80 percent in tissues. Cadmium and lead concentrations were higher in the 2008 samples than in the two previous years, reaching 0.4 mg/kg dry weight and 14 mg/kg dry weight, respectively, at the Bear Creek site.

Metal concentrations also were analyzed in westslope cutthroat trout tissues collected from Rock Creek and East Fork Rock Creek in 1985, as reported in the Rock Creek Project Final EIS (USDA Forest Service and DEQ 2001). In East Fork Rock Creek, mean copper concentrations were 3.0 mg/kg, mean zinc concentrations were 75.0 mg/kg, and mean mercury concentrations were 0.1 mg/kg. In the mainstem Rock Creek, mean copper concentrations were 3.0 mg/kg, mean zinc concentrations were 82.0 mg/kg, and mean mercury concentrations were 0.1 mg/kg. Mercury concentrations were measured in muscle tissue similar to the tissue from fish collected in the Libby Creek drainage. Copper and zinc concentrations were measured in gill tissue. These concentrations are assumed also to be based on wet weights. Copper and mercury concentrations in samples from Rock Creek and East Fork Rock Creek fish were generally less than concentrations in samples from Libby Creek fish, while zinc concentrations were substantially higher.

3.6.3.8 Historical Impacts on Fisheries

Baseline aquatic data reflect the influences of historical mining activities on fishery and habitat conditions in Libby Creek. Before the 1860s, the upper valley was essentially intact, influenced primarily by wildfires and floods. While Native Americans used the upper valley for subsistence purposes (harvesting berries and wildlife), upper Libby Creek was not among those streams routinely used for fishing (USDA Forest Service *et al.* 1992).

In 1867, placer mining began in Libby Creek and its tributaries, including the analysis area (Kline Environmental Research 2004). By 1868, about 800 miners were working the bed of Libby Creek and its tributaries, diverting streams, and cutting timber for housing and placer works. Left behind were scattered patches of disturbed streambed, floodplains devoid of timber, and degraded aquatic habitat.

In 1887, the mining community of Old Libby was established in the area. From the mid-1890s to 1937, hydraulic mining extended impacts on fisheries in the upper valley of Libby Creek within the analysis area (Kline Environmental Research 2004). After excavating and washing old stream channels, floodplains, and streambanks for gold and silver, the "waste" was left in place or allowed to wash down river. Use of mercury in the processing of ore increased, and mercury is found currently in area streams.

The upper Libby Creek drainage burned in 1889 and 1910, the valley was virtually stripped of all standing timber, and little habitat or fish resources were left to be affected by mining. Photos from the period indicate that Libby Creek was a wide, shallow stream with a cobble/gravel substrate. Howard Lake still remained a fishery after the 1910 fire. The few stream fish that remained after the 1910 fire probably were restricted to the headwaters, where only placer mines had been. Howard Lake and Libby Creek had regular stocking beginning in the late 1920s. In 1914, steam-operated mining equipment was used in Libby Creek. Large draglines and steam shovels dug into the bed and floodplain. Heavy equipment and hydraulic mining continued into the 1940s, after which time only a few placer mines remained. Additionally, timber was harvested on private land in the upper Libby Creek drainage in the 1950s. The first non-native fish (western coastal rainbow trout from California and brook trout from the eastern United States) were imported by rail in 1914 and released in local streams (USDA Forest Service *et al.* 1992).

Eighty years of mining and periodic wildfire in upper Libby Creek and the lower end of its tributaries limited available fish habitat throughout the Libby Creek drainage. The fish habitat that remained was concentrated in the upper headwaters of tributaries, including Bear, Ramsey, and Poorman creeks. Re-growth of conifers has begun to stabilize the stream system in the upper valley (USDA Forest Service *et al.* 1992).

3.6.3.9 Threatened and Endangered Fish Species

Bull trout occur in analysis area streams and are currently listed as threatened by the USFWS. The USFWS also designated bull trout critical habitat in the analysis area (Figure 55). The BA for threatened, endangered, and proposed aquatic species and designated aquatic critical habitat evaluated the following parameters (USFWS 1998), and rated each as functioning appropriately, functioning at risk, or functioning at unacceptable risk for the bull trout subpopulations within the analysis area.

3.6.3.9.1 Description of the Population Area

Historically, bull trout were likely distributed throughout the Libby Creek, East Fork Bull River, Rock Creek, and Fisher River watersheds. The current bull trout populations within the analysis area are composed of both a resident and a fluvial/adfluvial (stream/lake) migratory component (FWP 2012). Bull trout have been reported from both upstream and downstream of the Libby Creek Falls on Libby Creek, as well as within Bear Creek, Cable Creek, Midas Creek, Poorman Creek, Ramsey Creek, East Fork Rock Creek, West Fork Rock Creek, Rock Creek, West Fisher Creek, Fisher River, and the East Fork Bull River (Figure 55) (Western Resource Development Corp. 1989a; Chadwick Ecological Consultants, Inc. 2000; Kline Environmental Research 2004; FWP 2012). Bull trout spawning has also been documented within the Libby Creek watershed, with redds located in Libby Creek (both upstream and downstream of the falls), Bear Creek, and possibly in Ramsey Creek. The redds located in Ramsey Creek were not determined definitively to be bull trout redds. Additionally, redd surveys have documented bull trout spawning in the Fisher River, East Fork Bull River, and Rock Creek watersheds (Washington Water Power Company 1996; USFWS 2002).

3.6.3.9.2 Subpopulation Size

As summarized in section 3.6.3.5.1, *Libby Creek Drainage Fish Populations*, redd surveys conducted from 1988 to 2009 within various streams in the Libby Creek watershed identified bull trout redds during one or more of the surveys in reaches in Libby Creek, Ramsey Creek, and Bear Creek. Bear Creek appears to be used most frequently for bull trout spawning, with up to 36 redds identified during surveys. Bull trout densities in the Libby Creek watershed upstream of the Bear Creek confluence ranged up to 14 fish/100 square meters based on data collected from 1989 through 2010 (Western Resource Development Corp. 1989; Kline Environmental Research 2004; Kline Environmental Research and Watershed Consulting 2005a; FWP 2012). Density data were not provided for all sampling events, but count data indicated that over 100 bull trout were collected from single reach of Libby Creek or Bear Creek in one or more years (FWP 2012). Bull trout count data indicate that Bear Creek supports the strongest population within the Libby Creek watershed. Within Libby Creek, densities were often highest upstream of Libby Falls, where an isolated resident population exists. Based on these numbers and spawning survey data, the bull trout subpopulation, although viable, is small in the Libby Creek watershed.

The BA (USDA Forest Service 2013a) categorized the Libby Creek, Big Cherry Creek, and Bear Creek bull trout subpopulation sizes as functioning at risk based on low numbers, particularly of migratory adult trout, degraded habitat in some areas, and the possibility of catastrophic flooding events occurring. Ramsey and Poorman Creek were listed as having subpopulations that were functioning at risk and functioning at unacceptable risk, respectively. Limited data suggest discontinued use of Poorman Creek. Other tributaries had insufficient or no data available to determine the risk to the populations in those streams.

Most data for the Rock Creek and East Fork Bull River watersheds indicate relatively high densities of bull trout in these streams compared to streams within the Libby Creek drainage. In the East Fork Bull River, over 100 juvenile bull trout were captured annually in some years between 2000 and 2006 from the traps used by Avista as part of the downstream juvenile bull trout transport program (Moran *et al*. 2009). Numbers were lower from 2006 through 2008, with 29 juvenile trout or less collected from these traps in each of these three years. Additional Avista data from population surveys of two to three sites each year from 2000 to 2010 indicated that 20 to 65 bull trout were collected each year, at densities up to 43 trout/100 meters (Horn and Tholl 2011).

In Rock Creek, 17 to 136 juvenile bull trout were captured annually in the traps located in East Fork Rock Creek from 2001 through 2011, although in most years the number of juveniles captured was less than 60 (Moran *et al*. 2009; Avista 2011). Few to no adults were captured in most years. Electrofishing surveys that were conducted from 2001 through 2010 collected from 23 to 51 bull trout at densities reaching a maximum of 28 bull trout per 100 meters of stream (Avista 2011; FWP 2012). Much of these data support the contention that Rock Creek is secondary to the Bull River in terms of recruitment of juvenile bull trout to the Cabinet Gorge Reservoir, although Rock Creek has steadily contributed trout and had higher numbers in some years (USFWS 2006; Avista 2011).

Bull trout redds have been observed in the East Fork Bull River and Rock Creek. Surveys conducted by Avista in the East Fork Bull River reported the presence of 4 to 32 redds annually between 2001 and 2011, while one to six redds were observed in East Fork Rock Creek from 2004 through 2011 (Storaasli and Moran 2008, 2012; Salmon Environmental Services 2012). These surveys indicate that East Fork Bull River, and to a lesser extent Rock Creek, are two primary spawning streams that support the Cabinet Gorge bull trout population (Montana Bull Trout Scientific Group 1996). The Rock Creek bull trout subpopulation size was categorized as functioning at risk in the BA since the population is isolated by the intermittent flows (USDA Forest Service 2013a), while the East Fork Bull River subpopulation was categorized as functioning at risk/functioning appropriately.

Bull trout appear to be less numerous in the Fisher River watershed than in the East Fork Bull River or Rock Creek watersheds, but data are limited for this drainage. Fish population surveys within West Fisher Creek indicated that bull trout were present at densities less than 1 trout/100 square meters (FWP 2012). Spawning surveys from 1995 through 2009 observed up to 27 redds suspected to be bull trout redds annually (Dunnigan *et al*. 2011). The Fisher River and West Fisher Creek bull trout subpopulation sizes were categorized as functioning at risk due to the low numbers that are thought to be present in this drainage (USDA Forest Service 2013a).

3.6.3.9.3 Growth and Survival

Data to determine growth rates for the bull trout subpopulations within analysis area streams are limited. The only age and growth analysis data for the Libby Creek watershed were collected during the 1988 initial baseline data survey and were summarized in section 3.6.3.5.1, *Libby Creek Drainage Fish Populations*. Based on this analysis data, most bull trout within the Libby Creek drainage are young, as is typical for low-productivity mountain-headwater streams. Older bull trout were only found in the upstream portions of Libby Creek and Ramsey Creek, and in East Fork Rock Creek. Growth rates for all age classes were low, potentially due to limitations caused by low nutrient concentrations. Data to determine survival rates for the Libby Creek drainage subpopulation are insufficient.

Bull trout growth in Rock Creek and the East Fork Bull River was relatively low when compared with other tributaries to the lower Clark Fork River (Washington Water Power Company 1996). Instantaneous survival rates for age III+ bull trout were 18 percent for the East Fork Bull River and 23 percent for Rock Creek. These survival rates were lower than the average for the other tributaries to the lower Clark Fork River (Washington Water Power Company 1996). No data on bull trout growth rates were available for the Fisher River watershed.

Growth and survival was categorized as functioning at risk for Libby Creek, Ramsey Creek, the Fisher River, West Fisher Creek, and the East Fork Bull River based on the BA (USDA Forest Service 2013a). Poorman Creek and the Rock Creek drainage were categorized as functioning at unacceptable risk for this parameter based on the lack of bull trout being collected in Poorman Creek in recent years and the low growth and survival rates within the Rock Creek watershed. Bear Creek was categorized as functioning appropriately based on the consistent presence of juvenile bull trout and redds.

3.6.3.9.4 Life History Diversity and Isolation

Bull trout are widely distributed throughout the lower Kootenai River watershed, with spawning and rearing by migratory adults occurring in tributaries that drain British Columbia, Idaho, and Montana. The Libby Creek population has both a resident and a fluvial/adfluvial, migratory life history form. The resident population is isolated from the rest of the bull trout within and downstream of the analysis area by Libby Falls, which is located about 1.2 miles upstream of the Howard Creek confluence. The migratory population spends their adult lives in Kootenay Lake or the Kootenai River, with upstream migration limited by Libby Dam, which is impassable to bull trout moving upstream, but not downstream.

Spawning and rearing of bull trout have been documented in Libby Creek and the Fisher River watersheds, as well as other Kootenai River tributaries (Western Resources Development Corp. 1989a; USFWS 2002; FWP 2012). Specific spawning data within the upper Libby Creek watershed are limited, but the observation of redds has established that bull trout do use portions of Libby Creek, Bear Creek, and possibly Ramsey Creek for spawning (Western Resource Development Corp. 1989a; Dunnigan *et al.* 2005, 2011). It is not clear if these redds were from resident or fluvial bull trout in most cases, but Bear Creek was documented to have redds present from both life history forms in 1999 (Dunnigan *et al*. 2011). The Libby Creek and Fisher River subpopulations are categorized as functioning at risk in most streams assessed in the BA, with the Poorman Creek subpopulation listed as functioning at unacceptable risk (USDA Forest Service 2013a). The low numbers of migratory trout, fish passage barriers, high stream temperatures and periodic dewatering of short reaches that occurs downstream of the analysis area are listed as risk factors for this parameter.

Bull trout in the East Fork Bull River and Rock Creek are included in the Cabinet Gorge core area within the Lower Clark Fork River Recovery Unit (USFWS 2002), and are isolated from the bull trout populations in the lower Kootenai River watershed. East Fork Bull River and Rock Creek are considered important spawning streams for this subpopulation (Montana Bull Trout Scientific Group 1996), and redd surveys by Avista support this contention. The bull trout population in Rock Creek is likely composed primarily of resident fish (USFWS 2003a). Migratory fish do use the stream as demonstrated by radio tagged bull trout tracked to this stream (Hintz and Lockard 2007; Moran *et al*. 2009). Two reaches of Rock Creek, including a reach located near the confluence with the Clark Fork River, are intermittently dewatered and act as seasonal barriers to fish passage (USFWS 2007a; FWP 2012). The BA designated this parameter as functioning at risk for the Rock Creek watershed based on these barriers and the low numbers of migratory fish thought to be present (USDA Forest Service 2013a).

Both the resident life history forms and fluvial/adfluvial migratory life history forms are present in the East Fork Bull River drainage (Chadwick Ecological Consultants, Inc. 2000; Katzman and Hintz 2003; FWP 2012; Moran and Storaasli 2008; Moran *et al*. 2009). Radio tagged bull trout transported from Lake Pend Orielle have been observed moving in to the East Fork Bull River.

Genetic information, sampling surveys, and telemetry indicate this population is primarily a migratory population (Katzman and Hintz 2003). This subpopulation was categorized as functioning at risk in the BA because other connected subpopulations are not as strong (USDA Forest Service 2013a).

3.6.3.9.5 Persistence and Genetic Integrity

The bull trout populations that occur in the Libby Creek and Fisher River watersheds are part of the Kootenai River/Kootenay Lake primary core area (USFWS 2002). A primary core area indicates that good connectivity exists within the area, with large lakes and migratory corridors present. Six local populations have been documented in the Kootenai River/Kootenay Lake core area, with one of these populations estimated as having greater than 100 individuals, and three others, including the population in Libby Creek, estimated as having numbers approaching 100 individuals. If a core area has five local populations with 100 or more spawning adults and 1,000 or more adult fish, it is assumed to consist of enough individuals to protect genetic integrity and be less vulnerable to the effects of environmental instability (USFWS 2002).

Section 3.6.3.1.2*, Barriers to Fish Passage,* discusses barriers on analysis area streams to bull trout. Connectivity between Libby Creek and the Kootenai River varies from year to year, with the most downstream reach of Libby Creek becoming warm during the low flow period in some years, and presenting a thermal barrier to upstream migration into the analysis area. While the isolated, resident bull trout population that inhabits the upstream portion of Libby Creek has persisted for many years, it is more vulnerable to extirpation via catastrophic events such as droughts, landslides, floods, or fire than the trout in the watershed downstream of the falls. The Fisher River is connected to the Kootenai River and to Quartz Creek, the most prolific spawning tributary, but this watershed also experiences high temperatures that may limit migration during low flows (USDA Forest Service 2013a).

The bull trout populations within the Lower Clark Fork Recovery Unit, which includes Rock Creek and the East Fork Bull River, continue to persist, although sometimes in low numbers, in the watersheds where they likely occurred historically. Migratory trout life history forms have largely been replaced by resident trout life history forms in many of the tributaries, limiting genetic diversity and increasing the risk of local extinctions (Montana Bull Trout Scientific Group 1996; USFWS 2002). The presence of migratory bull trout has been established in both Rock Creek and the East Fork Bull River (Washington Water Power Company 1996; Chadwick Ecological Consultants, Inc. 2000; Moran *et al*. 2009; Avista 2011). Bull trout with migratory life histories are necessary for the long-term success of the species because generally they are more resilient and more resistant to environmental variation and stressors (Rieman and Mcintyre 1993; Montana Bull Trout Scientific Group 1996). The upstream and downstream transport program for bull trout conducted by Avista aids in ensuring the long-term success of this life history trait (Moran *et al*. 2009).

The presence of brook trout threatens the persistence and the genetic integrity of bull trout within the analysis area within both core areas. Brook trout have been documented downstream of the analysis area in the lower Libby Creek drainage for many years, and were first documented in upper Libby Creek drainage in 2004 and in the Fisher River drainage in 1986 (FWP 2012). During the 2005 surveys of the Libby Creek drainage, brook trout were almost eight times as numerous as bull trout at the Libby Creek sites surveyed (Figure 52). Additionally, a significant increasing trend in brook trout abundance was observed from 1998 through 2009 in a section of Libby Creek immediately downstream of the analysis area and the US 2 stream crossing in surveys conducted as part of the mitigation for the Libby Creek Dam project (Dunnigan *et al.* 2011). While no decreasing trend in bull trout densities was observed in this section and no trends in brook trout abundance were observed at sites further upstream, the increases indicate that the probability of impacts on bull trout populations from hybridization and displacement from competition with brook trout is high.

Genetic analysis in the upper Libby Creek drainage found no indication of hybridization (Arden *et al.* 2007). No genetic analyses have been performed on the bull trout within the Fisher River itself to determine if hybridization has occurred, but analysis indicated that hybridization between bull trout and brook trout was occurring in West Fisher Creek in 2007 (FWP 2012). Additionally, hybrid trout were reportedly collected from West Fisher Creek in 2009 and 2010 as well. Brook trout hybridization is suspected in O'Brien Creek, a Kootenai River tributary located farther north in the basin. Additionally, a 25 percent hybridization rate was detected from a sample of 24 bull trout from the Kootenai River (USFWS 2002). The subpopulation of bull trout that inhabit Libby Creek upstream of Libby Creek Falls is assumed to be protected from the threat of hybridization with brook trout because the barrier created by the falls prevents brook trout from accessing that portion of the stream. The bull trout populations in Libby Creek and the Fisher River are considered to be functioning at risk based on the analysis included in the BA (USDA Forest Service 2013a).

Within the Cabinet Gorge core area, genetic analyses on bull trout from three reaches of the East Fork Bull River were conducted in 1993. Almost 60 trout were tested; none showed signs of hybridization (FWP 2012). While genetic verification was not documented, a single brook trout/bull trout hybrid was noted as having been collected from a trap near the mouth of the East Fork Bull River in both 2007 and 2010 (Moran and Storaasli 2008; FWP 2012). Brook trout are present in most streams in the lower Clark Fork River drainage that currently support bull trout, including Rock Creek and the East Fork Bull River. Hybridization has not been verified as occurring in the Rock Creek drainage (Avista 2011), and the seasonally dry reach at the mouth of Rock Creek may be playing a role in excluding brook trout. Brook trout are known to be extensively hybridized with bull trout in Mission Creek (USFWS 2002; FWP 2012), a tributary to the Flathead River that is within the same Recovery Unit as the East Fork Bull River and Rock Creek. Brown trout do not pose a hybridization risk, but do pose a risk to bull trout persistence through interspecific competition for spawning and rearing habitat. Brown trout are well established in the downstream reaches of the East Fork Bull River. The Rock Creek and East Fork Bull River bull trout populations were categorized as functioning at risk for persistence and genetic integrity in the BA (USDA Forest Service 2013a).

3.6.3.9.6 Designated Critical Habitat

In 1998, the USFWS listed the bull trout as a threatened species and in 2005 designated critical habitat in five streams in the analysis area: Libby Creek, Poorman Creek, Ramsey Creek, Rock Creek, and West Fisher Creek. In 2010, the USFWS designated additional segments of Libby Creek, Rock Creek, and West Fisher Creek, and also designated some segments of Bear Creek, East Fork Bull River, and Fisher River (Figure 55). The 2010 designation removed the short segments of critical habitat in Ramsey Creek and Poorman Creek designated in 2005. In the 2010 designation, segments in Libby Creek, West Fisher Creek, and Fisher River covered by the Plum Creek Native Fish Habitat Conservation Plan are considered essential excluded habitat. Bull trout are found in the Libby Creek, Rock Creek, East Fork Bull River, and Fisher River drainages in the mine area and along the transmission line alternative corridors (Figure 55).

Most segments of designated critical habitat on Libby Creek are on Montana's list of water quality-impaired streams. Aquatic life support and cold-water fishery uses are only partially supported for this reach. Historical effects of mining and periodic wildfire in upper Libby Creek have limited available fish habitat throughout the Libby Creek drainage. Habitat data on Libby Creek suggest that riparian vegetation and bank stability are improving in the area. Pool habitat and large woody debris, which are important components of bull trout habitat, are present throughout Libby Creek and Bear Creek (Table 64 and Table 65), but the frequency and quality of large, deep pools is low. Redd surveys have indicated that use of Bear Creek for spawning is high, indicating appropriate habitat is available in this stream.

Two segments of designated critical habitat, one 2.8 miles and the other 3.1 miles long, are found on West Fisher Creek in the analysis area (Figure 55). These two segments are along the Alternative E-R transmission line corridor. West Fisher Creek has pools and large woody debris throughout most of its length other than near the mouth of the stream where it becomes very wide. Bank stability is variable, but there is adequate habitat to support fish through the reaches of critical habitat (Table 68).

The segment designated as critical habitat in the East Fork Bull River extends 8.0 miles upstream from the confluence with the Bull River and provides spawning and rearing habitat. The river provides adequate large wood debris to provide bull trout with adequate cover in most reaches. About 30 percent of the available habitat in the reaches above Snake Creek and into the wilderness is dominated by pools. The remainder is high-gradient riffle.

The designated critical habitat in East Fork Rock Creek and Rock Creek is on Montana's list of impaired streams. Probable causes for the Rock Creek impairment are anthropogenic substrate alterations, with the probable source of these impairments listed as silvicultural activities. The designated critical habitat in lower Rock Creek is adversely affected to some degree in most years due to the seasonal lack of connectivity preventing upstream movement of adult migratory bull trout. Rock Creek lacks surface flow during periods of low flow for the majority of its lower 3.4 miles. Annual subsurface streamflow conditions in summer and early fall severely affect the ability of bull trout to find suitable spawning areas. Consequently, it is likely that reproduction in most years is significantly limited (USFWS 2007a).

3.6.3.10 Forest Service Sensitive Species and State Species of Concern

Westslope cutthroat trout and interior redband trout are Forest Service sensitive species and inhabit streams within the analysis area. Western pearlshell mussels, another Forest Service sensitive species, and torrent sculpin, a Montana species of concern, may also occur within the analysis area.

3.6.3.10.1 Westslope Cutthroat Trout

Description of the Population Area

Historically, westslope cutthroat trout were likely distributed throughout the analysis area within the Kootenai and Clark Fork River watersheds. Based on the results of genetic analyses, no pure westslope cutthroat trout populations have been found to inhabit the Libby Creek watershed within the analysis area. The hybrid trout populations in Ramsey Creek, Bear Creek, Little Cherry Creek, and segments of Libby Creek downstream of the mine area likely include rainbow/westslope cutthroat, redband trout/westslope cutthroat, and westslope/redband/coastal rainbow trout hybrids (Kline Environmental Research 2004; FWP 2012). The trout tissues tested showed only slight hybridization of the rainbow or redband trout with westslope cutthroat trout, containing 2 percent or less westslope cutthroat trout genes. Based on these results, this species would not be impacted by the proposed activities within the Libby Creek watershed because pure populations are not present

While the MFISH database documented the collection of a few westslope cutthroat trout/rainbow trout hybrids, presumably visually identified, during surveys in 2002, 2009, and 2011, results from all genetic analyses indicated that the westslope cutthroat trout population in the East Fork Bull River is pure (FWP 2012). Genetic analysis of trout from the Rock Creek and the Fisher River watersheds also indicated that pure westslope cutthroat trout were present, but hybrid cutthroat trout have also been collected from these drainages (Horn and Tholl 2011, FWP 2012). Based on these analyses and surveys, pure westslope cutthroat trout populations exist in these three watersheds and could potentially be affected from activities in the analysis area, but the populations may already be threatened by hybridization with rainbow trout.

Subpopulation Size

Limited survey data were available to indicate subpopulation size in the Fisher River watershed. No westslope cutthroat trout were reported in fish population surveys of the Fisher River mainstem within the analysis area, and only two surveys and the results of genetic analyses recorded the collection of westslope cutthroat trout and their hybrids in West Fisher Creek (FWP 2012). These trout were collected frequently in Miller Creek, as were redband trout/westslope cutthroat trout hybrids, but density data were not provided for these surveys. Relative abundance data indicate that westslope cutthroat trout and their hybrids generally composed between 13 and 67 percent of the trout population in Miller Creek, although no westslope cutthroat trout were collected from the most upstream site surveyed in 2009 (FWP 2012).

Within the Rock Creek watershed, westslope cutthroat trout densities were variable in the surveys conducted annually in most years from 2001 through 2012 in East Fork Rock Creek, with population estimates ranging from 12 to 106 trout/100 meters (Horn and Tholl 2011; Avista 2011, FWP 2012; Kline and Savor 2012). Other earlier surveys also often reported relatively high densities of westslope cutthroat trout within this watershed (Western Resource Development Corporation 1989a; Washington Water Power Company 1996; USDA Forest Service and DEQ 2001), and westslope cutthroat trout were the dominant species in this stream in most surveys. Hybrid westslope cutthroat trout were collected from the more upstream reaches of East Fork Rock Creek and in Rock Lake in 1984, and a single hybrid trout was collected from a reach of East Fork Rock Creek downstream of Rock Meadows in 2010 (Horn and Tholl 2011). The hybridization in analysis area streams may be more widespread than reported, because reliably distinguishing between pure and hybridized westslope cutthroat trout in the field is difficult. The genetic analysis conducted in 1984 indicates that the hybrid trout are composed of 93 percent westslope cutthroat trout genes (FWP 2012).

Westslope cutthroat trout are also relatively abundant in the East Fork Bull River (Washington Water Power Company 1996; Chadwick Ecological Consultants, Inc. 2000; Horn and Tholl 2008, 2011; FWP 2012). They were frequently the dominant species in this upper reaches of this stream. Estimates of westslope cutthroat trout abundance in this stream ranged up to 52 trout/100 meters. Based on these data, westslope cutthroat trout populations in the Rock Creek and East Fork Bull River watersheds appear to be viable and thriving, although hybridization with rainbow trout is a concern in both watersheds.

Growth and Survival

Limited data are available on growth rates and age class structure of westslope cutthroat trout within the analysis area. Data collected in 1986 and 1987 in East Fork Rock Creek and Rock Lake showed few to no young-of-year fish (age I) (Western Resource Development Corp. 1989a). The trout collected from Rock Lake appeared to have an older age structure than those collected from East Fork Rock Creek, but likely this resulted from the different sampling methods employed to collect trout from the lake (Western Resource Development Corp. 1989a). Growth rates during these surveys were described as low in comparison to other tributaries within the lower Clark Fork River drainage. The instantaneous survival rate of 23 percent was similar to the average for these streams. The East Fork Bull River was surveyed during the same time frame, with the oldest trout collected in the age III+ class. Growth rates and the instantaneous survival rate (26 percent) were similar to the average for the other tributaries within the drainage (Washington Water Power Company 1996). Growth and survival rates in the Rock Creek and East Fork Bull River watersheds appear to be similar or slightly lower than other streams in the lower Clark Fork River drainage.

Life History Diversity and Isolation

Westslope cutthroat trout populations within the Fisher River, Rock Creek, and East Fork Bull River drainages likely consist of both resident and fluvial life history forms, although little data were available for the Fisher River drainage. The only documented barriers to fish passage in East Fork Rock Creek are in the upstream reaches near Rock Lake. No flow at the mouth of Rock Creek isolates fish in Rock Creek seasonally. A natural barrier is present on the East Fork Bull River upstream of the CMW boundary and downstream of the Isabella Creek confluence (Washington Water Power Company 1996; USDA Forest Service and DEQ 2001; Kline and Savor 2012). While the barrier was not assessed to determine if it was a barrier to all fish or if it would be navigable to some fish under some flow conditions, westslope cutthroat trout have been observed upstream of the barrier up to the confluence with Placer Creek (FWP 2012). The presence of migratory westslope cutthroat trout have been documented in the East Fork Bull River and the Rock Creek drainage, although resident fish likely compose the majority of the population in Rock Creek (Katzman and Hintz 2003; Avista 2011). The mainstem of West Fisher Creek has a partial barrier that exists at its mouth due to accumulated sediment that may limit the passage of large migratory fish in low water years, and Miller Creek also has intermittent flows near the mouth, limiting connectivity in this stream for much of the year.

Persistence and Genetic Integrity

In the Fisher River watershed within the analysis area, pure westslope cutthroat trout were collected from Miller Creek and West Fisher Creek, but westslope cutthroat/rainbow or westslope cutthroat/redband/coastal rainbow trout hybrids have also been collected from both streams (FWP 2012). Pure westslope cutthroat trout have not been found in any other stream in the Fisher River watershed within the analysis area. Unless barriers prevent rainbow and redband trout from accessing the upstream reaches of Miller Creek, the trout in the more upstream reaches of Miller Creek are vulnerable to hybridization.

Results of genetic analyses of trout in the East Fork Bull River indicate the westslope cutthroat trout population is pure, and seems to have a lower chance of hybridization occurring because no rainbow, redband, or Yellowstone cutthroat trout have been collected in the surveys of this stream. Population survey and weir trap data for the East Fork Bull River reported the collection of a small number of westslope cutthroat trout/rainbow trout hybrids in 2002, 2009, and 2011, generally from the downstream reaches of the river (FWP 2012). These fish may have been visually identified, as no data were provided to indicate genetic analyses were conducted. No physical barriers exist in the Bull River mainstem or the East Fork Bull River that prevent the rainbow trout and hybrid trout present elsewhere in the drainage from moving upstream to hybridize this population (Washington Water Power Company 1996).

Genetic analysis of trout from the Rock Creek and the Fisher River watersheds also were found to be pure westslope cutthroat trout, but a trout collected in 2010 from downstream of Rock Creek Meadows in East Fork Rock Creek was verified to be a westslope cutthroat trout/rainbow trout hybrid (Horn and Tholl 2011). Population survey and trapping data also indicated the presence of hybrid trout in the mainstem of Rock Creek, although these trout may have only been identified through their visible physical characteristics (FWP 2012). Additionally, several trout collected from an upstream section of East Fork Rock Creek near Rock Lake were found to be hybridized with Yellowstone cutthroat trout and rainbow trout in earlier years. Likewise, genetic analyses on trout collected from Rock Lake indicated that all trout collected were westslope cutthroat trout/Yellowstone cutthroat trout hybrids (FWP 2012).

The seasonally dewatered sections of Rock Creek at the confluence of the Clark Fork River (FWP 2012) may aid in protecting the purity of the westslope cutthroat populations somewhat by acting as a barrier to trout moving upstream during some parts of the year. Barriers to upstream fish passage in Rock Creek are in the upstream Rock Creek Meadows reach and at the outlet of Rock Lake. These barriers do not prevent the movement of fish in a downstream direction, indicating that hybridization of the pure trout within these reaches is possible (Washington Water Power Company 1996). The persistence of westslope cutthroat trout in these drainages is also threatened by the presence of brook trout and brown trout, which may outcompete westslope cutthroat trout for available resources or prey upon them. In the East Fork Bull River, brown trout appear to be flourishing, dominating the fish populations at downstream sites during most surveys (Washington Water Power Company 1996; FWP 2012). In 2007 through 2009, non-native salmonid suppression activities were conducted by Avista in the downstream reaches of East Fork Bull River (Moran and Storaasli 2008; Horn and Tholl 2011). While brown trout and other non-native fish were still present in the lower reaches following this effort, monitoring in 2009 and 2010 indicated a shift towards native species was occurring in this reach.

3.6.3.10.2 Redband Trout

Description of the Population Area

Historically, redband trout were distributed throughout much of the analysis area. Based on fish distribution surveys, redband trout and their hybrids are the dominant trout species within the Libby Creek watershed as well as in the upstream segment of the Fisher River. There are no records of redband trout from the Rock Creek and East Fork Bull River drainages (Washington Water Power Company 1996; Chadwick Ecological Consultants, Inc. 2000; USDA Forest Service and DEQ 2001; FWP 2012). Results of genetic analyses indicate that redband trout are largely hybridized throughout the Libby Creek watershed, but genetically pure redband trout have been collected from portions of Libby, Poorman, Bear, Ramsey, and Little Cherry creeks, and recently from the Fisher River (FWP 2012).

No spawning surveys were available for redband trout. Fish distribution surveys and genetic analyses (Western Resource Development Corp. 1989a; Kline Environmental Research 2004; Kline Environmental Research and Watershed Consulting 2005a; Leary 2006; Dunnigan *et al.*

2011) are the primary data for this subpopulation. Habitat surveys conducted in 1988 (Western Resource Development Corp. 1989a) and in 2005 (Watershed Consulting and Kline Environmental Research 2005) supplement the fish distribution data.

Subpopulation Size

While no redband trout redd surveys have been conducted in the Libby Creek or Fisher River watersheds, fish distribution surveys have shown that redbands and their hybrids are the dominant trout species within the analysis area in both watersheds, with densities over 130 trout/100 meters (Kline Environmental Research 2005a; Dunnigan *et al*. 2011). Based on these numbers, the mixed redband population is viable and thriving in the Libby Creek watershed, with small populations of pure redbands in all of Little Cherry Creek. Pure redband trout have also been collected in segments of Poorman Creek, Libby Creek, Bear Creek, and Ramsey Creek. While no abundance data were available for the Fisher River, the population in the upstream portion of this river consists of pure redband trout. No pure or hybrid redband trout populations occur in the East Fork Bull River or East Fork Rock Creek watersheds.

Growth and Survival

Data to determine growth rates for the Libby Creek drainage redband trout subpopulation are limited. The Libby Creek watershed within the analysis area is mainly inhabited by young trout, as is typical for headwater streams with low productivity. Available data have shown stable numbers of fish over time on streams where data were collected. Ramsey Creek was the only project stream in which older redband trout were collected. Growth rates for all age classes were low, probably due to low nutrient concentrations in these streams. Data to determine survival rates for the Libby Creek drainage subpopulation are insufficient.

Life History Diversity and Isolation

The Libby Creek and Fisher River watersheds' redband populations likely have both resident and fluvial, migratory life history forms. Redband trout have been collected in recent surveys from the segment of Little Cherry Creek located upstream of a series of fish barriers, which are considered impassable for trout. The redband trout population in this stream appears to be genetically pure based on the recent 2005 genetic analyses (Leary 2006). Genetic analyses of redband trout in Poorman Creek and the Fisher River also indicate that these populations are pure, possibly also as a result of barriers that keep the trout isolated from downstream hybridized populations. In the case of the redband trout present in the Libby Creek mainstem and the Fisher River, complete isolation from other rainbow, westslope cutthroat, or hybrid trout is unlikely because these other trout species have been identified in tributaries within the analysis area (FWP 2012). Migratory redband trout probably persist in the remainder of the Libby Creek watershed not isolated through barriers, as well as in the Fisher River watershed.

Persistence and Genetic Integrity

Based on data provided from a limited number of genetic analyses, the redband trout population within the Libby Creek watershed consists mostly of redband/cutthroat and redband/rainbow trout hybrids. Some genetically pure redband trout have been collected in Libby Creek. Rainbow trout are stocked annually in Howard Lake (FWP 2012) and likely access Libby Creek and its tributaries through Howard Creek. Genetic analyses have also shown that the redband populations in Ramsey Creek and Bear Creek are hybridized to a lesser extent with both rainbow and westslope cutthroat trout. Non-hybridized redband trout populations do persist in Poorman Creek and Little Cherry Creek, possibly due to the presence of barriers to fish moving upstream from

Libby Creek. Leary (2006) reviewed the 1991, 1992, and 2005 genetic analyses results from trout in Little Cherry Creek and noted that substantial genetic changes had been observed in the redband trout population over a relatively short time period. These changes suggest there is a low effective population size for redband trout in Little Cherry Creek. Non-hybridized redband trout also inhabit the upstream segment of the Fisher River, but they are likely vulnerable to hybridization because westslope cutthroat trout, rainbow trout, and hybrid trout exist in tributaries to this segment of the Fisher River and in downstream segments.

3.6.3.10.3 Western Pearlshell

The western pearlshell mussel is native to western North America. Montana populations are becoming less viable with decreased streamflows, warming, and habitat degradation. The mussel prefers stable gravel and pebble substrates in small to medium cold-water rivers characterized as having Rosgen C channel morphology and moderate slopes (Stagliano 2010). Surveys conducted by the Montana Natural Heritage Program (MNHP) of streams in or near the analysis area, such as Fisher River and Big Cherry Creek, did not find any evidence of a mussel population (Stagliano 2010).

3.6.3.10.4 Torrent Sculpin

Little data were available to determine the status and distribution of torrent sculpin within the analysis area; thus the discussion of the current status of this species within the analysis area is limited. This species is difficult to differentiate morphologically from slimy sculpin, and both species occur within the streams potentially affected by the mine. The MFISH database lists torrent sculpin as being abundant in Libby Creek and Miller Creek and as occurring rarely or being of unknown abundance in East Fisher Creek, Standard Creek, and Flower Creek (FWP 2012). No specific surveys in which these fish were collected were documented in the database, although many surveys did not identify sculpin that were collected at the species level. Sculpin were common at the downstream Libby Creek site surveyed in 2005 (Kline Environmental Research and Watershed Consulting 2005a), and were also collected in small numbers at the Libby Creek sites further upstream and in Poorman Creek. These may have been torrent sculpin, but slimy sculpin are also stated to be present in the Libby Creek drainage (FWP 2012).

Torrent sculpin distribution is somewhat patchy (Tabor *et al*. 2007), and they are limited to the Kootenai River system in Montana (Hendricks 1997). They generally inhabit fast, clear streams, but may also be found in lake shores. They prefer cobble or gravel substrates, and they spawn in spring or early summer by laying their eggs on the underside of rocks (Brusven and Rose 1981; Hendricks 1997). These fish prey on a large variety of organisms, including insects, clams, crustaceans, and fish, and are in turn considered prey for some salmonids and other fish (Hendricks 1997, Tabor *et al*. 2007). High peak flows have been observed to have a deleterious effect on some sculpin species (Erman *et al*. 1988).

3.6.3.11 Existing Watershed Conditions

The potentially affected threatened and sensitive fish species in analysis area streams include bull trout, redband trout, westslope cutthroat trout, and torrent sculpin. This analysis will focus on their habitat needs. Section 3.11, *Surface Water Hydrology*, gives a more thorough review of the existing hydrologic conditions in the Libby Creek watershed.

The variables analyzed correspond to habitat indicators listed on the USFWS matrix for bull trout (USFWS 1998), but these variables were also used to assess effects on other sensitive fish species in the analysis area. Existing conditions for each habitat indicator are described, with the assessment including the segments of the Libby Creek, Fisher River, East Fork Bull River, and Rock Creek watersheds that are within the analysis area. Sufficient stream habitat data are available for many of the habitat indicators for the Libby Creek, East Fork Bull River, and Rock Creek watersheds, but are limited for the Fisher River. Major assessments of the Libby Creek drainage occurred for the 1992 Montanore Project Final EIS in 1988 (Western Resource Development Corp. 1989a) and as an update of the 1992 Final EIS data in 2005 (Kline Environmental Research and Watershed Consulting 2005a; Kline Environmental Research 2005a, 2005b, 2005d; Kline Environmental Research *et al.* 2005; Watershed Consulting and Kline Environmental Research 2005). Habitat surveys at a more limited number of sites also were conducted before and after the baseline surveys in 1988, as summarized by Kline Environmental Research (2004) and USDA Forest Service (2005b). Surveys were also conducted by MMC or the Forest Service in the East Fork Bull River, Rock Creek, East Fork Rock Creek, and West Fork Rock Creek in 2012 to provide additional baseline data on the aquatic habitat (Kline and Savor 2012; Salmon Environmental Services 2012).

3.6.3.11.1 Temperature

Riparian harvest and channelization (especially on Libby Creek) on National Forest System lands and other private lands along the mainstems of streams in the analysis area has occurred for mining, land development, and land management. Grazing occurs only on private property in the Libby Creek drainage. It is likely that there has been a noticeable change in temperature as a result of these actions on lands in the analysis area.

Water temperature monitoring occurred on both Libby Creek (two sites, upper and lower) and West Fisher Creek (at one site near the confluence with the Fisher River). Temperature data indicate that the lower and middle segments of Libby Creek and the lower segment of West Fisher Creek are warmer than 59ºF, a maximum limit for salmonids, for numerous days during the summer months and may create thermal barriers for bull trout and other species.

Temperature data collected during the 2005 through 2007 in the Libby Creek watershed by Kline Environmental Research (2005, 2007b) ranged from 32°F to 70°F, with maximum 7-day average maximum temperatures at each site ranging from 50°F at a site on Libby Creek upstream of the Howard Creek confluence to 68°F at a site on Libby Creek downstream of the Crazyman Creek confluence over this time period. These data were from up to eleven temperature loggers placed at sites L1, L2, L9, L10, Be2, LC1, LC3, Po1, Po2, Ra2, and Ra3 (Figure 52). Temperatures were generally warmest in late July. A single temperature reading was also collected from multiple reaches in the headwaters of Libby Creek and Ramsey Creek in September 2012, with data at some sites in Libby Creek also collected in September 2010 and 2011 (Kline Environmental Research and NewFields 2012). Temperatures were often warmer at the more downstream sites, and ranged from 43°F to 50°F. Most of the sites where the temperature data were collected were upstream of the known bull trout distribution.

Temperature data also were collected in 1994, 2002, and in May 2009 through September 2011 in the East Fork Bull River. Temperatures averaged 50°F, 37°F, 38°F, and 43°F in the summer, fall, winter, and spring of 1994, with maximum temperatures of 62°F and 59°F occurring in 1994 and 2002, respectively (Washington Water Power Company 1996; Liermann and Tholl 2003). Daily mean temperatures ranged from 32°F to 57°F in 2009 through 2011, and peaked in August of each year (USDA Forest Service 2011h, 2011i, 2011j).

Temperatures were monitored in Rock Creek in 1994, 2008, and 2011. In 1994, stream temperatures averaged 51°F in the summer, 43°F in the fall, 38°F in the winter, and 44°F in the spring, with a maximum temperature of 54°F (Washington Water Power Company 1996). Temperature data from various sources in 2008, 2011, and 2012 indicated that the maximum temperature reached was 64°F in August 2011 (Moran *et al*. 2009; Salmon Environmental Services 2012; Kline Environmental Research and NewFields 2012).

Bull trout require water temperatures ranging from 36°F to 59°F, with temperatures at the low end of this range required for successful incubation (USFWS 1998). The other trout and sculpin species that occur in analysis area streams are also species that require cold water temperatures. While based on limited data, the temperatures in many stream reaches were within this range for most of the year. Maximum water temperatures were occasionally above 59°F within the Libby Creek, Fisher River, East Fork Bull River, and East Fork Rock Creek watersheds, generally at the more downstream site locations during the summer months. The BA categorized temperature as a habitat parameter that was functioning either at risk or at unacceptable risk for Libby Creek, Bear Creek, Ramsey Creek, the Fisher River, and the East Fork Bull River. The BA categorized temperature as functioning appropriately in Poorman Creek and Rock Creek (USDA Forest Service 2013a).

3.6.3.11.2 Sediment

Substrate composition is dominated by cobble and gravel in most surveyed sites in the analysis area (Watershed Consulting and Kline Environmental Research 2005; Kline and Savor 2012). The mean percent fines (described in the report as fines less than 6.25 mm or 0.25 inches) in gravel at each site within the Libby Creek watershed ranged from 15 percent at the lowest Libby Creek site to 39 percent at the most upstream Little Cherry Creek site in 2005 (Table 67) (Kline Environmental Research 2005). Surveys conducted in 2006 through 2008 indicated that the percent fines in low gradient riffle areas in the Libby Creek watershed were generally less than 10 percent at most sites, although the reach of Libby Creek upstream of the falls and the Little Cherry Creek reach had higher percentages during some surveys (Kline Environmental Research 2009). Fines at the Little Cherry Creek site were elevated up to 95 percent in 2008, potentially due to logging activity within the area.

Percent fines within core data collected in the Rock Creek watershed ranged from 0 percent to 34 percent during recent surveys, although the percentage within the pool crest areas was sometimes higher than this range (Carlson, pers. comm. 2012; Salmon Environmental Services 2012). Earlier surveys of this watershed in 1992 through 1994 measured fines as composing 43 percent of the substrate at one site on East Fork Rock Creek and up to 28 percent at two sites on West Fork Rock Creek (Table 67) (Washington Water Power Company 1996). Percent fines were measured in the East Fork Bull River during this time period as well, and ranged from 15 to 33 percent in spawning areas. Percent fines were measured in West Fisher Creek multiple times between 2006 and 2010, and ranged from 10 percent to 32 percent (Dunnigan *et al*. 2011).

Incubation of bull trout embryos begins to decrease substantially when more than 30 percent of the sediment is smaller than 0.25 inches in diameter, and other lethal, sublethal, and behavioral effects can occur when sediment levels are elevated above background levels. There is an inverse relationship between the percentage of fine sediment in the incubation habitat and survival until emergence (Weaver and Fraley 1991). Based on these data, sediment levels in many of the surveyed stream reaches are less than this level and are not currently a limiting factor. The percentage of fine sediment may be more of a risk factor in Little Cherry Creek, Libby Creek, and in the Fisher River watershed, as the percentage of fine sediment has been measured above or near the 30 percent threshold in these streams. Rock Creek also had fine sediment levels above this threshold in the past, but the more recent data indicates levels are near or below this threshold. The BA categorized this parameter as functioning at unacceptable risk for Libby Creek, Bear Creek, and the Fisher River (USDA Forest Service 2013a). Rock Creek and the East Fork Bull River were categorized as functioning at risk.

3.6.3.11.3 Nutrients and Contaminants

The Libby Creek reach from 1 mile upstream of the Howard Creek confluence to the US 2 bridge is included on Montana's list for water quality impaired streams. Use as a drinking water supply is not supported as a beneficial use, and aquatic life support and cold-water fishery uses are only partially supported for this reach. In 2012, probable causes listed by the DEQ were alteration in stream-side or littoral vegetative covers, mercury exceedances, and physical substrate habitat alterations likely resulting from impacts from abandoned mine lands and placer mining. In 2014, the DEQ and the EPA issued TMDLs and water quality improvement plan for the Kootenai River-Fisher River Project Area, which included Libby Creek. The DEQ performed updated assessments on Libby Creek for metals impairment and did not identify metals impairment conditions in Libby Creek in the reassessment (DEQ and Environmental Protection Agency 2014a). The impairment causes for the Libby Creek (mercury) will be removed from the 2014 Integrated Report. The remaining impairments, alteration in stream-side or littoral vegetative covers and physical substrate habitat alterations, do not require development of a TMDL (DEQ and Environmental Protection Agency 2014).

Generally, nutrient and most metal concentrations in analysis area streams are low. Nitrate/nitrite concentrations in Libby Creek downstream of the Libby Adit were elevated from 1990 through 1995 due to discharge from the adit (ERO Resources Corp. 2011c). Existing metal concentrations occasionally exceed the chronic ALS for aluminum, cadmium, copper, iron, and lead and the acute ALS for silver at various locations in the Libby Creek watershed, but most exceedances occur infrequently based on the available data (Appendix K) and likely do not pose significant risks to aquatic life inhabiting these streams under existing conditions. Metal concentrations in analysis area streams are often below the detection limit.

Copper concentrations could be of particular concern as increases in dissolved copper concentrations above ambient concentrations may result in interference with sensory systems in trout and other fish, and, thus with predator avoidance behaviors, juvenile growth, and migratory success (Baldwin *et al*. 2003; Hetch *et al*. 2007). Effects on mayflies and overall diversity in streams have also been attributed to elevated copper concentrations (Montz *et al*. 2010). While copper concentrations above the chronic ALS were documented infrequently in the Libby Creek watershed and East Fork Rock Creek, the majority of samples collected in these streams and throughout the analysis area had concentrations below detection limits (Appendix K). The presence of diverse size classes of fish in the Libby Creek watershed streams suggests concentrations of these metals are not contributing to acute toxic effects for fish populations. It is not known whether chronic metal toxicity may be contributing to low population densities in these streams. The BA categorized Libby Creek as functioning at unacceptable risk for nutrients and contaminants based on the impaired streams listing, while Bear Creek, Ramsey Creek, and Poorman Creek were classified as functioning appropriately or functioning at risk (USDA Forest Service 2013a).

The Fisher River from the confluence of the Silver Butte Fisher River and the Pleasant Valley Fisher River to the confluence with the Kootenai River is included on Montana's list of impaired streams, with aquatic life support and cold-water fishery uses only partially supported. In 2012, probable causes for the Fisher River impairment were an altered flow regime and high lead concentrations, with probable sources of these impairments listed as channelization, grazing, road runoff, road construction, silvicultural activities, and streambank modification and destabilization. Nutrients and contaminants were described as a parameter that was functioning between risk and unacceptable risk for this river (USDA Forest Service 2013a). In 2014, the DEQ and the EPA issued TMDLs and water quality improvement plan for the Kootenai River-Fisher River Project Area, which included the Fisher River. The DEQ performed updated assessments on the Fisher River for metals impairment and did not identify metals impairment conditions in the Fisher River in the reassessment. The impairment causes for the Fisher River (lead) will be removed from the 2014 Integrated Report. The remaining impairment, high flow regime, does not require development of a TMDL (DEQ and Environmental Protection Agency 2014).

While no mining or other industrial activities currently exist within the East Fork Bull River that would be likely to result in contamination in this watershed, activities on private land were cited as resulting in this parameter being classified as functioning at acceptable risk as well. Nutrient and contaminant levels within Rock Creek were low and categorized as functioning appropriately.

Rock Creek from the headwaters (Rock Lake and East Fork Rock Creek) to the mouth below Noxon Dam is also listed as impaired, with aquatic life support and cold-water fishery uses only partially supported. Probable causes for the Rock Creek impairment are other anthropogenic substrate alterations, with probable sources of these impairments listed as silvicultural activities. TMDLs are not required on Rock Creek because no pollutant-related use impairment has been identified (DEQ 2010a).

3.6.3.11.4 Physical Barriers

Presently, man-made barriers, natural barriers, intermittent flows, and the small stream size of many tributaries limit bull trout distribution and connectivity in the Libby Creek watershed. A natural 39-foot waterfall on Libby Creek upstream of the Howard Creek confluence is an upstream barrier to all fish under all flow conditions. This barrier isolates the bull trout population upstream of these falls to a portion of the watershed. Natural barriers on Little Cherry Creek, Poorman Creek, and Ramsey Creek cause portions of these tributaries to be inaccessible to fish from Libby Creek (Kline Environmental Research 2005a). Little Cherry Creek provides the least amount of habitat for fish moving from Libby Creek because of the close proximity of natural barriers to the confluence of Little Cherry Creek and Libby Creek. Culverts may limit the passage of juvenile fish on Little Cherry Creek and Poorman Creek. Thermal barriers also exist seasonally in some years within the Libby Creek watershed.

The BA categorized the presence of man-made physical barriers as a parameter that was functioning at risk in Libby Creek due to the thermal barriers and in Poorman Creek due to the culvert and intermittent reach that is present near the confluence with Libby Creek in some years (USDA Forest Service 2013a). The lack of any such barriers on Ramsey Creek and Bear Creek resulted in a classification of functioning appropriately for these streams. For the most part, the connectivity and availability of bull trout habitat is not significantly limited by man-made barriers in the portion of the Libby Creek watershed within the analysis area.

No man-made barriers have been described in the East Fork Bull River and the Fisher River, but no surveys specifically assessing fish passage were available. A natural barrier was documented over 1 mile upstream of the CMW boundary on the East Fork Bull River, but the navigability of this barrier was not assessed to determine if it is passable to some fish under some flow conditions (Washington Water Power Company 1996; USDA Forest Service and DEQ 2001; Kline and Savor 2012). Fish populations exist upstream of the barrier up to the confluence with Placer Creek (FWP 2012). Thermal barriers occur on the Fisher River seasonally. The East Fork Bull River and Fisher River were categorized as functioning appropriately and functioning at risk, respectively. In West Fisher Creek drainage, the mouth of the stream has become extremely braided. There are numerous small side channels connecting the Fisher River with West Fisher Creek. These channels allow minimal passage for large migratory fish. These fish stack up in the Fisher River under the US 2 bridge and wait for months until rain brings enough water to open up access into the drainage.

A natural barrier to upstream fish movement is present on East Fork Rock Creek 3 miles upstream of the confluence with West Fork Rock Creek (Washington Water Power Company 1996; USDA Forest Service 2013a). This barrier does not prevent downstream fish passage (Washington Water Power Company 1996). A waterfall that acts as barrier to upstream fish movement also exists on West Fork Rock Creek 2 miles upstream of the mouth. Two reaches of Rock Creek near the mouth, as well as reaches of West Fork Rock Creek, are periodically dry, which are barriers to fish during low flow periods (FWP 2012) and result in this parameter being categorized as functioning at unacceptable risk (USDA Forest Service 2013a).

3.6.3.11.5 Substrate Embeddedness

The dominant substrate classes in the Libby Creek watershed are cobble and gravel (Watershed Consulting and Kline Environmental Research 2005). Substrate embeddedness in low gradient riffle areas at most sites generally increased from 2006 through 2008 in the Libby Creek watershed. Embeddedness at most of the sites surveyed was scored as being less than 25 percent throughout 2006 and most of 2007, but was higher in fall 2007 and throughout 2008 (Kline Environmental Research 2009). Embeddedness in Little Cherry Creek in 2005 was low for most of the stream length, but high through a 1,000-foot reach about 3,300 feet upstream of the Libby Creek confluence (Kline Environmental Research 2005a). Embeddedness was also determined at a single site in Little Cherry Creek in 2007 and 2008, and varied from less than 10 percent to over 50 percent in low gradient riffle habitat (Kline Environmental Research 2009). Substrate embeddedness was also assessed for sites on Libby Creek in 2006 through 2008, and a site each on Poorman Creek, Ramsey Creek, and Bear Creek in 2007 and 2008. Embeddedness at most of the sites surveyed was scored as being less than 25 percent throughout 2006 and most of 2007, but was higher in fall 2007 and throughout 2008. Embeddedness was greater than 60 percent at two of the Libby Creek sites in October 2008.

Substrate in the East Fork Bull River is primarily gravel and cobble, while the substrate in Rock Creek is predominately cobble, gravel, and boulder (Washington Water Power Company 1996; Kline and Savor 2012). No data on embeddedness were available for these streams or streams within the Fisher River watershed. Based on these data, substrate embeddedness was categorized as functioning at acceptable risk for Libby Creek, Bear Creek, East Fork Bull River, and the Fisher River, and was functioning appropriately for Rock Creek and some of the Libby Creek tributaries (USDA Forest Service 2013a).

3.6.3.11.6 Large Woody Debris

The number of pieces of LWD per mile ranged from 22 to 338 within the Libby Creek watershed (Watershed Consulting and Kline Environmental Research 2005). LWD was most abundant in Little Cherry Creek, but was found at densities higher than 105 LWD/mile at all sites except for four of the Libby Creek sites (Table 64). Surveys indicated that adequate cover in the form of LWD was also available for bull trout within the East Fork Bull River and Rock Creek watersheds. An average of 243 pieces of LWD/mile and 274 pieces of LWD/mile were counted in the Rock Creek and East Fork Bull River reaches surveyed in 1992 through 1994 (Washington Water Power Company 1996). More recent surveys indicated that 115 to 754 pieces of LWD/mile were present in stream reaches within the Rock Creek watershed, and 59 to 96 pieces of LWD were present in reaches within the East Fork Bull River (Kline and Savor 2012; Carlson, pers. comm. 2012). Based on these data, the amount of large woody debris within the analysis area is sufficient to provide bull trout with adequate cover in most reaches. Streams in the analysis area generally met the RMO for LWD, with the exception of a few sites on Libby Creek and a site on West Fisher Creek (Table 65 and Table 68). The BA categorized this variable as functioning at risk in Libby Creek, Rock Creek, and the Fisher River, and functioning appropriately in Bear Creek and the East Fork Bull River (USDA Forest Service 2013a).

3.6.3.11.7 Pool Frequency and Quality

The streams within the analysis area are generally lacking in pools, with pool frequency less than the RMOs and the number of pools per mile recommended by the USDA Forest Service (1998b) during the sampling conducted in 2005 (Table 64) and other sampling events (Table 65, Table 68, and Table 69). With the past history of management in RHCAs, the high densities of roads in RHCAs, and the large amounts of bedload transport in these streams, it is unlikely that many pools will be naturally generated in the mainstems of these drainages to satisfy this RMO. Pool generation in small streams is directly related to production of LWD in RHCAs. As trees fall into the stream, they modify streamflows in such a way that creates pools. The lack of LWD causes stream velocities to be faster and more direct, resulting in a lack of scoured pools. Although the RMO for LWD was met in many small streams, future production of LWD in RHCAs of larger streams will be limited due to the high densities of road and past timber harvest. Fine sediment will continue to be produced from timber management and road construction in the drainages under existing conditions, which will continue to negatively impact pools. Libby Creek, Bear Creek, the Fisher River, Rock Creek, and the East Fork Bull River were all rated as functioning at risk or functioning at unacceptable risk in the BA based on a low frequency or quality of pools (USDA Forest Service 2013a).

3.6.3.11.8 Large Pool Frequency

Quality pools are generally over 3 feet deep and have sufficient cover to hide fish. Measured pools during fisheries habitat surveys generally had adequate cover but lacked depth. Attempts to enhance pools in Libby Creek (mostly by FWP) have not been successful. Constructed pools were destroyed by high peak flows in the spring of 2007. The KNF also constructed some pools and completed bank stabilization work on 3,800 feet on West Fisher Creek in 1997. The project is showing signs of stress from high flows and will need future work to further stabilize the area. High rain-on-snow events and active channel migration in these streams will continue to move large amounts of bedload and create channel widening. Loss of LWD and impacts from private land will continue in the RHCAs of both drainages. As long as conditions do not change, this habitat characteristic will not meet RMOs.

The downstream Libby Creek site had the highest number of deep and large pools per mile of the analysis area streams based on data from surveys conducted in 2005 (Watershed Consulting and Kline Environmental Research 2005). No other site had a significant number of deep pools (described in this survey as pools with a maximum depth greater than 5.2 feet), although large shallower pools (with depths greater than 2.6 feet and covering an area of greater than 215 square feet) were found on several Libby Creek sites, the Bear Creek site, and the two downstream Ramsey Creek sites. Some stream reaches within the analysis area may provide poor cover for bull trout due to the limited number of pools of sufficient depth and area. The Libby Creek and Bear Creek watershed were categorized as functioning at unacceptable risk and functioning at risk, respectively, for large pool frequency in the BA (USDA Forest Service 2013a).

Pool quality data were collected in August 2012 for the Rock Creek and East Fork Bull River watersheds, and indicated that a higher number of deep pools occur in the downstream reaches of these streams compared to those in the Libby Creek watershed. The number of deep pools per mile(described as those greater than 3.3 feet in maximum depth) in these two watersheds ranged from 1 pool per mile in West Fork Rock Creek to 13 pools per mile in the Rock Creek mainstem and one reach of the East Fork Bull River (Kline and Savor 2012). Pool quality data were not available for the Fisher River watershed. This parameter was categorized as functioning at risk for Rock Creek, functioning appropriately for the East Fork Bull River, and functioning at unacceptable risk for the Fisher River in the BA (USDA Forest Service 2013a).

3.6.3.11.9 Off-Channel Habitat

Off channel habitat is found in overflow and other side channels, backwaters, wetlands, tributary streams, and springs in the RHCAs of the mainstems of analysis area streams, and provides additional habitat for fish. The availability and type of habitat varies by stream in the analysis area. The analysis area supports classic mountain streams with moderate gradients and moderate entrenchment ratios. This changes to deeply incised boulder/bedrock-dominated streams in the headwaters and gentler gradient wider floodplains with low incision ratios in the lower segments of the larger streams. The analysis area contains almost every type of stream channel on the KNF. The high densities of road in the RHCAs limit the streams' ability to make adjustments and create off-channel habitat, disrupting the long-term stability of this type of habitat.

Off-channel habitat is somewhat limited in some stream segments within the Libby Creek watershed. Several off-channel pools/backwaters were noted in Little Cherry Creek, primarily in the more upstream reaches (Kline Environmental Research 2005a). Multiple side channels were documented in Bear Creek during the 2005 survey, which could provide habitat for juvenile salmonid rearing (Watershed Consulting and Kline Environmental Research 2005). Side channels, springs, and tributary streams were observed during the habitat surveys conducted within the Rock Creek watershed in 2012 as well (Carlson, pers. comm. 2012), although this stream was described as naturally limited for this type of habitat in previous assessments (USFWS 2006). The upstream reaches of the East Fork Bull River have side channels and off-channel rearing areas present (Land and Water Consulting 2001), while the Fisher River watershed has limited amounts of this type of habitat, with much of the backwaters, wetlands, and overflow channels eliminated by the rechannelization that has occurred in the Fisher River (USDA Forest Service 2013a). No other off-channel habitat has been documented in analysis area streams.

Off channel habitat availability was categorized as functioning at risk in almost all streams within the analysis area in the BA (USDA Forest Service 2013a). This parameter was described as functioning appropriately in the East Fork Bull River.

3.6.3.11.10 Refugia/Prime Habitat

Very few areas of high quality (prime) habitat exist in the analysis area due to roads within the riparian areas, past mining practices, and timber harvest in the lower portions of analysis area streams. Surveys have found that many streams do not meet the RMOs for pool frequency, and deep pool habitat that would serve as refugia is generally lacking. Stream reaches in the CMW portion of the analysis area are considered prime habitat. No timber management has occurred on these streams and human impacts are almost non-existent.

Only limited areas of diverse and high quality habitat exist over most of the analysis area in the Libby Creek watershed. Availability of habitat in the tributaries for fish moving from Libby Creek is limited by barriers, particularly in Little Cherry Creek (Kline Environmental Research 2005b). In 2002, the FWP completed stream restoration work on a segment of Libby Creek downstream of the Howard Creek confluence. The goal for this restoration project was to increase habitat quality for salmonids throughout this reach by increasing sinuosity, excavating depositional areas, and installing structures to increase bank protection, bank stabilization, gradient control, and pool habitat. The riparian vegetation was also restored (Dunnigan *et al.* 2003; Kline 2004). Much of this habitat work was destroyed by a rain-on-snow event that occurred in 2006, but the habitat has continued to recover and has remained better than before based on monitoring through 2009 (Dunnigan *et al*. 2011).

A channel restoration project in East Fork Bull River was completed in 2001. About 1,200 feet of the stream were restored by returning a braided channel to a single channel through the construction of rootwad and log revetments (logs anchored against the streambank to buffer stream energy), the placement of large woody debris weirs, and the revegetation of the streambanks and floodplain. The goal of this restoration was to move the channel away from a landslide with the intent of reducing sediment contributions (Avista 2007; FWP 2012). The channel has migrated to the opposite bank, so this section is currently dry. Additional work has been completed upstream of this section that should reduce sediment and improve habitat in the lower reaches of the East Fork Bull River.

The BA categorized the amount of refugia and prime habitat as functioning at unacceptable risk in Libby Creek, and as functioning at risk in Bear Creek, Rock Creek, and the Fisher River (USDA Forest Service 2013a). This parameter was determined to be functioning appropriately in the East Fork Bull River based on the abundant large woody debris and side channel development in this stream.

3.6.3.11.11 Scour Pool Width/Depth Ratio

To be categorized as functioning appropriately, the average wetted width/maximum depth ratio in scour pools within a reach is expected to be ten or less (USFWS 1998). Most measured pools on the lower segments of stream channels in the analysis area are shallow and wide, while pools measured in headwater reaches are narrow and deep. Pools in the mainstems of larger analysis area streams have high peak flows from spring runoff and rain-on-snow events. These high flows coupled with high bedload and the relatively wide floodplains make pool creation and maintenance extremely difficult.

Based on the data collected in 2005 (Watershed Consulting and Kline Environmental Research 2005), the average wetted width to average maximum depth ratio in scour pools within each reach in the Libby Creek watershed ranged from 6.5 to 11.2, with between six and 39 pools measured in each stream. All analysis area streams have ratios less than ten except for Ramsey Creek, indicating that, while pool frequency may be low, pools exist within the Libby Creek watershed in the analysis area of sufficient depth to provide refuge for larger migratory fish and rearing habitat for the young of year fish and sub-adults. The BA characterized scour pool width/depth ratios as functioning at acceptable risk for Libby Creek and Bear Creek (USDA Forest Service 2013a).

For the Fisher River watershed, no data were available for the Fisher River itself, but pools in Miller Creek had average width to average maximum depth ratios that were all 10 or lower, although all pools measured were not specifically scour pools. Habitat surveys conducted in 2012 in the Rock Creek and East Fork Bull River calculated the scour pool average width to maximum depth ratios as ranging from 5.8 in the Rock Creek mainstem to 7.8 in the middle reach surveyed on the East Fork Bull River. These values indicate that pools exist within these watersheds as well that are of sufficient depth to provide refuge for larger migratory fish and rearing habitat for the young of year fish and sub-adults. The width/depth ratios within scour pools were classified as functioning appropriately in the BA in the Fisher River, Rock Creek, and the East Fork Bull River (USDA Forest Service 2013a).

3.6.3.11.12 Streambank Conditions

Portions of Libby Creek and other analysis area streams have been cited as having accelerated bank erosion, altered riparian zones, and reduced high quality habitat for salmonids due to human-caused disturbances such as logging, mining, riparian road construction, and stream channel manipulation (Washington Water Power Company 1996; Dunnigan *et al*. 2004). Habitat restoration projects have focused on improving some of these segments. Additionally, the high spring peak flows and rain-on-snow events that occur within the analysis area have the capacity to destabilize banks, particularly in the larger streams. Based on the inability of the channel to contain peak flows and riparian disturbance, streambank stability within all of the larger streams within the analysis was categorized as functioning at risk in the BA (USDA Forest Service 2013a). The smaller streams are more armored, and less bank instability has been observed.

To be classified as functioning appropriately, 80 percent or more of the length of the streambanks within a reach should be at least 90 percent stable (USFWS 1998). Despite the alterations that have occurred in some areas, habitat surveys conducted from 1998 through 2005 generally found that bank stability was high at many sites, with ratings of 90 to 100 percent stability in almost all stream reaches in the Libby Creek and Fisher River watersheds (Table 64, Table 65, and Table 68) (USDA Forest Service 2005a; Watershed Consulting and Kline Environmental Research 2005). Bank stability was also described as stable in Rock Creek and the East Fork Bull River in surveys completed in 1992 through 1994 (Washington Water Power Company 1996). Percent bank stability in the 2012 survey of three reaches of the East Fork Bull River ranged from 92 to 96 percent (Table 69). The high stabilities reported in these surveys indicate that this should not be a factor limiting available trout habitat, although the riparian disturbance and high peak flows in the analysis area suggest that the stability could be further affected by these factors in the future under current conditions.

3.6.3.11.13 Floodplain Connectivity

Braiding is common throughout the mainstems of Libby Creek, West Fisher Creek, and Fisher River. Braiding occurs in streams with wide floodplains and large amounts of bedload. The bedload is moved during high flows, and can cause channels and associated wetlands to become disconnected from the main channel during low flows. Significant changes in riparian value and function due to channelization, land development, timber harvest, road construction, and mining, have contributed to destabilization of stream channels in the analysis area.

No specific data on floodplain connectivity were available for analysis area streams. Habitat surveys in the Libby Creek watershed stated that the channel capacity for most streams in the analysis area was inadequate or barely contained peak flows, with overbank flooding occurring occasionally or frequently (Kline Environmental Research 2004; USDA Forest Service 2005b). Overbank flooding is considered necessary for maintaining wetland functions, riparian vegetation, and succession (USFWS 1998). Assessing floodplain connectivity in headwater mountain streams is complicated by the fact that they are usually restricted by a narrow, frequently incised mountain valley configuration and may not have a classic "floodplain." The BA characterized floodplain connectivity as functioning at unacceptable risk for Libby Creek and the Fisher River, and functioning at risk for Bear Creek, Rock Creek, and the East Fork Bull River (USDA Forest Service 2013a).

3.6.3.11.14 Change in Peak Flow and Baseflow

Peak streamflows occur annually between April and June, with the highest flows most often occurring in May, then in April. Section 3.11, *Surface Water Hydrology*, discusses peak flow in analysis area streams. Typically, smaller, short-term increases in streamflow occur in October through March due to precipitation and snowmelt events. Libby Creek has a highly variable flow regime, with flooding regularly occurring and resulting in annually high suspended sediment levels and bedload movement (USDA Forest Service 2013a)

As discussed in section 3.11, *Surface Water Hydrology,* few streamflow data from the upper reaches of most analysis area streams draining the CMW are available. Based on the agencies' review of long-term flow data from perennial stream reaches determined to be similar to lower stream reaches of the Montanore Project analysis area, it appears that perennial streams in the area with a baseflow component may flow at baseflow for about 1 to 2 months sometime between mid-July to early October. The stream hydrographs indicate that periods of baseflow also may occur during November through March, but these baseflow periods were not included in the baseflow estimate of 1 to 2 months.

Since the turn of the century, timber harvest, road construction, mining, and human development have changed watershed character and, as a result, the watershed's response to weather events. Various stream reaches have become intermittent in nature due in part to the large depositions of bedload, channel braiding, and widening, including reaches of Little Cherry Creek, Poorman Creek, Rock Creek, West Fork Rock Creek, and West Fisher Creek (Kline Environmental Services 2005b; Salmon Environmental Services 2012; USDA Forest Service 2013a). While many of the analysis area streams naturally have high peak flows during spring snow melt and rain-on-snow events, these past human activities may be intensifying the damage to these streams caused by peak flows. In addition, the current adit dewatering has likely resulted in a reduction in Libby Creek baseflow, but the effect is not detected because either the reduction is very small and/or there are insufficient baseline data (before the adit was constructed) for comparison to current conditions. The range of measured minimum and maximum streamflows is provided in Table 104. This parameter was categorized as functioning at unacceptable risk in Libby Creek, Bear Creek, Rock Creek, and the Fisher River due to these factors, and was categorized as functioning at risk in East Fork Bull River (USDA Forest Service 2013a).

3.6.3.11.15 Increase in Drainage Network

Drainage network refers to the network of streams within the watershed. This parameter accounts for any increases in active channel length that are correlated with human caused disturbances, with zero to minimum increases considered to be functioning appropriately (USFWS 1998). There are no direct measurements of an increase in drainage network for analysis area streams.

Human-caused disturbances including riparian road construction and stream channel manipulation have been cited as causing accelerated bank erosion, altered riparian zones, and reduced high quality habitat for salmonids within some segments of analysis area streams (Washington Water Power Company 1996; Dunnigan *et al.* 2004). These data indicate that there has likely been an increase in the drainage network within the analysis area. Additionally, road densities in the Libby Creek and West Fisher Creek drainages are considered high, suggesting that increases in channel length to accommodate for construction of such roads has likely occurred in these watersheds to some extent. Road systems run parallel to or traverse every major tributary and the mainstems of Libby Creek and West Fisher Creek. Many of these roads have been in place for decades, having been constructed for access to mining locations in the late 1800s and early 1900s. Based on the limited data available, the drainage network was rated as functioning at unacceptable risk or functioning at risk for all of the larger analysis area streams (USDA Forest Service 2013a).

3.6.3.11.16 Road Network

Roads and trails run parallel to most of the length of Libby Creek, Miller Creek, West Fisher Creek, the Fisher River, East Fork Rock Creek, East Fork Bull River, and their major tributaries. Many of these roads were constructed within the RHCAs. Some of these roads were originally constructed in the early 1900s to low standards and maintained infrequently. Impacts on streams associated with these roads include increased sedimentation, water routing down ditch lines, road stream crossing failures, hill side slumping, and removal of riparian vegetation due to road construction. Libby Creek, Bear Creek, and the Fisher River were categorized as functioning at unacceptable risk for this parameter in the BA, while the East Fork Bull River and Rock Creek were categorized as functioning at risk (USDA Forest Service 2013a).

3.6.3.11.17 Riparian Habitat Conservation Areas

Timber harvest, mining, livestock grazing, road construction, and other human-caused disturbances have altered the riparian zones in some areas of the Libby Creek, Rock Creek, East Fork Bull River, and Fisher River watersheds. Roads have been constructed within the RHCAs throughout the analysis area watersheds. RHCAs are shown in Figure 53. The BA classified this parameter as functioning at unacceptable risk within Libby Creek and the Fisher River, and functioning at risk for Bear Creek, Rock Creek, and the East Fork Bull River (USDA Forest Service 2013a).

3.6.3.11.18 Disturbance History and Regime

Disturbance regime refers to any natural disturbances that were present historically in the analysis area. Natural disturbance regimes are highly variable in analysis area drainages, and include large fluctuations in runoff, such as rain-on-snow events and high peak flows during snow melt. Catastrophic disturbances are common within analysis area streams, including flood events, high bedload movement and deposition, channel braiding, and mass wasting. Analysis area streams are subject to periodic rain-on-snow floods. Windstorms resulting in blowdown have been minor and are generally associated with clearcutting activities. A large portion of the analysis area burned in 1889 and 1910; no major wildfires in the analysis area have occurred in several decades. The disturbance regime was categorized as functioning at unacceptable risk in Libby Creek and Fisher River, and as functioning at risk in Bear Creek, East Fork Rock Creek, and the East Fork Bull River (USDA Forest Service 2013a).

3.6.3.12 Integration of Species and Habitat Conditions

The quality of the bull trout habitat throughout the analysis area, especially in the larger tributaries, has been compromised by land development (particularly lower in the Libby Creek drainage), mining, and road construction in riparian areas along the mainstem of the streams. Natural disturbance has also occurred over the past 20 years and has included natural fires, large windstorms, 100-year flows, and rain-on-snow events. Impacts on stream channels and fish habitat have increased and include mass wasting, road culvert and bridge blowouts, bedload deposition, channel aggradation (buildup of bedload) and degradation (down cutting), and flooding. Historical data on bull trout abundance and distribution are fairly limited because, until recently, the major emphasis was on eliminating bull trout from local streams. Bull trout were viewed by some as undesirable as they prey upon small species of desirable sport fish.

The bull trout population in the Libby Creek drainage within the analysis area is currently at risk from the threat of hybridization and competition with the non-native brook trout moving into the area. Areas of high quality trout habitat in the Libby Creek watershed are limited. Bull trout have been routinely observed within the analysis area, but they persist only at low densities in the mainstem and most tributaries. Data on Bear Creek indicate stable or increasing bull trout populations are present in this tributary. The BA categorized the integration of species and habitat conditions as functioning at unacceptable risk in Libby Creek, and functioning at risk for Bear Creek, with most of the habitat factors resulting in the risk categorization in Bear Creek occurring in the downstream reach of this stream (USDA Forest Service 2013a).

Bull trout are found in higher densities in the Rock Creek and East Fork Bull River drainages, but, as with the Libby Creek population, they are at risk from hybridization and competition with brook trout. Brown trout are also present in the East Fork Bull River drainage, and while they present no risk of hybridization with bull trout, they can pose a risk to the bull trout population through competition for resources. Non-native suppression has been initiated to lessen this threat (Moran and Storaasli 2008). Logging, grazing, and wildfires have affected significant portions of the riparian zones in these streams (Washington Water Power Company 1996). Additionally, intermittent flows occur in some reaches of the Rock Creek drainage, limiting access for migratory bull trout, although it also limits access for nonnative fish. The integration of species and habitat conditions presented in the BA classified Rock Creek as functioning at unacceptable risk and the East Fork Bull River as functioning at risk (USDA Forest Service 2013a).

The Fisher River is a migratory corridor for populations of bull trout. Bull trout habitat quality within this stream is limited, with extensive amounts of road construction and other activities occurring in the riparian area of some reaches. Thermal barriers to upstream migration also exist in this watershed. West Fisher Creek is a priority watershed. Bull trout occur in the stream but are at risk from competition for resources. This stream was classified as functioning at unacceptable risk based on the integration of species and habitat conditions (USDA Forest Service 2013a). The two segments of designated critical habitat on West Fisher Creek have adequate habitat to support bull trout through these reaches.

Redband trout habitat has been similarly influenced by past mining efforts and other disturbances, but the largest threat to the redband trout is hybridization with introduced rainbow trout and native westslope cutthroat trout. Based on results from genetic analyses conducted in 1991 through 2009 (FWP 2012), most of the redband trout population within the Libby Creek watershed is at least slightly hybridized, with pure populations existing in small tributaries where barriers are thought to isolate them from mainstem populations. While they have been observed regularly within all the analysis area streams within the Libby Creek watershed, redband trout are found at relatively low densities.

Redband trout are not found in the Rock Creek or East Fork Bull River watersheds, but pure redband trout are found in the Fisher River drainage, including West Fisher Creek. As with the Libby Creek watershed, these fish are at risk from hybridization because the trout in the segment of the Fisher River downstream of the analysis area and in some of the tributaries are hybridized.

In the analysis area, pure westslope cutthroat trout are known to be present in the Rock Creek and East Fork Bull River watersheds and Miller Creek. In the Libby Creek drainage, westslope cutthroat trout are hybridized. As with redband trout, all populations are mainly at risk from hybridization and competition with introduced trout species. In East Fork Rock Creek, hybridization with rainbow trout and Yellowstone cutthroat trout is occurring in the upstream reaches, and no barriers have been identified that would protect the remaining genetically pure trout from these trout moving downstream. While the most recent genetic analysis in 2004 indicated that the westslope cutthroat population in the East Fork Bull River is pure, population surveys conducted in 2002, 2009, and 2011 reported hybrids were present. These fish were likely visually identified since no results of genetic analyses were presented. No barriers to protect these trout from hybridization have been observed. Westslope cutthroat trout densities are higher in these west side watersheds than bull trout densities, indicating that the westslope cutthroat trout population is less at risk of extirpation in these streams.

As discussed previously, while torrent sculpin are thought to inhabit analysis area streams, little data were available to determine the status and distribution of this species within the analysis area, possibly because of the difficulty in differentiating this species from slimy sculpin morphologically. Based on this, determining the current risks to the populations within the watershed is not feasible.

3.6.3.13 Climate Change

Changes in temperature and precipitation have occurred in Pacific Northwest and are likely to continue to occur in the future (Reclamation 2011a). Such changes are discussed under *Groundwater Hydrology* (section 3.10.3, *Affected Environment,* and section 3.10.4, *Environmental Consequences*), *Surface Water Hydrology* (section 3.11.3, *Affected Environment,* and section 3.11.4, *Environmental Consequences*), and *Water Quality* (section 3.13.3, *Affected Environment,* and section 3.13.4, *Environmental Consequences*). Weather data from the western United States have generally demonstrated a warming pattern, with the most consistent trends in streamflows observed being lower summer flows and shifts in the timing of spring runoff (Reclamation 2011c, Isaak *et al.* 2012). Precipitation is projected to remain relatively static during the early 21st century and then slightly increase during the last half of the 21st century (Reclamation 2011a). Much of the predicted effect on aquatic life is attributed to increased air temperatures that may result in increased stream and lake temperatures (Reclamation 2011c).

Climate change in northwest Montana has the potential to impact aquatic resources through rising stream temperatures, decreased summer streamflows, decreased snowpack, shifts in the timing of the runoff period, increased wildfire disturbance, and increased frequency of heavy precipitation events, including rain-on-snow events (US Global Change Research Program 2009; Herbst and Cooper 2010; USDA Forest Service 2010a; Wenger *et al*. 2011; Isaak *et al*. 2012). Drought periods could become more frequent or persist for longer time periods. Warmer stream temperatures and changes in flow regimes would directly affect some cold water fish species, including bull trout, cutthroat trout, and other salmonids, by contracting and shifting the range of habitat suitable for such fish and increasing the risk of egg scour. Wenger *et al*. (2011) used a hydrological model to predict the effects of changes in the flow regime and stream temperatures resulting from climate change on cutthroat trout, brook trout, brown trout, and rainbow trout. These species were predicted to lose between 35 and 77 percent of their current habitat due to increased temperatures beyond the species' thermal limits, negative biotic interactions, and increases in winter flood frequency. Rieman *et al*. (2007) predicted that climate warming could result in 18 to 92 percent loss of thermally suitable habitat for bull trout.

Effects on macroinvertebrate assemblages from climate change have been documented, but are not always consistent. Observed response of these communities are often specific to species, taxa with certain traits, or those that inhabit certain areas within the stream (Burgmer *et al*. 2007; Chessman 2009; Lawrence *et al*. 2010; Poff *et al*. 2010; Domisch *et al*. 2011; Sheldon 2012). For example, Sheldon (2012) focused on potential effects of increasing temperatures on stoneflies in the southern Appalachians, and observed strong and consistent evidence for a shift in distribution of one common stonefly species, although data for the second stonefly species was inconclusive based on confounding factors such as detectability and landscape change. A study of streams in Australia over a 13-year period determined that invertebrate families that favored cold water and faster flowing water were more likely to show a decline over this time period in comparison to those that favored warmer, slower water (Chessman 2009). Domisch *et al*. (2011) modeled impacts of climate change on almost 40 macroinvertebrate species, and predicted that significant declines in the abundance and distributions would be particularly noticeable for species that inhabit headwater reaches, which are often dominated by taxa that favor colder stream temperatures and faster flowing water.

The Intergovernmental Panel on Climate Change (2007) determined that changes in temperature and precipitation have occurred in northwest Montana and are likely to continue to occur in the future. Weather data from the western United States have generally demonstrated a warming pattern, with the most consistent trends in stream flows observed being lower summer flows and shifts in the timing of spring runoff (Isaak *et al*. 2012). Within regions and across species, the effects of these trends are anticipated to differ among streams and populations (USDA Forest Service 2010a). Additionally, many studies have not been conducted over sufficient time periods or diverse locations to determine the outcome of small, incremental changes on fish and invertebrate populations, and the complex responses of aquatic organisms to such changes is further confounded by changes in land use (Barbour *et al*. 2010; USDA Forest Service 2010a; Isaak *et al*. 2012). Predictions of the loss of trout habitat associated with climate change in the studies discussed ranged from 18 percent to 92 percent over a range of locations, and the hydrological models used for such predications were noted to be limited in terms of fine scale resolution and the ability to account for all possible factors (Rieman *et al*. 2007; Wenger *et al*. 2011). Because long-term data are not available for northwestern Montana streams, the magnitude and extent of the effects of climatic and hydrologic trends on fish and other aquatic organisms and their habitat are unclear (USDA Forest Service 2010a).

3.6.4 Environmental Consequences

3.6.4.1 Alternative 1 – No Mine

In this alternative, MMC would not develop the Montanore Project. Any existing exploration-related or baseline collection disturbances by MMC would be reclaimed in accordance with existing laws and permits. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System land.

Without mine development, aquatic populations and stream habitat would remain unchanged from existing conditions. Productivity of fish and other aquatic life in analysis area streams would continue to be limited by past natural and human-caused adverse habitat changes, by naturally low nutrient concentrations, and by natural habitat limitations from climatic and geologic influences.

Bull trout populations would continue to be marginal and the habitat in need of restoration work. They would be susceptible to decline or disappearance due to hybridization with introduced salmonids, competition with brook trout and other trout present in the analysis area, or from land use disturbances. Redband trout and westslope cutthroat trout also would continue to be subject to population declines, mainly due to the threat of hybridization from introductions of non-native salmonids. Limited data are available on the status of the torrent sculpin within the analysis area to predict what trends would occur in these populations under existing conditions. Improvements in habitat quality and productivity due to natural processes over time would potentially be adversely affected by the cumulative effects of continued forestry activities. Past, current, and future placer mining, continued recreational use, and other reasonably foreseeable actions would continue to affect fish populations.

3.6.4.2 Alternative 2 – MMC's Proposed Mine

Development of the Montanore Project would require construction of project facilities, including a mill, tailings impoundment, adits, access roads, and transmission lines. For Alternative 2, MMC's proposal, the mill and mine production adits would be located in the upper Ramsey Creek drainage, about 0.5 miles from the CMW boundary. An additional existing adit on private land held by MMC in the upper Libby Creek drainage and an adit on MMC's private land east of Rock Lake would be used for ventilation. The proposed Rock Lake Ventilation Adit would be on a steep, rocky slope about 800 feet east of and 600 feet higher than Rock Lake. Because the total disturbance area for this adit would be small (about 1 acre), any effects would be minor and are not discussed further. A tailings impoundment would be constructed in the Little Cherry Creek drainage, and would require the diversion of Little Cherry Creek. Two LAD Areas between Poorman Creek and Ramsey Creek would be used for discharge of water through land application.

Potential impacts on fish and other aquatic life in the Libby Creek, Rock Creek, and East Fork Bull River drainages from the various proposed alternatives for the Montanore Project can be grouped under six general categories: changes in sediment delivery, changes in water quantity, changes in water quality (nutrient concentrations, metal concentrations, and stream temperature), changes in toxic metal concentrations in fish tissues, effects on fish passage, and effects on threatened, endangered or sensitive species. These effects will be addressed individually for each alternative.

3.6.4.2.1 Sediment

Evaluation, Construction, and Operations Phases

Streams

Section 3.13.4 in the *Water Quality* section discusses anticipated effects of the alternatives on sediment delivery to analysis area streams. This discussion was used to qualitatively assess the effects of any predicted increases in sediment on aquatic life and aquatic habitat. Sediment increases to streams from the mine facilities would most likely occur during the Construction Phase of the mine, when trees, vegetation, or soils were removed from many locations for mine facilities, roads, and the transmission line. Increases in sediment delivery to Libby Creek may also occur during this phase via the two channels that would be used to divert water around the Little Cherry Creek impoundment. These channels would likely transport higher loads of sediment temporarily into Libby Creek until they stabilize under their new flow regime, particularly when heavy precipitation events occurred. Additionally, as part of Alternative 2, one of the fisheries mitigation projects proposed by MMC would be to conduct a sediment-source inventory in the watershed, and stabilize, recontour, and revegetate priority source areas, which are typically roadcuts in Libby, Hoodoo, Poorman, Midas, and Crazyman creeks. If implemented, this project would reduce the contribution of sediment from priority source areas to the Libby Creek watershed. Because specific priority source areas have not been identified, the effects of the mitigation were not quantified.

Road construction and reconstruction is often considered the largest source of sediment in mining and timber harvest areas due to the removal of vegetation and construction of cut and fill slopes that expose large areas subject to erosion (Belt *et al.* 1992). The potential for sediment increases to occur from Alternative 2 would mainly exist in analysis area streams within the Libby Creek watershed. The total disturbance area within the Rock Creek drainage (for the ventilation adit) would be small (less than 1 acre. The potential for any increase in sediment delivery to the Rock Creek drainage from these activities is minimal. No surface disturbances would occur in the East Fork Bull River drainage.

Alternative 2 would disturb 266 acres within Riparian Habitat Conservation Areas (RHCAs) on National Forest System land; 152 acres of other riparian areas on private land would be disturbed (Table 74). Portions of LAD Area 2, the tailings impoundment, the Ramsey Plant Site, and the Libby Adit would be within RHCAs or riparian areas on private land under this alternative (Figure 53). Roads would be constructed or reconstructed within the RHCAs of Little Cherry, Libby, Bear, Poorman, and Ramsey creeks, as well as other unnamed tributaries. Adverse direct effects on fish habitat could occur where roads and facilities were constructed in RHCAs and particularly where roads crossed streams, but the design features and BMPs to be implemented under Alternative 2 would minimize such effects (MMI 2006). Most of the roads planned for reconstruction are existing roads that cross a RHCA only at a stream crossing, but segments of existing roads parallel the RHCAs along Ramsey and Libby creeks. Any new or altered culverts and bridges at stream crossings would be designed to avoid stream flow constriction and streambed scouring. New bridges that would cross Poorman Creek and Ramsey Creek are proposed.

Table 74. RHCAs and Other Riparian Areas within Mine Disturbance Areas.

Ownership of Riparian Area	Alternative 2 – MMC's Proposed Mine	Alternative 3 – Agency Mitigated Poorman Impoundment Alternative	Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative
RHCAs on National Forest System land	266	256	236
Other riparian areas on private land	152	9	147
Total	418	265	383

All units are acres.
RHCAs are found only on National Forest System land.
Source: GIS analysis by ERO Resources Corp. using KNF data.

In addition to the potential for sediment increases from roads and mine facility construction, short-term increases in sediment delivery to streams would also be generated when sediment traps or ponds designed to hold runoff from a 10-year/24-hour storm event at the plant facilities and adits overflowed during larger storm events. The seepage pond associated with the tailings impoundment on Little Cherry Creek would be designed to accommodate a larger 100-year/24-hour storm event. Overflows from the sediment ponds and traps associated with plant facilities and adits would be directed into Ramsey and Poorman creeks, while overflows associated with the seepage pond would be directed into Little Cherry Creek. Such overflows would occur only during high flow events when sediment delivery to streams would already be naturally elevated. Based on this, distinguishing the additional sediment input from any overflows that occurred from existing conditions may not be feasible. Sediment from such overflows would be deposited into flood plains or low gradient stream reaches, or would be carried to the Kootenai River.

The KNF's analysis of sediment erosion from roads to streams (KNF 2013) indicates that 79 tons of sediment would be generated during the project in the combined Evaluation, Construction, and Operations Phases under Alternative 2 with BMPs (Table 125, p. 693). This would be a 52 percent decrease from the 163.5 tons of sediment estimated to be produced under existing conditions without the project over the same time frame. The highest percentage of reductions would occur in the Construction Phase. The reductions in road-related sediment delivery would be greatest in the Bear Creek, Big Cherry Creek, Getner Creek (a Libby Creek tributary), Ramsey Creek, and Little Cherry Creek watersheds (KNF 2013).

While substantially less sediment is predicted to be delivered overall to analysis area streams from roads under the alternatives than under existing conditions, temporary increases in sediment input would occur at some locations. Any sedimentation that were to occur from roads, sediment pond overflows, or other sources would have the potential to alter aquatic habitat by decreasing pool depth and habitat complexity, changing substrate composition by filling in interstitial spaces, and increasing substrate embeddedness (Rieman and McIntyre 1993; Waters 1995). These changes to stream habitat can affect salmonid reproductive success by degrading and decreasing spawning and rearing habitat, and by increasing egg and juvenile mortality (Shepard *et al.* 1984; Fraley and Shepard 1989; Weaver and Fraley 1991; Waters 1995; Watson and Hillman 1997; Montana Bull Trout Scientific Group 1998; Muck 2010). Optimal bull trout spawning and rearing areas should have less than 20 percent of the substrate consisting of fine particles of 6 mm or less for the habitat to be functioning appropriately (USFWS 1998), and less than 30 percent fines (<6.35 mm) has been reported to be necessary for successful bull trout incubation (Parametrix 2005). Behavioral effects can also result from increased suspended or deposited sediment as fish may avoid stream reaches with high sediment levels, or their migration, foraging, or predation behaviors may be altered, resulting in population declines or mortality over time (Muck 2010).

Benthic macroinvertebrate communities can be affected by increases in fine sediment, with decreases in abundance, taxa richness, EPT taxa richness, and diversity observed as fine sediment increases and substrate suitability for many taxa decreases (Angradi 1999; Kaller and Hartman 2004; Harrison *et al*. 2007; Larsen *et al*. 2009; Bryce *et al*. 2010). Changes in invertebrate metrics were associated with percent fine sediment increases as low as less than 5 percent to 30 percent of the substrate composition. A reduction in macroinvertebrate abundance or changes in the composition of the macroinvertebrate population can also indirectly have deleterious effects on fish populations by causing slower growth rates, higher mortality, and reduced fecundity (Berkman and Rabeni 1987; Waters 1995; USFWS 2003a; Muck 2010). Large increases in suspended sediment can directly result in mortality of fish and invertebrates by clogging gills and causing respiratory impairment (Muck 2010).

The existing levels of fine sediment in spawning areas in analysis area streams within the Libby Creek watershed were measured one or more times per year in 2005 through 2008. The mean percent fines (described in the report as fines less than 6.25 mm or 0.25 inches) in gravel at each site within the Libby Creek watershed ranged from 15 percent at the lowest Libby Creek site to 39 percent at the most upstream Little Cherry Creek site in 2005 (Table 67) (Kline Environmental Research 2005). Surveys conducted in 2006 through 2008 indicated that the percent fines in low gradient riffle areas in the Libby Creek watershed were generally less than 10 percent at most sites, although the reach of Libby Creek upstream of the falls and the Little Cherry Creek reach had higher percentages during some surveys (Kline Environmental Research 2009). Fines at the Little Cherry Creek site were elevated up to 95 percent in 2008, potentially due to logging activity within the area. These data indicate that most surveyed stream reaches currently have levels below the 30 percent fine sediment threshold (Parametrix 2005), which begins to substantially decrease successful bull trout incubation.

While no level of sedimentation has been determined to have no effect on aquatic populations, it is anticipated that the levels of sediment generated through Alternative 2 would be small in volume and duration based on implementation of the BMPs and design features of the mine facilities, as well as the natural flow regime in the analysis area. Any introduction of limited amounts of additional small gravels and fine sediment from construction or operation of the mine would likely have few if any effects on macroinvertebrate and fish populations, as annual snowmelt runoff would likely flush any accumulation of fine sediments downstream each spring. While some short-term effects to aquatic populations are possible under this and other alternatives, the BMPs are predicted to decrease long-term sediment delivery substantially over existing conditions, resulting in long-term benefits to fish and invertebrate populations. These factors make it unlikely that effects from the alternatives would result in detectable adverse changes in existing levels of sediment, quality of fish habitat, or sustainability of aquatic populations over the long-term. Effects would only be larger if required BMPs did not have the anticipated result of eliminating or reducing the existing sediment input into analysis area streams or if the Little Cherry Creek impoundment or tailings line were to fail.

A failure modes effects analysis completed for the Little Cherry Creek impoundment estimated catastrophic failure as having a 0.1 to 1 percent chance of occurrence (Klohn Crippen 2005). The risk of failure of the tailings pipeline is also small, with proposed containment structures in place at the Ramsey Creek and Poorman Creek stream crossings where such an occurrence would pose the greatest risk. If such a failure occurred, the greatest effect to aquatic life would result from the large masses of sediment that would flow to Little Cherry Creek, Poorman Creek, Ramsey Creek, or Libby Creek, and from there into the Kootenai River. Dependent on the magnitude and duration, such a failure could cause substantial alterations to the stream channel and aquatic life habitat, and could cause extensive adverse impacts on bull trout and other aquatic life populations. Portions of this sediment mass likely would remain within the Libby Creek channel for an undefined period following the failure, while the rest would be carried downstream to the Kootenai River. The amount of sediment transported into area streams and the effect on aquatic life would depend on the volume of water associated with the failure, and the initial volume and character of the sediments. The effect could be substantial, and result in a large-scale loss of aquatic populations (Klohn Crippen Berger 2009).

The long-term decreases in sediment in some locations during the Evaluation, Construction, and Operations Phases would likely benefit the aquatic habitat and assemblages to a greater extent than they would be adversely affected by the short-term increases to some streams. Less sediment delivery to streams would improve spawning success for trout and would benefit the both fish and macroinvertebrate populations by providing higher quality habitat in terms of substrate composition. Additionally, as part of Alternative 2, one of the fisheries mitigation projects proposed by MMC would be to conduct a sediment-source inventory in the watershed, and stabilize, recontour, and revegetate priority source areas, which are typically roadcuts in Libby, Hoodoo, Poorman, Midas, and Crazyman creeks. If implemented, this project would reduce the contribution of sediment from priority source areas to the Libby Creek watershed. Because specific priority source areas have not been identified, the effects of the mitigation were not quantified. The two road closures proposed in Alternative 2 for grizzly bear mitigation would not reduce sediment reaching streams because they are not available for closure.

Sediment (as percent fines) would be monitored within the Libby Creek drainage to detect any potential sediment increases. Sediment sampling would occur at a station on Libby Creek downstream of the Little Cherry Creek confluence. Sampling would occur daily during the Construction Phase, as most potential increases in sedimentation is expected to occur then. During initial mine operations, sampling would occur on alternate days, and frequency would then be reduced to once per week for the remainder of the Operation and Closure phases. Based on the sampling schedule, any increases in sediment within the Libby Creek system would be detected quickly, allowing for prompt action and remediation.

Lakes

No sediment increases are projected for analysis area lakes during construction or operation of the mine because no mine facilities or activities would be located near any of the lakes.

Closure and Post-Closure Phases

Streams

The potential for increased sedimentation in streams during the Closure and Post-Closure phases would be small and the effects on aquatic habitat and populations would be minimal in most analysis area streams. MMC would remove facility structures and reslope and revegetate disturbed areas. Revegetation would reduce erosion potential by providing a stabilizing cover, and BMPs would be used until vegetation has been established to minimize sediment movement to streams.

The KNF's estimate of sediment delivery to analysis area streams in the Closure and Post-Closure phases under Alternative 2 with the BMPs implemented is 25.6 tons, compared to 32.7 tons under existing conditions, a 22 percent decrease in road-related sediment delivery to streams in these two phases. The total sediment delivery to these streams under Alternative 2 was estimated to be 91.6 tons over all phases with BMPs, which would be a decrease of 47 percent from existing conditions (Table 125, p. 693). Based on this, aquatic habitat would improve in the long-term, and aquatic populations within these streams would benefit.

The Little Cherry Creek tailings impoundment is expected to be reclaimed incrementally to minimize potential long-term erosion and maximize tailings dam stability. Surface runoff from the tailings impoundment would be directed toward Bear Creek, and may cause some increases in stream sedimentation during construction of the check dam and diversion channel. The check dam would be sized to hold flows from a 100-year storm event, and the channel would be designed to minimize sediment delivery. Any stream sedimentation that occurs would have a short-term adverse effect on fish and invertebrate populations due to increased sediment in the water column. An increase in fine sediment would alter substrate composition and increase substrate embeddedness, and may affect fish and macroinvertebrate habitat as previously discussed. These increases would be temporary, with most of the sediment flushed out of the system during high flow events, such as during snowmelt runoff or rain-on-snow events.

Lakes

No sediment increases are projected for analysis area lakes after the completion of mining. No mine closure activities would be located near any of the lakes.

3.6.4.2.2 Water Quantity

The agencies' analysis of streamflow effects is described in section 3.11, *Surface Water Hydrology.* This section discusses streamflow effects on aquatic life. The agencies used the facilities and mitigation in the agencies' preferred alternative, Alternative 3, to model changes in streamflow. Therefore, the quantitative portion of the evaluation of effects on aquatic life was also specific to this alternative, and is based on the impact analysis included in the BA conducted (USDA Forest Service 2013a). This analysis estimated the maximum effects that would occur to bull trout passage and habitat availability in Alternative 3 as a result of the changes to low flows from the project (Table 76) (USDA Forest Service 2013a). The effects on other aquatic populations are also discussed. Further details about the data and analyses used are provided in the BA.

As the quantitative portion of the impact analysis for effects on aquatic life from changes in streamflows was based on effects in Alternative 3, effects from Alternatives 2 and 4 used the results from this analysis as a guideline, but were assessed qualitatively. Without mitigation, the effects on west side streams (East Fork Rock Creek and East Fork Bull River) would be the same for Alternatives 2 and 4 as Alternative 3. The effects on east side streams would be similar between all alternatives, but would differ in some streams based on facility locations and other factors.

Evaluation, Construction, and Operations Phases

East Side Streams

Effects to streamflow during the low flow period of the year in Alternative 2 for east side streams, would be similar to effects in Alternative 3 during the Evaluation, Construction, and Operations phases (Table 108, p. 626 and Table 110, p. 630). The resulting effects predicted to occur from these streamflow changes on aquatic life are discussed in more detail under Alternative 3, but are summarized below, with differences between Alternatives 2 and 3 emphasized.

In Alternative 2, discharges of treated wastewater from the LAD Areas or the Water Treatment Plant would occur in all phases and would result in increased flow in portions of the Libby Creek watershed. The increased flow would potentially provide more thermal refuge areas as well as deeper pool areas during the low flow period of the year that could benefit fish populations. When the LAD Areas were in use, these discharges would be less than those under Alternative 3 as much of the water discharged to the LAD Areas would evapotranspire. Water that percolated to groundwater would flow to Ramsey, Poorman, and Libby Creeks, and increase flows in those streams downstream of the LAD Areas. These discharges would partially offset the decreases predicted to occur in Libby, Ramsey and Poorman creeks from mine inflows, which would be greatest at the end of the Operations Phase. Low flows in Ramsey Creek at RA-600 and in Poorman Creek at PM-1200 were estimated to decrease by 2 and 12 percent, respectively, in Alternative 3 (Table 110), and decreases would be similar in magnitude to Alternative 2. The magnitude of these decreases suggests that aquatic habitat in Ramsey Creek would be minimally affected, while habitat availability would likely decrease more in Poorman Creek. MMC did not propose to discharge treated water to Libby Creek to prevent adverse effects on senior water rights in Alternative 2 as was included in the other Alternatives.

Effects on low flows in Libby Creek upstream of the Water Treatment Plant at LB-300, a reach used by the resident bull trout population, would be slightly less than in Alternative 3, while effects on Ramsey Creek low flows would be slightly greater. These effects differ from those in Alternative 3 due to differences in the locations of the adits. Decreased streamflow, especially under low flow conditions, would decrease available salmonid habitat.

Peak flows in Ramsey Creek would increase by 8 percent as a result of timber clearing for the mine facilities. Peak flows and average annual flows in Libby Creek at LB-300 would increase by 5 percent or less. These changes in peak flows are within the error of peak flow measurement, as discussed in more detail in section 3.11, *Surface Water Hydrology*, and would be unlikely to adversely affect aquatic habitat.

Alternative 2 would adversely affect fish habitat in Little Cherry Creek due to the construction of the tailings impoundment and Diversion Channel. The impoundment would remove about 15,600 feet of fish habitat in the existing Little Cherry Creek from the Diversion Dam to the mouth of the former Little Cherry Creek. The agencies anticipate that the engineered Diversion Channel would not provide any fish habitat, while Drainages 10 and 5, which have intermittent flows under existing conditions, would eventually provide marginal fish habitat. The time frame over which this habitat would develop is uncertain, but changes in various habitat parameters would continue to occur within these drainages for many years following the diversion. Flow in the original Little Cherry Creek downstream of the tailings impoundment would be substantially reduced, as only 13 percent of the watershed would continue to contribute to this stream channel.

Alternative 2 would result in an irreversible loss of genetic diversity from the redband trout found in Little Cherry Creek if proposed efforts to collect and transfer fish from the affected segment of Little Cherry Creek to the diversion drainage were not entirely successful or if flow was not adequate to support the population. Hybridization of the pure redband trout population in Little Cherry Creek may occur in Alternative 2 if barriers predicted to develop did not develop in the diversion drainage and the redband trout came in contact with non-native trout in the Libby Creek drainage.

Flows would not be affected in Bear Creek during the Evaluation and Construction Phases. During operations, streamflow would be reduced in this stream by the pumpback well system and interception of surface runoff. The change in streamflow was not quantified. Aquatic habitat in lower Bear Creek would be reduced, which could adversely affect salmonid populations.

West Side Streams

The effect on streamflows and aquatic habitat in west side streams would be the same as Alternative 3 without mitigation, and are discussed in more detail in section 3.6.4.3.2, *Water Quantity*. Streamflow reductions during the low flow period of the year would either not occur or be minimal in East Fork Rock Creek, Rock Creek, and East Fork Bull River during the Evaluation and Construction Phases and would not likely affect aquatic habitat. During the Operations Phase, the effect would be larger, with the greatest effect occurring at the end of mining operations in the upstream reaches of East Fork Rock Creek. Trout habitat would be reduced during low flows. This habitat loss would be detrimental to the resident westslope cutthroat trout populations in the higher elevations of East Fork Rock Creek. Given the minimal decrease in low flow (≤ 1.0 percent) predicted for RC-3 near the West Fork confluence and for the mainstem of Rock Creek near the mouth for Evaluation through Operations Phases (Table 108, Table 109, and Table 110, pp. 626-630), trout habitat in the downstream portion of East Fork Rock Creek and the mainstem of Rock Creek would not be substantially affected. Decreases in flow may exacerbate intermittent flows near the mouth, restricting movement of migratory and resident fish.

No effects to low flows are predicted to occur within the East Fork Bull River during the Evaluation and Construction Phases (Table 108). The slight reduction in streamflow in this stream during the Operations Phase would not be likely to substantially affect aquatic habitat in the river either within or outside of the CMW.

Lakes

Changes in Rock Lake and St. Paul Lake levels would be negligible during the Evaluation, Construction, and Operations phases and any effect on aquatic life would be minimal.

Closure and Post-Closure Phases

East Side Streams

Most effects to aquatic habitat and populations for east side stream during the Closure and Post-Closure phases would be similar to those discussed for Alternative 3 without mitigation. In Libby

Creek, discharges for the Water Treatment Plant and LAD Areas would increase streamflow and offset the effects of the pumpback wells in lower Libby Creek. The higher flows below the Water Treatment Plant discharge point would benefit aquatic habitat in Libby Creek within this reach and for some distance downstream, but to a lesser extent than in Alternative 3 based on use of the LAD Areas. Less of an increase in flows would occur in the Post-Closure Phase compared to the Closure Phase. Farther downstream in Libby Creek near LC-2000 and the confluence of Bear Creek, streamflow and aquatic habitat would not be affected by activities in the Closure and Post-Closure Phases. The effects of reduced baseflow in the reach of Libby Creek upstream of LC-300 would be greater than in the Operations Phase, but would be slightly less than in Alternative 3. After the pumpback well system ceased operations, discharges were discontinued, and the groundwater table reached steady state conditions, streamflow in Libby Creek would return to pre-mine conditions.

In Poorman and Ramsey creeks, changes in streamflow would be minor and would likely not impact aquatic life in these phases. When groundwater levels in the mine area reached steady state conditions, streamflow in Ramsey and Poorman creeks would return to pre-mine conditions. The increase in peak flows predicted to occur in Ramsey Creek as a result of timber clearing would be less in the Closure Phase.

The tailings impoundment and Diversion Channel on Little Cherry Creek would remain in place. Flow in the diverted Little Cherry Creek channel would be about one-half the flow in the original channel. The pumpback well system would potentially eliminate flow in the Diversion Channel and Drainage 10 as long as it operated. At most, marginal fisheries habitat would be exist to support fish populations.

The watershed area of the former (original) Little Cherry Creek channel would be about one-fourth of the original watershed area. The pumpback well system would reduce flow in the former Little Cherry Creek channel as long as it operated. Any surface water flow below the tailings impoundment entering the former lower Little Cherry Creek channel would not support a viable fish population and redband trout populations would continue to be impacted as in the Operations Phase.

Runoff from the impoundment surface would be directed toward Bear Creek in to a riprapped channel post-mining. Downstream of where runoff flowed into Bear Creek, average annual streamflow would increase as a result of the increase in watershed area, and would benefit fish habitat.

West Side Streams

The effect on streamflows in west side streams would increase from the Operations Phase and be greatest during the Post-Closure Phase (Table 112, p. 636). The effects on aquatic habitat would be the same as described for Alternative 3 without mitigation. Decreased low flows would reduce salmonid and macroinvertebrate habitat in East Fork Rock Creek. Without mitigation, all baseflow would be eliminated in the reach of East Fork Rock Creek near the CMW boundary. Further downstream near the confluence with West Fork Rock Creek at RC-3, low flows would be predicted to decrease by an estimated 9 percent during the Post-Closure phase (Table 109). The effects on aquatic habitat in upper East Fork Rock Creek would be substantial and last for hundreds of years, and westslope cutthroat trout and bull trout populations would be adversely affected by the loss of habitat. The reduced streamflow would acerbate the chronic dewatered condition during low flow in Rock Creek.

After groundwater levels in the analysis area reached steady state conditions, reduced streamflow would have a slight adverse effect on aquatic habitat. At steady state conditions without mitigation, streamflow in the East Fork Rock Creek and Rock Creek would be slightly reduced and habitat conditions would likely be indistinguishable from pre-mining conditions. At steady state conditions with mitigation, streamflow in the East Fork Rock Creek would return to pre-mine conditions, and at Rock Creek at the mouth would increase slightly, and aquatic life conditions would return to pre-mining conditions.

Decreased low flow in the East Fork Bull River would likely reduce available salmonid habitat until the mine void filled and groundwater levels reached steady state conditions, with the maximum effect occurring in the stream reaches near and upstream of the CMW boundary. Predicted percent decreases in low flows would be less than for East Fork Rock Creek. Decreased habitat availability could result in impacts on the bull trout and other salmonids inhabiting the East Fork Bull River. At steady state conditions, habitat conditions would likely return to pre-mining conditions at sites from the CMW boundary. At EFBR-500 at the CMW boundary, a slight permanent flow reduction of 1 percent or less (Table 113, p. 637) would be predicted to occur, and would likely not affect aquatic habitat at that time.

Lakes

Effects to lake levels and volumes and the corresponding changes to aquatic habitat in Rock Lake would be the same for Alternative 2 as discussed in Alternative 3 without mitigation. Groundwater flow into Rock Lake would continue to decline after mining ceased. Reductions in lake levels and volume would be 5 percent or less and would probably not have a detectable effect on the aquatic biota of Rock Lake. While the lake level is projected to be permanently reduced by 2 percent without mitigation, aquatic habitat changes would likely be difficult to separate from those caused by natural variability in lake levels. This would be due to in part to the large influxes of surface water runoff that occur every year to Rock Lake during spring snowmelt and storm events, which would not be affected by the mine. When groundwater levels reached steady state conditions, lake levels and volume would, with mitigation, return to pre-mine conditions.

St. Paul Lake may be affected similarly by the mine as Rock Lake, but the much greater natural fluctuations that occur in St. Paul Lake would make habitat changes more difficult to separate from those caused by natural variability in lake levels.

Climate Change

The predicted effects of climate change are described above for the affected environment. Due to the possible range in effects of climate change on the aquatic resources and the many factors that could affect that outcome, quantifying the combined impacts of Alternative 2 and climate change was not feasible. The effects of the reduced low flows on aquatic resources combined with the effects of climate change may be greater than those estimated to occur in Alternative 2 alone.

3.6.4.2.3 Water Quality-Nutrients

All Phases

Streams

Section 3.13, *Water Quality* discusses anticipated effects of the alternatives on nutrient concentrations in area streams. This section discusses the effects of the predicted changes in nutrient concentrations on aquatic life.

In Alternative 2, increases in nutrient concentrations as a result of discharges would occur in the Libby Creek drainage from the LAD Areas or Water Treatment Plant to Ramsey, Poorman and Libby creeks. These discharges may occur in all phases, and water quality effects would be similar. Therefore, predicted impacts are discussed collectively rather than divided into phases. The uncertainties associated with the predictions of changes in water quality in the analysis area as a result of the alternatives are discussed in section 3.13.4.5; these uncertainties also result in a level of uncertainty in the magnitude and location of effects on aquatic life from changes in nutrient concentrations in surface water.

Reductions in groundwater discharge due to mine inflows may reduce nutrient concentrations in waters in the East Fork Bull River and East Fork Rock Creek drainages, particularly during the low flow period of the year during the Operations, Closure, and Post-Closure Phases. The magnitude of the reduction in nutrient concentrations is not known and may not be detectable. Decreases in nutrient concentrations would not be directly deleterious to fish and macroinvertebrates, but primary productivity could decrease and adversely affect fish and invertebrate assemblages if an insufficient amount of nutrients were available to support these assemblages. If mine void water flowed to the East Fork Bull River or East Fork Rock Creek after mine closure, it is not likely that changes in nutrient concentrations in the river would be detectable.

As discussed in section 3.6.2.3.3, *Water Quality,* the BHES Order set a limit of 1 mg/L for TIN in Libby, Ramsey and Poorman creeks (Appendix A). The DEQ has developed seasonal numeric standards between July 1 to September 30 in wadeable streams of 0.025 mg/L for total phosphorus and 0.275 mg/L for total nitrogen. If these standards were exceeded, they may not protect beneficial uses, and could result in nuisance levels of bottom-attached algae.

DEQ's total nitrogen and total phosphorus standards are based on regional stressor-response studies within each ecoregion and studies from outside the region, as well as scientific literature that has a more general application, such as nutrient ratio preferences of nuisance algal species. The goal of some of the studies used was to maintain an in-stream chlorophyll-*a* concentration of less than the 150 mg/square meter threshold considered acceptable for river recreation by the Montana public (Suplee *et al.* 2009; Suplee and Watson 2013).

If significant increases in algal growth occurred as a result of the project alternatives, dissolved oxygen concentrations could decrease in streams as a response, particularly during early fall low flow periods, and aquatic life would be adversely affected. Increased algal growth may also result in higher daily pH values, but it is difficult to determine if the pH standard would be exceeded due to instream factors such as chemical buffering and re-aeration rates (Suplee, pers. comm. 2014). Such increases in algal growth may not occur in response to an increased total nitrogen concentration because phosphorus concentrations may limit algal growth when nitrogen is already present in surplus supply (Allan 1995, Steinman and Mulholland 1996). Co-limitation is also common in flowing waters, with additions of both total nitrogen and total phosphorus resulting in increases in algal growth of a larger magnitude than either nutrient separately (Suplee and Watson 2012). Other factors such as light, temperature, and length of the growing season can be important factors determining algal growth (Suplee *et al*. 2008; Lewis and McCutchan 2010). In streams with heavy canopy cover, systems become "light limited" and can attenuate algal growth, while elevation often controls stream temperature and length of the growing season in unpolluted or minimally polluted streams. High flow events can also affect algal growth by scouring algae from the streambed by high stream velocities alone or in combination with bedload movement. The effects of scouring depend on the timing, magnitude, and frequency of the high flow event (Suplee *et al*. 2008). total nitrogen and total phosphorus concentrations can also vary seasonally based on stream discharge or the proportion of groundwater discharge contributing to streamflow, and can increase following storm events (Suplee and Watson 2012). How these site-specific factors would combine with nutrient concentrations to affect algal assemblages in stream reaches in the analysis area has not been quantified.

The surface waters of the Libby Creek watershed have generally low nitrate+nitrite, ammonia, and phosphorus concentrations (Table 75). Low nutrient concentrations contribute to limited aquatic productivity. The mass balance calculations completed to evaluate effects on water quality (Appendix G) predict increases in nitrate, ammonia, total nitrogen, and total phosphorus concentrations above ambient concentrations during periods of low flow in Ramsey, Poorman, and Libby creeks from the LAD Areas without pre-treatment (Table 75). Discharges from the Water Treatment Plant would also increase nitrate, ammonia, total nitrogen, and total phosphorus concentrations in Libby Creek downstream of the discharge point (slightly upstream of LB-300) without pre-treatment.

Assuming MMC discharges 130 gpm of untreated water at the LAD Areas and 370 gpm from the Water Treatment Plant, TIN concentrations would exceed the BHES Order limit of 1.0 mg/L at RA-600 and PM-1200 (Table 75). Total nitrogen concentrations in Libby, Ramsey, and Poorman creeks would increase (Table 122, Table 123, and Table 124, pp. 688-690). The predicted total phosphorus concentration would exceed the standard and the general variance treatment requirement (DEQ 2014b) at RA-600. If exceedances of any treatment requirement, applicable standard or limit occurred, less water would be sent to the LAD Areas, and additional water would be sent to the Water Treatment Plant.

Whether increased nitrogen concentrations would actually increase algal growth to the extent that it would be considered "undesirable aquatic life" is unknown based on the other factors that influence such growth. Libby Creek from the US 2 bridge to the Kootenai River is on Montana's list of impaired streams for sedimentation/siltation, a factor that could increase total phosphorus availability in the stream channel. Although projected TIN concentrations would be greater than existing conditions, the ammonia component of TIN would remain well below the applicable ammonia aquatic life standard (Table 75), indicating no potential toxicity from increased ammonia concentrations in analysis area streams.

Table 75. Maximum Projected Changes in Total Inorganic Nitrogen and Total Phosphorus Concentrations in Alternative 2.

Condition	Units	RA-600	PM-1200	LB-1000
Ammonia chronic aquatic life standard[1]	mg/L	6.29	5.91	6.12
Total nitrogen standard[2]	mg/L	0.275	0.275	0.275
BHES Order TIN limit	mg/L	1	1	1
Total phosphorus standard[2]	mg/L	0.025	0.025	0.025
Ambient Surface Water Quality[3]				
Field pH	s.u.	6.8	7.0	6.9
Ammonia	mg/L	<0.052	<0.050	<0.030
Nitrate, as N	mg/L	<0.081	<0.053	<0.034
Total inorganic nitrogen (TIN)	mg/L	<0.13	<0.10	<0.064
Total nitrogen	mg/L	<0.25	<0.22	<0.11
Total phosphorus	mg/L	<1.5	<0.012	<0.009
Predicted Surface Water Quality during Low Flow[4]				
Ammonia	mg/L	<0.22	<0.16	<0.17
Nitrate, as N	mg/L	<1.4	<0.95	0.62
TIN	mg/L	<1.5	<1.0	<0.72
Total nitrogen	mg/L	<1.63	<1.14	<0.77

mg/L = milligram per liter; s.u. = standard units; < = less than.
Concentrations presented with a < symbol had at least one sample with a reported concentration less than the detection limit used in calculating representative values; detection limit used in calculating representative value when reported concentration was below the detection limit.
[1]Ammonia chronic aquatic life standard value is pH and temperature dependent. To calculate the standard values, field pH values for each site were used and temperature was assumed to be 57°F.
[2]MMC may obtain a general or individual variance to the basic nutrient standards.
[3]Representative values in analysis area streams are presented in Appendix K.
[4]Predicted TIN concentrations are based on discharging 130 gpm of untreated water at the LAD Areas and 370 gpm from the Water Treatment Plant; water would be sent to the Water Treatment Plant as necessary to prevent exceedances of applicable standards outside of a mixing zone.

If algal growth occurred from project discharges, significant seasonal dissolved oxygen decreases along a stream could result, which would be harmful to fish (Suplee and Suplee 2011) and macroinvertebrates. Adverse changes in the composition of macroinvertebrate assemblages to favor those taxa that are tolerant of nutrients or low dissolved oxygen, or those that feed directly on periphyton such as grazers, could also occur. Because TIN concentrations in Ramsey Creek and Poorman Creek are predicted to be greater than 1 mg/L and total nitrogen concentrations could increase without further treatment, effects on aquatic life may occur in these streams during low flows periods. Increased algal growth could stimulate productivity rates for aquatic insects and, consequently, stimulate populations of trout and other fish populations. Small increases in aquatic macroinvertebrate richness were associated with increases in nutrients in small, closed canopied streams in the western U.S.; decreases in richness were observed in larger, open-canopied systems in the same study (Yuan 2010). Increased algal growth could also reduce habitat availability for macroinvertebrates (Suplee, pers. comm. 2014).

The BHES Order discussed protection of beneficial uses. On page 5, the Order states "surface water and groundwater monitoring, including biological monitoring, as determined necessary by the Department [DEQ], will be required to ensure that the allowed levels are not exceeded and that beneficial uses are not impaired." Further on page 7, the Order indicates that the limit of 1 mg/L for TIN "should adequately protect existing beneficial uses. However, biological monitoring is necessary to insure protection of beneficial uses and to assure compliance with …applicable standards." The applicable standards include the existing narrative standard prohibiting undesirable aquatic life, or nuisance algal growth. According to the reopener provisions of MPDES permits described in ARM 17.30.1361(2)(b), "permits may be modified during their terms if…the department [DEQ] has received new information …indicating that cumulative effects on the environment are unacceptable, or (c) the standards or requirements on which the permit was based have been changed by amendment or judicial decision after the permit was issued." Consequently, the TIN limit for ambient surface waters set in the BHES Order could be modified in the MPDES permit issued by DEQ at any time if nuisance algal growth caused by MMC's discharge was observed. To address the uncertainty regarding the response of area streams to increased TIN concentrations, MMC would implement the water quality and aquatic biology monitoring described in Appendix C. This includes monitoring for periphyton and chlorophyll-a monthly between July and September.

Lakes

Mine dewatering and the resulting drawdown of bedrock groundwater may subtly change the water quality of Rock Lake and St. Paul Lake. Reducing the source of deeper groundwater may reduce nutrient concentrations. If such a change occurred, it would be detectable only during low flow periods when bedrock groundwater is the major source of supply to surface water. Even at low flows, the changes in water quality may be difficult to measure. The reduced nutrient availability may decrease algal and macroinvertebrate production in both lakes, and potentially reduce the fishery in Rock Lake. Data confirming the presence or absence of fish populations in St. Paul Lake were not available in the FWP (2012) database.

3.6.4.2.4 Water Quality-Metals

All Phases

Section 3.13, *Water Quality* discusses anticipated effects of the alternatives on metal concentrations in area streams. This section discusses the effect of changes in predicted metal concentrations on aquatic life. Changes in metal concentrations are expected during all phases. Predicted impacts are discussed collectively rather than divided into phases because the effects to aquatic life would be similar during all mine phases. Potential sources of elevated metals in the Libby Creek watershed include waste rock, ore, and tailings. Additional evaluation and characterization of the waste rock would be conducted during mine development and operations to minimize the potential for the waste rock to become a source of any increased metal concentrations. In addition, discharges from the LAD Areas would increase concentrations of some metals in Alternative 2.

Detectable changes in metal concentrations would not occur during all mine phases in the East Fork Rock Creek and East Fork Bull River, except potentially during the late Post-Closure Phase, when flow may occur from the mine void toward the East Fork Bull River or East Fork Rock Creek. As discussed in Section 3.13.4, *Water Quality*, it is unlikely that this flow would affect water quality or aquatic habitat. The west side streams are not discussed further with regard to effects of changing metal concentrations.

Streams

Section 3.13, *Water Quality* provides estimated concentrations of various parameters for streams affected by discharges of wastewater from the LAD Areas after mixing at RA-600, PM-1200, and LB-1000 (Table 122, Table 123, and Table 124). Effects at other locations are provided in Appendix G. Concentrations of most metals included in the mass balance analysis are predicted to increase over ambient conditions. Increases in these metal concentrations above ambient conditions could adversely affect aquatic life without additional primary treatment before land application occurred, but all metals would be estimated to remain below the acute and chronic criteria for aquatic life during all phases of mine activity. Predicted manganese concentrations at all locations would remain well below 1.04 mg/L.

The BHES Order would allow total copper concentrations up to 0.003 mg/L in all surface waters affected by the project (BHES 1992). The total copper concentration outside of a mixing zone resulting from project discharges could not exceed the chronic aquatic life standard (ALS) of 0.00285 mg/L. If the discharges at the LAD Areas resulted in exceedances of the ALS, MMC would treat the water to be discharged at these areas at the Water Treatment Plant instead of using the LAD Areas.

Increases in dissolved copper concentrations above ambient conditions in surface water can disrupt fish behaviors by interfering with their sensory systems and thus affecting predator avoidance, juvenile growth, and migratory success (Hetch *et al*. 2007). Potential effects on aquatic life from an increase in copper concentrations in the analysis area are difficult to determine given recent uncertainties regarding the protectiveness of the hardness-modified copper standard and the variability of existing instream copper concentrations. Since the 1996 release of hardness-modified copper criteria recommendations (EPA 1996), additional research has shown that water quality parameters other than hardness and ionic composition affect copper toxicity. In 2007, the EPA released new water quality recommendations for copper toxicity using the biotic ligand model (BLM). The BLM uses multiple water quality parameters when determining the appropriate copper standard (EPA 2007c). The detailed water chemistry data needed for BLM predictions are not available for the Libby Creek watershed. Preliminary analysis with the BLM indicates dissolved organic carbon and pH can be the primary drivers that influence copper toxicity (HydroQual, Inc. 2008). Typical groundwater and snowmelt-fed mountain streams is expected to have low dissolved organic carbon concentrations that make dissolved copper bioavailable and potentially toxic. Predicted increases in nitrogen and phosphorus concentrations may increase primary productivity, potentially resulting in increases in dissolved organic carbon concentrations, which could then possibly offset potential toxic responses due to increased copper concentrations. Furthermore, most measured instream copper concentrations are either at or near minimum laboratory detection limits, creating some uncertainty with any change in concentration from existing conditions (Appendix K-1).

The low concentrations of dissolved minerals in surface waters of the Libby Creek drainage cause these waters to tend toward acidic pH levels and to have extreme sensitivities to fluctuations in acidity. For most metals, the percentage of the metal occurring in the dissolved form increases with increasing acidity. Generally, dissolved metals are the most bioavailable fraction and have the greatest potential toxicities and effects on fish and other aquatic organisms. Any increase in metal concentrations could increase the potential risk for future impacts on fish and other aquatic life in some reaches. Metal concentrations near the ALS could result in physiological stress, such as respiratory and ion-regulatory stress, and mortality.

Predicting potential impacts on fish and other aquatic life in the Libby Creek watershed is significantly complicated by the fact that the very low hardness and total alkalinity occurring in these waters naturally cause potential ion-regulatory difficulties and stress in fish. These problems are exacerbated by the low nutrient and productivity levels in the streams that permit only minimal production of food organisms for fish, causing additional stress to fish and other aquatic life.

The design criteria for the tailings impoundment and seepage collection system would result in a low risk of exposure of aquatic life to any residual metals in the tailings. Catastrophic failure of the tailings impoundment would release tailings with elevated metal concentrations into the diverted Little Cherry Creek and Libby Creek. The release of metals would cause severe adverse effects on the aquatic biota that would persist for an undetermined period of time depending upon the type of failure, size of the impoundment at the time of failure, volume of water, and volume and character of sediments.

Lakes

Metal concentrations in Rock and St. Paul lakes may decrease due to less deep bedrock groundwater entering the lakes. With mitigation, at steady state post-mining, water from the mine void is predicted to flow at a rate of 0.01 cfs toward Rock Lake. Because the net result would be no change in the lake volume, lake level or surface area at steady state, effects to aquatic habitat are not anticipated. The barrier pillars with access opening bulkheads included in the mitigation would be designed to minimize post-mining changes in East Fork Rock Creek and East Fork Bull River streamflow and water quality. The mitigation of increasing the buffer zones near Rock Lake and the Rock Lake Fault, which was not modeled, may eliminate effects on Rock Lake during and after mining.

3.6.4.2.5 Temperature

All Phases

The mine project may affect stream temperatures by vegetation clearing, discharge of treated water from the Water Treatment Plant, decreased streamflows due to direct diversions, and changes in groundwater discharge to area streams and lakes. As discussed in Section 3.13, *Water Quality*, temperature changes as a result of the alternatives were not included in the mass balance calculations. Due to the numerous factors naturally affecting stream temperatures and the constantly changing stream temperature regime that occurs, predictions as to how the project alternatives would alter stream temperatures and affect aquatic assemblages are difficult to determine.

The fish assemblages within the analysis area streams are dominated by salmonid species that are adapted to cold water temperatures. Bull trout are found in the coldest waters and among the most limited range of temperatures (Mebane 2002), and generally require water temperatures ranging from 36°F to 59°F, with temperatures at the low end of this range required for successful incubation (USFWS 1998). Constant temperatures greater than 61°F have been shown to be intolerable to bull trout (Maret *et al*. 2005). Based on limited data, the temperatures in many stream reaches appear to be within this range for most of the year, but some exceedances occur in the summer (see section 3.6.3.11.1, *Temperature*). Cutthroat trout, rainbow trout, brook trout, and sculpin are also categorized as moderately or strongly stenothermal (Mebane 2002), indicating that they also require cold water temperatures. These fish could also be affected by any increasing stream temperatures. An increase in temperature, even within the thermal range of each species, can be associated with an increase in food demand, an increase in physiological stress, or a decrease in competitive fitness (Taniguchi *et al*. 1998; Morgan *et al*. 1999). In addition, some macroinvertebrates also have narrow thermal ranges and would only be present in streams with cold temperatures, with 66°F designated as the maximum average daily temperature considered suitable for cold aquatic life in Idaho (Grafe *et al*. 2002). Changes in temperature above the optimal range for the fish and macroinvertebrate species within the analysis area could result in decreases in diversity or abundance, changes in taxa composition, or other adverse effects to these assemblages.

In Alternative 2, water would be discharged from the LAD Areas and the Water Treatment Plant. Water discharged from the LAD Areas would cool as it flowed via the subsurface to nearby streams. Water discharged from the Water Treatment Plant, if discharged to the percolation pond next to Libby Creek, also would cool as it flowed from the percolation pond via the subsurface to the creek. Discharges to either the percolation pond or directly to Libby Creek would cool further when mixed with receiving creek water. For all Water Treatment Plant discharges, the DEQ would determine during the MPDES permitting process effluent limits for each necessary parameter at each outfall that were protective of aquatic life Stream temperatures would be monitored in receiving waters. The decrease in low flows from reduced groundwater inflows that would occur in some portions of the Libby Creek watershed and in the west side streams as a result of the alternatives could result in increased stream temperatures during the low flow period in late summer and early fall, as well as possibly narrower daily temperature ranges. These decreases in flow and any associated effects on stream temperature that occurred would be greatest in the Closure and Post-Closure Phases for most streams.

The BA categorized stream temperatures as a habitat parameter that was currently functioning either at risk or unacceptable risk for most streams within the analysis area (USDA Forest Service 2013a). In general, multiple factors such additional inflow of groundwater as water travels downstream, the increase in average air temperature as elevation decreases, the influence of channel geometry, and the generally higher percentage of canopy cover on narrower streams would all play a role in determining the magnitude of any temperature increases. Data on the extent of canopy coverage within the analysis area is limited, but measures of this parameter in the Rock Creek, East Fork Bull River, and Libby Creek drainages indicated it varies widely (Kline Environmental Research and NewFields 2012). Given the multiple factors that can affect stream temperature, the effect on aquatic life or the potential for stream temperature standards to be exceeded is uncertain.

Rock Lake and St. Paul Lake would be impacted by reduced groundwater inflows during some phases of the project, but the small predicted change in lake level, volume and surface area in the lakes would suggest that any water temperature changes would likely be minimal.

3.6.4.2.6 Metals in Fish

All Phases

Increases in metal concentrations above ambient conditions were predicted to occur from discharges from the Water Treatment Plant and LAD areas in the Libby Creek watershed in Alternative 2 (Table 122, Table 123, and Table 124). Any increased metal concentrations in surface water would potentially increase metal concentrations in fish. MMC has committed to treating water before discharge at the LAD areas, if necessary, to meet water quality standards or BHES Order limits. With treatment, the risk of increasing metal concentrations in fish would decrease for all east side streams.

Changes in metal concentrations in fish within the East Fork Rock Creek drainage are not predicted with any of the alternatives because surface disturbance near this stream would be limited to the construction of the Rock Lake Ventilation Adit, and there would be no discharges of water to the East Fork Rock Creek. At steady state conditions post-mining, without mitigation, water from the mine void is predicted to flow at a rate of 0.07 cfs to the East Fork Bull River, and could undergo changes in chemistry along this flow path. It is not likely that changes in water quality would be detectable or result in increased metal concentrations in fish tissues. The effect cannot be accurately quantified without additional information from the underground mine, which would be collected during the Operations Phase. With mitigation, the loss of water from the mine void to the East Fork Bull River may be minimized.

3.6.4.2.7 Fish Passage and Fish Loss

Evaluation, Construction, and Operations Phases

Streams

Proposed road reconstruction between US 2 and the Ramsey Plant Site would include new bridges over Ramsey and Poorman creeks and a new culvert on Little Cherry Creek. Bridge and culvert construction so as to meet INFS standards, along with implementation of MMC's proposed BMPs, would minimize effects on fish passage. Based on these measures, no additional barriers to fish passage in east side streams from stream crossings would be created in Alternative 2. No additional stream crossings are proposed in the East Fork Rock Creek and East Fork Bull River drainages; therefore, no effects on fish passage from road or bridge construction is expected to occur in west side streams.

Effects on bull trout passage as a result of decreases in flow during the low flow period of each year were evaluated in the BA (USDA Forest Service 2013a), and the results of this analysis are summarized in section 3.6.4.3.2, *Water Quantity* as part of the discussion on the effects of mine dewatering in Alternative 3. Effects in Alternative 2 would be the same for west side streams and similar for east side streams.

Decreased streamflow predicted to occur in the upper East Fork Rock Creek and East Fork Bull River drainages may reduce available salmonid habitat and fish passage. The reduction in habitat may affect bull trout more severely than westslope cutthroat trout because they spawn during low-flow times of the year from August through November. Additionally, dry reaches of Rock Creek have been observed during low flow time periods under existing conditions, and these reaches might remain dry for longer time periods or the length of dry channel may increase. Because these reaches are near the mouth of Rock Creek, they may further reduce migratory bull trout from accessing any significant portion of the Rock Creek drainage for spawning. The bull trout population in Rock Creek is composed primarily of resident fish, but migrant bull trout also have been observed. To some extent, the dry reaches may be protecting the resident bull trout population in Rock Creek from hybridization or competition with non-native fish by limiting non-native fish access to Rock Creek from the lower Clark Fork River.

The Little Cherry Creek diversion would not alter fish passage because the creek currently has a series of permanent barriers thought to prevent upstream fish passage under all flow conditions. These barriers limit access to Little Cherry Creek from fish in Libby Creek to the most downstream 950 feet of Little Cherry Creek (Kline Environmental Research 2005b). Downstream fish passage would be unrestricted by the diversion, but the amount of habitat available for the redband trout that inhabit the diverted Little Cherry Creek would substantially decrease.

Flow in the diverted Little Cherry Creek would be substantially reduced during operations, as the pumpback well system, if implemented, would likely eliminate $7Q_{10}$ flows. The loss of available habitat in the diverted Little Cherry Creek would adversely affect the redband trout population in the diverted creek because the remaining habitat would not support the population at its current numbers, if at all. To mitigate the fisheries impacts associated with the Little Cherry Creek diversion and the riprapped tailings impoundment overflow channel to Bear Creek, MMC would implement a Fisheries Mitigation Plan. Before any other mitigation work was attempted, and immediately before closure of the Little Cherry Creek Diversion Dam, MMC would collect all fish in the existing stream section and move the fish to the newly constructed diversion channel. MMC would design the Little Cherry Creek Diversion Channel, to the extent practicable, for fish habitat and passage. MMC's survey of Drainage 10, the drainage that would receive diverted water, indicates that most of the drainage could develop habitat comparable to Little Cherry Creek over time.

Lakes

Changes in the outflow of Rock Lake could create a barrier to fish leaving the lake and moving into East Fork Rock Creek during the low flow period of the year, and would be more likely to occur in dry years when precipitation was limited. Barriers to upstream fish passage into Rock Lake are already present and would not be affected by mine activities. No surface outlet exists at St. Paul Lake; therefore, no effects on fish passage would occur.

Closure and Post-Closure Phases

Streams

Negligible effects on aquatic populations would occur due to stream crossings once the mine was closed and reclamation completed. Predicted decreased fish habitat and possible flow barriers in the East Fork Rock Creek and Rock Creek drainages from reduced low flow are expected to continue during the post-operational phases. When groundwater levels in the mine area reached steady state conditions, fish passage would be similar to pre-mine conditions. The pumpback well system would substantially reduce flow and habitat potential in the Diversion Channel as long as it operated. Flow from the tailings impoundment at closure would be directed toward Bear Creek, with flow in the diverted Little Cherry Creek estimated to be 45 percent less than existing flow. No additional direct unmitigated losses of fish are expected during the post-operational phases.

Lakes

Reductions in groundwater inflows into Rock Lake would continue during the Closure and Post-Closure Phases, and would be greatest 16 years after mining ceased. The natural barriers that prevent upstream fish movement into Rock Lake would persist, and downstream fish movement out of Rock Lake could be affected during the low flow period of the year. As discussed previously, while these limitations decrease available trout habitat in the Rock Creek drainage, they may help reduce hybridization of the westslope cutthroat trout population in East Fork Rock Creek. When groundwater levels in the mine area reached steady state conditions, fish passage would be similar to pre-mine conditions.

3.6.4.2.8 Threatened and Endangered Species

Evaluation, Construction, and Operations Phases

Streams

Alternative 2 would affect bull trout and their habitat in analysis area streams. The BA (USDA Forest Service 2013a) analyzed effects to bull trout populations under Alternative 3, but most effects, including the changes in habitat availability resulting from altered low flows, would be similar between the alternatives. Section 3.6.4.3.2, *Water Quantity*, and section 3.6.4.3.6, *Threatened and Endangered Species*, discusses these effects and summarizes the results of the BA analysis in more detail, and also provides quantitative estimates of the maximum loss of bull trout habitat that would result from the project (Table 76).

As discussed in previous sections, some short-term effects to bull trout habitat may result from increases in the amount of fine sediment. BMPs would minimize any sedimentation to streams and would result in a long-term decrease in sedimentation into streams in the analysis area. This would result in a benefit to the aquatic biota, including bull trout. There is the potential that the decrease in sediment delivery to analysis area streams could benefit brook trout populations as well, thus increasing the risk of interspecific competition and hybridization with bull trout. The benefits of the long-term sediment decreases are expected to outweigh the potential adverse impacts on bull trout populations through this pathway. Less sediment delivery to streams would result in increased bull trout spawning success and growth, as well as survival of other life stages impacted by suspended or deposited sediments.

Bull trout populations in Libby Creek and the rest of the tributaries would not be directly affected by the loss of habitat in Little Cherry Creek because they do not have access to that habitat as a result of barriers to fish passage near the mouth. Most changes in flow within the Libby Creek drainage are expected to be minimal during Evaluation and Construction Phases and would not impact the bull trout populations within the drainage. Predicted flow increases when wastewater was treated and discharged in Libby Creek during the Evaluation, Construction, and Operations phases would be substantial during the time of the year when flows are typically low, and would result in increases to juvenile, adult, and spawning habitat for bull trout downstream of the Water Treatment Plant in these phases.

Upstream of the Water Treatment Plant, decreases in flow would occur during operations in Libby Creek and would decrease salmonid habitat, potentially adversely affecting the resident bull trout population that inhabits Libby Creek upstream of Libby Falls. Decreases in low flows would also occur in Poorman and Ramsey creeks, but bull trout abundances are low in these streams, and spawning has been documented infrequently or not at all. Changes to peak flows in analysis area streams would be minimal and would have a negligible effect on bull trout populations.

Vegetation clearing and other disturbances are proposed within RHCAs. If riparian shading decreased significantly, increases in stream temperatures would result and would potentially adversely affect bull trout populations. Based on measured temperatures of the Water Treatment Plant influent, discharges from the Water Treatment Plant during the Evaluation, Construction, and Operations phases may occur at temperatures up to 65°F. Effects of the disturbance and discharges could be exacerbated by decreases in groundwater inflows to streams resulting from mine dewatering. Low flow decreases would be minimal during these phases in the Rock Creek mainstem, East Fork Bull River, and Ramsey Creek, and increased flows would occur in the reaches of Libby Creek downstream of the Water Treatment Plant discharges. Decreases in low flows would be more substantial during the Operations Phase in Poorman Creek, Little Cherry Creek, and East Fork Rock Creek, ranging up to 21 percent. The effect on stream temperature is uncertain based on the many factors that influence this parameter, as discussed in section 3.6.4.2.5, *Temperature*. Bull trout require water temperature ranging from 36°F to 59°F, with temperatures at the low end of this range required for successful incubation (USFWS 1998). Water discharged from the Water Treatment Plant, if discharged to the percolation pond next to Libby Creek, would cool as it flowed from the percolation pond via the subsurface to the creek. Discharges to either the percolation pond or directly to Libby Creek would cool further when mixed with receiving creek water. Temperatures in the receiving waters downstream of the discharges would be monitored.

A substantial long-term reduction in road-related sediment delivery to Bear Creek is expected to occur under Alternative 2, but low flow in Bear Creek would also be reduced during the Operations Phase by diversions and a pumpback well system at the Little Cherry Creek impoundment. The effect was not quantified but would impact bull trout habitat in Bear Creek.

Under Alternative 2, bull trout populations in the Libby Creek watershed would continue to be marginal and their habitat in need of restoration work from existing, non-project impacts. Bull trout populations would continue to be susceptible to decline or disappearance due to hybridization with introduced brook trout, competition with brook trout and other trout present in the analysis area, or from other land use disturbances. Based on limited survey data, brook trout abundances appear to be increasing within the Libby Creek drainage, and habitat degradation generally favors brook trout when competing with bull trout (Rieman and McIntyre 1993). The effect of any habitat change from mine activities in Alternative 2 may indirectly be magnified by giving brook trout an additional competitive advantage.

The small resident bull trout population upstream of Libby Falls would be protected from the threat of hybridization or competition with brook trout because the falls prevent access to this segment of Libby Creek from fish downstream. Decreases in low flows were not quantified for most of the upstream portion of this segment as part of the surface water impact analysis, but predicted changes to baseflow at the end of operations were included in the groundwater analysis under Alternative 3. An estimated 20 percent reduction in baseflows would occur in the reach near LB-100 at the CMW boundary with mitigation in the Operations Phase (Table 98, p. 565). The decreased baseflows would result in decreases in habitat availability for bull trout during the low flow part of the year and would result in adverse impacts on this population without mitigation.

Components of MMC's Fisheries Mitigation Plan would benefit bull trout populations and habitat in the Libby Creek watershed. The mitigation plan includes habitat restoration projects in Libby Creek and its tributaries, evaluation of potential habitat restoration or enhancement, replacement of culverts and removal of bridges, stabilization of sediment sources, and the potential exclusion of livestock from areas where grazing and bull trout distributions overlap. The proposed restoration and enhancement projects would be aimed at creating high quality habitat necessary to sustain wild trout populations. Mitigation projects involving habitat restoration and enhancement would be assessed further before being initiated to determine which of the proposed options would likely result in the greatest benefits to fish habitat and populations. The mitigation projects in bull trout-occupied streams, such as Libby and Poorman creeks, if implemented, would improve the bull trout population and habitat.

Bull trout populations in the East Fork Rock Creek, Rock Creek, and East Fork Bull River drainage would be adversely affected by mine activities in Alternative 2 in the Evaluation, Construction, and Operations Phases. Only minimal changes in habitat availability would occur in the Rock Creek drainage in the reaches inhabited by bull trout, with an estimated 1 percent decrease in low flows within the reach of East Fork Rock Creek upstream of West Fork Rock Creek in the Operations Phase (Table 76). Habitat availability would decrease more in the East Fork Bull River, with a 7 percent decrease in low flows estimated to occur at EFBR-2 near the confluence with Isabella Creek in the Operations phase. Changes in streamflow would reduce bull trout habitat, and may create barriers by reducing low flow within these drainages. Because bull trout spawn from August through November when low flow conditions often occur, available spawning habitat in these streams would decrease. Additionally, bull trout prefer to spawn in areas with groundwater discharge because these areas tend to remain open throughout winter, maintain appropriate incubation temperatures, and increase the water exchange rate (Montana Bull Trout Scientific Group 1998). Because the East Fork Bull River is considered the most important bull trout stream in the lower Clark Fork River drainage (Montana Bull Trout Scientific Group 1996), decreased levels of bull trout spawning within this stream could have long-term adverse effects on the bull trout population within the lower Clark Fork River drainage.

Lakes

Bull trout do not inhabit any of the analysis area lakes; the hydrological effects on these lakes would not directly affect bull trout populations.

Closure and Post-Closure Phases

Streams

Within the Libby Creek watershed, the flow effects and associated changes in habitat availability for bull trout in Libby Creek upstream of the Libby Adit and in lower Ramsey Creek would be similar to those in the Operations Phase and would gradually return to pre-mine conditions when steady state groundwater conditions were reached. The greatest reduction in flows would occur immediately after the adits were plugged. Reduced bull trout habitat availability would continue to have the potential to adversely affect bull trout populations without mitigation, including the resident population that inhabits the reach of Libby Creek upstream of the falls. Predicted flow increases when wastewater was treated and discharged in Libby Creek would provide additional flow during spawning season. Decreased sediment input to analysis area streams would continue to benefit bull trout populations in the Libby Creek watershed. Unrelated to mine activities, hybridization with brook trout would continue to threaten the bull trout populations in the Libby Creek watershed.

Surface runoff from the Little Cherry Creek tailings impoundment would be directed toward Bear Creek after operations ceased. The design of the diversion channel and other BMPs would minimize the amount of sediment reaching Bear Creek. The effect of any increases in sediment on bull trout in Bear Creek would be negligible. The pumpback well system would reduce low flow and bull trout habitat in the Bear Creek as long as it operated. After pumpback well operation ceased, average annual streamflow would increase in Bear Creek as a result of the increase in watershed area, and would benefit bull trout habitat.

Within the west side streams, the maximum effects from decreased low flows would occur during the Post-Closure Phase, and would be similar to the effects in Alternative 3 without mitigation. Access to the Rock Creek drainage for migratory bull trout could be further impacted by the decreases in flows if they increase the length, duration, or frequency of occurrence of the seasonally dry reaches. The decreased flows would potentially decrease the possibility of brook trout accessing Rock Creek as well, which could benefit the resident bull trout population in the Rock Creek drainage by decreasing the possibility of hybridization or competition. Unrelated to mine activities, hybridization with brook trout would continue to threaten the bull trout populations in the East Fork Bull River watershed.

Lakes

Bull trout do not inhabit Rock Lake or any of other analysis area lakes; the hydrological effects on these lakes would not directly affect bull trout populations.

Effects on Critical Habitat

The USFWS has designated critical habitat in the Clark Fork River and Kootenai River drainages within the following streams in the analysis area: Rock Creek, East Fork Bull River, Libby Creek, Bear Creek, and West Fisher Creek (Figure 55). Alternative 2 would affect bull trout critical habitat in all of these streams except West Fisher Creek. None of the mine alternatives, including Alternative 2, would affect designated critical habitat in West Fisher Creek. Effects on designated critical habitat in West Fisher Creek are discussed in section 3.6.4.9.3, *Threatened, Endangered, or Sensitive Species* for the transmission line Alternative E-R. No roads or other facilities are proposed in any designated segment in Alternative 2.

Predicted flow increases when wastewater was treated and discharged in Libby Creek during all phases would provide additional flow during spawning season. Long-term reductions in sediment delivery to streams would also beneficially affect critical habitat in analysis area streams. Decreases in low flow in the reach of Libby Creek upstream of the Water Treatment Plant would occur in the Operations, Closure, and Post-Closure phases and may be substantial enough to adversely affect bull trout critical habitat. Increased nutrient and metal concentrations could occur within the critical habitat in Libby Creek during all phases as well, but if discharges to the LAD Areas resulted in exceedances of BHES Order or ALS limits, MMC would treat the water to be discharged at these areas at the Water Treatment Plant instead, minimizing the risk of effects occurring. The pumpback well system would reduce low flow and bull trout critical habitat in Bear Creek as long as it operated.

Alternative 2 may affect critical habitat in East Fork Bull River, East Fork Rock Creek, and Rock Creek. Changes in streamflow may affect bull trout habitat, and create barriers by reducing low flow within these drainages. Because bull trout spawn from August through November when low flow conditions often occur, available spawning habitat in these streams may decrease.

3.6.4.2.9 Forest Service Sensitive Species and State Species of Concern

Evaluation, Construction, and Operations Phases

Streams

Alternative 2 would adversely impact the redband trout population that inhabits the Libby Creek drainage within the analysis area. Abundance may decrease as a result of possible short-term increases in sediment in Alternative 2, although the net reduction in road-related sediment delivery would benefit these populations over time. Additionally, the diversion of Little Cherry Creek to accommodate placement of the tailings impoundment would result in a loss of 15,600 feet of pure redband trout habitat. Because barriers to fish passage exist near the confluence of

Little Cherry Creek and Libby Creek, this loss of habitat would not affect the hybrid redband trout populations in Libby Creek and the remaining tributaries within the analysis area. The purity of the redband trout population within Little Cherry Creek has likely persisted due to the location of these barriers, which effectively block the entry of rainbow trout and hybrid trout from Libby Creek into Little Cherry Creek.

MMC's proposed mitigation in Alternative 2 would include the removal of all trout inhabiting Little Cherry Creek and their subsequent transfer to the diversion drainage. These efforts would minimize any immediate loss of trout resulting from the proposed alterations to Little Cherry Creek. In the 1993 ROD (U.S. Forest Service 1993), the Forest Service and FWP concluded the mitigation options had a near certain probability of success in replacing the functions and values projected to be lost in Little Cherry Creek due to Montanore. The effects analysis did not consider the likely need for a pumpback well system to prevent tailings seepage from reaching surface water. Flow in the diverted Little Cherry Creek would be substantially reduced during operations, as the pumpback well system, if implemented, would likely eliminate $7Q_{10}$ flows. The loss of available habitat in the diverted Little Cherry Creek would adversely affect the redband trout population in the diverted creek because the remaining habitat would not support the population at its current numbers, if at all. While the loss of this population would represent a loss of genetic diversity and individual trout, the reduction in the redband trout population and habitat would not likely cause a trend to federal listing or cause a loss of viability to the population or species. A recent assessment of the status of redband trout in the Northwest (May *et al.* 2012) determined that over 70 percent of the populations were at least moderately healthy based on amount of habitat occupied, abundance within the population, habitat quality parameters, presence of non-native fish, and number of streams associated with the populations.

Alternative 2 may impact westslope cutthroat trout. A pure westslope cutthroat trout population is present in East Fork Bull River, and pure and hybrid westslope cutthroat trout exist in the Rock Creek drainage. These trout are present in relatively high densities, particularly in the East Fork Bull River. As with bull trout, reduced low flow in the upstream reaches of these streams during certain times of the year would decrease the amount of available habitat to westslope cutthroat trout populations. While these effects would adversely impact the westslope cutthroat populations in these streams, the higher numbers of westslope cutthroat trout indicate that the populations are at less risk than the bull trout populations. Additionally, this species spawns during the spring, rather than during the low flow time period when analysis area streams would be most affected by decreased groundwater input. The effects on the westslope cutthroat trout would not likely cause a trend to federal listing or cause a loss of viability to the population or species. The main risk to westslope cutthroat populations would likely continue to be hybridization and competition with non-native trout.

Alternative 2 may impact onrrent sculpin populations, but little data were available to determine their existing status in the analysis area. While the changes in low flows and other effects associated with the project may adversely impact this abundance of this species, predictions of effects from the alternatives could not accurately be made based on the limited data available. Western pearlshell mussels have not been documented to occur in streams within the analysis area. Alternative 2 would not likely impact this species.

Lakes

Pure populations of redband or westslope cutthroat trout do not inhabit any analysis area lakes; thus, the hydrological effects on these lakes would not directly affect redband or westslope cutthroat trout populations.

Closure and Post-Closure Phases

The flow effects and associated changes in habitat in Libby Creek in the Closure and Post-Closure phases would be similar to those in the earlier phases and would gradually return to pre-mine conditions when steady state groundwater conditions were reached. Flow in the diverted Little Cherry Creek would likely be eliminated as long as the pumpback well system operated. The diverted creek would not be capable of supporting redband trout. Flow from the tailings impoundment at closure would be directed toward Bear Creek, with flow in the diverted Little Cherry Creek estimated to be 45 percent less than existing flow. Reestablishment of the redband trout population in Little Cherry Creek would not likely occur after the pumpback wells ceased operating and flows increased.

As the mine void filled, westslope cutthroat trout populations in East Fork Rock Creek and the East Fork Bull River would also continue to be affected by decreased flows in these streams. The decreased flows are predicted to persist until after mine operations ceased and be similar to pre-mine conditions when groundwater levels in the analysis area reached steady state conditions. Hybridization would continue to be the primary threat to both the redband trout and the westslope cutthroat trout populations in these watersheds.

3.6.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Alternative 3 would incorporate the agencies' proposed modifications and mitigating measures that would reduce or eliminate impacts on area streams. Four major mine facilities would be located in alternative locations, which would reduce effects on aquatic life. The tailings impoundment would be at the Poorman Impoundment Site, eliminating the need for a diversion of Little Cherry Creek. Additionally, the plant site would be between Libby and Ramsey creeks, avoiding construction in a RHCA. Two additional adits would be constructed in the upper Libby Creek drainage, eliminating most construction in the Ramsey Creek watershed. The LAD Areas would not be used and all wastewater would be treated and discharged from the Water Treatment Plant. The Water Treatment Plant would be modified to treat nitrogen compounds and phosphorus, and possibly dissolved metals. The unmitigated effects of Alternative 3 on aquatic life in area lakes (Rock Lake and St. Paul Lake) and west side streams (East Fork Rock Creek and East Fork Bull River) would be the same as Alternative 2. The discussion of effects in these areas is limited to the effects of the agencies' mitigation, except for changes to water quantity resulting from the project, as these changes were modeled specifically for this alternative.

3.6.4.3.1 Sediment

Evaluation, Construction, and Operations Phases

As with Alternative 2, the Libby Creek watershed would be at risk due to short-term impacts from increased sediment. Potential sediment impacts would be reduced in Alternative 3 compared to Alternative 2, but would impact the fish and other aquatic populations through the same mechanisms as discussed for that alternative.

The locations and structures of the plant and impoundment site in Alternative 3 would decrease disturbance within RHCAs. Alternative 3 would affect 256 acres of RHCAs on National Forest System land and 9 acres of other riparian areas on private land, substantially less than Alternative 2 (Table 74). Because RHCAs are designed to act as a buffer to protect the streams from sediment as well as other impacts, fewer disturbances within these areas would reduce the amount of sediment that would reach the streams, particularly during the Construction Phase when sediment impacts have the greatest probability of occurring. Sediment delivery to streams would be reduced substantially beginning in the Evaluation Phase and continuing long-term through road closure mitigation under Alternative 3 (Table 125, p. 693) (KNF 2013), and aquatic habitat would be improved throughout the analysis area as a result.

High flow events would scour sediment that entered the stream, and natural sediment transport processes would take place. Substrate embeddedness and surface fines may increase temporarily as a result of the project, but would decrease over time, improving salmonid spawning habitat and aquatic macroinvertebrate habitat in the long term. Road closure mitigation in the Libby Creek, Fisher River, and East Fork Rock Creek watersheds also may allow the reestablishment of RHCAs along these roads. The BMPs and monitoring discussed under Alternative 2 would also be implemented under Alternative 3 to minimize sediment reaching streams. Because the tailings impoundment in Alternative 3 would not require diversion of a perennial stream and would be located within a smaller watershed, the amount of disturbance and subsequent erosion potential is expected to be less than in Alternative 2.

The Libby Plant site would be located more than 500 feet from the stream channel, reducing the potential for overland flow carrying sediment to reach Libby Creek, and there would be no LAD Areas, eliminating those as a source of erosion. Flow increases as a result of Water Treatment Plant discharges would occur in Libby Creek under Alternative 3, but are not expected to alter the physical substrate composition or affect sediment transport. Measures would be taken by MMC in Alternative 3 in addition to those described for Alternative 2 to incrementally stabilize soil stockpiles and begin revegetation of these stockpiles immediately to reduce erosion rather than waiting until capacity was reached. Furthermore, replacement of soils in the impoundment area would be based on their erodibility and slope steepness to minimize erosion potential. All permanent cut and fill slopes on roads would be seeded, fertilized, and stabilized. Under Alternatives 3 and 4, MMC would implement additional BMPs and road closure mitigation, with some of the road closures completed before the Evaluation and Construction Phases, and others completed at the end of the Operations Phase.

Based on these measures and the overall decreased amount of disturbed areas within RHCAs, impacts on aquatic life from sediment are expected to be substantially reduced compared to Alternative 2, and would be short-term, as described in section 3.6.4.2.1 *Sediment.* Based on the KNF's analysis (Table 125) (KNF 2013), 136.5 tons of sediment would be delivered to analysis area streams from roads over the 25-year period included in the Evaluation, Construction, and Operations phases, which would be a reduction of 194.0 tons (59 percent) from what was estimated for existing conditions under the same time frame. The tons of sediment predicted to be delivered from roads to streams cannot be compared directly between alternatives as the roads proposed for use under each alternative would different but the percentage decrease from existing conditions is greater under Alternative 3 than Alternative 2 by 7 percent.

Such reductions would result in long-term benefits to aquatic habitat and populations. Sediment reduction would be substantial in most of the analysis area streams in the Libby Creek watershed, including Bear Creek, which is an important bull trout spawning area in the Kootenai River Core Area and supports the highest reported average density of these trout within the Libby Creek watershed. Sediment delivery to East Fork Rock Creek from NFS road #150A would also decrease by almost 87 percent with the project and BMPs. No sediment decreases to East Fork Rock Creek were predicted under Alternative 2.

Additionally, the Seepage Collection Pond would be designed to accommodate up to 30 days of drain flow plus runoff from a 6-hour PMP event, in comparison to the pond associated with Alternative 2, which was designed to accommodate the smaller 100-year/24-hour storm event. Such large storm events is expected to occur infrequently, but overflow would be directed into Poorman and Little Cherry creeks if and when they occurred. Temporary increases in sediment delivery to streams would result if such large storm events happened, although the high flows associated with this type of event would likely distribute the sediment downstream in flood plains or low gradient stream reaches, or carry the excess sediment to the Kootenai River. The sediment ponds containing mine drainage or process water associated with the other mine facilities in Alternative 3 would be designed to accommodate a 100-yr/24-hour storm event, compared to a 10-yr/24-hr storm event under Alternative 2. These structures would be less likely to overflow and cause increased sediment to occur temporarily to Poorman, Ramsey, and Libby creeks.

The Poorman impoundment has a similar risk profile to the Little Cherry Creek impoundment. The probability of catastrophic failure of the tailings impoundment or sediment ponds is low and the effect would be the same as Alternative 2.The tailings pipeline would be buried for most of its length where practical rather than being on the surface as in Alternative 2, which would reduce the risk of tailings reaching streams. The creek crossings at which the pipeline would not be buried would have secondary containment built into the crossings and would be designed to minimize the quantity of tailings that would reach the streams if a rupture were to occur.

The stream mitigation plan proposed by MMC for Alternative 3 (see section 2.5.7.1) includes stream enhancement or restoration projects, removal of culverts or bridges, and riparian planting that would improve aquatic habitat along Swamp Creek, Poorman Creek, and Little Cherry Creek. MMC's analysis of the potential credits of these projects using the Corps' Montana Stream Mitigation Procedure (Corps 2013a) is described in MMC's revised Preliminary Mitigation Design Report (MMC 2014a).

Closure and Post-Closure Phases

Once the mine closed, the risk of increased sediment to streams within most of the analysis area would be low. The existing bridge across Poorman Creek on Little Cherry Loop Road (NFS road #6212) would be removed at closure and the road revegetated. Bridge removal would result in some short-term increases in sedimentation, but the long-term effect would be a 60 percent and 42 percent reduction in sediment delivery to streams compared to existing conditions in the Closure and Post-Closure phases, respectively. A decrease in sediment delivery to analysis area streams would benefit the aquatic habitat and biota compared to existing conditions.

During the Closure and Post-Closure Phases, 33.7 tons of sediment were estimated to be delivered to analysis area streams, compared to 66.1 tons under existing conditions (Table 125, p. 693), a reduction of 49 percent. The total amount of sediment delivery to streams over all phases with BMPs and road mitigation under Alternative 3 is 170.2 tons, a reduction of 57 percent over the same time period under existing conditions with no BMPs. The overall percent reduction in sediment delivery was 10 percent greater under Alternative 3 compared to Alternative 2.

Surface runoff from the tailings impoundment would be directed toward a tributary to Little Cherry Creek, and may cause some increases in stream sedimentation during construction of the diversion channel. The channel would be designed to minimize erosion and sedimentation. The increased watershed area of Little Cherry Creek would increase streamflows, which may also increase the sediment delivery to Little Cherry Creek when storm runoff occurred. Initial sediment delivery would have an adverse effect on the aquatic biota, but sediment delivery would decrease over time and the channel would readjust to provide higher quality aquatic habitat than is currently available.

3.6.4.3.2 Water Quantity

Evaluation, Construction, and Operations Phases

East Side Streams

Without mitigation, the primary difference between Alternatives 2 and 3 regarding effects on streamflows would be the location of the tailings impoundment between Poorman and Little Cherry creeks. Flow in Bear Creek would not be affected by Alternative 3. Operation of the pumpback wells would reduce streamflow and available habitat in Libby and Poorman creeks. Discharges from the Libby Creek Water Treatment Plant would occur in all phases, and would be greater in Alternative 3 compared to Alternative 2 because the LAD Areas would not be used.

The Forest Service has a year-round 40 cfs instream flow right for a segment of Libby Creek from the Bear Creek confluence downstream to above the Hoodoo Creek confluence, as discussed in section 3.12, *Water Rights*. This right is used to provide adequate flows for bull trout to migrate from Libby Creek into Bear Creek and spawn. In Alternative 3, MMC would monitor the flow at LB-2000, and whenever flow was less than 40 cfs at LB-2000, would treat and discharge water from the Water Treatment Plant at a rate equal to its Libby Creek watershed appropriations to avoid adversely affecting this senior water right. Typically, flows less than 40 cfs occur within this reach between August and March. Up to 2.5 cfs would be diverted from Libby Creek upstream of Little Cherry Creek in the intervening months if necessary. Effects on aquatic habitat from this diversion would not occur or be minimal, as the diversions would only occur during the high flow period of the year. Stored and treated water would be released into Libby Creek from the Water Treatment Plant when flow at LB-2000 was less than 40 cfs. Likewise, discharges to Ramsey Creek equaling MMC's baseflow changes to Ramsey Creek would occur if flows at RC-300 were less than 1 cfs to avoid adversely affecting water rights in this stream.

The analysis of effects to aquatic life from changes to water quantity in Alternative 3 was based on the impact analysis presented in the BA (USDA Forest Service 2013a). This analysis used data presented in USGS studies (Maret *et al*. 2005, 2006; Sutton and Morris 2004, 2005) to establish passage criterion for adult migratory bull trout in riffle areas that could be applied to analysis area streams. It also used these data to evaluate the relationship between habitat availability and flow for bull trout at different discharges to assess possible impacts on bull trout populations as a result of the changes in low flows projected to occur in Alternative 3. Further details on the methods used and the applicability of the USGS data are provided in the BA (USDA Forest Service 2013a).

The criteria used to determine if decreases in low flows would result in restrictions on adult migratory bull trout passage were a minimum depth of 0.6 feet for at least 25 percent of the stream width, with 10 percent of this stream width of at least this minimum depth being contiguous habitat (USDA Forest Service 2013a). For all stream reaches likely to be affected by decreased water quantity during low flows, the existing $7Q_{10}$ flows (Table 108 and Table 109) were determined to be unlikely to allow passage by adult migratory bull trout through riffle habitat based on the minimum depth criteria and habitat data from the analysis area streams (USDA Forest Service 2013a). Therefore, under all action alternatives and phases, these reaches would continue to potentially act as low flow barriers to adult migratory bull trout. The stream length, duration, and frequency of the existing passage restrictions would possibly increase in all bull trout occupied stream reaches within the analysis area except for the reaches of Libby Creek downstream of the Water Treatment Plant discharges. Flows in this portion of Libby Creek are predicted to increase under all alternatives during all phases, which could increase the likelihood of bull trout being capable of moving into and out of this reach or the time period in which they could do so. Redband trout are typically smaller in size than adult migratory bull trout, which would suggest that their movement would be likely be less affected by the decrease in low flows projected to occur in some analysis area streams.

Flow in Libby Creek in the reach upstream of the Water Treatment Plant discharges would decrease, which could affect fish movement throughout this reach during the low flow period of the year. The only salmonid species present within this portion of Libby Creek upstream of Libby Falls are resident bull trout. Resident bull trout are generally smaller than migratory forms, ranging in size from six to 12 inches compared to 24 inches or more for adult migratory bull trout (Riemann and McIntyre 1993). Thus their movement might be impacted less by the decreases in low flows.

The impact analysis included in the BA evaluated the maximum changes to habitat availability that would occur in Alternative 3 using bull trout life history information and the habitat-flow relationships developed from the USGS data (USDA Forest Service 2013a). For every one percent decrease in low flows resulting from the project, a corresponding 0.4 percent, 0.5 percent, and 1 percent decrease was predicted to occur in adult, juvenile, and spawning bull trout habitat (Table 76).

Effects on low flows would not occur or would be minimal during the Evaluation Phase, and impacts on aquatic habitat would not be expected and are not addressed further. Changes to water quantity would occur during the Construction Phase but would be of a lesser magnitude than those occurring in later phases for all analysis area streams. The analysis presented in the BA (USDA Forest Service 2013a) focused on evaluating effects to habitat availability for bull trout when these effects would be the greatest in each stream reach. Based on this, changes to habitat availability for bull trout were not quantified for the Construction Phase, but are instead addressed qualitatively based on the estimated changes in low flows in each analysis area stream.

Within the east side streams, low flows during the Construction Phase are predicted to increase slightly in the downstream reaches of Poorman Creek and Little Cherry Creek (3 percent), and to decrease slightly in Ramsey Creek (-1 percent) (Table 76). Changes of this magnitude would likely have negligible or minor impacts on aquatic habitat that would be difficult to detect. Upstream of the Water Treatment Plant discharges, baseflow reductions in Libby Creek near the CMW boundary were estimated to be 9 percent (section 3.11.4, *Surface Water Hydrology*), which would decrease the available aquatic habitat to a greater extent than estimated for the tributaries. The resident bull trout population within this portion of Libby Creek may be adversely affected by the reduction in available habitat.

Table 76. Estimated Impacts on Bull Trout Habitat Availability based on Changes Predicted to Occur to Low Flows in Analysis Area Streams in Alternative 3.

Stream Site Location	Maximum Percent Change in Habitat Availability at Low Flow			
	Phase	Adult	Juvenile	Spawning
Libby Creek Watershed				
LB-100	Operations	-8	-10	-20
LB-300	Operations	+55	+69	+139
LB-2	Operations	+4	+5	+10
LB-2000	Operations	+4	+5	+9
RA-600	Operations	-1	-1	-2
PM-1200	Operations	-5	-6	-12
Rock Creek Watershed				
RC-3	Post-Closure	-4	-4	-9
RC-2000	Post-Closure	-3	-4	-7
East Fork Bull River Watershed				
EFBR-2	Post-Closure	-4	-5	-11
EFBR-500	Post-Closure	-4	-5	-11
EFBR Near Mouth	Post-Closure	-2	-2	-9

Source: USDA Forest Service 2013a, except for RC-2000; EFBR=500, and EFBR near mouth. The BA reported cumulative impacts for these sites; this table discusses direct and indirect effects of Montanore only.
Site locations are shown on Figure 76.

Water treatment plant discharges to Libby Creek would result in large flow increases downstream of LB-300 (79 percent), which would lessen farther downstream near the Bear Creek confluence to an estimated 7 percent increase. These discharges would increase available habitat within a small portion of the Libby Creek reach used by the resident bull trout population, which may offset the habitat reductions that occur from the decreased flows upstream of the discharges to some extent. While the resident bull trout population is limited in distribution to the portion of Libby Creek above Libby Falls, the increased flows and corresponding habitat availability would continue for some distance downstream, with smaller increases estimated to occur further downstream. These increases would benefit the bull trout and other fish species within this section of Libby Creek, including the redband trout population. Higher flows resulting from the Water Treatment Plant discharges would increase the depth of the pool habitat and provide more thermal refuge areas for salmonids and other fish during the times of year when flows are lowest. Macroinvertebrate populations may also be beneficially affected, as the increased flow would result in greater wetted area and thus potential habitat within the affected reaches of Libby Creek.

Toward the end of the Operations Phase (Table 98, p. 565), impacts resulting in decreased low flows would be greater to all east side streams in Alternative 3 compared to impacts during the Construction Phase, although Ramsey Creek would continue to be minimally affected by any changes. Low flow in Little Cherry and Poorman creeks were estimated to decrease by 19 and 12 percent, respectively. Such decreases would result in substantial reductions in habitat availability and quality for fish populations. Bull trout have not been collected in Little Cherry Creek in any survey or in Poorman Creek since 1994 (FWP 2012), but redband trout and their hybrids are present in both streams. The impact analysis presented in the BA was not specifically calibrated to account for habitat preferences of redband trout, but reduced flows and bull trout habitat availability would indicate decreases in habitat availability for redband trout and other salmonids. Thus, the redband trout populations in Poorman and Little Cherry creeks would potentially be adversely impacted by the decreases in low flows predicted to occur in the Operations phase.

Upstream of the Water Treatment Plant discharges to Libby Creek, baseflows would decrease to their maximum extent (20 percent) at the end of the Operations phase, resulting in decreased habitat availability for the resident bull trout that inhabit a portion of this reach up to the near the CMW boundary. Based on the BA analysis, habitat availability for these trout would decrease in this reach of Libby Creek by an estimated 8, 10, and 20 percent for adult, juvenile, and spawning habitat, respectively (Table 76) (USDA Forest Service 2013a). The proposed bull trout mitigation plan (USDA Forest Service 2013a) includes habitat restoration in this portion of Libby Creek to mitigate for the potential for detrimental effects to occur to the resident bull trout population in this portion of Libby Creek. The mitigation plan is further discussed in section 3.6.4.3.6, *Threatened and Endangered Species*.

Macroinvertebrate populations in Little Cherry Creek, Poorman Creek, and the upstream Libby Creek reach could be adversely affected by the decreases in low flows, but effects on these assemblages may not be detectable in analysis area streams. Macroinvertebrate populations would also be present in headwater stream reaches that do not support fish populations, and could be impacted by the reduced low flows in these areas. Baseflows at the end of the Operations Phase at near or upstream of the CMW boundary on Ramsey and Libby Creeks were predicted to be reduced by 8 and 11 percent (Table 98, p. 565), respectively. The reach of Poorman Creek near the CMW boundary would not be affected by reductions in baseflow. Results of some studies have demonstrated that flow reductions, even when substantial, have resulted in no or variable changes in metrics used to assess macroinvertebrate assemblages (Dewson *et al*. 2007; Poff and Zimmerman 2010). Invertebrate taxa differ in their sensitivity to environmental stressors and their habitat requirements, which may have resulted in the lack of a consistent response to flow changes in these studies. Additionally, peak flows would not be measurably affected in the analysis area; therefore, flushing of any accumulated sediment would still occur under a similar regime as existing conditions. Based on this, substrate composition would not be altered.

As in the Construction Phase, increases in low flows would occur in Libby Creek in the reaches downstream of the Water Treatment Plant discharge point during the Operations Phase. These increases would be greater than in any other phase (Table 110), with low flows estimated to increase by 138 percent at LB-300 and by 9 percent further downstream at LB-2000. The KNF (2013a) determined that such an increase would affect adult, juvenile, and spawning habitat availability for bull trout in the reach near LB-300 by increasing it by an estimated 55, 69, and 139 percent (Table 76). Bull trout habitat availability for adults and juveniles further downstream near LB-2 and LB-2000 would benefit to a lesser extent, with juvenile and adult bull trout habitat availability estimated to increase by 5 percent or less during this phase, while spawning habitat would increase by 9 to 10 percent. Use of this reach by spawning bull trout is questionable. While other existing factors unrelated to streamflow may continue to limit bull trout populations in this reach of Libby Creek, such substantial increases in habitat availability would be beneficial to bull trout populations, as well as other fish and macroinvertebrate populations. Bull trout abundance in all reaches of Libby Creek downstream of Libby Falls near LB-300 is low based on recent survey data. Redband trout and their hybrids are more abundant within this reach, and should benefit from the increased habitat as a result of increased low flows. Flow in Bear Creek, which supports the highest densities of bull trout within the Libby Creek watershed, would not be affected in Alternative 3.

West Side Streams

Predicted changes in low flows in west side streams in the Construction Phase in Alternative 3 are estimated to be three percent or less. Changes in low flows are predicted to continue to be minimal in the Operations Phase at RC-3, RC-2000, EFBR-2, and EFBR-500 but a decrease of 21 percent was estimated for the reach of East Fork Rock Creek at the CMW boundary (EFRC-200) (Table 110). Bull trout do not inhabit this reach of the stream near the Rock Lake outlet, but hybridized westslope cutthroat trout have occasionally been collected and would be adversely affected by the decrease in habitat availability and quality during the low flow time of the year within this reach. During the Operations Phase, predicted decreases in low flow and wetted perimeter at RC-3 (Figure 76), a stream reach that supports bull trout and pure westslope cutthroat trout populations, are 1 percent (Table 109). Effects on aquatic populations from these minimal decreases would likely not be measurable within this reach or farther downstream in the Rock Creek mainstem. The intermittent flows that occur in the mainstem of Rock Creek under existing conditions could be exacerbated by the slight decreases in low flows, and, if so, would further restrict movement of migratory and resident fish. A decrease in low flow of 2 percent was predicted for the most upstream reach inhabited by bull trout on the East Fork Bull River (EFBR-2), although the estimated change in wetted perimeter (7 percent) was greater than for the East Fork Rock Creek site (Table 109).

Lakes

Changes in Rock Lake levels would be negligible during the Evaluation, Construction, and Operations phases, and any effect on aquatic habitat and populations would be minimal. St. Paul Lake may be affected similarly by mining, so any effect on aquatic habitat and populations is expected to be minimal.

Closure and Post-Closure Phases

East Side Streams

In east side streams, most effects on aquatic habitat from decreased low flows in the Closure and Post-Closure phases would be similar to or less than those predicted to occur during the Operations Phase, and little to no difference in these effects is expected to occur with or without mitigation (Table 111 and Table 112). The magnitude of the decrease (-12 percent) in low flow predicted to occur in Poorman Creek during operations would remain the same during the Closure and Post-Closure phases. The decrease in low flow predicted to occur in Little Cherry Creek would also be the same in the Closure Phase as in the Operations Phase (-19 percent). An increase in low flow would occur in Little Cherry Creek during the Post-Closure Phase as a result of reclamation of the impoundment and routing of the surface water runoff into an unnamed tributary of Little Cherry Creek. Any increased flow in Little Cherry Creek would be a long-term benefit to aquatic habitat and thus the pure redband trout population in this stream. The decrease in low flow in Ramsey Creek would continue to be minimal in these two phases (-1 percent). During the Closure and Post-Closure phases, decreases to aquatic habitat described for the Operations Phase would continue to occur in Poorman Creek, and during the Closure Phase in in Little Cherry Creek.

Within the portion of Libby Creek within the analysis area, the increases in flows observed in the earlier phases in the reach immediately downstream of the Water Treatment Plant discharges would continue, but be less in the Closure and Post-Closure phases (Table 111 and Table 112). The benefits to bull trout and other aquatic assemblages resulting from the increases in flow would still occur, but be less in these phases. In Libby Creek near the Bear Creek confluence, the additional flow provided by the Water Treatment Plant discharge would result in a net zero change in low flow.

Upstream of the Water Treatment Plan discharge in the reach of Libby Creek near the CMW boundary, the decrease in baseflow and corresponding decrease in bull trout habitat availability that occurred in the Operations Phase would continue to occur in the Closure and Post-Closure phases, but would lessen over time (USDA Forest Service 2013a). With mitigation, the effects of changes on aquatic biota would be the same as or similar to unmitigated effects in the Libby Creek watersheds during all phases.

After the pumpback well system ceased operations and the groundwater table reached steady state conditions, streamflow in Libby Creek and most tributaries would return to pre-mine conditions (Table 113). Low flow conditions in Little Cherry Creek would be permanently higher by an estimated 44 percent based on the increase in drainage area, with benefits to the aquatic habitat.

West Side Streams

The reduction in low flows and aquatic habitat would increase in the west side streams in the Closure and Post-Closure phases compared to the previous phases (Table 111 and Table 112). Effects on aquatic habitat would be greatest in the headwater reaches of these streams, including those stream reaches near and upstream of Rock Lake and St. Paul Lake. A maximum reduction of 97 percent is estimated at EFBR-300. Westslope cutthroat trout have been occasionally collected near the outlet of Rock Lake, and could potentially use the reach immediately upstream of the lake (Kline Environmental Research and NewFields 2012). The streams that flow into St. Paul Lake are isolated from the East Fork Bull River by a moraine below the lake, and likely do not support fish populations. Macroinvertebrate populations are present throughout these reaches, and would be affected by the reduction or elimination of flow that are predicted during low flow periods. Headwater streams also perform important ecological functions in terms of transport of organic matter, invertebrates, nutrients, and woody debris to downstream waters (Meyer *et al*. 2007; Wipfli *et al*. 2007; Freeman *et al*. 2007), as discussed in Kline Environmental Research and NewFields (2012). Reductions in flow could adversely affect the ability of these headwater reaches to perform such functions.

In the Rock Creek drainage downstream of Rock Lake, low flows would be decreased by an estimated 62 percent during the Closure Phase and 100 percent during the Post-Closure Phase in the reach near the CMW boundary (EFRC-200) without mitigation (Table 111 and Table 112). With mitigation, the reduction in flow is estimated to be 59 percent in the Post-Closure phase. The mitigation actions simulated in MMC's 3D model included partial grouting and bulkheads, as discussed further in the effects analysis in section 3.11.4.2, *Surface Water Hydrology*. The reduction in low flow in East Fork Rock Creek following closure of the mine would decrease aquatic habitat and adversely affect hybridized westslope cutthroat populations within this reach, with habitat utilization potentially eliminated seasonally in at least some years during the Post-Closure period without mitigation. The composition of the aquatic macroinvertebrate assemblages within this reach would also be affected, though likely to a lesser extent. Some macroinvertebrates have adaptations that allow them to tolerate periods of drought or quickly recolonize reaches. With mitigation, the Post-Closure effects on aquatic habitat and assemblages in this portion of East Fork Rock Creek would be less, but may still be substantial.

Effects on low flow in East Fork Rock Creek would lessen farther downstream in both phases, with such decreases estimated to be 9 percent within the reach near the West Fork Rock Creek confluence (RC-3) and 7 percent near the mouth of the mainstem of Rock Creek (RC-2000) (Table 109 and Table 112) in the Post-Closure Phase. Wetted perimeter was estimated to decrease by 9 percent at RC-3. Decreases in adult, juvenile, and spawning habitat availability for bull trout in East Fork Rock Creek as a result of flow decreases in the Post-Closure Phase when these effects would be greatest were estimated to be 4 percent for adult and juvenile bull trout, with spawning habitat decreasing by 9 percent (Table 76) (USDA Forest Service 2013a). Similar changes to bull trout habitat would occur at the mouth of Rock Creek near RC-2000 (Table 76), and this reach might be further affected by increasing the length, duration, or frequency of intermittent flow that occurs in the mainstem. Westslope cutthroat trout and other salmonid populations within this drainage would also be adversely affected by decreasing flow and corresponding loss of habitat in East Fork Rock Creek and the mainstem of Rock Creek. These effects would be reduced with hydrology and fisheries mitigation. The agencies' hydrology mitigation would include grouting, installing barriers in the mine void, using multiple adits during closure, or other measures as discussed in section 3.11.4.2, *Surface Water Hydrology*. Mitigation measures would be further evaluated after additional data were collected during the Evaluation Phase. The agencies' fisheries mitigation is discussed section 3.6.4.3.6, *Threatened and Endangered Species*.

At steady state conditions without mitigation, streamflow in East Fork Rock Creek at EFRC-200 is estimated to be permanently reduced by 10 percent (Table 113). With mitigation at steady state conditions, streamflow and habitat conditions in East Fork Rock Creek at EFRC-200 would return to pre-mine conditions. With or without mitigation, streamflow in the Rock Creek mainstem near the mouth would be affected by less than 1 percent, and habitat conditions would likely be indistinguishable from pre-mine conditions.

Predicted reductions in flow in the East Fork Bull River would also be greater during the Closure and Post-Closure phases compared to previous phases as the mine void filled (Table 111 and Table 112), and aquatic habitat for bull trout and other salmonids would be adversely affected. Low flows at EFBR-500 are estimated to decrease by 4 percent and 11 percent during the Closure Phase and Post-Closure phases, respectively, with or without mitigation. Decreases in bull trout habitat availability would be similar for the reach near the Isabella Creek confluence (EFBR-2) and the reach near the CMW boundary (EFBR-500) with decreases of 4 to 5 percent predicted in both reaches for adult and juvenile bull trout habitat and 11 percent in spawning habitat (Table 76). Effects would be less at the mouth. East Fork Bull River is considered a stronghold for bull trout populations within the Lower Clark Fork core area, and surveys indicate that the affected reach supports much of the bull trout spawning. Wetted perimeter at EFBR-2 was estimated to decrease by 26 percent, which indicates that aquatic habitat for other salmonids and macroinvertebrates would be adversely affected. Available habitat in the East Fork Bull River would essentially return to pre-mine conditions when the mine void filled and the potentiometric surface reached steady state conditions (Table 113), with a 1 percent or less reduction in low flow with mitigation.

Lakes

Groundwater flow into Rock Lake would continue to decline after mining ceased. Reductions in lake levels and volume would probably not have a detectable effect on the aquatic biota of Rock Lake. While the lake volume is projected to be decreased by 2 percent post closure with mitigation and up to 5 percent without mitigation, aquatic habitat changes would likely be difficult to separate from those caused by natural variability in lake levels that occur in part due to large influxes of surface water into the lake during snowmelt and storm events. Surface water influxes to the lake would not be affected by the project alternatives. Adverse effects on the hybrid cutthroat trout population in Rock Lake would not likely occur.

When groundwater levels reached steady state conditions, lake levels and volume would, with mitigation, return to pre-mine conditions. St. Paul Lake may be affected similarly by the mine as Rock Lake, so effects to the aquatic biota of St. Paul Lake would likely be immeasurable. In addition, much greater natural fluctuations in St. Paul Lake would make habitat changes virtually inseparable from those caused by natural variability.

Climate Change

As discussed above under Alternative 2, due to the possible range in effects of climate change on the aquatic resources and the many factors that could affect that outcome, quantifying the combined impacts of Alternative 3 and climate change was not feasible. The effects of the reduced low flows on aquatic resources combined with the effects of climate change may be greater than those estimated to occur in Alternative 3 alone.

3.6.4.3.3 Water Quality-Nutrients, Metals, and Temperature

All Phases

The modifications and mitigations included in Alternative 3 would decrease the impacts on water quality from the project. During all phases in Alternative 3, excess water would be treated at the Water Treatment Plant and discharged to an MPDES-permitted outfall. No LAD Areas would be used, so there would be no discharge to Ramsey or Poorman creeks. Discharges would meet ALS or BHES Order limits at the end of the mixing zone in Libby Creek (Table 127 and Table 128). Increases in water quality parameters in Libby Creek would be less than predicted under Alternative 2 because no LAD Areas would be used. The effect on aquatic life of any increase in nutrient or metal concentrations up to the ALS or BHES Order limits would be the same as discussed for Alternative 2. TIN and TN concentrations would increase over ambient conditions, but remain less than the 1.0 mg/L limit set as the BHES Order limit in Libby Creek in all phases. Total phosphorus concentrations would increase, but would remain lower than the standard. During mining, Alternative 3 would not affect the existing water quality in Little Cherry Creek and, therefore, would have no effect on its aquatic life. During the Closure and Post-Closure phases, the potential for the diluting effect to streams due to a reduction in groundwater inflows would still exist, but would be less than in Alternative 2 for most stream reaches, except the effect would be slightly greater in upper Libby Creek due to the difference in adit locations. Baseflow reductions in Libby Creek at the CMW boundary would be -22 percent during Closure and -13 percent during Post-Closure.

As in Alternative 2, increases in stream temperature could occur as a result of riparian disturbance, Water Treatment Plant discharges, and decreased groundwater inflow to streams. The maximum decreases in low flows are predicted to occur in the upstream reaches of East Fork Rock Creek and the East Fork Bull River during the Post-Closure Phase as the mine void filled.

Low flow decreases would also occur in most of the Libby Creek watershed, except increases would occur in the Libby Creek reach downstream of the Water Treatment Plant discharges. As with Alternative 2, factors such as air temperature, topography, weather, shade, streambed substrate, stream morphology, and the amount of subsurface streamflow also affect stream temperature. Based on this, effects on aquatic life would be possible but the extent and magnitude of these effects are uncertain.

3.6.4.3.4 Metals in Fish

As in Alternative 2, any increased metal concentrations in surface water would potentially increase metal concentrations in fish. All metal concentrations would be estimated to remain below the acute and chronic criteria for aquatic life during all phases of mine activity, including the chronic aquatic life standard for manganese adopted in Colorado. In Alternative 3, the LAD areas would not be used, and all discharges would be through the Water Treatment Plant, which may be modified to treat dissolved metals under this alternative. The risk of any increasing metal concentration in fish would be reduced under Alternative 3 in comparison to Alternative 2 based on these factors. Changes in metal concentrations in fish within the East Fork Bull River and East Fork Rock Creek drainage are not predicted with any of the alternatives as discussed in Alternative 2.

3.6.4.3.5 Fish Passage and Fish Loss

All Phases

The effects on bull trout passage due to changes in low flows were discussed in section 3.6.4.3.2, *Water Quantity*. The effects on the fisheries in Little Cherry Creek resulting from construction and use of the tailings impoundment in Alternative 2 would not occur in Alternative 3. During construction and operation of the mine, many of the same roads would be used for access to mine facilities in Alternative 3 as in Alternative 2. Alternative 3 would require one new road crossing across a perennial and a smaller stream (Table 107). The Seepage Collection Pond would affect 2.3 acres of designated 100-year floodplain of Libby Creek.

All bridges and other road work would comply with INFS standards and Forest Service guidance (USDA Forest Service 1995, 2008a), and would not affect fish passage. The agencies' proposed stream mitigation plan, discussed in section 2.5.7.1.2, would include the replacement of two culverts on Little Cherry Creek, one culvert on Poorman Creek, and bridge removal on Poorman Creek, which would improve fish passage. A detailed analysis of the potential credits of these projects using the Corps' Montana Stream Mitigation Procedure (Corps 2013a) is described in the revised Preliminary Mitigation Design Report for impacts on waters of the U.S. (MMC 2014a).

3.6.4.3.6 Threatened and Endangered Species

All Phases

The BA (USDA Forest Service 2013a) concluded that the project may affect, and is likely to adversely affect, bull trout in Libby Creek, Big Cherry Creek, Bear Creek, Cable Creek, Midas Creek, Poorman Creek, Ramsey Creek, West Fisher Creek, Fisher River, Rock Creek, East Fork Rock Creek, and the East Fork Bull River under Alternative 3. Effects to the Fisher River drainage and some of the Libby Creek drainage streams would be affected by the transmission line alternatives, as discussed in those sections of the BA. The bull trout mitigation proposed in Alternatives 3 and 4 may affect, but is not likely to affect, bull trout in Flower Creek, West Fork Rock Creek, and Copper Gulch. These streams have been proposed as potential mitigation sites, and bull trout populations are expected to benefit from the proposed mitigation projects where enacted. As with Alternatives 1 and 2, bull trout populations in analysis area streams would continue to be marginal and their habitat in need of restoration work from existing, non-project impacts in Alternative 3 without mitigation. Bull trout populations would continue to be susceptible to decline or disappearance due to hybridization with introduced brook trout, competition with brook trout and other trout present in the analysis area, or from other land use disturbances.

The analysis presented in the BA (USDA Forest Service 2013a) concluded that potential impacts from peak flow changes, water quality changes, and fish passage were considered to be negligible or beneficial to bull trout habitat and populations. The extent of these impacts was discussed in previous sections. The actual magnitude and direction of any such impacts would be confirmed through monitoring, and mitigated for if necessary. The TIN limit set in the BHES Order could be modified in the MPDES permit at any time if bull trout populations or other aquatic life were determined to be adversely affected by TIN concentrations below this limit. The impacts determined to likely affect bull trout populations in east and west side streams would mainly be from the short-term increases in sediment delivery to streams and the decreases in low flows that would be predicted to occur as a result of the project.

Impacts from the short-term increases in sediment delivery to streams would be mitigated through road access changes, which would result in long-term decreases in sediment to all streams affected. As discussed in section 3.6.4.2.1 *Sediment*, short-term sediment increases would be associated with facility construction, road construction, road reconstruction, and mitigation. Many of the adverse short-term effects of sediment increases would be less than in Alternative 2 because the tailings impoundment would not require a stream diversion in Alternative 3, and fewer disturbances in RHCAs would occur. The increases that occurred would affect bull trout by decreasing the food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish, and increasing the percentage of fine sediment in streams, which would adversely affect the success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival (USDA Forest Service 2013a). The sediment generated would fill interstitial spaces in the stream bed substrate reducing macroinvertebrate habitat and secondary productivity in the vicinity of bridge replacements on Bear Creek temporarily. Road use and reconstruction would contribute sediment to Libby and West Fisher Creeks, with similar effects. With the implementation of BMPs, a long-term decrease in sediment delivery to streams from roads in the analysis area would occur under Alternative 3 (Table 125) (KNF 2013).

The long-term decreases in sediment would potentially benefit brook trout populations in the Libby Creek and Rock Creek watersheds, but would be detrimental to bull trout populations due to an increased risk of competition and hybridization with brook trout. The benefits of the long-term sediment decreases are expected to be greater than the potential impacts from increasing brook trout populations.

The magnitude of effects on bull trout habitat availability within analysis area streams from the streamflow reductions during low flow conditions were discussed in section 3.6.4.3.2, *Water Quantity*. The largest estimated reductions were to spawning habitat availability in the Libby Creek, Rock Creek, and East Fork Bull River watersheds (Table 76) during the Operations or Post-Closure phases. Juvenile and adult habitat availability was also reduced in these watersheds.

Decreased low flows during the late summer/early fall months would result in fewer deep pools, which are limited in most analysis area streams under existing conditions. The presence of deep pools is a habitat requirement for adult and juvenile bull trout (Parametrix 2005). Deep pools help moderate stream temperatures, serving as thermal refuge and cover during the warm summer months. Reduced low flows would continue to occur during the winter months, when deep pools and runs serve as important features of the overwintering habitat for bull trout (Jakober *et al*. 1998; Muhlfeld and Morotz 2005; Al-Chokhachy *et al*. 2010), as well as other trout species. Spawning habitat has also been associated with areas of groundwater upwelling, as these tend to remain open through the winter, reducing the risk of redd freezing or dewatering (Fraley and Shepard 1989; Parametrix 2005). Decreases in groundwater upwelling associated with the project could adversely affect the quality of spawning habitat for bull trout and reduce egg survival.

The decreases in habitat availability in the Libby Creek watershed would be offset to some degree by the increases in streamflow due to discharges from the Water Treatment Plant, which are predicted to increase all types of habitat for bull trout substantially for some distance downstream of LB-300. The habitat for the resident bull trout population upstream of Libby Falls would be adversely affected by the decreases in low flow in the headwaters of Libby Creek upstream of the Water Treatment Plant discharge.

Decreased streamflow during low flow conditions would affect bull trout populations in Rock Creek and the East Fork Bull River. Flow reductions would affect reaches of both streams that support much of the bull trout spawning known to occur currently in these streams. Spawning habitat was estimated to decrease up to 9 and 13 percent in the East Fork Rock Creek and East Fork Bull River, respectively (Table 76). The East Fork Bull River supports the highest densities of bull trout in the Bull River drainage (Washington Water Power Company 1996) and is considered a stronghold for bull trout populations in the Lower Clark Fork Core Area.

Decreases in streamflow during low flow conditions could also adversely affect bull trout passage in Libby Creek above the Libby Adit, Rock Creek, and East Fork Bull River watersheds, but the analysis presented in the BA (as summarized in section 3.6.4.3.2, *Water Quantity*) indicates that conservative passage criteria currently indicate that sufficient depths are not present to allow for passage of adult migratory bull trout during low flows in these streams. Increasing stream temperatures or changes to the diurnal temperature ranges that currently exist may also occur in the east and west side streams due to decreased groundwater inflows to streams and lower flows associated with the project, as well as from riparian disturbance in some areas. Denser canopy cover may be present in some of the higher elevation stream reaches most affected by flow impacts, and, combined with the lower air temperatures at these elevations, may minimize such temperature changes, but the effect of these factors is uncertain, as discussed in section 3.6.4.2.5, *Temperature*. The limited data available on the percentage of canopy cover in the Rock Creek, East Fork Bull River, and Libby Creek watersheds indicate this parameter varies (Kline Environmental Research and NewFields 2012). A lower amount of disturbance within riparian areas would occur under Alternative 3 compared to the other alternatives.

Mitigation projects in the Kootenai and Lower Clark Fork Core areas are planned to offset the risk of the population declines estimated to occur from the project. As described in more detail in the BA appendix (USDA Forest Service 2013a) and in section 2.5.7.3, *Bull Trout*, these projects are designed to increase resident and migratory bull trout populations in the Kootenai and Lower Clark Fork Core Areas. The proposed projects would be in areas where bull trout populations were historically but not currently present, are currently present but only at low population densities, are present but at risk from the presence of non-native fish species, or are present but expected to be detrimentally affected by the project. Proposed mitigation actions for these areas could include creating secure genetic reserves through bull trout transplant or habitat restoration, incorporating actions to correct any limiting factors in streams so that higher abundances of bull trout would be supported, or eradicating non-native fish. The impact analysis provided in the BA was used as a guideline to evaluate effects, but mitigation success for all of these projects would be monitored to determine that the value of the projects actually exceeds any predicted impacts on bull trout populations.

Within the Kootenai River Core area, mitigation projects would focus on offsetting any decreases in bull trout habitat and populations that may occur in the reach of Libby Creek upstream of Libby Falls where the isolated resident bull trout population currently exists. On-site mitigation within this reach of Libby Creek would be the preferred option, and opportunities include installation of large wood aggregates in the floodplain and riparian areas to improve spawning and rearing habitat for bull trout. Large wood aggregates have been found to create more habitat for other aquatic and semiaquatic biota, and allow establishment of riparian vegetation (Wu *et al.* 2011, He *et al.* 2009). If the on-site mitigation were to fail, the contingency plan would be to locate a mitigation project in Flower Creek. Flower Creek is a historical bull trout stream, but the presence of dams and brook trout complicate the improvement or reestablishment of this species in this stream. Several options for mitigation in Flower Creek would be available, and these would be further prioritized if necessary based on the habitat conditions that were present. Options include establishing a genetic reserve by transferring bull trout from Libby Creek or Bear Creek, implementing a non-native fish eradication plan, and reestablishing upstream passage. The BA estimated the number of bull trout that could be gained by implementing mitigation projects in Flower Creek as 1,010 trout. This estimate is based on reach length and an average of bull trout densities within the analysis area (USDA Forest Service 2013a). The feasibility of the proposed mitigation actions would be evaluated for each project area to assess what actions would be likely to succeed.

Within the Lower Clark Fork Area, mitigation projects were proposed to specifically offset decreases in bull trout habitat and populations that may result from the decreased low flows associated with mine dewatering. Possible projects were proposed on West Fork Rock Creek and the mainstem of Rock Creek to account for losses that may occur in East Fork Rock Creek, while Copper Gulch was the location chosen for mitigation of any losses in the East Fork Bull River. Within West Fork Rock Creek, additional habitat and population surveys would be conducted to identify limiting factors for bull trout and to assess the ability of this stream to provide spawning habitat. The BA (USDA Forest Service 2013a) estimated possible gains in bull trout in West Fork Rock Creek as ranging from 148 to 566 trout. Possible gains were estimated using an average of the existing bull trout density data available for the analysis area streams and the length of the reach in which the mitigation projects are planned to occur. The mainstem of Rock Creek would also be assessed to determine if brook trout removal would be feasible, which would further benefit bull trout populations by lowering the risk of hybridization and competition. Bull trout were historically present with in Copper Gulch, but are currently absent. If feasible, habitat within the lower reach of Copper Gulch that currently has intermittent flows seasonally would be restored to improve access for migratory bull trout and allow for the reestablishment of a self-sustaining bull trout population. Brook trout removal may also be included as part of this project. From 126 to 183 bull trout were estimated to be potentially gained as a result of this project. All projects are described further in the BA appendix (USDA Forest Service 2013a).

Effects on Critical Habitat

The locations and structures of the plant and impoundment site in Alternative 3 would decrease disturbance within RHCAs and reduce the potential for short-term effects from sediment reaching streams designated as critical habitat in the Libby Creek watershed. Alternative 3 would affect the same segments in East Fork Rock Creek and Rock Creek as Alternative 2. Effects of streamflow changes on the designated critical habitat in Libby Creek, East Fork Rock Creek, Rock Creek, and the East Fork Bull River would be similar to Alternative 2. The reduced flows would affect designated bull trout critical habitat due to direct effects on springs, seeps, and groundwater sources, and subsurface water connectivity that contribute to water quality and quantity and provide thermal refugia. The adverse effects of the project in critical habitat for bull trout may inhibit the normal reproduction, growth, and survival of these populations. Mitigation would reduce post-mining effects on East Fork Rock Creek streamflow and thus the aquatic habitat. Critical habitat in Bear Creek would not be adversely affected by changes in streamflow.

Sedimentation in critical habitat would be reduced through access changes in the Rock Creek and Libby Creek watersheds and implementation of sediment abatement and instream stabilization measures designed to reduce sediment contribution from the identified sediment sources in the Libby Creek watershed. These measures would decrease sediment delivery in designated critical habitat in Libby Creek and Bear Creek. Increases in nutrient and metal concentration are likely to be similar to, but less than, in Alternative 2 because the LAD Areas would not be used.

The greatest potential effect to designated critical habitat would occur in the event of a tailings pipeline failure. A leak could introduce tailings to Poorman, Ramsey or Libby creeks reducing food resources and introducing fine sediment, adversely affecting critical habitat. If successful, the mitigation options described in the mitigation plan (section 2.5.7.3, *Bull Trout*) would offset the impacts predicted to occur to critical habitat in the Kootenai and Lower Clark Fork core areas.

3.6.4.3.7 Forest Service Sensitive Species and State Species of Concern

All Phases

Potential effects on the redband trout populations in the Libby Creek drainage would be less in Alternative 3 than in Alternative 2. In Alternative 3, no diversion of Little Cherry Creek would be necessary in the Construction Phase, and the population in Little Cherry Creek would not be adversely affected. A small flow increase in Little Cherry Creek would result in a long-term benefit to the redband trout population in the creek. All wastewater would be treated at the Water Treatment Plant before discharge in all phases, reducing the risk of nutrient and metal concentrations exceeding ALSs. Redband trout in the remainder of the Libby Creek drainage are largely hybridized and effects are expected to be minimal, for the most part less than predicted in Alternative 2. Alternative 3 may impact westslope cutthroat trout populations in the Rock Creek and East Fork Bull River drainages and would be similar to effects described in Alternative 2.

The effects of flow changes and associated changes in redband trout habitat in Libby Creek in the Closure and Post-Closure phases would be similar to Alternative 2. Streamflows would gradually return to pre-mine conditions when all site activities were completed and the groundwater table reached steady state conditions. Surface runoff from the Poorman tailings impoundment would be directed toward Little Cherry Creek, and may likely cause short-term increases in stream sedimentation during construction of a diversion channel to Libby Creek. Any increased stream sedimentation would have a short-term adverse effect on the redband trout population in Little Cherry Creek due to increased sediment in the water column and the substrate. These increases would be temporary, and would be minimized through BMPs. Post-operations, average annual flows would increase in Little Cherry Creek due to the increased watershed size, which would benefit the pure redband trout in this stream in the long term. Effects on westslope cutthroat trout in Rock Creek and the East Fork Bull River would be similar to Alternative 2. Mitigation would reduce post-mining effects on East Fork Rock Creek streamflow.

The primary risk to both the redband and the westslope cutthroat populations would remain hybridization, which is unrelated to mine activities. Little data exist to determine the status of torrent sculpin populations within the analysis area, but potential effects would generally be expected to be less under Alternative 3.

3.6.4.3.8 Effectiveness of Agencies' Proposed Monitoring and Mitigation

Monitoring

As part of a plan to assess project effects, MMC would conduct aquatic biological monitoring before, during, and after project construction and operation at sites within and downstream of the analysis area in the Libby Creek watershed and at benchmark sites upstream of any potential influence of the project (Appendix C). The collection of data at benchmark sites and before any mine construction or activity would provide comparative data to evaluate whether any changes detected in aquatic assemblages were related to impacts from mine activities. The monitoring plan is comprehensive, and includes assessment of fish, macroinvertebrate, and periphyton assemblages, as well as habitat and substrate conditions. This plan would effectively assess the condition of the aquatic communities and habitat within analysis area stream sites in the Libby Creek watershed and detect potential impacts on these populations. Most sampling activities would occur once a year or more frequently, and, over time, would provide sufficient data to detect trends occurring over times within these populations. Monitoring reports discussing the results of the sampling would be submitted annually, and modifications to the plan would be made if necessary.

In addition, as part of the proposed bull trout mitigation plan, MMC would prepare a fisheries monitoring plan that includes all monitoring necessary to document and verify project effects on bull trout populations, including effects of mitigation actions. This plan would include monitoring in the Libby Creek, East Fork Rock Creek, and East Fork Bull River watersheds, as well as in other watersheds proposed as mitigation sites, and thus would provide data to document any effects that may occur to bull trout populations in both Core Areas potentially affected by the project. Monitoring would be initiated before any construction began to provide baseline data. Further details of this plan would be developed before any construction being initiated for the mine, and aspects of the plan would be modified if necessary to effectively detect any changes in bull trout populations and their habitat within the analysis area. Monitoring would continue throughout all phases of the project.

Mitigation

In Alternative 3, potential impacts on aquatic resources would be mitigated through road status changes, projects that would be conducted for waters of the U.S. mitigation, and projects developed specifically to mitigate for impacts on bull trout. Components of all mitigation projects are presented in section 2.5.7.2, *Bull Trout*, and additional discussion of the bull trout mitigation projects was also included in section 3.6.4.3.6, *Threatened and Endangered Species*, with further detail provided in the BA (USDA Forest Service 2013a).

Road status changes would result in substantial long-term reductions in sediment delivery to streams which would effectively mitigate for any short-term increases in sediment delivery to streams resulting from construction of mine-related structures and facilities. Benefits to aquatic habitat from the substantial reduction in sediment delivery to streams compared to existing conditions would begin to occur to occur in the Evaluation Phase before the mine began operating and would continue throughout the project. The effect of these reductions on aquatic habitat would be confirmed through the monitoring data.

The stream mitigation in Alternatives 3 and 4 are also directed in part at decreasing sediment levels as a compensatory mitigation action to offset any short-term sediment increases resulting from the project (USDA Forest Service 2013a). Multiple projects are proposed for this mitigation that would be effective at reducing sediment levels in Little Cherry Creek, which have been documented to be high in some reaches under existing conditions. Reductions in fine sediment in Little Cherry Creek would mitigate for effects to this or other analysis area streams from the short-term increases in sediment that may occur as a result of construction activities associated with the project. The removal of culverts in Little Cherry Creek would be included with this mitigation, and would likely improve fish passage in this stream. Some of these projects would occur before the Construction Phase, and would thus offset impacts before they occurred. Other actions are also included in the stream mitigation, such as removal of a bridge on Poorman Creek at closure and habitat restoration on Swamp Creek, a tributary of Libby Creek. These actions would also be expected to improve aquatic habitat and mitigate for the adverse impacts that may occur as a result of mine construction and operation.

The proposed mitigation actions included in the bull trout mitigation plan were selected to identify and address factors that are likely limiting bull trout populations within the analysis area under existing conditions. They include creating genetic reserves through bull trout transplanting, securing genetic reserves through habitat restoration, and eradicating non-native fish species. Creating and securing genetic reserves would mitigate for potential impacts on bull trout populations by effectively lessening the risk of loss of genetic diversity from project impacts or natural events. A non-native salmonid repression program has already been initiated by Avista in the East Fork Bull River and a shift towards more native species has been documented (Horn and Tholl 2011). Similar beneficial effects would be projected under the mitigation plan from removal of non-native fish species, which pose a risk to bull trout populations through hybridization or increased competition under existing conditions.

Mitigation projects would be evaluated for feasibility before being initiated, but would likely be effective in offsetting the effects on bull trout populations from the potential decrease in aquatic habitat resulting from decreased low flows associated with the alternatives. Effectiveness of the projects included in the bull trout mitigation plan would be assured through several steps. Initially, more detailed surveys of the mitigation streams would be conducted to provide additional data on the status of the bull trout populations in these areas and the presence of any factors that could limit success (USDA Forest Service 2013a). These data would be used in a preliminary analysis of the feasibility of each project that would be completed in the Evaluation Phase. Additional mitigation options would be identified if necessary. Mitigation projects would be initiated before the Construction Phase, and a report detailing and quantifying progress toward accomplishment of mitigation objectives would be prepared before construction began to allow MMC and the agencies to determine if and what adaptive management changes would be required to meet all objectives. Additional progress reports completed periodically throughout the mine phases would document project and mitigation effects on bull trout populations.

Beneficial and adverse impacts occurring to the bull trout populations as a result of both the alternatives and the mitigation projects would be verified and confirmed through the monitoring data (USDA Forest Service 2013a). As discussed in section 3.6.2.3, *Impact Analysis Methods,* impacts on the aquatic populations were assessed using the best available methods, but uncertainty as to the extent and magnitude of impacts on aquatic life exists. Based on this uncertainty, use of monitoring data collected before and during the project phases would ensure that the value of the mitigation projects exceeds and precedes documented and predicted impacts for each Core Area. Adaptive management changes would be undertaken if necessary to meet those objectives.

3.6.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would be similar to Alternative 2, with modifications to MMC's proposed Little Cherry Creek Tailings Impoundment as part of the alternative. All other modifications and mitigations described in Alternative 3, other than those associated with the Poorman Tailings Impoundment Site, would be part of Alternative 4.

3.6.4.4.1 Sediment

Evaluation, Construction, and Operations Phases

In general, potential sediment impacts would be reduced in Alternative 4 compared to Alternative 2, but would be similar or greater than those predicted for Alternative 3. In Alternative 4, the permit and disturbance boundaries for the Little Cherry Creek Tailings Impoundment Site would be modified to reduce effects on RHCAs in this drainage in comparison to Alternative 2. Alternative 4 would affect 236 acres of RHCAs on National Forest System land and 147 acres of other riparian areas on private land (Table 74). Because RHCAs are designed to act as buffers to protect the streams from sediment as well as other impacts, fewer disturbances within these areas would reduce the amount of sediment that would reach the streams, particularly during the Construction Phase when the sedimentation impacts associated with the mine facilities are expected to be the most severe.

As in the Alternatives 2 and 3, some short-term increases in sediment delivery to streams may occur under Alternative 4 as a result of construction activities. Pathways through which effects to aquatic habitat and populations would occur from such increases were discussed in section 3.6.4.2.1, *Sediment.* The mitigation plans for Alternative 4 regarding sediment reduction would be the same as Alternative 3. Proposed road BMPs, road closure mitigation, and implementation of sediment abatement and instream stabilization measures designed to reduce sediment contribution from the identified sediment sources would substantially reduce the contribution of sediment over the long-term to most analysis area streams within the Libby Creek watershed, and would also decrease the sediment delivery in East Fork Rock Creek (KNF 2013). The estimated sediment delivery from roads to analysis area streams for the Evaluation, Construction, and Operations phases would be 140.7 tons, compared to 335.3 tons under existing conditions, which would be a 58 percent decrease (Table 125, p. 693). The percentage decrease would be greater than that predicted to occur in Alternative 2 and similar to Alternative 3.

The Diversion Channel in Alternative 4 would be constructed to minimize erosion. Some periodic increases in sediment in the lower channels and Libby Creek would occur, particularly during storm events. These increases is expected to only persist in the short term because much of the sediment would likely be flushed out of the upper Libby Creek drainage by the high flows. The probability of catastrophic failure of the tailings impoundment for this alternative was not specifically evaluated, but is expected to be similar to Alternative 2 and therefore low. If it were to occur, short- and long-term effects would occur to the aquatic habitat and aquatic life as described in Alternative 2.

Closure and Post-Closure Phases

Minimal increases in sedimentation is expected in Alternative 4 once mine operations ceased. Additional sedimentation of the diversion channels may occur as the channels re-established to accommodate runoff from the tailings impoundment. Any sedimentation would adversely affect the transplanted redband trout population in the diverted Little Cherry Creek channel. The increase in sediment in Bear Creek in Alternative 2 from surface runoff from the tailings impoundment would not occur in Alternative 4. All short- and long-term reclamation objectives in Alternative 2 are retained in Alternative 4, and all of the erosion and sediment control measures described in Alternative 2 and 3 also would be implemented. The KNF's analysis of roads estimated that 33.9 tons of sediment would be delivered to analysis area streams during Closure and Post-Closure Phases with the implementation of BMPs, compared to 67.1 tons under existing conditions (Table 125), a decrease of 49 percent. The total sediment delivery to these streams under Alternative 4 was estimated to be 174.6 tons over all phases with BMPs and road mitigation, which would be a decrease of 57 percent from existing conditions, compared to the decreases of 47 percent and 57 percent predicted to occur under Alternatives 2 and 3, respectively. Based on this, aquatic habitat and populations within these streams would not be adversely affected in the long-term.

3.6.4.4.2 Water Quantity

All Phases

The effects of Alternative 4 on water quantity and aquatic habitat would be similar to Alternative 2. The mitigated effects on west side streams and lakes would be the same as described for Alternative 3. Alternative 4 post-mining effects would be similar to Alternative 3 except for effects on diverted Little Cherry Creek and former Little Cherry Creek. After the tailings impoundment was reclaimed, surface runoff from the impoundment would be directed to the diverted Little Cherry Creek and Drainage 10, and then into Libby Creek, rather than being directed into Bear Creek as occurs under Alternative 2. Flows in Drainage 10 would be greater than flows during operations. Average flow in the diverted creek would be about 90 percent of the original Little Cherry Creek flows. The higher flows would provide better habitat than during operations, but slightly less than currently exist in Little Cherry Creek.

3.6.4.4.3 Water Quality-Nutrients, Metals, and Temperature

All Phases

As with Alternatives 2 and 3, increased nutrient and metal concentrations may occur in analysis area streams in the Libby Creek watershed. The Water Treatment Plant would be modified to treat nitrogen compounds and phosphorus, and possibly dissolved metals, as in Alternative 3. The effects on aquatic life would be the same as Alternative 3. Temperature increases as a result of riparian disturbance, Water Treatment Plant discharges, and decreased low flows would also potentially occur, but factors such as air temperature, topography, weather, shade, streambed substrate, stream morphology, the amount of subsurface streamflow, and groundwater inflows also affect stream temperature and may make changes in stream temperature due to the project difficult to separate from natural variability.

3.6.4.4.4 Metals in Fish

Changes in metal concentrations in fish would be the same as discussed for Alternative 3.

3.6.4.4.5 Fish Passage and Fish Loss

Evaluation, Construction, and Operations Phases

Streams

Many of the same roads would be used for access to mine facilities in Alternative 4 as in Alternative 2. Alternative 4 would require two perennial and one other stream crossing (Table 107. As in Alternative 3, all bridges and other road work would comply with INFS standards and Forest Service guidance (USDA Forest Service 1995, 2008a) and KNF BMPs. The Diversion Channel at the Little Cherry Creek Impoundment would be designed for fish passage, which would provide better fish habitat than Alternative 2. As in Alternative 2, flow in the diverted Little Cherry Creek would be substantially reduced during operations, as the pumpback well system, if implemented, would likely eliminate $7Q_{10}$ flows. The loss of available habitat in the diverted Little Cherry Creek would adversely affect the redband trout population in the diverted creek because the remaining habitat would not support the population at its current numbers, if at all. Changes in fish passage in East Fork Bull River and Rock Creek drainages would be the same as Alternative 3.

Closure and Post-Closure Phases

Flow in the diverted Little Cherry Creek would likely be eliminated as long as the pumpback well system operated. The diverted creek would not be capable of supporting redband trout. Flow from the tailings impoundment at closure would be directed toward diverted Little Cherry Creek, with flow in the diverted Little Cherry Creek estimated to be 10 percent less than existing flow. Reestablishment of the redband trout population in the diverted Little Cherry Creek may be possible in the creek after the pumpback wells ceased operating and flows increased.

3.6.4.4.6 Threatened and Endangered Species

Evaluation, Construction, and Operations Phases

Alternative 4 may affect bull trout populations and would be similar to Alternative 3. The risk of sedimentation or increased temperatures from decreased riparian shading would be greater than Alternative 3 and similar to Alternative 2. Effects on bull trout populations in the Rock Creek and East Fork River drainages would be the same as Alternative 3.

The Wildlife Mitigation Plan, Waters of the U.S. Mitigation, and Bull Trout Mitigation Plan in Alternative 4 would be the same as Alternative 3 and are anticipated to benefit bull trout populations in the Libby Creek and its tributaries, as well as in the Rock Creek watershed. Success of the bull trout mitigation plan would be determined through monitoring. As in all alternatives, bull trout populations in the Libby Creek watershed would continue to be marginal as a result of non-project impacts such as hybridization and competition with non-native trout present within the drainage.

Closure and Post-Closures

The effects on bull trout populations with mitigation would be the same as Alternative 3.

Effects on Critical Habitat

The effect on designated critical habitat would be the same as Alternative 3.

3.6.4.4.7 Forest Service Sensitive Species and State Species of Concern

All Phases

Alternative 4 may impact redband trout. Effects on the pure redband trout population in Little Cherry Creek and the hybrid populations elsewhere within the Libby Creek drainage in Alternative 4 would be similar to effects described in Alternative 2. The diversion drainage would have higher flow post-mining and be designed for fish passage, which would provide better fish habitat than Alternative 2. As in Alternative 2, flow in the diverted Little Cherry Creek would be substantially reduced during operations, as the pumpback well system, if implemented, would likely eliminate $7Q_{10}$ flows. The loss of available habitat in the diverted Little Cherry Creek would adversely affect the redband trout population in the diverted creek because the remaining habitat would not support the population at its current numbers, if at all. The effects of the proposed mitigation plan would be the same as Alternative 3. Effects on westslope cutthroat trout would be the same in Alternative 4 as in Alternative 3. Data on the torrent sculpin populations within the analysis area are limited, but the effects on this species in Alternative 4 is expected to be similar to those under Alternative 3.

3.6.4.5 Alternative A – No Transmission Line Alternative

In Alternative A, the transmission line, substation and loop line for the Montanore Project would not be built. Possible impacts on aquatic resources due to construction, operations, and maintenance of a new transmission line would not occur.

3.6.4.6 Alternative B – North Miller Creek Transmission Line Alternative

MMC's proposed alignment for the transmission line would be in the Fisher River, Miller Creek, Midas Creek, Libby Creek, and Ramsey Creek watersheds. None of the transmission line alternatives would have any effect on analysis area lakes. All transmission line alternatives include BPA's construction of the Sedlak Park Substation and loop line. With the implementation of BMPs, no effects to aquatic resources and riparian areas would result from the construction of the Sedlak Park Substation and loop line. The effects of the alternative transmission lines and associated access roads on stream habitat and aquatic populations in area streams are discussed in this section. The transmission line would be removed following mine closure and reclamation, resulting in additional effects. Roads and disturbed areas would be contoured and revegetated following closure of the mine; sediment production over time would be reduced to essentially zero (USDA Forest Service 2013a), resulting in benefits to the aquatic biota.

3.6.4.6.1 Sediment

This alternative would potentially cause the greatest amount of disturbance close to streams and would increase sediment delivery to area streams. The greatest effect would be in the Fisher River, Miller Creek, and Midas Creek watersheds. Effects of sediment increases on aquatic populations and habitat are discussed in section 3.6.4.2.1, *Sediment*. A Stormwater Pollution Prevention Plan would be finalized and implemented to minimize the discharge of pollutants resulting from Alternative B. Structural and non-structural BMPs would be implemented to minimize stream sedimentation, with the largest reductions occurring in the Construction Phase (KNF 2013). In the event that a large runoff-producing storm occurred during the initial reclamation period, soil losses along roads and road cuts may be locally moderate to severe.

The primary sources of sediment during construction of the transmission line would include timber clearing, road construction, and road upgrades. The KNF's sediment delivery analysis estimated sediment delivery from transmission line access roads to streams (Table 132). The transmission line would span six streams: Hunter Creek, Fisher River, an unnamed tributary of Miller Creek, Howard Creek, Libby Creek, and Ramsey Creek. In Alternative B, two structures would be located immediately adjacent to the Fisher River. Some minor amounts of sediment would likely reach the river despite BMPs to reduce sediment transport. Implementation of a SWPPP and use of BMPs, Environmental Specifications, and other design criteria would minimize sediment reaching area streams under most conditions, including large runoff-producing weather events, and should likewise minimize effects to the aquatic biota. The access road between the two structures next to the Fisher River could introduce small amounts of sediment to the Fisher River because the road would be located adjacent to the river. Two other structures would be located immediately adjacent to Miller Creek (Figure 84). Construction could introduce small amounts of sediment to Miller Creek. Stream crossings would be constructed to meet KNF and DEQ requirements. Disturbance on active floodplains would be minimized to reduce sedimentation to streams during annual runoff, and construction activities would be curtailed during heavy rains to reduce erosion.

Use of BMPs would result in long-term sediment reductions in some analysis area streams. In Alternative B, road-related sediment delivery would be reduced 15 percent compared to existing conditions over the 30-year analysis period, with the greatest reductions occurring in the Construction and Closure phases (Table 132) (KNF 2013). Total sediment delivery from roads proposed for use in Alternative 2 during all phases would be 97.1 tons, compared to 113.7 tons under existing conditions. These reductions would occur within the Libby Creek and Fisher River drainages, and would result in the improvement of aquatic habitat in these areas. The greatest reduction in sediment in this alternative would occur in Poorman Creek.

Road Construction and Reconstruction

Alternative B would disturb 8.9 acres for new access roads or roads with high upgrade requirements on soils having severe erosion risk, the majority of which occur along Libby and Miller creeks and Fisher River (see Table 166, p. 855). Most soils with high sediment delivery potential disturbed by access roads occur along Ramsey, Libby, and Miller creeks and Fisher River (Figure 84). Some sediment increases would occur, particularly during periods of high activity or large storm events.

All transmission line alternatives would require the construction of new roads, including a short access road for the Sedlak Park Substation and loop line. Alternative B would require 9.9 miles of new road construction (Table 77). Five smaller streams would be crossed by new roads in Alternative B (Table 77). An analysis was made of the combined effects of the mine alternatives with the transmission line alternatives from new road construction. The combination of mine Alternative 2 and transmission line Alternative B would require the most new road construction with 17.2 miles of new roads. New road construction in the other mine and transmission line alternative combinations would be less, ranging from 4.1 miles to 7.4 miles (Table 77). Following MMC's Proposed Environmental Specifications (MMI 2005b) and using BMPs are predicted to reduce sediment delivery from roads used during construction (see Table 132, p. 725). Similar effects would occur during line decommissioning.

Table 77. Stream Crossings and New Road Requirements by Alternatives and Alternative Combinations.

Alternatives	Number of Stream Crossings by Transmission Line		Number of Stream Crossings by New Roads		Miles of New Road Construction
	Perennial Stream	Other Streams	Perennial Stream	Other Streams	
Transmission Line Alternatives					
B	4	16	0	5	9.9
C-R	5	15	0	0	3.1
D-R	4	18	0	0	5.1
E-R	4	19	0	1	3.2
			Combined Mine and Transmission Line Alternatives		
2 and B	NA	NA	3	6	17.2
3 and C-R	NA	NA	1	1	4.1
3 and D-R	NA	NA	1	1	6.1
3 and E-R	NA	NA	1	2	4.2
4 and C-R	NA	NA	2	1	5.4
4 and D-R	NA	NA	2	1	7.4
4 and E-R	NA	NA	2	2	5.5

Source: GIS analysis by ERO Resources Corp. using KNF data.

Riparian Areas

Clearing vegetation, constructing new roads, and upgrading roads in Alternative B would disturb 30 acres of RHCAs on National Forest System land and 35 acres of other riparian areas on private land (Table 78). In the event that a large runoff-producing storm occurred during the initial reclamation period, soil losses along roads and road cuts may be locally moderate to severe. The bull trout, redband trout, westslope cutthroat trout, and sculpin populations that inhabit portions of the Fisher River drainage within the analysis area may be adversely affected by sediment increases under this alternative, at least in the short term.

An analysis was made of the combined effects of the mine alternatives with the transmission line alternatives on RHCAs on National Forest System land and other riparian areas on private and State land. Effects on RHCAs on National Forest System land would range from 260 acres with mine Alternative 4 and transmission line Alternative C-R to 296 acres for mine Alternative 2 and transmission line Alternative B (Table 79). Much of the “other private” land affected by combinations with mine Alternatives 2 and 4 is owned by MMC in the Little Cherry Creek Impoundment Site.

Table 78. Effects on RHCAs and Riparian Areas by Transmission Line Alternatives.

Criteria	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
***Riparian Areas within Clearing Area*†**				
RHCAs on National Forest System land (ac.)	30	24	35	32
Other riparian areas on private or State land (ac.)	35	13	13	28
Total (ac.)	65	37	48	60
***Number of Structures within Riparian Areas*‡**				
RHCAs on National Forest System land	9	4	6	8
Other riparian areas on private or State land	12	3	3	9
Total	21	7	9	17

†Acreage is based on a 150-foot clearing width for monopoles (Alternative B) and 200-foot-width for H-frame structures (other alternatives except for a short segment of the West Fisher Creek Alternative that has monopoles). Actual acreage cleared would be less than listed and would depend on tree height, slope, and line clearance above the ground.
New and upgraded roads are included in the acreage.
INFS standards apply only to National Forest System land.
‡Number and location of structures are based on preliminary design.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Table 79. Effects on Riparian Areas by Combination of Mine and Transmission Line Alternatives.

Combination of Alternatives	RHCAs on National Forest System Land	Other Riparian Areas			Total
		State	Plum Creek	Other Private	
2 and B	296	0	35	152	466
3 and C-R	280	0	13	9	244
3 and D-R	291	0	13	9	255
3 and E-R	291	13	18	9	270
4 and C-R	260	0	13	147	393
4 and D-R	271	0	13	147	404
4 and E-R	269	13	15	147	413

All units are in acres. Acreage is based the disturbance area for mine alternatives and, for transmission line alternatives, on a 150-foot clearing width for monopoles (Alternative B) and 200-foot-width for H-frame structures (other alternatives except for a short segment of the West Fisher Creek Alternative that has monopoles). Actual acreage cleared would be less than listed and would depend on tree height, slope and line clearance above the ground.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Roads opened or constructed for transmission line access would remain open for maintenance and used for removal of the transmission line at mine closure. At that time, the road surface would be reseeded as an interim reclamation activity designed to stabilize the surface. Where soil had been salvaged from new roads, the road surface would be covered with soil and then reseeded. Sediment delivery would decrease following reseeding. Transmission line maintenance may periodically result in short-term minor sediment increases to streams at locations where the transmission line was located adjacent to or crossed streams. Transmission line decommissioning also may result in a short-term sediment increases to streams that may temporarily affect aquatic populations and habitat.

3.6.4.6.2 Peak Streamflow

The KNF ECAC storm flow model (Appendix H) indicates that peak streamflow would increase by 12 percent in Ramsey Creek with a combination of Alternative 2 and transmission line Alternative B. All other stream peak flows in the analysis area would not be affected by Alternative B. This small increase would not substantially change fish habitat in Ramsey Creek.

3.6.4.6.3 Threatened, Endangered, or Sensitive Species

Alternative B may affect bull trout and their habitat, designated bull trout critical habitat in Libby Creek and essential excluded habitat in the Fisher River (Figure 55). Vegetation clearing and road construction during construction may result in minor short-term increases of sediment in the Fisher River and Libby Creek drainages occupied by bull trout. Alternative B would have 36 structures and 9.6 miles of new road within 1 mile of bull trout habitat. Vegetation clearing would disturb 182 acres in watersheds with occupied bull trout habitat. Following Environmental Specifications and using BMPs are predicted to reduce sediment delivery from roads used during construction (see Table 132, p. 725). Similar effects would occur during line decommissioning.

Alternative B may affect redband trout and westslope cutthroat trout. The pure and hybrid redband trout populations that exist in portions of the Fisher River, Miller Creek, and Libby Creek drainages may be adversely affected by potential releases of fine sediment that may occur from the land clearing and road construction necessary for transmission line installation, although BMPs would likely prevent or minimize such effects. A pure westslope cutthroat trout population is found in Miller Creek. The population may be affected in a manner similar to the hybrid redband trout population. Following Environmental Specifications and using BMPs would minimize impacts.

3.6.4.7 Alternative C-R – Modified North Miller Creek Transmission Line Alternative

The primary modification in Alternative C-R to MMC's proposed North Miller Creek Alternative would be routing the line on an east-facing ridge immediately north of the Sedlak Park Substation. This modification would result in the transmission line crossing less area with soils that are highly erosive soils and those with potential for high sediment delivery and slope failure. H-frame poles, which generally allow for longer spans and fewer structures and access roads, would be used for this alternative. In some locations, a helicopter would be used to place the structures. As in Alternative B, transmission line construction and operation are not expected to have any impact on lakes within the analysis area. The transmission line would be removed following mine closure and access roads and disturbed areas would be contoured and revegetated. Based on road sedimentation analysis, no long-term effect from these activities on the aquatic habitat and populations should occur.

3.6.4.7.1 Sediment

Compared to Alternative B, Alternative C-R has numerous changes that would reduce potential effects on aquatic life in streams along the transmission line corridor:

- Fewer structures and access roads in the Fisher River floodplain
- Fewer structures and access roads on highly erodible soils
- Fewer structures and access roads in RHCAs
- Structures farther from Miller Creek
- Placement into intermittent stored service of all new roads on National Forest System land
- Use of helicopter for structure placement and vegetation clearing in some areas
- Implementation of a Vegetation Removal and Disposition Plan to reduce clearing
- Limited use of heavy equipment in RHCAs

The modifications incorporated into Alternative C-R would reduce potential impacts from sedimentation by reducing the clearing necessary to construct new access roads, and decreasing erosion by altering the alignment of the transmission line. This alternative would require 3.1 miles of new road construction (Table 77). Estimated sediment delivery with road closures and BMPs would be reduced by 20 percent compared to existing conditions during the 30-year analysis period, with the total sediment delivery to streams estimated to be 150.3 tons (Table 132). The highest percentage reductions would occur in the Operations and Closure phases. Road closure mitigation and BMPs would substantially reduce sediment delivery in the Libby Creek and Fisher River watersheds, with the highest percent reductions in Miller Creek. These reductions would benefit aquatic habitat in these watersheds.

Road Construction and Reconstruction

Stream crossings of the transmission line would have one more perennial stream crossing, and one less other stream crossing than Alternative B (Table 77). No perennial streams or smaller streams would be crossed by new roads in Alternative C-R (Table 77). New access roads and closed roads with high upgrade requirements in Alternative C-R would disturb 3.1 acres of soils having severe erosion risk, and 0.5 acres of soils with high sediment delivery potential (see Table 166, p. 855). Most soils having severe erosion risk along access roads occur along Libby Creek in the extreme western portion of the transmission line, along Miller and West Fisher creeks, and near the Fisher River crossing (Figure 84). Soils having high sediment delivery potential along access roads occur along Libby and Miller creeks and along the Fisher River. Most soils having potential for slope failure along access roads occur just east of Libby Creek, along Miller Creek and east of Fisher River. Some sediment increases may occur, particularly during periods of high activity or large storm events. Following the agencies' Environmental Specifications (Appendix D), implementing access changes, and using BMPs are predicted to reduce sediment delivery from roads used during construction (see Table 132, p. 725). Similar effects would occur during line decommissioning.

Riparian Areas

Alternative C-R would disturb 24 acres of RHCAs on National Forest System land and 13 acres of other riparian areas on private land (Table 78). Based on a preliminary design, four structures would be in a RHCA on National Forest System land and three structures would be in a riparian area on private land. During final design, MMC would locate these structures outside riparian areas if alternative locations were technically and economically feasible. Minimizing structure locations in riparian areas, decommissioning new access roads on National Forest System land after construction and using a helicopter for line stringing, logging, and line decommissioning would reduce potential contributions of sediment to area streams. Some small periodic sediment increases may still occur within the streams, but the likelihood of such occurrences would be substantially less than in Alternative B. MMC would use the same general methods to operate, maintain, and reclaim the line and access roads as in Alternative B. The potential for effects of sediment on fish populations would be less on Howard Creek, Ramsey Creek, West Fisher Creek, and Fisher River than for Alternative B.

3.6.4.7.2 Peak Streamflow

The KNF ECAC storm flow model (Appendix H) indicates that peak streamflow would not measurably increase in any of the streams potentially affected by Alternative C-R. No peak flow-related habitat effects would occur within the analysis area.

3.6.4.7.3 Threatened, Endangered, or Sensitive Species

Alternative C-R may affect bull trout, hybrid redband trout, and hybrid westslope cutthroat trout populations and their habitat in area drainages. Torrent sculpin are also likely present in the Miller Creek drainage and potentially inhabit other streams also, and this species may be affected by Alternative C-R. The measures discussed in section 3.6.4.7.1, *Sediment* would minimize impacts on these populations. Alternative C-R may affect designated bull trout critical habitat in Libby Creek and essential excluded habitat in West Fisher Creek where the line would cross such habitat (Figure 55). Alternative C-R would have 28 structures and 3.9 miles of new road within 1 mile of bull trout habitat. Vegetation clearing would disturb 101 acres in watersheds with occupied bull trout habitat. Following Environmental Specifications, using BMPs and the agencies' road closures for wildlife mitigation are predicted to reduce sediment delivery from roads used during construction (see Table 132, p. 725). Similar effects would occur during line decommissioning. Fisheries mitigation, including mitigation specific for bull trout as described for mine Alternative 3, are anticipated to offset these effects.

3.6.4.8 Alternative D-R – Miller Creek Transmission Line Alternative

This alternative modifies MMC's proposal using the measures described for Alternative C-R. Instead of routing the line along an unnamed tributary of Miller Creek as in Alternative C-R, the alignment would follow Miller Creek into the Howard Creek drainage. As in Alternative B, transmission line construction and operation would not be expected to have any impact on lakes within the analysis area. The transmission line would be removed following mine closure and reclamation, and roads and disturbed areas would be contoured and revegetated. Based on road sedimentation analysis, no long-term effect from these activities on the aquatic habitat and populations should occur.

3.6.4.8.1 Sediment

The modifications incorporated into Alternative D-R would reduce potential impacts from sedimentation by reducing the clearing necessary to construct new access roads and decreasing erosion by altering the transmission line alignment. The transmission line would cross four perennial streams and 18 other streams (Table 77). Estimated sediment delivery is 103.7 tons with road closures and BMPs (Table 132), which would be a 23 percent decrease from existing conditions during the 30-year analysis period. Road closure mitigation would substantially reduce sediment delivery in Miller Creek, primarily as a result of road closure during the Evaluation and

Construction Phases. Other streams in the Fisher River and Libby Creek watersheds would also benefit to a lesser extent from sediment reductions.

Road Construction and Reconstruction

Alternative D-R would require 5.1 miles of new roads (Table 77). This alignment also would cross less area with soils that are highly erosive soils and those with potential for high sediment delivery and slope failure than Alternative B (see Table 166, p. 855). New access roads and closed roads with high upgrade requirements would disturb 2.6 acres of soils having severe erosion risk, and 0.5 acres of soils with high sediment delivery potential. Most of the soils having severe erosion risk that would be crossed by access roads occur along West Fisher Creek and the Fisher River. The majority of soils with high sediment delivery potential along access roads occur along Libby Creek and the Fisher River (Figure 84). No perennial streams and smaller stream would be crossed by new roads in Alternative D-R (Table 77). Following Environmental Specifications, using BMPs and the agencies' road closures for wildlife mitigation are predicted to reduce sediment delivery from roads used during construction (see Table 132, p. 725). Similar effects would occur during line decommissioning.

Riparian Areas

Disturbance within riparian areas would be less than Alternative B, with 35 acres of RHCAs on National Forest System land and 13 acres of other riparian areas on private land (Table 78). Based on a preliminary design, six structures would be in a RHCA on National Forest System land and three structures would be in a riparian area on private or State land. During final design, MMC would locate these structures outside of riparian areas if alternative locations were technically and economically feasible. Minimizing structure locations in riparian areas, and using a helicopter for line stringing and site clearing would minimize contributions of sediment to area streams.

3.6.4.8.2 Peak Streamflow

The KNF ECAC storm flow model (Appendix H) indicates that peak streamflow would not measurably increase in any of the streams potentially affected by Alternative D-R. No peak flow-related habitat effects would occur within the analysis area.

3.6.4.8.3 Threatened, Endangered, or Sensitive Species

Effects on bull trout, bull trout critical habitat, and redband trout would be similar to Alternative C-R. Alternative D-R would have 25 structures and 4 miles of new road within 1 mile of bull trout habitat. Vegetation clearing would disturb 70 acres in watersheds with occupied bull trout habitat. Following Environmental Specifications, using BMPs and the agencies' road closures for wildlife mitigation are predicted to reduce sediment delivery from roads used during construction (see Table 132, p. 725). Similar effects would occur during line decommissioning. More structures would be near Miller Creek than Alternatives B and C-R, potentially affecting the pure westslope cutthroat trout population in Miller Creek.

3.6.4.9 Alternative E-R – West Fisher Creek Transmission Line Alternative

This alternative modifies MMC's proposed North Miller Creek alignment by routing the line to generally follow West Fisher Creek. H-frame poles, which generally allow for longer spans and fewer structures and access roads, would be used for this alternative. Alternative E-R would include measures described for Alternative C-R. As in Alternative B, transmission line construction and operation are not expected to have any impact on lakes within the analysis area. The transmission line would be removed following mine closure and reclamation, and roads and disturbed areas would be contoured and revegetated. Any long-term effects from these activities on the aquatic habitat and populations would be minor post-operation.

3.6.4.9.1 Sediment

The modifications incorporated into Alternative E-R would reduce potential impacts from sedimentation by reducing the clearing necessary to construct new access roads and decreasing erosion by altering the transmission line alignment. The transmission line would cross four perennial streams and 19 other streams (Table 77). Estimated sediment delivery with road closures and BMPs is 174.3 tons to the Fisher River, Hunter Creek, and West Fisher Creek watersheds (Table 132). This represents a 20 percent decrease in the predicted road-related sediment delivery to streams compared to existing conditions during the 30-year analysis period. A substantial decrease in sediment would occur in Miller Creek, but other streams within the Libby Creek and Fisher River watershed would also benefit to a lesser extent from reduced sediment delivery.

Road Construction and Reconstruction

Alternative E-R would require the construction of 3.2 miles of new roads (Table 77). New access roads and closed roads with high upgrade requirements would disturb 2.9 acres of soils having severe erosion risk (see Table 166, p. 855), which occur primarily along occur along West Fisher Creek and the Fisher River (Figure 84). This alternative would affect 0.5 acre of soil with high sediment delivery potential. No perennial streams and one smaller stream would be crossed by new roads in Alternative E-R (Table 77). In the event that a large runoff-producing storm occurred during the initial reclamation period, soil losses along roads and road cuts may be locally moderate to severe. Following Environmental Specifications, using BMPs and the agencies' road closures for wildlife mitigation are predicted to reduce sediment delivery from roads used during construction (see Table 132, p. 725). Similar effects would occur during line decommissioning.

Riparian Areas

Disturbance within riparian areas would be slightly less than Alternative B, with 32 acres of RHCAs on National Forest System land and 28 acres of other riparian areas on private or State land (Table 78). Based on a preliminary design, eight structures would be in a RHCA on National Forest System land and nine structures would be in a riparian area on private or State land. During final design, MMC would locate these structures outside of riparian areas if alternative locations were technically and economically feasible. Minimizing structure locations in riparian areas and using a helicopter for line stringing and site clearing would help minimize the potential for sediment movement to area streams.

3.6.4.9.2 Peak Streamflow

The KNF ECAC storm flow model (Appendix H) indicates that peak streamflow would not measurably increase in any of the streams potentially affected by Alternative E-R. No peak flow-related habitat effects would occur within the analysis area.

3.6.4.9.3 Threatened, Endangered, or Sensitive Species

Alternative E-R may affect bull trout, redband trout, and their habitat, and could also affect torrent sculpin if they are present in these streams. Effects on redband trout would be similar to Alternatives C-R and D-R. Alternative E-R would have more effect on bull trout than the other alternatives. About 6 miles of line and 1.5 miles of new or upgraded access roads would be in the

Fisher River and West Fisher Creek watersheds, which provide occupied bull trout habitat. Vegetation clearing would disturb 177 acres in watersheds with occupied bull trout habitat. It would have the same crossings at West Fisher Creek and Libby Creek as Alternative D-R. With the exception of the modifications along Miller Creek, measures described for Alternative C-R (section 3.6.4.7.1, *Sediment*) would be used in this alternative as well and would minimize effects.

Alternative E-R would follow West Fisher Creek for about 5 miles; two segments of designated bull trout critical habitat are located in the creek (Figure 55). Alternative E-R would have 67 structures and 7.4 miles of new road within 1 mile of bull trout habitat. Following Environmental Specifications, using BMPs and the agencies' road closures for wildlife mitigation are predicted to reduce sediment delivery from roads used during construction (see Table 132, p. 725). Similar effects would occur during line decommissioning. Effects of Alternative E-R on the critical habitat downstream of the Libby Creek and Howard Creek confluence would be the same as Alternative D-R (section 3.6.4.8.3, *Threatened, Endangered, or Sensitive Species*). Road closures and reconstruction, as well as fisheries mitigation as described for Alternative 3, are anticipated to offset these effects.

3.6.4.10 Cumulative Effects

Cumulative effects in the analysis area include past and current actions that are likely to continue in the future and reasonably foreseeable actions that could affect aquatic biota. There are ongoing and planned mine reclamation activities. Other activities that could affect the aquatic biota include timber harvesting, land clearing, home construction, road construction, septic field installation, water well drilling, livestock grazing, and stream channel and bank stabilization or restoration projects. These activities can either have adverse or beneficial effects on the aquatic biota.

3.6.4.10.1 Rock Creek Project

The groundwater numerical model was used to predict low flow changes to streams due to implementing both the Montanore and Rock Creek Projects. Assuming the Montanore and Rock Creek projects occur concurrently, they would cumulatively reduce streamflow and aquatic habitat in the Rock Creek, East Fork Bull River, and Bull River watersheds. Maximum effects within the analysis area would occur after both mines ceased operations, assuming they operated and closed simultaneously. Sediment increases in the Rock Creek watershed could occur in the short-term as a result of the Rock Creek Project, but, as with the Montanore Project, long-term sediment decreases are predicted to occur (USDA Forest Service and DEQ 2001). No other cumulative effects would occur within these watersheds that would affect aquatic resources. Effects on streamflow would remain the same for Libby, Poorman and Ramsey creeks.

In Rock Creek, cumulative flow reductions from both projects would be 0.03 cfs greater at the mouth during low flows than reductions predicted to occur with only the Montanore Project (Table 117). The cumulative reduction in the wetted perimeter at RC-3 on East Fork Rock Creek would be 18 percent. The functioning of the core area population may be adversely affected due to additional reductions in flow at the mouth of Rock Creek, which may exacerbate the intermittency over what currently exists and would exist under the Montanore Project alone. Therefore, access to Rock Creek by migratory fish may be excluded for longer periods of time. Additionally, resident bull trout populations in Rock Creek would have longer periods of time with restricted movement, making them more susceptible to environmental changes. Recovery efforts are continuing with fish passage and habitat restoration activities addressing the main threats to the core area population. If current efforts to recover the adfluvial component under the Avista program are successful, they may negate the potential loss, and the recovery rate of the core area may not be affected (USFWS 2007a). The cumulative reductions in streamflow and wetted perimeter in East Fork Rock Creek would result in more substantial decreases in habitat availability for bull trout, westslope cutthroat trout, and macroinvertebrates than with the Montanore Project alone. With mitigation, the cumulative effect on the East Fork Rock Creek and Rock Creek would be the same as discussed if only the Montanore Project were to occur.

In the East Fork Bull River, decreased low flow would be 0.03 cfs greater in the East Fork Bull River at the mouth, and 0.08 cfs greater at EFBR-500 at the CMW boundary. The cumulative decrease at EFBR-500 would be a 13 percent reduction in low flow. Wetted perimeter was estimated to decrease by 30 percent as a result of the cumulative impacts of the projects on streamflow. For the Bull River at the mouth, the impacts of both projects would decrease estimated low flows by 1 percent. When placed into the context of a likely loss of habitat under Montanore alternatives, the cumulative effects would result in additional habitat loss downstream of St. Paul Lake including during the bull trout spawning period. It is difficult to determine with certainty whether a risk to bull trout would exist under project implementation because of the lack of data or pertinent scientific information on the relationship of underground mining effects on aquatic species (USFWS 2007a). During high flow periods, reductions in streamflow and the associated effects on aquatic habitat from the two projects would be negligible at the Bull River near the mouth.

As the mine void filled and groundwater levels above the mines and adits reached steady state conditions, effects on aquatic habitat and populations in the Rock Creek and East Fork Bull River watersheds would decrease. Cumulative effects on streamflow at steady state conditions were not quantified.

3.6.4.10.2 Other Reasonably Foreseeable Actions

The proposed Wayup Mine in upper West Fisher Creek and the Libby Creek Ventures drilling plan adjacent to Upper Libby Creek road would have negligible effects on streamflows and water quality, and thus would not affect aquatic resources.

The Avista fish passage program is well-funded, with full-time dedicated staff to implement the trap and transport of bull trout for the entire 45-year licensing period. The Avista program has identified and implemented habitat acquisition and restoration projects as funding allowed. Cooperative efforts between Avista, FWP, and local watershed groups are providing long-term habitat protection through land acquisition, conservation easements, and watershed restoration. Fragmentation of the historical migratory populations in the lower Clark Fork River is considered the highest risk, but this threat is being addressed with the attempted consolidation of four core areas into one (Lower Clark Fork Core Area). The consolidation is contingent upon the success of fish passage around Cabinet Gorge Dam, which has not yet happened with reliability.

Any loss of bull trout from these cumulative impacts would represent an irretrievable loss of genetic diversity. Improvements in habitat quality and productivity due to natural processes over time would potentially be adversely affected by the cumulative effects of continued forestry activities. Past placer mining, possible private land development, future mining activities, and continued recreational use also may inhibit fish population increases.

3.6.4.11 Regulatory/Forest Plan Consistency

3.6.4.11.1 Organic Administration Act and Forest Service Locatable Minerals Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources; comply with applicable state and federal water quality standards including the Clean Water Act; take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations; and construct and maintain all roads so as to assure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water, and other resource values.

Minimize Adverse Environmental Impact (36 CFR 228.8)

Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8. In these alternative, MMC did not propose to implement feasible measures to minimize changes in streamflow or all practicable measures to maintain and protect fisheries and to minimize effect from road usage. The agencies' alternatives (Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R) would incorporate additional feasible and practicable measures to minimize adverse environmental impacts on surface water quality and fisheries habitat. These measures would include minimizing the disturbance area; developing and implementing a final Road Management Plan and a Vegetation Removal and Disposition Plan; decommissioning unused roads or placing them into intermittent stored service; constructing all stream crossings in compliance with INFS standards and guidelines; and implementing measures such as increased buffer zones and using multiple adit plugs at closure to minimize changes in streamflow. The agencies' mine and transmission line alternatives would have less disturbance in RHCAs and other riparian areas, minimizing effect on bull trout and other aquatic life. The agencies' transmission line alternatives would have few structures and new roads within 1 mile of bull trout critical habitat and less vegetation clearing in watersheds with occupied bull trout habitat.

Fisheries and Wildlife Habitat (36 CFR 228.8(e))

Compliance with state and federal water quality standards, specifically changes in streamflow and floodplains are discussed in section 3.11.4.10, *Regulatory/Forest Plan Consistency* in the subsequent *Surface Water Hydrology* section (p. 651). Section 3.13.4.11, *Regulatory/Forest Plan Consistency* in the subsequent *Water Quality* section discusses compliance with water quality laws and regulations (p. 729).

Alternative 2 would have a disturbance area of 2,582 acres. The disturbance area of Alternative 4, which would have a tailings impoundment at the same location as Alternative 2, would be smaller than Alternative 2 by 658 acres by eliminating the LAD disturbance area and minimizing the disturbance area around the tailings impoundment. The disturbance area of Mine Alternative 3 would be the smallest. Because the clearing width for Transmission Line Alternative B would be narrower than the agencies' transmission line alternatives, the maximum clearing width for Alternative B would be less than the agencies' alternatives. Clearing associated with the agencies' transmission line alternatives would be minimized through the development and implementation of a Vegetation Removal and Disposition Plan. The agencies' transmission line alternatives would have less clearing and new road development in the watersheds of impaired streams, in watersheds of Class 1 streams, and on soils with severe erosion risk, high sediment delivery, and slope failure. The predicted delivery of sediment to project area streams from roads in the agencies' mine and transmission line alternatives would be less than in MMC's alternatives. The agencies' mine and transmission line alternatives would have less disturbance in RHCAs and other riparian areas, minimizing effect on bull trout and other aquatic life. The agencies' transmission line alternatives would have few structures and new roads within 1 mile of bull trout critical habitat and less vegetation clearing in watersheds with occupied bull trout habitat. All mine and transmission line alternatives would include the use of BMPs to minimize erosion and effects on surface water quality. The agencies' alternatives would include more frequent BMP monitoring than MMC's alternatives. In summary, Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8 because MMC did not propose to implement feasible measures to minimize the disturbance area and adverse environmental impacts on surface water quality. Mine Alternatives 3 and 4 Transmission Line Alternatives C-R, D-R, and E-R would comply with 36 CFR 228.8 because the modifications to the disturbance area are feasible and would minimize adverse environmental impacts on fisheries habitat.

MMC's mitigation plans contained limited measures to protect fisheries habitat from changes in streamflow. The agencies' alternatives would create or secure genetic reserves through bull trout transplanting or habitat restoration; rectify factors that are limiting the potential of streams to support increased production of bull trout; and eradicate non-native fish species, especially brook trout that are a hybridization threat to bull trout.

Roads (36 CFR 228.8(f))

In all mine and transmission line alternatives, roads would be constructed and maintained to ensure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water, and other resource values. The Environmental Specifications describe how transmission line roads would be constructed and maintained to ensure adequate drainage and to minimize or eliminate damage to resource values. The agencies' transmission line alternatives would have less new road development in the watersheds of impaired streams, in watersheds of Class 1 streams, and on soils with severe erosion risk, high sediment delivery, and slope failure. The predicted delivery of sediment from roads to streams in the agencies' mine and transmission line alternatives would be less than in MMC's alternatives. At the end of operations, all mine and transmission line alternatives would have roads no longer needed for operations. The agencies' mitigation provides more specificity regarding management of roads no longer needed for operations. Such roads would be placed either in intermittent stored service or decommissioned. Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8(f) as it relates to water quality because MMC did not propose to implement all practicable measures to minimize adverse environmental impacts on surface water quality and fisheries habitat. Mine Alternatives 3 and 4 Transmission Line Alternatives C-R, D-R, and E-R would comply with 36 CFR 228.8(f) as it relates to surface water quality and fisheries habitat.

Additional discussion regarding compliance with 36 CFR 228.8(f) is in the *Kootenai Forest Plan* section regarding roads management (RF-2 through RF-5), beginning on page 453.

3.6.4.11.2 Endangered Species Act

All action alternatives may affect and are likely to adversely affect the bull trout and designated bull trout critical habitat. These effects were summarized in section 3.6.4.3.6, *Threatened and Endangered Species*. The KNF submitted a BA to the USFWS that describes the potential effect on threatened and endangered species that may be present in the area (USDA Forest Service 2013a). Implementation of any of the alternatives may affect, and is likely to adversely affect threatened bull trout, may affect, and is likely to adversely affect designated bull trout critical habitat, and would have no effect on endangered white sturgeon. After review of the BA and consultation, the USFWS issued a Biological Opinion for the proposed Montanore Project in 2014.

In its 2014 Biological Opinion on the bull trout, the USFWS indicated that it was the USFWS' biological opinion that the project as proposed in the KNF's preferred Mine Alternative 3 and the agencies' preferred Transmission Line Alternative D-R is not likely to jeopardize the bull trout, and is not likely to destroy or adversely modify bull trout critical habitat (USFWS 2014c). The Service does not review or provide concurrence on no effect determinations but acknowledged the KNF's analysis that the project would have no effect on the Kootenai River white sturgeon (USFWS 2014b).

3.6.4.11.3 Wilderness Act

All mine alternatives have the potential to indirectly affect wilderness qualities. Alternatives 3 and 4 would be conducted to protect the surface resources, including aquatic resources. All alternatives would be in accordance with the general purpose of maintaining the wilderness unimpaired for future use and enjoyment as wilderness and to preserve the wilderness character consistent with the use of the land for mineral development and production in compliance with 36 CFR 228.15 and the Wilderness Act.

3.6.4.11.4 National Forest Management Act/Kootenai Forest Plan

Riparian Habitat Conservation Areas

This section discusses compliance with the following RHCA standards and guidelines:

- Timber management (TM-1)
- Roads management (RF-2 through RF-5)
- Minerals management (MM-1, MM-2, MM-3, and MM-6)
- Lands (LH-3)
- General riparian area management (RA-2 through RA-4)
- Watershed and habitat restoration (WR-1)
- Fisheries and wildlife restoration (FW-1)

Timber Management (TM-1)

Standard

Prohibit timber harvest, including fuelwood cutting, in Riparian Habitat Conservation Areas, except as described below:

a. Where catastrophic events such as fire, flooding, volcanic, wind, or insect damage result in degraded riparian conditions, allow salvage and fuelwood cutting in Riparian Habitat Conservation Areas only where present and future woody debris needs are met, where cutting would not retard or prevent attainment of other Riparian Management Objectives, and where adverse effects can be avoided to inland native fish. For priority watersheds, complete watershed analysis prior to salvage cutting in RHCAs.

Mine Alternatives

Alternative 2. In Alternative 2, the disturbance area for LAD Area 2 would be within a RHCA along Ramsey Creek. Compliance with TM-1 would be achieved through minimizing timber harvest in RHCAs and favoring riparian species and hardwoods.

Alternatives 3 and 4. Alternatives 3 and 4 would comply with TM-1. The LAD Areas would not be used.

Road Management (RF-2)

Standard

For each existing or planned road, meet the Riparian Management Objectives and avoid adverse effects to inland native fish by:

a. completing watershed analyses prior to construction of new roads or landings in Riparian Habitat Conservation Areas within priority watersheds.

b. minimizing road and landing locations in Riparian Habitat Conservation Areas.

c. initiating development and implementation of a Road Management Plan or a Transportation Management Plan. At a minimum, address the following items in the plan:

1. Road design criteria, elements, and standards that govern construction and reconstruction.

2. Road management objectives for each road.

3. Criteria that govern road operation, maintenance, and management.

4. Requirements for pre-, during-, and post-storm inspections and maintenance.

5. Regulation of traffic during wet periods to minimize erosion and sediment delivery and accomplish other objectives.

6. Implementation and effectiveness monitoring plans for road stability, drainage, and erosion control.

7. Mitigation plans for road failures.

d. avoiding sediment delivery to streams from the road surface.

1. Outsloping of the roadway surface is preferred, except in cases where outsloping would increase sediment delivery to streams or where outsloping is infeasible or unsafe.

2. Route road drainage away from potentially unstable stream channels, fills, and hillslopes.

e. avoiding disruption of natural hydrologic flow paths.

f. avoiding sidecasting of soils or snow. Sidecasting of road material is prohibited on road segments within or abutting RHCAs in priority watersheds.

Road width in all new and reconstructed roads would be the minimum necessary to provide for safe and efficient use. The KNF has implemented several actions independent of the Montanore Project to meet RMOs associated with road management. The Libby Ranger District completed a Roads Analysis Report for the Libby Ranger District that established road design criteria, elements, and standards that govern construction and reconstruction and developed management objectives for existing roads. The report provided a descriptive ranking of the problems and risk associated with the current road system, and a list of prioritized opportunities for addressing identified problems and risk (KNF 2005).

Mine Alternatives

Alternative 2. MMC would minimize road crossings in RHCAs and would implement BMPs to minimize sediment delivery to crossed streams. All debris removed from the road surfaces except snow and ice would be deposited away from the stream channels. Snow removal would be conducted in a manner to minimize damage to travelways, prevent erosion damage, and preserve water quality. No side casting near stream crossings and bridges would occur, or be implemented as directed by the agencies. Alternative 2 would not be in compliance with RF-2c because MMC's Plan of Operations does not address all items required by RF-2c. MMC's Plan of Operations also does not address the Libby Creek Road (NFS road #231) that would be used during the Evaluation Phase, and while the Bear Creek Road was reconstructed.

Alternatives 3 and 4. Alternatives 3 and 4 would comply with RF-2 because they provide for the development and implementation of a final Road Management Plan. MMC would develop for the lead agencies' approval, and implement a final Road Management Plan that would describe the following for all new and reconstructed roads:

- Criteria that govern road operation, maintenance, and management
- Requirements of pre-, during-, and post-storm inspection and maintenance
- Regulation of traffic during wet periods to minimize erosion and sediment delivery and accomplish other objectives
- Implementation and effectiveness monitoring plans for road stability, drainage, and erosion control
- Mitigation plans for road failures
- Analysis of any new road constructed in a RHCA, documenting it was the minimum necessary for the approved mineral activity

The plan would describe management of road surface materials during plowing, such as snow and methods to control road ice. Sidecasting of soils or snow would be avoided. Sidecasting of road material would be prohibited on road segments within or abutting RHCAs in priority bull trout watersheds. Culverts along the Bear Creek Road (NFS road #278) and the Libby Creek Road (NFS road #231) that pose a substantial risk to riparian conditions would be replaced as necessary to comply with INFS standards and Forest Service guidance, such as fish passage or conveyance of adequate flows (USDA Forest Service 1995, 2008a).

Transmission Line Alternatives

Alternative B. Compliance with RF-2 would be the same as Alternative 2 (see previous discussion in this section). Alternative B would not in compliance with RF-2c because MMC's Plan of Operations does not address all items required by RF-2c.

Alternatives C-R, D-R, and E-R. Compliance with RF-2 would be the same as Alternatives 3 and 4 (see previous discussion in this section). Alternatives C-R, D-R, and E-R would in compliance with RF-2 because they provide for the development and implementation of a Road Management Plan, as discussed under Alternatives 3 and 4.

Road Management (RF-3)

Standards

Determine the influence of each road on the Riparian Management Objectives. Meet Riparian Management Objectives and avoid adverse effects on inland native fish by:

a. reconstructing road and drainage features that do not meet design criteria or operation and maintenance standards, or that have been shown to be less effective than designed for controlling sediment delivery, or that retard attainment of Riparian Management Objectives, or do not protect priority watersheds from increased sedimentation.

b. prioritizing reconstruction based on the current and potential damage to inland native fish and their priority watersheds, the ecological value of the riparian resources affected, and the feasibility of options such as helicopter logging and road relocation out of Riparian Habitat Conservation Areas.

c. closing and stabilizing or obliterating, and stabilizing roads not needed for future management activities. Prioritize these actions based on the current and potential damage to inland native fish in priority watersheds, and the ecological value of the riparian resources affected.

Mine Alternative 2 and Transmission Line Alternative B. Compliance with RF-3 would be achieved by controlling sediment delivery through BMPs on new roads, reconstructing drainage features on existing roads if necessary, and obliterating and stabilizing roads not needed in the active mining phase or after mine closure and removal of the transmission line. Road design features and BMPs designed to INFS riparian goals include chip-sealing of the main access road; regular maintenance of unimproved roads; construction of bridges on main stream crossings versus culverts; placement of the tailings pipeline outside any RHCAs; installation of sediment traps and other structures as part of the stormwater and surface water runoff plan; and minimization of any stream activities during road construction (MMI 2006). MMC's Plan of Operations did not address drainage features along the Libby Creek Road (NFS road #231) that would be used during the Evaluation Phase and while the Bear Creek Road was reconstructed.

Mine Alternatives 3 and 4, and Transmission Line Alternatives C-R, D-R, and E-R. In mine Alternatives 3 and 4, compliance with RF-3 would be the same as Alternative 2 (see previous paragraph) except as follows. Culverts along the Libby Creek Road (NFS road #231) that pose a substantial risk to riparian conditions would be replaced as necessary to comply with INFS standards and Forest Service guidance, such as fish passage or conveyance of adequate flows (USDA Forest Service 1995, 2008a). In addition, MMC would be responsible for developing, for lead agencies' approval, a final Road and Management Plan that meets standards for RF-3. The Final Road Management Plan would address all roads thall new and reconstructed roads affected by the Construction and Operations Phases of the mine and transmission line, including all roads with proposed access change, and would be incorporated into an amended Plan of Operations for the KNF.

In transmission line Alternatives C-R, D-R, and E-R, compliance with RF-3 would be the same as Alternative B (see previous discussion in this section) except as follows. The status of the transmission line roads on National Forest System land would be changed to intermittent stored service after line installation was completed. Intermittent stored service roads would be closed to traffic and would be treated so they would cause little resource risk if maintenance were not performed on them during the operation period of the mine and prior to their future need. Intermittent stored service roads would require some work to return them to a drivable condition. A culvert on roads used for maintenance access would be installed on any stream flowing at the time of use, if a culvert were not already in place. Intermittent stored service road treatments would include:

- Conducting noxious weed surveys and performing necessary weed treatments before storage activities
- Blocking entrance to road prism
- Removing culverts determined by the KNF to be high risk for blockage or failure; laying back stream banks at a width and angle to allow flows to pass without scouring or ponding so that revegetation has a strong chance of success
- Installing cross drains so the road surface and inside ditch would not route any intercepted flow to ditch-relief or stream-crossing culverts
- Removing and placing unstable material at a stable location where stored material would not present a future risk to watershed function
- Replacing salvaged soil and revegetating with grasses in treated areas and unstable roadway segments to stabilize reduce erosion potential.

Transmission line roads on National Forest System land would be decommissioned after closure of the mine and removal of the transmission line. Decommissioned roads would be removed from service and would receive a variety of treatments to minimize the effects on other resources. In addition to all of the intermittent stored service road treatments, a decommissioned road would be treated by one or more of the following measures:

- Conducting noxious weed surveys and performing necessary weed treatments before decommissioning
- Removing any remaining culverts and removing or bypassing relief pipes as necessary
- Stabilizing fill slopes
- Obliterating road prism by restoring natural slope and contour; restoring all watercourses to natural channels and floodplains
- Revegetating road prism
- Installing water bars or outsloping the road prism
- Removing unstable fills.

Road Management (RF-4)

Standard

Construct new, and improve existing, culverts, bridges, and other stream crossings to accommodate a 100-year flood, including associated bedload and debris, where those improvements *would/do pose a substantial risk to riparian conditions. Substantial risk improvements include those that do not meet design and operation maintenance criteria, or that have been shown to be less effective than designed for controlling erosion, or that retard attainment of Riparian Management Objectives, or that do not protect priority watersheds from increased sedimentation. Base priority for upgrading on risk in priority watersheds and the ecological value of the riparian resources affected. Construct and maintain crossings to prevent diversion of streamflow out of the channel and down the road in the event of crossing failure.*

Mine Alternative 2 and Transmission Line Alternative B. Mine Alternative 2 and Transmission Line Alternative B would not comply with RF-4. MMC would construct all new bridges on stream crossings to accommodate the 100-year flood, including associated bedload and debris. Crossings would be maintained to prevent diversion of streamflow out of the channel and down the road in the event of crossing failure. Culverts on the Bear Creek Road would be installed or extended as necessary. MMC's Plan of Operations did not address drainage features along the Libby Creek Road (NFS road #231) that would be used during the Libby Adit evaluation program, and while the Bear Creek Road was reconstructed. On roads for the transmission line, MMC anticipates that no drainage would be provided, but would follow the agencies' guidance if installation of culverts were required.

Mine Alternatives 3 and 4, and Transmission Line Alternatives C-R, D-R, and E-R. Mine Alternatives 3 and 4, Transmission Line Alternatives C-R, D-R, and E-R would comply with RF-4. In mine Alternatives 3 and 4, compliance with RF-3 would be the same as Alternative 2 except as follows. Along the Bear Creek Road (NFS road #278) and the Libby Creek Road (NFS road #231), culverts that pose a substantial risk to riparian conditions would be replaced as necessary to comply with INFS standards and Forest Service guidance, such as fish passage or conveyance of adequate flows (USDA Forest Service 1995, 2008a). The development and implementation of a final Road Management Plan in mine Alternatives 3 and 4, and transmission line Alternatives C-R, D-R, and E-R, would include a mitigation plan for road failures at stream crossings. For transmission line roads, culverts on roads would be installed on any stream where channel scour was present, if a culvert were not already in place. Culverts would be sized generally to convey the 100-year storm, but culvert sizing would be determined on a case-by-case basis with the lead agencies' approval of final sizing. When transmission line roads were placed into intermittent stored service, culverts would remain in place unless determined by the KNF to be high-risk for blockage or failure. All culverts would be removed when roads were decommissioned.

Road Management (RF-5)

Standard

Provide and maintain fish passage at all road crossings of existing and potential fish-bearing streams.

All Action Alternatives. Compliance in all alternatives with RF-5 would be the same as RF-4 (see previous discussion).

Minerals Management (MM-1)

Standard

Minimize adverse effects to inland native fish species from mineral operations. If a Notice of Intent indicates that a mineral operation would be located in a Riparian Habitat Conservation

Area, consider the effects of the activity on inland native fish in the determination of significant surface disturbance pursuant to 36 CFR 228.4. For operations in a Riparian Habitat Conservation Area ensure operators take all practicable measures to maintain, protect, and rehabilitate fish and wildlife habitat which may be affected by the operations. When bonding is required, consider (in the estimation of bond amount) the cost of stabilizing, rehabilitating, and reclaiming the area of operations.

All Action Alternatives. All mine alternatives would have facilities located in RHCAs. This EIS considers the effects of all alternatives on inland native fish in the determination of significant surface disturbance pursuant to 36 CFR 228.4. The KNF would share responsibility with the DEQ to monitor and inspect the Montanore Project, and has authority to approve a Plan of Operations that includes all the necessary modifications to ensure that impacts on surface resources would be minimized. These modifications are incorporated into mine Alternatives 3 and 4, and transmission line Alternatives C-R, D-R, and E-R. The KNF and the DEQ would collect a reclamation bond from MMC to ensure that the land affected by the mining operation was properly reclaimed. The joint reclamation bond would be held by the DEQ to ensure compliance with the reclamation plan associated with the DEQ Operating Permit and the Plan of Operations. The KNF may require an additional bond if it determined that the bond held by the DEQ was not adequate to reclaim National Forest System land or was administratively unavailable to meet KNF requirements. The KNF and the DEQ would collect a reclamation bond for National Forest System land affected by the transmission line; the DEQ would collect a reclamation bond for private land affected by the transmission line.

Minerals Management (MM-2)

Standard

Locate structures, support facilities, and roads outside Riparian Habitat Conservation Areas. Where no alternative to siting facilities in Riparian Habitat Conservation Areas exists, locate and construct the facilities in ways that avoid impacts on Riparian Habitat Conservation Areas and streams and adverse effects on inland native fish. Where no alternative to road construction exists, keep roads to the minimum necessary for the approved mineral activity. Close, obliterate and revegetate roads no longer required for mineral or land management activities.

Mine Alternative 2 and Transmission Line Alternative B. MMC's Alternative 2 and Alternative B would not comply with MM-2. The Ramsey Plant Site would be located in a RHCA. The lead agencies identified that the Libby Plant Site, proposed in mine Alternatives 3 and 4, is a practicable alternative to the Ramsey Plant Site. The disturbance areas for LAD Area 2 would disturb the RHCA along Ramsey Creek. The LAD Areas would not be used in Alternatives 3 and 4. No alternative to road construction in RHCAs was identified for roads associated with the mine facilities. In all mine alternatives, road construction in RHCAs would be kept the minimum necessary for the approved mineral activity. MMC would avoid or minimize, to the extent practicable, locating facilities, such as the Seepage Collection Pond, in RHCAs. MMC's Alternative B would locate roads and transmission line structures in RHCAs. The lead agencies' modifications to MMC's proposed alignment and structure placement incorporated into Alternative C-R, which would reduce the number of roads and transmission line structures in RHCAs, is a practicable alternative. In Alternative 2 and Alternative B, MMC would close, obliterate and revegetate roads no longer required for mineral or land management activities.

Mine Alternatives 3 and 4, and Transmission Line Alternative C-R-R, D-R, and E-R. These alternatives incorporate modifications and mitigations to MMC's proposals that are alternatives to siting facilities in RHCAs. The LAD Areas would not be used in Alternatives 3 and 4. These alternatives would reduce the number of facilities located in RHCAs. During final design, MMC would locate these structures outside of riparian areas if alternative locations were technically and economically feasible. No alternatives exist that eliminate the need to site facilities in RHCAs. These alternatives would minimize effects on RHCAs and inland native fish. Because no alternative to road construction existed, MMC would develop a Road Management Plan that analyzed any new road constructed in a RHCA, documenting it was the minimum necessary for the approved mineral activity. Roads no longer required for mineral or land management activities would be placed into intermittent stored service or decommissioned (see INFS standard RF-3).

Minerals Management (MM-3)

Standard

Prohibit solid and sanitary waste facilities in Riparian Habitat Conservation Areas. If no alternative to locating mine waste (waste rock, spent ore, tailings) facilities in Riparian Habitat Conservation Areas exists, and releases can be prevented and stability can be ensured, then:

a. analyze the waste material using the best conventional sampling methods and analytic techniques to determine its chemical and physical stability characteristics.

b. locate and design the waste facilities using the best conventional techniques to ensure mass stability and prevent the release of acid or toxic materials. If the best conventional technology is not sufficient to prevent such releases and ensure stability over the long term, prohibit such facilities in Riparian Habitat Conservation Areas.

c. monitor waste and waste facilities to confirm predictions of chemical and physical stability, and make adjustments to operations as needed to avoid adverse effects to inland native fish and to attain Riparian Management Objectives.

d. reclaim and monitor waste facilities to assure chemical and physical stability and revegetation to avoid adverse effects to inland native fish, and to attain the Riparian Management Objectives.

e. require reclamation bonds adequate to ensure long-term chemical and physical stability and successful revegetation of mine waste facilities.

Mine Alternatives-Plant Site. The Ramsey Plant Site in Alternative 2 would not comply with MM-3. The Ramsey Plant Site would be located in a RHCA and would be constructed with waste rock. The lead agencies identified that the Libby Plant Site, proposed in mine Alternatives 3 and 4, is a practicable alternative to the Ramsey Plant Site. Preliminary evaluation indicates the Libby Plant Site could be built of fill material from the large cut on the west side of the plant site. The cut and fill materials would be balanced, and waste rock would not be used in plant site construction.

Mine Alternatives-Tailings Impoundment. The tailings impoundment in all mine alternatives would comply with MM-3. Sections 2.13.4 and 2.13.5 discuss the lead agencies' analysis of alternative tailings disposal methods and locations. Compliance with INFS was a key criterion in the alternatives analysis. The lead agencies developed Alternatives 3 and 4 to minimize the extent to which RHCAs would be affected. Alternatives that would eliminate all effects on RHCAs were not identified during the agencies' analysis.

The waste material (tailings) has been analyzed using the best conventional sampling methods and analytic techniques to determine its chemical and physical stability characteristics. The waste analysis results are discussed in section 3.9, *Geology and Geochemistry*. In Alternative 2, during operations MMC would collect representative rock samples from the adits, ore zones, above, below, and between the ore zones, and tailings for static and kinetic testing. In Alternatives 3 and 4, MMC also would collect samples of the lead barren zone, altered waste zones within the lower Revett, and portions of the Burke and Wallace Formations for static and kinetic testing, assess potential for trace metal release from waste rock, and conduct operational verification sampling within the Prichard Formation during development of the new adits. Appendix C provides the agencies' Geochemical Sampling and Analysis Plan.

Potential acid-generating materials would be segregated for special handling as they were mined and would be placed under sufficient cover to minimize direct exposure to the atmosphere and precipitation. Such locations could include the inner portions of the tailings dam and inside the mine workings. No rock material would be used for construction before determination of its acid-producing potential. In addition, waste rock generated from the underground barren zone would be minimized, to the extent possible, due to higher lead concentrations present in this rock zone, and the greater potential for acid generation. Barren zone waste rock would be segregated from other waste rock and disposed underground.

All waste rock would be evaluated with water quality monitoring data to determine whether any changes in water quality were the result of acid or sulfate production. Annual reports documenting sample location, sample methods, detection limits, and testing results would be submitted to the lead agencies. Acid-base accounting results would be correlated with lithology and total sulfur analyses.

The tailings impoundment in all mine alternatives would be located and designed using the best conventional techniques to ensure mass stability and prevent the release of acid or toxic materials. Acid generation of the tailings would be unlikely, but tests of metal mobility and monitoring at the Troy Mine suggest that some metals would be mobile in tailings effluent at a near-neutral pH.

Seepage from the impoundment would be minimized by a seepage collection system. In the 1992 and 1993 RODs and the DEQ Operating Permit #00150, the lead agencies required Noranda to modify the impoundment design to minimize seepage from the tailings impoundment to the underlying groundwater. As this section discusses, MMC incorporated this requirement into the current tailings impoundment design. A seepage collection system would collect seepage from in and around the tailings impoundment. The collection system would consist of a Seepage Collection Dam and Pond, underdrains beneath the dams and impoundment, blanket drains beneath the dams, and a HDPE geomembrane liner beneath portions of the tailings impoundment (Figure 8 and Figure 26). Pumpback wells would be used to collect tailings impoundment seepage that reached groundwater. Tailings seepage would not reach any RHCAs or surface water.

MMC has addressed the stability of the tailings impoundment dams through a series of minimum allowable safety factors against failure for static and dynamic loading conditions of the facilities (Klohn Crippen 2005). MMC's design criteria are industry design standards for dam design and construction and have been established as measures of certainty for the design of safe earth and rock fill dams.

MMC's reclamation goal is to establish a post-mining environment compatible with existing and proposed land uses and consistent with the KFP. Specific objectives are: 1) long-term site stability, 2) protection of surface water and groundwater, 3) establishment of a self-sustaining native plant community where applicable and possible, 4) wildlife habitat enhancement, 5) protection of the public health and safety, and 6) attaining post-mining land use. The reclamation plan would be revised periodically to incorporate new reclamation techniques and update bond calculations. Before temporary or final closure, MMC would submit a revised reclamation plan to the lead agencies for approval.

MMC expects all stockpiled waste rock to be used in various construction activities. It is anticipated that no waste rock would remain at the LAD Area 1 stockpile after cessation of mining operations. Soil removed from this area before its use would be replaced and the area revegetated. Waste rock characterization testing would be conducted during mine operations in the event that unanticipated modifications to the reclamation plan were required.

The KNF and the DEQ would require a reclamation bond adequate to ensure long-term chemical and physical stability and successful revegetation of mine waste facilities (see discussion of INFS standard MM-1).

Minerals Management (MM-6)

Standard

Develop inspection, monitoring, and reporting requirements for mineral activities. Evaluate and apply the results of inspection and monitoring to modify mineral plans, leases, or permits as needed to eliminate impacts that prevent attainment of Riparian Management Objectives and avoid adverse effects on inland native fish.

All Action Alternatives. All action alternatives would comply with MM-6. In Alternative 2 and Alternative B, MMC would follow all inspection, monitoring, and reporting requirements for mineral activities developed by the agencies. MMC would evaluate and apply the results of inspection and monitoring to modify mineral plans, leases, or permits as needed to eliminate impacts that prevent attainment of RMOs and avoid adverse effects on inland native fish. In the other action alternatives, the lead agencies have modified the monitoring and reporting requirements to better assess the effects of the proposed project (see Appendix C).

Lands (LH-3)

Standard

Issue leases, permits, rights-of-way, and easements to avoid effects that would retard or prevent attainment of the Riparian Management Objectives and avoid adverse effects on inland native fish. Where the authority to do so was retained, adjust existing leases, permits, rights-of-way, and easements to eliminate effects that would retard or prevent attainment of the Riparian Management Objectives or adversely affect inland native fish. If adjustments are not effective, eliminate the activity. Where the authority to adjust was not retained, negotiate to make changes in existing leases, permits, rights-of-way, and easements to eliminate effects that would prevent attainment of the Riparian Management Objectives or adversely affect inland native fish. Priority for modifying existing leases, permits, rights-of-way, and easements would be based on the *current and potential adverse effects on inland native fish and the ecological value of the riparian resources affected.*

All Mine Alternatives. All mine alternatives would comply with LH-3. The KNF issuance of any permit or approval associated with the Montanore Project would avoid effects that would retard or prevent attainment of the RMOs and avoid adverse effects on inland native fish.

Alternative B. Alternative B would comply with LH-3. Compliance with LH-3 would be achieved through minimizing vegetation clearing and adverse effects in RHCAs through the use of steel monopoles, which would require a clearing area up to 150 feet. Clearing associated with Alternative B would occur outside RHCAs, if possible. If clearing were necessary in an RHCA, effects would be minimized through use of appropriate BMPs.

Other Transmission Line Alternatives. The other transmission line alternatives would comply with LH-3. Structure type in Alternatives C-R, D-R, and E-R would be H-frame wooden poles (except for a short segment on Alternative E-R), which would require a clearing area up to 200 feet. Wooden H-frame structures generally allow for longer spans and require fewer structures and access roads in RHCAs. Some structures would be installed using a helicopter to minimize road construction and vegetation clearing in RHCAs. Disturbance and vegetation clearing in RHCAs at stream crossings would be minimized through implementation of a Vegetation Clearing and Disposal Plan. As mitigation, MMC would leave large woody material for small mammals and other wildlife species within the cleared transmission line corridor on National Forest System land.

General Riparian Area Management (RA-2)

Standard

Trees may be felled in Riparian Habitat Conservation Areas when they pose a safety risk. Keep felled trees on site when needed to meet woody debris objectives.

All Action Alternatives. Timber harvest in RHCAs in LAD Area 2 in Alternative 2 is discussed in the previous INFS standard TM-1. Trees cleared in RHCAs for the transmission line would be limited to those that pose a safety risk. Developing and implementing a Vegetation Removal and Disposition Plan, minimizing heavy equipment use in RHCAs (Environmental Specifications, Appendix D), and using helicopters for structure placement and vegetation clearing in Alternatives C-R, D-R, and E-R would minimize clearing and disturbance in RHCAs. Alternatives C-R, D-R, and E-R would comply with RA-2.

General Riparian Area Management (RA-3)

Standard

Apply herbicides, pesticides, and other toxicants, and other chemicals in a manner that does not retard or prevent attainment of Riparian Management Objectives and avoids adverse effects on inland native fish.

All Action Alternatives. All action alternatives would comply with RA-3. In Alternative 2 and Alternative B, measures outlined in MMC's Weed Control Plan approved by the Lincoln County Weed Control District would be followed during operations and reclamation. All herbicides used in the analysis area would be approved for use in the KNF, and would be applied according to the labeled rates and recommendations to ensure the protection of surface water, ecological integrity, and public health and safety. In the other action alternatives, MMC also would implement all weed BMPs identified in Appendix A of the KNF Invasive Plant Management Final EIS (KNF 2007a) for all weed-control measures. These measures would ensure that herbicides, pesticides, and other toxicants, and other chemicals were used in a manner that would not retard or prevent attainment of RMOs and would avoid adverse effects on inland native fish.

General Riparian Area Management (RA-4)

Standard

Prohibit storage of fuels and other toxicants within Riparian Habitat Conservation Areas. Prohibit refueling within Riparian Habitat Conservation Areas unless there are no other alternatives. Refueling sites within a Riparian Habitat Conservation Area must be approved by the Forest Service or Bureau of Land Management and have an approved spill containment plan.

Mine Alternatives. MMC's Alternative 2 would not comply with RA-4. Fuel storage at the Ramsey Plant Site would be about 150 feet from Ramsey Creek, within the Ramsey Creek RHCA. The lead agencies identified that the Libby Plant Site, proposed in mine Alternatives 3 and 4, is a practicable alternative to the Ramsey Plant Site. Fuel storage at the Libby Plant site would not be within a RHCA. MMC's Spill Response Plan provides a spill containment and response plan. Alternatives 3 and 4 would comply with RA-4.

Watershed and Habitat Restoration (WR-1)

Standard

Design and implement watershed restoration projects in a manner that promotes the long-term ecological integrity of ecosystems, conserves the genetic integrity of native species and contributes to attainment of Riparian Management Objectives.

All Action Alternatives. Alternative 2 and B would not comply with WR-1. The fisheries mitigation proposed in Alternative 2 was developed in 1993 during the permitting of the original Montanore Project, and did not focus on bull trout or designated bull trout critical habitat. The agencies' mitigation plans for the agencies' alternatives would promote the long-term ecological integrity of ecosystems, conserve the genetic integrity of native species and contribute to attainment of the RMOs. About 43 miles of proposed access changes and either placing roads into intermittent stored service or decommissioning them would reduce sediment to area creeks and contribute to attainment of the RMOs.

Fisheries and Wildlife Restoration (FW-1)

Standard

Design and implement watershed fish and wildlife habitat restoration and enhancement actions in a manner that contributes to attainment of the Riparian Management Objectives.

All Action Alternatives. Alternative 2 and B would not comply with FW-1. The fisheries mitigation proposed in Alternative 2 was developed in 1993 during the permitting of the original Montanore Project, and did not focus on bull trout or designated bull trout critical habitat. The agencies' mitigation plans for the agencies' alternatives would contribute to attainment of the RMOs. About 43 miles of proposed access changes and either placing roads into intermittent stored service or decommissioning them would reduce sediment to area creeks and contribute to attainment of the RMOs.

Hellgate Treaty of 1855

The Hellgate Treaty of 1855 reserved for the Kootenai Nation, among other rights, "the right to fish at all usual and accustomed places….on open and unclaimed lands." The KFP recognizes these treaty rights, and allows the Flathead/Kootenai-Salish Indian tribes to fish within the KNF. Ongoing consultation with the CSKT ensures that tribal treaty rights are protected. Section 3.5, *American Indian Consultation* discusses American Indian rights.

Forest Service Sensitive Species Statement of Findings

This analysis serves as the biological evaluation for effects on Forest Service sensitive aquatic species associated with the various alternatives for implementing the Montanore Project. Implementing the action alternatives ***may impact westslope cutthroat trout individuals or habitat within the analysis area, but would not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species***. Alternatives 2 and 4 ***may impact individual redband trout and habitat within the analysis area, but would not contribute to a trend toward federal listing or cause a loss of viability to the population or species***. The action alternatives would have ***no impact on the western pearlshell***.

Transmission line construction and decommissioning, as well as some road status changes, would result in short-term increases in sediment delivery to streams, but long-term decreases would occur under all alternatives, and would benefit aquatic habitat in analysis area streams. The reductions in low flows would result in decreased aquatic habitat for redband trout in some tributary reaches within the Libby Creek watershed. Increases in flows as a result of the Water Treatment Plant discharges would increase available habitat within the reaches of Libby Creek in which redband trout are present and likely offset the decreased habitat available in the tributaries to some extent. Most subpopulations in the analysis area are currently hybridized to some extent, and this would continue to be a risk to the redband trout populations.

The reduction in habitat and decreased flows in Little Cherry Creek in Alternatives 2 and 4 from construction and use of the tailings impoundment would adversely affect the pure interior redband trout population in this stream. The population would be unlikely to re-establish after mine closure and reclamation, and would represent a loss of these redband trout and of genetic diversity. These losses would affect interior redband trout individuals or habitat within the analysis area, but would not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species. The reduced habitat and flows would not occur under Alternative 3.

The streamflow reductions in East Fork Rock Creek and the East Fork Bull River during the low flow period of the year would reduce habitat availability for westslope cutthroat trout, but would not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species. As with redband trout, hybridization would remain a threat to these populations. In summary, this effects analysis demonstrates that the effects of implementing Mine Alternatives 2, 3, or 4 and Transmission Line Alternatives B, C-R, D-R, and E-R may impact westslope cutthroat trout or interior redband trout and their habitat, but would not likely contribute to a trend toward federal listing of the population of westslope cutthroat trout or interior redband trout.

3.6.4.12 Short- and Long-Term Effects

Short-term effects of construction and operation of the project in all alternatives would include increases in sedimentation to streams within the Libby Creek and West Fisher Creek watersheds. The potential for increases in sediment to streams in these watersheds in Alternatives 3 and 4 would be less. While all of the transmission line alternatives pose some risk of increased sedimentation in analysis area streams, Alternative C-R represents the lowest risk of sediment effects from the transmission line and access roads. Possible changes in sedimentation rates with these alternatives likely would have few, if any, effects on fish populations, and these effects would be short-term because annual snowmelt runoff or storm flows would flush accumulated fine sediments downstream. Additionally, BMPs and road closures under Alternative 3 and 4 would greatly reduce sediment delivery to analysis area streams compared to existing conditions, resulting in long-term benefits for aquatic biota.

Long-term effects of the project would include a permanent loss of 15,600 feet of the pure redband trout habitat in Little Cherry Creek due to the construction of the tailings impoundment and diversion channel in Alternative 2, and a similar loss of habitat in Alternative 4. No pure redband trout habitat in Little Cherry Creek would be lost in Alternative 3. This loss of habitat would adversely affect the pure redband trout population that currently exists in Little Cherry Creek. Although not specifically aimed at mitigation for pure redband trout populations, habitat improvement and mitigation measures included (to varying extent) in Alternatives 2, 3, and 4 would result in restoration of stream habitat and recreational access lost due to the development of the diversion channel and other mine facilities.

Long-term decreases in flow in the Libby Creek, Rock Creek, and the East Fork Bull River watersheds are predicted to occur for all action alternatives during and after mine operations. After groundwater levels reached steady state conditions, flow in these streams would be higher than during and after mine operations, but flows in some streams would not return to pre-mine conditions. Mitigation would reduce effects to streamflows and Rock Lake, and would result in flows in most streams returning nearly to existing conditions at steady state. Streamflow in Little Cherry Creek would permanently increase compared to existing conditions with mitigation in Alternative 3. Although some of the predicted flow changes may not be detectable or separable from natural flow variability, any decrease in flow could have adverse long-term effects on the bull trout, redband trout, and westslope cutthroat trout populations by decreasing available habitat in these streams during certain times of the year. Bull trout may be particularly affected by these decreases because the habitat loss would occur during their spawning period. The East Fork Bull River is considered one of the most important bull trout spawning streams in the lower Clark Fork River drainage. Changes would likely not be detectable once steady state conditions are reached in this stream, but decreased low flows would affect habitat availability for these trout in the Operations, Closure, and Post-Closure phases. The Little Cherry Creek Diversion Channel would reduce the available habitat by 15,600 feet for the pure redband populations in Little Cherry Creek using Alternatives 2 and 4.

Mitigation projects would be included in Alternatives 2, 3, and 4, and, if successful, would benefit aquatic habitat and salmonid populations in analysis area streams. The bull trout mitigation plan in Alternative 3 would include multiple projects that are projected to account for the impacts predicted to occur to bull trout populations and critical habitat in the Kootenai and Lower Clark Fork core areas. The Waters of the U.S. mitigation would increase flows in Little Cherry Creek and restore aspects of the stream habitat in this stream and in Swamp Creek.

3.6.4.13 Irretrievable and Irreversible Commitments

The Little Cherry Creek diversion would reduce available habitat by 15,600 feet for the small, pure redband population in Little Cherry Creek in Alternatives 2 and 4. These alternatives would irreversible loss of genetic diversity from the redband trout population found in Little Cherry Creek if proposed efforts to collect and transfer fish from the affected segment of Little Cherry Creek to the diversion drainage were not entirely successful or if flow was not adequate to support the population, as expected. Even if flows were sufficient to support some trout, the loss of habitat in Little Cherry Creek would result in a decrease in redband populations in that stream with these alternatives. The loss of habitat would not occur under Alternative 3.

Hybridization of the pure redband trout population in Little Cherry Creek is unlikely to occur in Alternative 3, but may occur in Alternatives 2 and 4 if barriers did not develop in the diversion drainage as predicted, and the redband trout were to come in contact with non-native trout in the Libby Creek drainage. Habitat restoration efforts would be included in Alternative 2, and to a greater extent in Alternatives 3 and 4, and would provide mitigation for the loss of trout habitat in Little Cherry Creek by restoring portions of Libby Creek or other streams within the drainage.

Alternatives 2, 3, and 4 could irreversibly reduce bull trout and westslope cutthroat trout habitat in Rock Creek and East Fork Bull River drainages due to decreases in flow. Mitigation would slightly reduce effects on streamflows and aquatic habitat in both streams in Alternatives 3 and 4. Loss of bull trout habitat in the East Fork Bull River in all alternatives could be detrimental to bull trout populations in the lower Clark Fork River because this stream is considered a primary spawning location in this system. The planned mitigation projects for bull trout are projected to mitigate for the impacts predicted to occur to bull trout populations and critical habitat in the Kootenai and Lower Clark Fork core areas.

3.6.4.14 Unavoidable Adverse Environmental Effects

Mining of the ore body would unavoidably reduce streamflow and spring flows, and affect lake levels in Rock and St. Paul lakes. Decreased streamflows would result in the loss of aquatic habitat in the Libby Creek, Rock Creek, and East Fork Bull River watersheds. Water levels are predicted to reach steady state conditions 1,150 to 1,300 years after mining ceased. The actual time to reach steady state conditions may be shorter or longer and would be reevaluated using the 3D model after additional data were collected during the Evaluation Phase.

3.7 Cultural Resources

3.7.1 Regulatory Framework

Section 106 of the National Historic Preservation Act (NHPA) of 1966 as amended and its implementing regulations under 36 CFR 800 require all federal agencies to consider effects of federal actions on cultural resources eligible for or listed in the National Register of Historic Places (NRHP). Both listed and potentially eligible properties must be considered during Section 106 review. In the Section 106 review, the Forest Service considers effects on cultural resource properties within the APE. The APE is defined as "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist (36 CFR 800.16)."

Traditional cultural properties (TCPs) are protected under Section 106 of the NHPA; the American Indian Religious Freedom Act; and the Native American Grave Protection and Repatriation Act. A TCP may be eligible for listing in the NRHP because of its association with cultural practices or beliefs of a living community that (a) are rooted in the history of the community or tribe, and, (b) are important in maintaining the continuing cultural identity of the community or tribe. Effects on American Indians are discussed in section 3.5, *American Indian Consultation*.

Generally, any site of human activity older than 50 years is considered to be a potential cultural resource. The NHPA requires federal agencies to identify any cultural resource properties that might be affected by a federal undertaking. An undertaking refers to any federal action, such as approval of a Plan of Operations for the Montanore Project. If the cultural resource is affiliated with American Indian use, then consultation with any interested tribes begins. Once identified, a cultural resource property is formally evaluated by the KNF in consultation with the SHPO, to determine whether the property is eligible for listing on the NRHP.

After consultation, the SHPO provides a determination of eligibility for each cultural resource affected by the project. If the property is found to be eligible, the KNF will determine whether the property would be adversely affected by the undertaking. Cultural resources that are determined eligible for listing in the NRHP and that cannot be avoided during project implementation would be considered adversely affected. When adverse effects are anticipated, MMC may choose to redesign the project to avoid the property. If avoidance is not feasible, actions will be taken to mitigate any adverse effects on the property. A mitigation plan would be developed by MMC, reviewed by the KNF, reviewed by culturally affiliated tribes, and approved by the SHPO and the Advisory Council on Historic Preservation.

The location of cultural resource sites is exempt from public disclosure under Public Law 94-456. The purpose of this exemption is to protect a site from potential vandalism and to retain confidentiality of sites culturally significant to American Indian Tribes. Similar state laws governing cultural resources are found in 22-3, MCA.

3.7.2 Analysis Area and Methods

3.7.2.1 Analysis Area

The APE includes all mine-related facilities and four transmission line alternatives, each with a 500-foot buffer. The buffer areas are included in the analysis of direct, indirect, and cumulative effects. No formal consultation has occurred between the KNF and the SHPO regarding definition of the APE, but consultation will take place before project implementation.

3.7.2.2 Cultural Resource Inventories

Cultural resources were identified within the APE using three methods:

- A Class I file and literature review with the SHPO and the KNF by Historical Resource Associates (Historical Research Associates 2006a, 2006b) to identify previous cultural resource inventories and archaeological sites within the APE
- A Class III intensive pedestrian cultural resource inventory was conducted within all mine facility footprints, including portions of the APE that are on private land (Historical Research Associates 1989a; 1989b; 1989c; 1990; 2006a; 2006b)
- Shovel testing areas identified by the KNF as medium to high probability areas for cultural resources, in addition to pedestrian survey (Historical Research Associates 2006a; 2006b)

Mine facility areas proposed in Alternative 2 (Little Cherry Creek Tailings Impoundment Site, LAD Areas 1 and 2, Ramsey Plant Site, and Libby Adit Site) were inventoried at an intensive level, including shovel testing in areas of low ground visibility (Historical Research Associates 2006a, 2006b). Previous inventory conducted for NMC included portions of proposed facility locations (Historical Research Associates 1990). Of the transmission line alternatives, only segments of the North Miller Creek, Modified North Miller Creek, and Miller Creek Alternatives were subject to intensive inventory (Historical Research Associates 1990, 2006b). The Sedlak Park Substation also was inventoried at an intensive level (Historical Research Associates 1990). It is not known if the substation loop line was included in the inventory of the substation. Effects on cultural resources were evaluated using GIS spatial analysis to compare the location of cultural resources in relation to proposed project facilities. Because not all of the proposed transmission line alternatives were inventoried for cultural resources, only those cultural resources identified through the file and literature review were considered in the effects analysis.

After the agencies have identified a preferred transmission line alignment, any remaining pedestrian inventory and/or exploratory shovel testing would be conducted to comply with Section 106 of the NHPA. If previously unknown cultural or historical resources were discovered during any remaining inventory, MMC would avoid disturbing the sites and their setting as recommended after formal evaluation and consultation with SHPO, and as allowed by the landowner.

3.7.2.3 Site Evaluation Criteria

Cultural resources are evaluated for their eligibility to be listed on the National Register of Historic Places (NRHP). NRHP significance criteria are codified under 36 CFR 60.4 and are specified below (National Register Bulletin No. 15, revised 1998):

The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and—

> a) that are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> b) that are associated with the lives of persons significant in the past; or
>
> c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic value, or that represent a significant or distinguishable entity whose components may lack individual distinction; or
>
> d) that have yielded, or are likely to yield, information important in prehistory or history.

Ordinarily, cemeteries, birthplaces, or graves of historical figures; property owned by religious institutions or used for religious purposes; structures that have been removed from their original location; reconstructed historic buildings; properties that are primarily commemorative in nature; and properties that have achieved significance within the last 50 years shall not be considered eligible for the National Register. Such properties will qualify if they are integral parts of districts that do meet the criteria, or if they fall within the following categories:

> a) a religious property deriving primary significance from architectural or artistic distinction or historical importance; or
>
> b) a building or structure removed from its original location but which is significant primarily for its architecture, or which is the surviving structure most importantly associated with an historic person or event; or
>
> c) a birthplace or grave of an historical figure of outstanding importance if there is no other appropriate site or building directly associated with his or her productive life; or
>
> d) a cemetery which derives its primary significance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events; or
>
> e) a reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan and when no building or structure with the same association has survived; or
>
> f) a property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own historical significance; or
>
> g) a property achieving significance within the past 50 years if it is of exceptional importance.

In addition, sites evaluated as eligible must retain physical integrity. Eroded or otherwise heavily disturbed sites are generally not considered eligible under Criterion d, although intact portions of an otherwise degraded site may still qualify the site as eligible. Unevaluated sites are those that may conform to the eligibility criteria, but require further work to determine NRHP significance. In most cases, these sites are prehistoric or historic sites with suspected buried cultural material or historic sites where additional archival research is necessary to determine historical context and overall significance. Sites that are evaluated as not eligible do not meet any of the eligibility criteria and/or have lost physical integrity. For purposes of the EIS, any unevaluated site is considered potentially eligible for the NRHP.

If the project involves a ground disturbing action, all documented cultural resources must be evaluated for potential adverse effects as codified under 36 CFR 800.5. Effects may be "no effect," "no adverse effect," or "adverse effect," depending on the type of anticipated disturbance. Determinations of effect must take into account the action involved and may be "beneficial" if the action has the potential to further preserve the cultural resource.

3.7.3 Affected Environment

3.7.3.1 Cultural Resource Overview

The following cultural overview is summarized from a synthesis provided by Historical Research Associates (1989a; 1989b; 1990; 2006a; 2006b). At the time of Euro-American contact, two major ethnic groups occupied and used areas that include the current analysis area. The Kalispell or Lower Pend d'Oreille occupied the Clark Fork River drainage from the area around Lake Pend d'Oreille in Idaho to the vicinity of Plains, Montana. The Kootenai (also spelled Kutenai) occupied the area drained by the Kootenai River in Montana and the Kootenay and upper Columbia rivers in British Columbia. They occupied semi-permanent winter encampments and seasonally exploited other sites. The Kootenai, who subsisted on a hunting-gathering economy based primarily on fish, big game and camas, have used the analysis area for the last three to five centuries.

The most salient prehistoric data come from the work conducted at the Libby Dam and Reservoir area. Work from this area established clear continuity between prehistoric use of the area and the historic Kutenai. The spatial extent of the Kutenai, and by extension most other groups in the region, was considerable due to seasonal mobility between the mountains and plains as a means of successful adaptation. It is likely that the Kutenai split into smaller groups early in the Common Era, each relying more heavily on either plains or mountain-based resources, depending on their location, while using extensive trade networks.

The first contact between Native Americans and Euro-Americans in the area was initiated by explorers and fur traders. The first Euro-Americans to enter the analysis area were LeGasse and LeBlanc, employees of the Northwest Company sent into the region in 1801. Jaco Finley crossed the Rocky Mountains via Howse Pass in 1806 and David Thompson arrived in the Libby area in May, 1808; his travels are described in journals dated 1808-1812. Several trading posts were established in the region and travel routes such as the "Kootenai Road" became important links to connect the Kootenai River region with the trading posts.

More permanent Euro-American settlements resulted from the influx of people during the gold strikes of the 1860s and the construction of the transcontinental railroads through the Clark Fork Valley in 1883 and the Kootenai Valley in 1892. There was placer mining and an established mining camp along Libby Creek by 1867-1868. The initial rush to Libby Creek included 500 to 600 men, but the number quickly diminished to a handful by early 1868. The camp was referred to as Libbysville. Little to no placer mining took place during 1876 to 1885 when a small rush resumed after gold was once again discovered. Settlement along the Kootenai River was limited to the town of Tobacco Plains until the late 1880s, when Old Town or Lake City was established near with the mouth of Ramsey Creek on upper Libby Creek. The Thompson Falls to Libby Creek Trail was extended to Old Town and a general store existed to supply goods. Old Town was abandoned in 1889 with the establishment of Old Libby, which in turn was abandoned in 1891 when the Howards, among others, established ranches near the mouth of Libby Creek in anticipation of the Great Northern Railroad route to be established closer to the Kootenai. Placer mining in the Libby Creek drainage peaked in the early 1900s. Both railroads and mining contributed to the development of the timber industry, which became the economic base in both Lincoln and Sanders counties.

A major change in the region resulted from the establishment of the Forest Reserves, later known as National Forests. Lands within the reserves came under the administration and protection of the Federal Government, and timber cutting became regulated. Portions of the land within the analysis area were included in the Cabinet Forest Reserve, now part of the Libby and Cabinet Districts of the KNF.

3.7.3.2 Archaeological Resource Potential

Based on sites recorded in the region, and a synthesis of expected cultural resources provided in the KNF Heritage Guidelines (KNF 2002a), the following cultural resource types were considered most likely to occur in the analysis area: prehistoric campsites, scarred trees, historic cabins, trading posts, mining and logging sites, homesteads, bridges, and trash dumps. Cultural resources in upland areas are expected to be fewer than in lower elevation areas and along major water courses. Upland areas were used seasonally by hunter-gatherer groups for specific economic procurement tasks and, as such, the cultural imprints from these activities are expected to be less visible than long-term habitation sites located at lower elevations (KNF 2002a). Identification of specialized economic activity sites expected in upland areas is difficult because of the limited material assemblage associated with this type of site and the extensive vegetation cover of the analysis area. Subsurface testing was used in high probability areas to locate cultural resources.

3.7.3.3 Recorded Cultural Resources

3.7.3.3.1 Mine Facilities

The file and literature review and inventory of mine related facilities determined that 11 cultural resources have been previously recorded within the APE (Table 80). Two potential resources are known but have not been formally recorded (site leads FS D5-241SL and D5-363).

Known cultural resources in mine facility areas (Table 80) are six eligible sites, two recommended not eligible sites, one recommended eligible site, and two sites that have not been evaluated. The Libby Mining District (District) encompasses most of the mine facility areas and the northwest terminus of the transmission line alternatives. This site is a NRHP eligible historic district that embodies the physical features of mining from 1867 to the 1950s and a visual aspect that conveys both setting and location criteria. Six of the sites are related to the District and are considered contributing elements of the District. Sites 24LN320, known as the Comet Placer, 24LN1677 (Beager Cabin), and 24LN1678 (unnamed cabin) are eligible for the NRHP as contributing elements to the District. Sites 24LN943 and 24LN980 are recommended not eligible as contributing elements of the District, and site 24LN1209, the Old Libby Wagon Road, is considered a contributing element to the District. Sites 24LN320 and 24LN1209 are located within the Little Cherry Creek Tailings Impoundment Site (Alternatives 2 and 4) and are eligible for the NRHP. Site 24LN943 is a historic logging camp originally recommended as not eligible that has since been destroyed by previous construction associated with the Libby Adit (private property). Site 24LN1680 is believed to be a portion of a placer mine that extends about 100 feet into the Libby Adit facility. It is currently unknown if any elements of this resource actually extend into the APE.

Table 80. Known Cultural Resources within Mine Facility Areas.

Smithsonian Site #	Site Type	NRHP Eligibility	Area of Potential Effect
24LN320[†]	Historic Mining features - Comet Placer	Eligible	Little Cherry Creek Tailings Impoundment Alternatives 2 and 4
24LN943[†]	Logging Camp	Recommended Not Eligible (destroyed)	Libby Adit (All Alternatives)
24LN980[†]	Dam	Recommended Not Eligible	Alternative 2 – Proposed Mitigation Area
24LN1209[†]	Historic road/trail – Libby Wagon Road	Eligible	Little Cherry Creek Tailings Impoundment Alternatives 2 and 4
24LN1323	Libby Mining District	Eligible	All project components except Libby Adit
24LN1677[†]	Beager Cabin	Eligible	Alternative 2 – Proposed Mitigation Area
24LN1678[†]	Cabin	Eligible	Alternative 2 – Proposed Mitigation Area
24LN1680	Placer Mine Ditch	Eligible	Libby Adit (100 feet according to GIS) All Alternatives
24LN2203	Prehistoric	Recommended Eligible	Alternative 2 – Proposed Mitigation Area
FS D5-241SL	Mining features and cabin	Not Evaluated	Alternative 2 – Proposed Mitigation Area
FS D5-363	Mining Camp	Not Evaluated	Alternative 2 – Proposed Mitigation Area

[†]Contributing cultural resources to the Libby Mining District (24LN1323).

The KNF has identified an additional four cultural resources and two unrecorded sites that may be affected by proposed fishery mitigation work associated with Alternative 2. These include sites 24LN1677 and 24LN1678, which are contributing elements to the Libby Mining District (24LN1323); site 24LN2203, a prehistoric site with an unknown eligibility status; an unrecorded feature of 24LN980 (historic dam) recommended not eligible; and site leads D5-241SL and D5-363 that require documentation and evaluation before project implementation.

3.7.3.3.2 Transmission Line Alignments

Known cultural resources located within the four transmission line corridor alternatives are listed in Table 81. Cultural resources common to all transmission line alternatives include 24LN208, 24LN722, 24LN963, 24LN977, 24LN1323 (Libby Mining District), 24LN1679, and the Libby Divide and Miller Creek Trails. Site 24LN208 (Trail #6) would be crossed by all alternatives north of the Sedlak Substation where the alignment parallels US 2. Site 24LN722 was recorded within the area proposed for the Sedlak Substation, but could not be relocated by Historical Research Associates during its inventory efforts. Historical Research Associates assumed the scarred tree that comprised this resource had been logged and no longer exists. Site 24LN963 and the Libby Divide and North Fork of the Miller Creek Trail are a system of trails crossed by all transmission line alternatives except the West Fisher Alternative (Historical Research Associates 2006a, 2006b). Site 24LN977 is a historic school crossed by all alternatives. Sites crossed by all alternatives are eligible except for sites 24LN208 and 24LN722 (undetermined eligibility). Site 24LN1679 is the Libby Placer Mining Camp listed as officially eligible and a contributing resource to the Libby Mining District (24LN1323).

Table 81. Cultural Resource Sites Located within the Transmission Line Alternatives.

Smithsonian Site #	Site Type	NRHP Eligibility	Area of Potential Effect
24LN165	Unknown	Unknown	Alternative E-R
24LN208	Trail #6	Recommended Not Eligible	All Alternatives
24LN718†	Historic Log Structure	Eligible	Alternative E-R
24LN719	Historic Townsite	Eligible	Alternative E-R
24LN720†	Historic Mining and Prehistoric campsite	Eligible	Alternative E-R
24LN722	Scarred Tree	Undetermined (destroyed)	All Alternatives (Sedlak Park Substation area)
24LN756	Fisher River Bridge	Undetermined (bridge removed)	Alternative B
24LN962	Teeter Peak Trail	Recommended Not Eligible	Alternatives D-R and E-R
24LN963	Historic road/trail	Recommended Not Eligible	All Alternatives
24LN977	Historic School	Eligible	All Alternatives
24LN1323	Libby Mining District	Eligible	All Alternatives (no contributing elements affected)
24LN1584	Two scarred trees	Recommended Eligible	Alternative B
24LN1585	Four scarred trees	Recommended Eligible	Alternative B
24LN1677†	Historic Mining	Eligible	Alternatives D-R and E-R
24LN1679†	Libby Placer Mining Camp	Eligible	All Alternatives
24LN1818	Portions of US 2	Not Evaluated	All Alternatives
FS D5-122	North Fork Miller Creek Trail #505	Avoidance per 1997 PMOA	All Alternatives
FS D5-126	Libby Divide Trail #716	Avoidance per 1997 PMOA	All Alternatives

†Contributing cultural resources to the Libby Mining District (24LN1323).

Cultural resources solely located within the transmission line corridor of Alternative E-R include 24LN165, 24LN718, 24LN719, and 24LN720. Site 24LN165 is a historic dump that requires SHPO concurrence to be determined as not eligible and 24LN719 is a large historic townsite eligible for the NRHP. Site 24LN718 is a historic log structure likely related to the mining activity in the area and is eligible for the NRHP. Site 24LN720 is a multi-component historic mining and prehistoric campsite and is eligible for the NRHP.

Site 24LN962 is the Teeter Peak Trail that would be crossed by Alternatives D-R and E-R and is recommended not eligible. Sites 24LN1584 and 24LN1585 include two and four culturally modified trees, respectively, located within the buffer area of Alternative B. Both sites are recommended eligible. Site 24LN1818 is a portion of US 2 that would be crossed by Alternatives B, C-R, and D-R. Because of the ongoing modification that the highway receives, the resource has not been evaluated for the NRHP.

3.7.4 Environmental Consequences

3.7.4.1 Alternative 1 – No Mine

No direct, indirect, or cumulative effects would occur to cultural resources in Alternative 1. Natural weathering, deterioration, and vandalism of cultural resources would continue. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands.

3.7.4.2 Alternative 2 – MMC's Proposed Mine

All eleven cultural resources identified within mine facilities would be affected by Alternative 2 (Table 80) and remain potentially eligible for listing in the NRHP. Six of these resources may be affected by proposed fishery mitigation areas and are discussed separately below. Site 24LN1323, the Libby Mining District, would be affected by all Alternative 2 facility components except construction of the Libby Adit site. The District includes an extensive area where placer mining took place, including locations along drainages of Libby, Big Cherry, Midas, Bear, Poorman, Ramsey, Little Cherry, and Howard creeks. Mitigation would be necessary for those areas of the District that would be adversely affected by facility construction. A determination as to whether individual contributing sites (such as mines and mine-related sites) should be included in the mitigation plan for the Historic District would be the decision of the Forest Service. Mitigation for the District could include formal documentation under the USDI National Park Service's Cultural Landscapes Program or updating the existing site form for the District, or could be limited to mitigation for individually contributing historic properties. The type of data recovery necessary for a mining historic district and contributing properties would be determined from a data recovery plan developed in consultation with the KNF and the SHPO.

Site 24LN320 is located on private land within the Little Cherry Creek Tailings Impoundment Site and is individually eligible for the NRHP and a contributing element to the Historic District. The KNF recommends that additional recording is necessary in addition to potential data recovery efforts of known site components. Mitigation plans for sites 24LN320 and 24LN1209, also located within the Little Cherry Creek Tailings Impoundment Site, would need to be developed in consultation with the SHPO and could include Level II HAER documentation for

24LN1209 and/or HABS documentation for site 24LN320 depending on the type of mining features present. Review and consultation with SHPO is required for site 24LN943 in order to receive a consensus determination of not eligible based on the loss of physical integrity of the site. Assuming concurrence from the SHPO, no additional work would be required. GIS analysis indicates that about 100 feet of an eligible mining ditch (site 24LN1680) extends into the disturbance area of the Libby Adit Site; any portion of the eligible mining ditch that may have once extended into the Libby Adit disturbance area would have been destroyed by previous ground disturbing activity. Monitoring should be conducted in this area should any new disturbance occur.

Alternative 2 also includes proposed fishery mitigation work around Howard Lake and Libby Creek, which may have the potential to adversely affect six cultural resources. Trail paving associated with mitigation activities around Howard Lake has the potential to adversely affect site 24LN2203. The Forest Service has recommended that mitigation be implemented before ground disturbance, which could include either protective covering or data recovery. Rehabilitation efforts associated with Libby Creek have the potential to adversely affect three cultural resource sites (24LN980, 24LN1677, and 24LN1678) and two unrecorded sites (D5-241SL and D5-363). An unrecorded feature of 24LN980 would require documentation and evaluation as a potential contributing element of the District (24LN1323). The eligible historic cabins (24LN1677 and 24LN1678) would require HABS documentation if adversely affected by fishery mitigation activities. Review and consultation also would be required for site 24LN980 in order to receive a consensus determination of not eligible. This site also would need to be evaluated as to whether it contributes to the District. If the site were not eligible either individually or as a contributing element to the District, no additional work would be required. If the site were a contributing element to the District a data recovery plan would need to be developed and could include HAER documentation. The two unrecorded sites (D5-241SL and D5-363) would need to be formally documented and evaluated for effects from the proposed mitigation activities. The KNF has recommended that the sites 24LN980, 24LN1677, 24LN1678, and the two unrecorded sites be considered for interpretation to benefit the public.

For those sites with unresolved eligibility status (24LN943, 24LN980, 24LN2203, D5-363, and D5-241SL), review and consultation with SHPO would be necessary before ground disturbing activities. For those cultural resources found to be eligible for listing in the NRHP following consultation, the project proponent would develop a data recovery plan that would require approval by the Forest Service, SHPO and the Tribes, if necessary. Finally, for those sites with consensus eligible determinations (24LN320, 24LN1209, 24LN1323, 24LN1677, and 24LN1678), data recovery plans would need to be developed in consultation between the Forest Service and the SHPO, and the Tribes, if necessary.

3.7.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Effects on cultural resource sites 24LN943, 24LN1323, and 24LN1680 are the same as described under Alternative 2. Alternative 3 would not directly affect any other cultural resources. Cultural resources in the analysis area may see increased vandalism, artifact collecting, and inadvertent physical disturbance as a result of increased human activity and accessibility to the sites over the life of the mine.

3.7.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Effects on cultural resource sites 24LN320, 24LN943, 24LN1209, 24LN1323, and 24LN1680 are the same as described under Alternative 2. Alternative 4 would not directly affect any other cultural resources. Cultural resources in the analysis area may see increased vandalism, artifact collecting, and inadvertent physical disturbance as a result of increased human activity and accessibility to the sites over the life of the mine.

3.7.4.5 Alternative A – No Transmission Line

No direct, indirect, or cumulative effects in the transmission line corridors would occur to cultural resources in Alternative A. Natural weathering, deterioration, and vandalism of cultural resources would continue.

3.7.4.6 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Twelve cultural resources are located within the North Miller Creek Transmission Line (Alternative B) alignment and 500-foot buffer area (Table 81). Affected sites would be 24LN208, 24LN722, 24LN756, 24LN963, 24LN977, 24LN1323, 24LN1584, 24LN1585, 24LN1679, 24LN1818, and Forest Trails 505 and 716. Effects on site 24LN1323 and potential mitigation efforts are discussed under Alternative 2.

Site 24LN722 was once located within the proposed Sedlak Substation facility. Fieldwork determined that logging operations have removed the tree (Historical Research Associates 2006a). Site 24LN756 is the former location of the Fisher River Bridge. Since the bridge was removed from this location, no further work is necessary except for a formal eligibility review by SHPO. The North Miller Creek Alternative would cross site 24LN208 north of the Sedlak Substation location and an unnamed historic road/trail (24LN963). Both of these sites require SHPO consultation in order to receive consensus determinations of not eligible for the NRHP. Sites 24LN977 and 24LN1679 are both eligible for the NRHP. Site 24LN977 is located south of the Sedlak Substation and site 24LN1679 is a contributing resource to the Libby Mining District. Both sites would not be directly affected by this alternative.

Sites 24LN1584 and 24LN1585 are both culturally scarred tree locations within the 500-foot buffer area of the alignment; both have an eligibility status of recommended eligible. If the sites were determined eligible, they would be either avoided or a data recovery plan would be developed. Preliminary field review indicates they could be avoided by flagging and appropriate pole placement. Other trees would be preserved in the general location, if possible, to maintain integrity of setting and location. Site 24LN1818 remains unevaluated for the NRHP due to the ongoing modifications that the highway receives.

Although considered significant under the 1997 PMOA, Forest Trails 505 and 716 (the North Fork of the Miller Creek Trail and Libby Divide Trail, respectively) would be formally recorded and evaluated for the NRHP. If determined eligible, a plan would be necessary to mitigate adverse effects. If feasible, vegetation clearing for the transmission line would be conducted in a manner that maintains integrity of setting and location. Pole placement would also be designed to avoid or minimize visual effects on the trails.

Review and consultation with the SHPO would be necessary for sites 24LN208, 24LN722, 24LN756, 24LN963, 24LN1584, and 24LN1585 in order to receive consensus determinations and to develop a plan of action for site 24LN1818. Additional fieldwork may be necessary to complete evaluation before SHPO consultation. Because effects would entail crossing of an overhead transmission line with no direct effects, a determination of no adverse effect may be achieved through consultation for eligible sites 24LN977 and 24LN1679. For those cultural resources determined to be ineligible for the NRHP, no additional work would be necessary.

3.7.4.7 Alternative C-R – Modified North Miller Creek Transmission Line Alternative

Effects on cultural resource sites 24LN208, 24LN722, 24LN963, 24LN977, 24LN1323, 24LN1677, 24LN1679, 24LN1818, and Forest Trails 505 and 716 and proposed mitigation would be the same as described in Alternative B.

3.7.4.8 Alternative D-R – Miller Creek Transmission Line Alternative

Effects on cultural resource sites 24LN208, 24LN722, 24LN963, 24LN977, 24LN1323, 24LN1677, 24LN1679, 24LN1818, and Forest Trails 505 and 716 and proposed mitigation would be the same as described in Alternative B. Alternative D-R would cross the Teeter Peak Trail (24LN962), which has an unresolved eligibility status of not eligible. Review and consultation with the SHPO to receive a consensus determination for 24LN962 and an effects determination for 24LN1677 would be necessary before project implementation.

3.7.4.9 Alternative E-R – West Fisher Creek Transmission Line Alternative

Effects on cultural resource sites 24LN208, 24LN722, 24LN963, 24LN977, and 24LN1323, 24LN1677, 24LN1679, 24LN1818, and Forest Trails 505 and 716 and proposed mitigation would be the same as described in Alternative B. Alternative E-R would cross the Teeter Peak Trail (24LN962) described in Alternative D-R. Sites 24LN718 is also located within the buffer zone for Alternative E-R. 24LN718 is officially eligible and requires a determination of effect from SHPO. Site 24LN720 is multi-component historic mining and prehistoric campsite that is officially eligible for the NRHP. It was not included in Historical Research Associates' file and literature review because it was not under consideration as an alternative at the time of Historical Research Associates' review. Direct effects on this site may be avoided by proper pole placement and a protective cover of vegetation to maintain integrity of setting. Site 24LN719 is a historic townsite that is largely buried. The site covers an extensive area (about 2 acres). It remains unknown as to whether Alternative E-R could avoid this site given the site's spatial area.

3.7.4.10 Summary of Effects

Table 82 and Table 83 provide a summary of cultural resource effects for the mine and transmission line alternatives. The Sedlak Park Substation and loop line are included in the transmission line alternatives. The number of cultural resources affected under each alternative is:

- Alternative 2—11 cultural resources
- Alternative 3—3 cultural resources
- Alternative 4—5 cultural resources
- Alternative B—12 cultural resources
- Alternative C-R—9 cultural resources

- Alternative D-R—11 cultural resources
- Alternative E-R—15 cultural resources

3.7.4.11 Indirect Effects Common to All Alternatives

Indirect effects on cultural resources are possible from the increased access to the KNF that would result from the improvement and new construction of access roads. Effects would be more pronounced to visible historic properties such as mining or homesteading related cultural resources. Access would increase during mine operation and potential effects on cultural resources may result from recreational activities. Access to cultural resources would be similar to pre-mine levels following mine closure and decommissioning of all mine-related access roads. Specific effects on cultural resources could include the illegal collection of artifacts and vandalism to standing structures or features.

3.7.4.12 Mitigation

All mine and transmission line alternatives, including the loop line at the Sedlak Park Substation site, would require additional cultural resource inventory and SHPO consultation to satisfy requirements of Section 106 under the NHPA. The number of cultural resources that would require mitigation may increase pending the results of these additional inventory efforts. The appropriate type of mitigation would depend on the nature of the cultural resource involved and would be determined during consultation among MMC, the KNF, and the SHPO.

Mitigation could include data recovery (excavation) of prehistoric archaeological sites, a HABS for standing structures, or HAER for engineered resources such as mines, roads, and trails. For landscape-level resources such as the Libby Mining District, the USDI National Park Service's (NPS) Cultural Landscapes Program may be implemented as an appropriate mitigation tool (see below). Mitigation would also include monitoring during ground disturbing activities when the subsurface spatial extent of the resource is unknown or because of the fragility of the resource and its proximity to the activity.

Any mitigation plan would be developed by MMC and approved by both the KNF and the SHPO under a Programmatic Agreement, and would include consulting American Indian Tribes if affected cultural resources were of cultural significance. A Programmatic Agreement been developed that addresses remaining Section 106 compliance, the mitigation of unavoidable historic properties, and inadvertent cultural resource discoveries.

Mitigation effectiveness is evaluated by assessing whether impacts on unavoidable historic properties would be mitigated appropriately and whether all available data contained within those properties would be fully captured. All historic properties except the Libby Mining District would be avoided through proper pole placement and minor shifts in the overall alignment. Effects on properties within mine disturbance areas would be unavoidable, but would be fully mitigated using four different approaches: HABS/HAER, archaeological excavation, and completion of a cultural landscapes report or site form update. Any of the four approaches would capture all available data contained within the affected properties. The KNF and the SHPO would review and approve MMC's final mitigation plan. The agencies anticipate that the cultural resources mitigation would have high effectiveness.

Table 82. Summary of Effects of Mine Alternatives on Cultural Resources within the APE and Potential Mitigation Efforts.

Site	Type	NRHP Status	SHPO Consultation Necessary	Potential Mitigation
		Alternative 2		
24LN320[†]	Historic Mining features - Comet Placer	Eligible	No	HABS/HAER
24LN943[†]	Logging Camp	Recommended Not Eligible (destroyed)	Yes – eligibility	No Further Work
24LN980[†]	Dam	Recommended Not Eligible	Yes – eligibility	Pending Consultation HAER
24LN1209	Historic road/trail –Libby Wagon Road	Eligible	No	HAER
24LN1323	Libby Mining District	Eligible	No	NPS Cultural Landscapes Program
24LN1677[†]	Beager Cabin	Eligible	No	HABS
24LN1678[†]	Cabin	Eligible	No	HABS
24LN1680	Placer Mine Ditch	Eligible	No	HAER (if necessary)
24LN2203	Prehistoric	Recommended Eligible	Yes	Protective Covering or Data Recovery (excavation)
FS D5-241SL	Mining features and cabin	Not Evaluated	Yes– eligibility following evaluation	Pending Consultation HABS/HAER
FS D5-363	Mining Camp	Not Evaluated	Yes– eligibility following evaluation	Pending Consultation HABS/HAER
		Alternative 3		
24LN943[†]	Logging Camp	Recommended Not Eligible (destroyed)	Yes – eligibility	No Further Work
24LN1323	Libby Mining District	Eligible	No	NPS Cultural Landscapes Program
24LN1680	Placer Mine Ditch	Eligible	No	HAER (if necessary)

Site	Type	NRHP Status	SHPO Consultation Necessary	Potential Mitigation
Alternative 4				
24LN320[†]	Historic Mining features - Comet Placer	Eligible	No	HABS/HAER
24LN943[†]	Logging Camp	Recommended Not Eligible (destroyed)	Yes – eligibility	No Further Work
24LN1209	Historic road/trail –Libby Wagon Road	Eligible	No	HAER
24LN1323	Libby Mining District	Eligible	No	NPS Cultural Landscapes Program
24LN1680	Placer Mine Ditch	Eligible	No	HAER (if necessary)
All Mine Action Alternatives				
24LN943[†]	Logging Camp	Recommended Not Eligible (destroyed)	Yes – eligibility	No Further Work
24LN1323	Libby Mining District	Eligible	No	NPS Cultural Landscapes Program
24LN1680	Placer Mine Ditch	Eligible	No	HAER (if necessary)

[†]Associated with the Libby Mining District.

Table 83. Summary of Effects of Transmission Line Alternatives on Cultural Resources within the APE and Potential Mitigation Efforts.

Site	Type	NRHP Status	SHPO Consultation Necessary	Potential Mitigation
Alternative B				
24LN756	Fisher River Bridge (removed)	Undetermined	Yes – eligibility	No Further Work (Pending Consultation)
24LN1584	Two scarred trees	Recommended Eligible	Yes – eligibility and effects	Avoidance and monitoring
24LN1585	Four scarred trees	Recommended Eligible	Yes – eligibility and effects	Avoidance and monitoring
Alternative C-R				
24LN208	Trail #6	Recommended Not Eligible	Yes – eligibility	No Further Work
24LN722	Scarred Tree (destroyed)	Undetermined	Yes – eligibility	No Further Work (Pending Consultation)
24LN963	Historic road/trail	Recommended Not Eligible	Yes – eligibility	No Further Work (Pending Consultation)
24LN977	Historic School	Eligible	Yes – effects	Avoidance
24LN1323	Libby Mining District	Eligible	No – eligibility Yes – mitigation plan	NPS Cultural Landscapes Program
24LN1679	Libby Placer Mining Camp	Eligible	Yes – effects	Avoidance
FS D5-122	North Fork Miller Creek Trail #505	Avoidance per 1997 PMOA	Yes – eligibility and effect	Pending Consultation
FS D5-126	Libby Divide Trail #716	Avoidance per 1997 PMOA	Yes – eligibility and effect	Pending Consultation
24LN1818	Portions of US 2	Not Evaluated	Yes – eligibility and effects	Pending Consultation
Alternative D-R				
24LN962	Teeter Peak Trail	Recommended Not Eligible	Yes – eligibility	No Further Work (Pending Consultation)
24LN1677	Historic Mining	Eligible	Yes – effects	Avoidance

Site	Type	NRHP Status	SHPO Consultation Necessary	Potential Mitigation
Alternative E-R				
24LN165	Historic Dump	Recommended Not Eligible	Yes – eligibility	No further work
24LN718	Historic Log Structure	Eligible	No – eligibility Yes – effects	Avoidance
24LN719	Historic Townsite	Eligible	Yes – effects	Avoidance or Data Recovery
24LN720	Historic Mining and Prehistoric campsite	Eligible	No – eligibility Yes – effects	Avoidance
24LN962	Teeter Peak Trail	Recommended Not Eligible	Yes – eligibility	No Further Work (Pending Consultation)
24LN1677[†]	Historic Mining	Eligible	Yes – effects	Avoidance
All Alternatives				
24LN208	Trail #6	Recommended Not Eligible	Yes – eligibility	No Further Work
24LN722	Scarred Tree (destroyed)	Undetermined	Yes – eligibility	No Further Work (Pending Consultation)
24LN963	Historic road/trail	Recommended Not Eligible	Yes – eligibility	No Further Work (Pending Consultation)
24LN977	Historic school	Eligible	Yes – effects	Avoidance
24LN1323	Libby Mining District	Eligible	No – eligibility Yes – mitigation plan	NPS Cultural Landscapes Program
24LN1679	Libby Placer Mining Camp	Eligible	Yes – effects	Avoidance
FS D5-122	North Fork Miller Creek Trail #505	Avoidance per 1997 PMOA	Yes – eligibility and effect	Pending Consultation
FS D5-126	Libby Divide Trail #716	Avoidance per 1997 PMOA	Yes – eligibility and effect	Pending Consultation
24LN1818	Portions of US 2	Not Evaluated	Yes – eligibility and effects	Pending Consultation

3.7.4.12.1 Mine Alternatives

Alternative 2 – MMC's Proposed Mine

In Alternative 2, nine cultural resources would require mitigation. The largest of these is the Libby Mining District (24LN1323), a historic vernacular landscape that encompasses a large geographic area. Six other cultural resources contribute to the District. These include the Comet Placer (24LN320), an unnamed logging camp (24LN943), a dam (24LN980), the Libby Wagon Road (24LN1209), the Beager Cabin (24LN1677), an unnamed cabin (24LN1678), and a prehistoric archaeological site (5LN2203). Although site 24LN980 is recommended not eligible, the site may contribute to the overall significance of the District.

The most appropriate mitigation would be to complete a Cultural Landscape Report developed by the USDI National Park Service for the treatment of landscape-level cultural resources. This report would document the history, significance, and treatment of the Libby Mining District, including any changes to its geographical context, features, and use (NPS Preservation Brief 36). Specific topics addressed under a Cultural Landscape Report include detailed history, existing conditions, analysis and evaluation, a visual history that documents its past and current setting, and management recommendations. Although developed by the NPS, a Cultural Landscape Report is not restricted to NPS lands and the documentation method can be applied to any landscape that reflects the cultural character of a people – specifically in this case, the mining character of the mid to late 1800s gold rush within the Libby Mining District. Individually, the remaining historic sites would require either HABS or HAER documentation (24LN320, 24LN1209, 24LN1677, and 24LN1678), including one site that has not been related to the District (24LN1680), but would probably be found to be contributing through additional archival research. Two known but unrecorded sites require formal documentation and evaluation (D5-241 and D5-363). If either site is found to be eligible for the NRHP, mitigation would require HAER documentation and may be included within the Libby Mining District and the Cultural Landscape Report.

Site 24LN2203 would require either protective covering or data recovery (excavation) if covering is not found to be an appropriate mitigation tool. An excavation plan would be developed by the project proponent in consultation with the KNF, SHPO, and any interested Tribes.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

In Alternative 3, two cultural resources would require mitigation. These sites are the Libby Mining District (24LN1323) and the Placer Mine (24LN1680). Mitigation efforts are described in Alternative 2.

Alternative 3 would require the KNF to contact the Confederated Salish and Kootenai Tribes and Kootenai Tribe of Idaho. The Tribes would be afforded the opportunity to monitor construction activities associated with the mine. Section C.3, *Cultural Resources*, of Appendix C discusses monitoring requirements.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

In Alternative 4, four cultural resources would require mitigation. All four of the sites, are discussed above in Alternative 2.

Tribal monitoring requirements would be the same as described under Alternative 3.

3.7.4.12.2 Transmission Line Alternatives

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

In Alternative B, 10 cultural resources may require mitigation depending on the outcome of eligibility determinations between the KNF and SHPO. Segments of US 2 (24LN1818) affected by the alternative have not been evaluated for the NRHP. If found to be eligible for the NRHP, mitigation for US 2 would entail HAER documentation. It is unlikely that mitigation would be required given the on-going use and maintenance of the road and the no effect, other than visual, for the resource. Mitigation for the Libby Mining District (24LN1323) is discussed above in Alternative 2. Two of the sites, 24LN1584 and 24LN1585 can be avoided during pole placement and vegetation clearing and would not require mitigation. In the event that they could not be avoided, mitigation would include extensive photographic documentation. The two trails located within this alternative (D5-122 and D5-126) could also be avoided during pole placement. Visual effects on the trails could not be avoided under this alternative and therefore Level I HAER documentation would be necessary. The historic school (24LN977), located south of the Sedlak Substation and within the 500-foot corridor, is avoidable and no further work should be necessary. The Libby Placer Mining Camp (24LN1679) is also avoidable during pole placement and vegetation clearing. In the event that the sites are unavoidable, mitigation would include a combination of HABS/HAER and data recovery (excavation). Consultation is required with both the KNF and the SHPO to determine potential effects and mitigation efforts for significant cultural resources and to provide consensus determinations for 24LN208, 24LN722, 24LN756, 24LN963 (all recommended not eligible), and 24LN1818. Should any of the recommended not eligible or unevaluated sites become eligible, a mitigation plan would be developed. Two sites, 24LN722 and 24LN756, no longer exist, and no mitigation is recommended, pending SHPO consultation.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

In Alternative C-R eight cultural resources may require mitigation depending on the outcome of eligibility determinations between the KNF and SHPO. All nine sites under Alternative C-R are discussed above under Alternative B.

All agency-mitigated transmission line alternatives (C-R, D-R, and E-R) would require the KNF to contact the Confederated Salish and Kootenai Tribes and Kootenai Tribe of Idaho. The Tribes would be afforded the opportunity to monitor any ground disturbing activities (construction and reclamation) associated with the transmission line on state and federal lands. Section C.3, *Cultural Resources*, of Appendix C discusses monitoring requirements.

Alternative D-R – Miller Creek Transmission Line Alternative

In Alternative D-R, six to seven cultural resources may require mitigation depending on the outcome of eligibility determination. All sites except for 24LN962 and 24LN1677 are discussed under Alternative B. Site 24LN962 requires an eligibility consensus from the SHPO; should the site become eligible following review, the resource would require pole placement avoidance and mitigation of adverse visual effects through Level 1 HAER documentation. If site 24LN1677 is unavoidable, mitigation would include HABS/HAER documentation.

Tribal monitoring requirements would be the same as described under Alternative C-R.

Alternative E-R – West Fisher Creek Transmission Line Alternative

In Alternative E-R, 16 cultural resources may require mitigation depending on the outcome of eligibility determinations between the KNF and SHPO. Sites common to all alternatives are discussed above in Alternative B. Potential mitigation for sites 24LN962 and 24LN1677 is discussed above in Alternative D-R.

The alternative would affect a multi-component historic mining and prehistoric site (24LN720). If unavoidable, the mining portion of the site would require either HAER and/or HABS treatment (depending on the type of features present) and the prehistoric component would require data recovery (excavation). Site 24LN718 is a historic log structure that would require HABS documentation if found to be adversely effected by this alternative. Site 24LN719 is a very large (2-acre) buried historic townsite that, if unavoidable, would require extensive data recovery (excavation). Finally, site 24LN165 is a historic dump recommended not eligible and would require a consensus determination from the SHPO.

Tribal monitoring requirements would be the same as described under Alternative C-R.

3.7.4.13 Cumulative Effects

Past action, such as road building and timber harvest, may have affected cultural resources. Cultural resources affected by past actions after the passage of the NHPA in 1966 were mitigated in accordance with approved mitigation plans. The Miller-West Fisher Vegetation Management Project would avoid or protect eligible cultural resources and there would be no cumulative effect with the Montanore Project. No other reasonably foreseeable actions would have a cumulative effect with the Montanore Project.

3.7.4.14 Regulatory/Forest Plan Consistency

Following the identification of cultural resources, mitigation, and consultation, all alternatives would comply with the KFP and all applicable federal regulations concerning cultural resources.

3.7.4.15 Irreversible and Irretrievable Commitments

Regardless of mine facility alternative or transmission line alternative, project implementation would require the irreversible commitment of portions of the Libby Mining District (24LN1323) and possibly a portion of 24LN1680. Additionally, five and possibly seven potentially NRHP eligible cultural resources would require irreversible commitments in Alternative 2: 24LN320, 24LN1209, 24LN1677, 24LN1678, 24LN2203, and possibly unrecorded sites D5-241SL and FS D5-363. Evaluation of potential irreversible effect was determined using GIS analysis. Each of these sites would be destroyed following mitigation by the construction of mining related facilities. Their loss would be irreversible. Mitigation would serve to preserve these cultural resources in perpetuity through documentation. Pending consultation, an additional non-significant cultural resource would require irreversible commitments (24LN980). Aside from 24LN1323 and 24LN1680, no additional cultural resources would require an irreversible commitment. Alternative 4 would require irreversible commitments to sites 24LN320 and 24LN1209, in addition to sites 24LN1323 and 24LN1680. All transmission line alternatives could avoid significant cultural resources except for the Libby Mining District (24LN1323).

3.7.4.16 Short-term Uses and Long-term Productivity

Since cultural resources are non-renewable, the short-term use of the area for project implementation has the potential for permanent impacts as discussed above in Alternative 2.

3.7.4.17 Unavoidable Adverse Environmental Effects

Unavoidable effects on cultural resources would be mitigated through the development of mitigation plans approved by KNF, in consultation with the SHPO. When Tribally-affiliated sites were affected, consultation with Native American Tribes would also be initiated.

3.8 Hydrologic and Geochemical Approach to Water Quality Assessment

3.8.1 Generalized Approach to Water Resources Impact Analysis

The agencies revised the approach to the water resources impact analysis in response to comments on the Draft EIS. In their comments on the Draft EIS analysis, the EPA requested more information on water management and the project water balance, better integration of geology and geochemistry with the water quality assessment, and a discussion of mitigation measures or contingency plans for potential water quality impacts.

The lead agencies met with the EPA and other interested agencies in 2009 to discuss EPA's comments. Following the 2009 interagency meeting, the agencies formed interagency workgroups to address EPA's concerns with the water resources impact analysis. The five workgroups addressed geochemistry, groundwater hydrology, water quality and quantity, monitoring and compliance, and regulatory issues. Most workgroups held a series of conference calls to discuss possible resolution of EPA's comments. To ensure integration between workgroups, a meeting was held in 2010 to discuss workgroup progress and the interrelationship between the workgroups. The outcome of the workgroups was twofold: a more integrated approach to the water resources impact analysis, and a revised monitoring section that better defines monitoring objectives and implementation (Appendix C), both of which were presented in the Supplemental Draft EIS.

The results of the agencies' 2-dimensional (2D) model were provided in the Draft EIS (USDA Forest Service and DEQ 2009). Subsequently, MMC prepared a more complex and comprehensive 3D model of the same analysis area. The results of the 2D and the 3D models were used to evaluate the site hydrogeology and analyze potential impacts due to mining. Although the results of the two models were similar, the 3D model provides a more detailed analysis by incorporating the influence of known or suspected faults on groundwater hydrology, recent underground hydraulic testing results from the Libby Adit, a more comprehensive calibration process, and better simulation of vertical hydraulic characteristics of the geologic formations that would be encountered during the mining process.

A more thorough integration of geochemistry with groundwater hydrology and surface water hydrology recognizes the interdependent nature of effects on water quality. For example, the relative saturation or rate of water flow through mined rock influences drainage quality, and the inflow of groundwater into mine workings potentially affects streamflow.

3.8.2 Project Water Balance, Potential Discharges, and Impact Assessment Locations

The project water balances presented in the *Water Use and Management* section of each mine alternative in Chapter 2 are estimates of inflows and outflows for various project components that are used for the analysis of alternatives. Actual volumes for water balance variables (*e.g.*, mine and adit inflows, precipitation and evaporation, dust suppression) would vary seasonally and annually from the volumes estimated. The agencies developed graphical representations of the estimated water balance for Alternative 3 throughout the Evaluation, Construction, Operations, Closure, and Post-Closure phases (Figure 56 through Figure 60). The water balance for

Alternatives 2 and 4 is very similar and varies only slightly from those shown for Alternative 3. Alternative 2 would include discharge of some water during all phases except Operations to the LAD Areas. The following sections briefly discuss the water balance for each phase, locations where discharges during each phase may occur, and the location where the agencies are assessing effects, or "impact assessment locations." The subsequent sections on *Groundwater Hydrology* (section 3.10), *Surface Water Hydrology* (section 3.11), and *Water Quality* (section 3.13) provide a more detailed discussion of impact analysis methods and an analysis of effects.

3.8.2.1 Evaluation Phase

During the Evaluation Phase, MMC would dewater the full extent of the existing Libby Adit, extend the adit to beneath the ore zones, and develop an additional 7,100 feet of drifts from 16 drill stations. Groundwater in the vicinity of the adit and drifts would flow toward the adit and drift void. An estimated 256,000 tons (174,000 cubic yards) of waste rock would be generated and stored on private land at the Libby Adit site. The waste rock storage areas would be lined to collect runoff from the area and seepage through the waste rock. Based on the 3D model results (Geomatrix 2011a), the agencies estimate average mine and adit inflows over the 2-year phase would be 230 gpm of water flowing into the adit and drifts, and 30 gpm of water from mineralized zones, or mine water (Figure 56). A small amount of water (3 gpm) from precipitation is expected to be collected from the waste rock stockpiles.

Adit, mine, and waste rock water would be collected and piped to a Water Treatment Plant at the Libby Adit Site. Following treatment, treated water would be discharged to a percolation pond at the Libby Adit Site or to Libby Creek. Water discharged to the pond would percolate to groundwater, which would then flow to Libby Creek adjacent to the adit site (Figure 56).

In the impact analysis in the subsequent sections, the agencies assess the effects of mine inflows on groundwater levels and streamflow. The streams to be assessed are those potentially affected by dewatering in the Libby Creek, East Fork Rock Creek, and East Fork Bull River watersheds. The impact assessment locations for the effects of discharged water on streamflow and surface water quality are streams downstream of any discharge location. Groundwater quality is assessed adjacent to any discharge location. Impact assessment locations are shown on Figure 76.

Certain monitoring and mitigation would be required before MMC started the Evaluation Phase. Such activities are described as occurring in the Pre-Evaluation Phase.

3.8.2.2 Construction Phase

The Construction Phase would begin after MMC analyzed the data from the Evaluation Phase, collected the necessary data for final design, submitted final design plans to the agencies, and received agency approval to implement the Construction Phase. Two new adits would be constructed in the Ramsey Creek drainage in Alternative 2 and in the Libby Creek drainage in Alternatives 3 and 4. In addition to the new adits, limited development would occur in the ore zones. Waste rock generated during the Construction Phase would be sampled to address uncertainty about spatial geochemical variation within the deposit identified at the end of the Evaluation Phase (see Appendix C). Rock would be stockpiled on a liner, either at the LAD Areas in Alternative 2, or at the impoundment area in Alternatives 3 and 4. Waste rock that met suitability criteria established following the Evaluation Phase would be used in the construction of impoundment dams in all alternatives. Groundwater would flow toward the mine and adits. In MMC's model, the Construction Phase was combined with the first two years of mining. The modeled period had estimated average inflows of 450 gpm of adit water and 30 gpm of mine water (Figure 57).

In Alternative 2, mine and adit inflows would be piped to the LAD Areas for discharge to groundwater. The Water Treatment Plant would be used, if necessary, to meet BHES Order limits or applicable nondegradation criteria. Groundwater from the LAD Areas would flow to Ramsey, Poorman, and Libby creeks. The agencies assumed 130 gpm would be sent to the LAD Areas for discharge and 370 gpm to the Water Treatment Plant for discharge in the Construction, Closure and Post-Closure phases in Alternative 2. MMC did not propose in Alternative 2 to discharge water to Libby Creek from the Water Treatment Plant to prevent adverse effects on senior water rights.

Water management in Alternatives 3 and 4 would be substantially different from Alternative 2 in the Construction, Operations, Closure, and Post-closure Phases to accommodate the Forest Service's instream flow water right of 40 cfs in Libby Creek at the confluence of Bear Creek with a 2007 priority date. Mine and adit water would not be used beneficially in any phase, and would be treated and discharged from the Water Treatment Plant during all phases. MMC would divert groundwater from Libby Creek during high flows (April through July) and store it in the tailings impoundment, Seepage Collection Pond, or mine water pond at the Libby Plant Site. No appropriation would be made whenever flow at LB-2000 was less than 40 cfs. Storage of diverted water would occur during the late Construction Phase after the Starter Dam was lined and MMC began storing water for mill startup, during the Operations Phase, and during the Closure Phase until the impoundment was dewatered for reclamation. In Alternatives 3 and 4, MMC would increase the Water Treatment Plant capacity before mill startup. The impact assessment locations are the same as for the Evaluation Phase.

Certain monitoring and mitigation would be required before MMC started the Construction Phase. Such activities are described as occurring in the Pre-Construction Phase.

3.8.2.3 Operations Phase

The Operations Phase would begin with mill operations. Waste rock generated during the Operations Phase that met the suitability criteria would be used in the construction of impoundment dams for all alternatives or returned underground. Annual average inflows are estimate to be 370 to 380 gpm throughout operations. The amount of mine water is anticipated to be the greatest in the last years of operations, reaching 200 gpm of adit water and 170 gpm of mine water in Operations Phase Years 11-19 (Figure 58). Groundwater over the mine area would continue to flow toward the mine and adits.

Sometime after the first 5 years of mill operations in Alternative 2, additional water, or make-up water, would be needed at the mill. Make-up water requirements are expected to average 159 gpm over Project Years 16 to 24 (Table 14). MMC would not withdraw any surface water for operational use whenever flow at the point of withdrawal was less than the average annual low flow. MMC did not propose in Alternative 2 to discharge water to Libby Creek from the Water Treatment Plant to prevent adverse effects on senior water rights.

In Alternative 3, groundwater tributary to Libby Creek would be appropriated from Libby Creek alluvium between April 1 and July 31 at an average flow rate of 765 gpm and a maximum flow rate of 1,125 gpm (410 acre-feet/year maximum volume) in an average precipitation year. Water would be diverted using a subsurface infiltration gallery installed in the gravels along the west side of the Libby Creek channel at the proposed point-of-diversion (Figure 26). The gallery would be connected to a pumping station that would pump water in a single pipe to the Poorman tailings impoundment. Groundwater tributary to Libby Creek also would be appropriated year-round at an average and maximum flow rate of 250 gpm (403 acre-feet/year maximum volume) from the pumpback wells. Precipitation captured by the impoundment would be appropriated year-round at an average flow rate of 625 gpm and a maximum flow rate of 1,950 gpm (1,038 acre-feet/year maximum volume). (The values shown in Table 25 are what MMC requested and may be different from those in any beneficial water use permit issued.) Diverted water would be stored in the impoundment water pond and would be pumped to the plant/mill for ore-processing make-up water. Whenever flow in Libby Creek at LB-2000 was less than 40 cfs, stored water would be treated at the Libby Adit Water Treatment Plant, and discharged at a rate equal to all Libby Creek appropriations. The rates would vary, depending on actual precipitation and the total pumping rate of the pumpback wells. Similar appropriations and discharges would occur in Alternative 4.

In all alternatives, an estimated 25 gpm of tailings seepage not intercepted by the seepage collection system beneath the impoundment would flow to groundwater beneath the gravel drains of the Seepage Collection System. A pumpback well system in the impoundment area would intercept groundwater containing tailings seepage that was not collected by the gravel drains. Water intercepted by the pumpback wells would be routed to the tailings impoundment and then to the mill for re-use (Figure 58).

In the subsequent effects analysis, the agencies assess effects on groundwater quality beneath the tailings impoundment. Effects of inflows and appropriations on streamflow are assessed in Libby Creek, Ramsey Creek, Poorman Creek, Little Cherry Creek, East Fork Rock Creek, and East Fork Bull River. Impact assessment locations are shown on Figure 76.

3.8.2.4 Closure Phase

The Closure Phase would begin when mill operations ceased. Closure activities would include the removal of surface facilities, decommissioning of the underground workings, adit plugging, and reclamation of surface disturbances in accordance with the approved closure plan. The tailings impoundment would be dewatered to facilitate capping. The agencies estimate that the dewatering of the tailings impoundment may last from 5 to 20 years. The seepage collection system would continue to operate until BHES Order limits or applicable nondegradation criteria were met in receiving waters. Water would be pumped from the impoundment to the LAD Areas or Water Treatment Plant, if necessary, in Alternative 2, and to the Water Treatment Plant in Alternatives 3 and 4.

In Alternative 2, MMC would plug the adits near the adit portal after the workings are decommissioned. Mine and adit inflows would flow toward the mine void and would begin filling it. In Alternatives 3 and 4, MMC would place two or more plugs in each adit. The plugs would be located to isolate the adits hydraulically from the mine void and to ensure any groundwater tributary to Libby and Ramsey creeks would flow into the adits, and remain within the Libby Creek watershed. Following adit plugging, water flowing into the adits would begin to refill the adits. As long as MMC appropriated or diverted water from Libby Creek whenever flow at LB-2000 was less than 40 cfs, MMC would treat stored and adit water, if necessary to meet MPDES permitted effluent limits, and discharge it to Libby Creek at a rate equal to all of MMC's Libby Creek appropriations or diversions occurring at that time. Discharges of water to Ramsey Creek also may be required to avoid adversely affecting senior water rights. After facilities were reclaimed, appropriations or diversions from the Libby Creek watershed would be limited to adit inflows and pumping from the pumpback well system.

The agencies estimate the adits would take one to two decades to fill after the initial plugs in each adit were in place. Filling would be reduced to a few years if MMC used groundwater diverted from Libby Creek alluvium using the infiltration gallery during high flows to fill the adits during the Closure Phase. When the water level in the adits reached the bedrock-colluvium interface (about 800 feet from the adit portal), MMC would place an additional plug in bedrock at the bedrock-colluvium interface and allow the adits to reach steady state hydrologic conditions. A third plug would be placed at the opening of each adit. The adit portals then would be reclaimed. Treatment and discharge of adit water would cease after the portal plug in each adit was installed.

Water appropriated by the pumpback well system during the Closure and Post-Closure Phases would be treated and discharged at the Water Treatment Plant. After the second plug was placed in each adit in Alternatives 3 and 4, no further discharges to Libby Creek other than from the pumpback well system would be required to avoid adversely affecting senior water rights.

The impact assessment locations for effects on groundwater quality are beneath the tailings impoundment and LAD Areas in Alternative 2, and beneath the tailings impoundment and adjacent to the Libby Adit Site in Alternatives 3 and 4. The effect of mine void flooding on streamflow are assessed in areas potentially affected by dewatering in Libby Creek, Ramsey Creek, Poorman Creek, East Fork Rock Creek, East Fork Bull River, and downstream of any discharge location. Impact assessment locations are shown on Figure 76.

3.8.2.5 Post-Closure Phase

The Post-Closure Phase would consist of long-term operations, maintenance, and associated monitoring of the Water Treatment Plant and the seepage pumpback well facilities at the tailings impoundment. MMC would maintain, operate, and monitor these facilities until BHES Order limits or applicable nondegradation criteria were met in all receiving waters. After BHES Order limits or nondegradation criteria were met, seepage from the impoundment would flow to Libby Creek. The length of time that treatment would be required is unknown. Hydrologic and geochemical data would be collected throughout Post-Closure in the same locations as the Closure Phase.

In Alternative 2, mine and adit water would continue to fill the mine void and discharge of water from the Seepage Collection System after treatment at the Water Treatment Plant as discussed in the Closure Phase would continue in the Post-Closure Phase. In Alternatives 3 and 4, the adits and the mine void would be isolated hydrologically. In all mine alternatives, the Water Treatment Plant would continue to operate until all water that came from project facilities could flow to area streams without treatment. MMC also would continue water monitoring as long as the MPDES permit was in effect. As long as post-closure water treatment operated, the agencies would require a bond for the operation and maintenance of the water treatment plant. The length of time that these closure activities would occur is not known, but may be decades or more.

The 3D groundwater model developed for the project (see section 3.10, *Groundwater Hydrology*) predicts that the mine void would fill in about 490 years and water levels overlying the mine void would reach steady state conditions in 1,150 to 1,300 years. The actual time to recover to steady state may be shorter or longer and would be re-evaluated using the 3D model after additional data were collected during the Evaluation Phase. At steady state conditions, groundwater levels would not reach pre-mining levels, but flow paths would be similar to pre-mining conditions (Figure 60).

3.8.3 Streamflow, Baseflow, and $7Q_2$ and $7Q_{10}$ Flow Definitions and Uses in EIS Analyses

The agencies used the Region 1 Water Yield and Sediment Model (WATSED) and ECAC model to predict streamflow changes and used estimated 3D model-derived streamflow to analyze the effects of the mine alternatives on streamflow and water quality (see section 3.11.2, *Analysis Area and Methods* for a discussion of the models). Available streamflow data are presented in section 3.11.3. Because none of the analysis area streams have been continuously gaged for more than 2 years, hydrographs have not been developed and baseflow and average low flow values have not been determined. Certain low flows, as defined in the next section, have been estimated or simulated for specific locations. The uncertainties associated with the use of these estimated low flows in the hydrology and water quality analyses are discussed in section 3.13.4.5, *Uncertainties Associated with the Water Quality Assessment.*

3.8.3.1 Definitions and Comparisons of Peak Flow, Annual Flow, Baseflow, and $7Q_2$ and $7Q_{10}$ Flows

Snowmelt, rainfall, and groundwater discharge are the main sources of water supplied to streams in the analysis area. Precipitation ranges from 100 inches per year at higher elevations in the Cabinet Mountains to about 30 inches per year at the proposed tailings impoundment site (Geomatrix 2006b). The period of highest precipitation generally occurs in November through February and the lowest in July through October.

Peak flow is that portion of the annual water cycle that contains the highest 30 continuous days of streamflow in the watershed. It is during this time period when the greatest potential impacts on stream channels usually occur. Peak flows are affected by weather events and management activities in the watershed. Changes in peak flows were estimated using the WATSED and ECAC models.

Annual flow is the total output of the watershed on a yearly basis. Changes in annual flow occur due to climatic variability, such as drought, which can decrease the total amount of streamflow over a yearly cycle. Natural and management activities such as forest fires, timber harvest, and road building can also impact the amount of water leaving the watershed. The removal of vegetation allows more of the natural precipitation to leave the watershed because it is not used by the plants for transpiration. About 15 percent of the annual flow occurs during the time period when streams are in the baseflow condition. Changes in annual flows were estimated using the WATSED and ECAC models.

Baseflow is the contribution of near-channel alluvial groundwater and deeper bedrock groundwater to a stream channel. Baseflow does not include any direct runoff from rainfall or snowmelt into the stream. During the driest portions of the year, the only flow into the stream channel is baseflow. Streamflow may not reduce to baseflow in years when higher than normal precipitation occurs in later summer/early fall or when the residual snow pack continues to melt through late summer/early fall. In the analysis area, streamflow is generally reduced to only the baseflow component from mid-August to mid-October, and may occur during November through March. Baseflow was simulated using a 3D numerical groundwater model (Geomatrix 2011a).

Above an elevation of between about 5,000 to 5,600 feet, the only source of water to drainages is surface water from snowmelt and storm runoff, so there is no baseflow and surface flow is ephemeral.

The $7Q_{10}$ flow is defined as the lowest streamflow averaged over 7 consecutive days that occurs, on average, once every 10 years. The $7Q_{10}$ flow has a 10 percent probability of occurring in any given year (10-year recurrence interval) and is commonly used when setting MPDES permit effluent limits and allowable pollutant loads for streams. The $7Q_2$ flow is the lowest streamflow averaged over 7 consecutive days that occurs, on average, once every 2 years. The $7Q_2$ flow has a 50 percent probability of being exceeded in any one year (2-year recurrence interval). Because streamflow in analysis area streams has not been continuously gaged for an extended period, $7Q_{10}$ and $7Q_2$ flows cannot be estimated directly. The agencies used an alternative method to estimate flow. The two most commonly used methods for estimating streamflow statistics at ungaged sites are the drainage-area ratio method and the regression equations method (Ries and Friesz 2000). The drainage-area ratio method is best used when the ungaged site is located near a gaging station on the same stream and the ratio between the drainage areas of the index site and the ungaged site is between 0.5 and 1.5 (Hortness 2006). Because no such index sites are available for the analysis area streams, the agencies estimated $7Q_{10}$ and $7Q_2$ flows for analysis area streams using a regression equations method developed by the USGS (Hortness 2006). The agencies considered the USGS method to be the best available information on $7Q_{10}$ and $7Q_2$ flows of analysis area streams. The USGS used multiple linear regression analyses to develop equations for estimating $7Q_{10}$ and $7Q_2$ flows at ungaged, unregulated streams in northeast Idaho and northwest Montana. Based on the regression analysis, the USGS developed specific equations using different variables for eight regions of the study area, one of which (Region 2) encompassed the Montanore Project area (Hortness 2006). Data from 41 gaging stations within the region, with at least 10 years of flow records, were used to develop the equations. Streamflow data from gaging stations were statistically related to various watershed basin physical and climatic characteristics to develop the equations. The Montanore Project analysis area is similar to the USGS study area, which was composed mainly of rugged mountainous terrain where most precipitation results from storms moving inland from the Pacific Ocean. The most significant amounts of precipitation are a direct result of orographic effects (mountainous terrain-induced precipitation) and occur primarily in the winter months. The lowest streamflow typically occurs in August through March, but large rain-on-snow events may occur occasionally.

Drainage area and mean annual precipitation were the location-specific variables in the final equations for Region 2 developed by the USGS to estimate both $7Q_2$ and $7Q_{10}$ flows (Hortness 2006). The agencies calculated drainage area from KNF watershed mapping, with small adjustments at specific locations based on USGS topographic maps. Mean annual precipitation was estimated using a weighted area average within the drainage area.

There are many methods of interpolating precipitation from monitoring stations to specific areas, but few have been able to adequately explain the complex variations in precipitation that occur in mountainous regions. The PRISM (Parameter-elevation Regressions on Independent Slopes Model) climate data have been developed to provide such information. PRISM is an analytical model that uses point data and a digital elevation model to generate gridded estimates of monthly and annual precipitation. PRISM is well suited to mountainous terrain because it incorporates a conceptual framework that addresses the spatial scale and pattern of orographic precipitation. The PRISM gridded climate maps are considered the most detailed, highest-quality spatial climate datasets currently available (National Weather Service 2011). The agencies used the 1971-2000 in the analysis (Oregon State University 2006). The 1981-2010 dataset became available in July 2012. The agencies' comparison of precipitation values from the 1971-2000 and 1981-2010 datasets for a sample of four watersheds in the analysis area showed fairly small differences ranging from 7 percent lower to 3 percent higher using the 1981-2010 dataset (ERO Resources Corp. 2012a). Due to the small difference using the newer dataset, precipitation values from the 1971-2000 dataset were used, and assumed to be representative of precipitation occurring in the analysis area during recent decades.

The drainage area of the USGS study Region 2 ranged from 3 to 2,443 square miles, and the mean annual precipitation ranged from 24.8 to 69.4 inches. The mean annual precipitation for the monitoring sites in the analysis area is greater than 69 inches at higher elevations, such as within the CMW and in the upper half of the Poorman Creek watershed. Three of the drainage areas at the CMW boundary (Ramsey Creek, Poorman Creek, and East Fork Rock Creek) are less than 3 square miles and one is near the minimum of 3 square miles (Table 84). All of the drainage areas listed in Table 84 have estimated annual precipitation that exceeds 69 inches.

At the highest elevations, the source of water is only surface water runoff, and flow is ephemeral. In the upper perennial reaches of the analysis area streams (below about 5,000 to 5,600 feet), the estimated $7Q_{10}$ and $7Q_2$ flows may not be reliable and are higher than the modeled baseflows (Table 84). The upper reaches of each drainage (mostly within the CMW) are characteristically steep, with exposed bedrock and little, if any, surficial deposits. Runoff from precipitation generally is rapid and there is little porous material for seasonal groundwater storage. In these areas, below about 5,000 to 5,600 feet, baseflow is maintained primarily by discharge from fractured bedrock. The lower reaches of each stream, including the East Fork Bull River at the CMW boundary, contain thick deposits of alluvium and glacial deposits sufficiently porous to store large volumes of groundwater that continue to provide water to streams even during dry years (although in some years, sections of lower reaches appear dry because the baseflow is below the channel surface within the alluvium).

Table 85 provides the modeled baseflow and estimated $7Q_{10}$ and $7Q_2$ flows for the lower reaches of the nine analysis area streams. At six of the nine locations listed in Table 85, the estimated $7Q_{10}$ values are less than the modeled baseflow values. The drainage areas of the watersheds in Table 85 are between 5.9 and 28.2 square miles, and the average annual precipitation values range from 47.8 to 64.1 inches, well within the ranges to provide reliable $7Q_2$ and $7Q_{10}$ values. The exception is EFBR-500, which has an estimated annual average precipitation of 69.5 inches, above the maximum precipitation range for the equations. Therefore, the estimated $7Q_2$ and $7Q_{10}$ values for this location may not be reliable.

The USGS developed standard error of prediction ranges for each $7Q_2$ and $7Q_{10}$ equation. The standard error of prediction includes the model error as well as an estimate of the sample error and is a better indicator of the model's overall predictive ability (Hortness 2006). In Region 2, the standard error of prediction for the $7Q_{10}$ equation was +113 percent to -53.1 percent. For the $7Q_2$ equation, the standard error of prediction was +78.9 percent to -44.1 percent (Hortness 2006). The estimated range of $7Q_2$ values and $7Q_{10}$ values for locations in the analysis area are provided in Table 86; the locations are shown on Figure 76. The equations may not yield reliable results for sites with characteristics outside the range of or near the minimums and maximums of the equation variables.

Table 84. Simulated Baseflow and Estimated $7Q_2$ and $7Q_{10}$ Flow in Upper Analysis Area Streams.

Monitoring Site	Drainage Area (square miles)	Average Watershed Area Precipitation (inches)§	Modeled Baseflow (cfs)[1]	Estimated $7Q_2$ Flow (cfs)	Estimated $7Q_{10}$ Flow (cfs)
Libby Creek at CMW boundary (~LB-100)†	3.3	79.4	0.54	2.35	1.49
Libby Creek LB-300	7.8	71.7	1.22	4.73	3.03
Poorman Creek at CMW boundary†	1.0	84.7	0.12	0.76	0.47
Ramsey Creek at CMW boundary†	2.3	83.3	0.38	1.76	1.11
East Fork Bull River at Isabella Creek (EFBR-2)	7.1	74.3	2.92	4.57	2.93
East Fork Rock Creek at CMW boundary (EFRC-200)†	1.4	77.6	0.29	0.92	0.57

§Estimated using 1971-2000 PRISM data (Oregon State University 2006); all values exceed the maximum value of 69 inches for the USGS equation variable.
†Watershed area is near or less than 3 square miles.
[1]Modeled baseflows are the best currently available estimates that can be obtained using the 3D groundwater models. The baseflow estimates would be refined after baseflow measurements were collected during the Evaluation Phase and incorporated into the model.
Source: Geomatrix 2011a; Appendix G.

Table 85. Modeled Baseflow and Estimated $7Q_2$ and $7Q_{10}$ Flow in Lower Analysis Area Streams.

Monitoring Site	Drainage Area (square miles)	Average Watershed Area Precipitation (inches)§	Modeled Baseflow (cfs)‡	Estimated $7Q_2$ Flow (cfs)	Estimated $7Q_{10}$ Flow (cfs)
Libby Creek					
LB-800	21.2	59.2	5.90	9.27	5.99
LB-1000	34.9	54.4	9.80	13.23	8.59
LB-2	35.7	53.8	10.55	13.27	8.62
LB-2000	40.8	51.2	12.20	13.85	8.99
At US 2	67.4	47.8	19.83	20.46	13.36
Ramsey Creek					
RA-600	6.7	64.1	1.50	3.26	2.07
Poorman Creek					
PM-1200	6.5	56.3	1.80	2.46	1.55
Rock Creek					
RC-3	14.9	69.7	3.08	8.80	5.70
RC-2000	32.4	57.3	7.70	13.53	8.80
East Fork Bull River					
EFBR-500†	10.0	69.5	4.36	5.77	3.71
At mouth (Lower East Fork Bull River)	28.2	58.7	11.34	12.27	7.97

§Estimated using 1971-2000 PRISM data (Oregon State University 2006); all values exceed the maximum value of 69 inches for the USGS equation variable.
†Average annual precipitation for EFBR-500 watershed is 69.5 inches, and at RC-3 is 69.7 inches, just above the maximum range for the $7Q_2$ and $7Q_{10}$ equations; therefore, $7Q_2$ and $7Q_{10}$ values shown in table may not be reliable.
‡Modeled baseflows are the best currently available estimates that can be obtained using the 3D groundwater models The baseflow estimates would be refined after baseflow measurements were collected during the Evaluation Phase and incorporated into the model.
Monitoring sites are shown on Figure 76.
Source: Geomatrix 2011a; Appendix G.

Table 86. Estimated $7Q_2$ and $7Q_{10}$ Ranges for Streams in the Analysis Area.

Stream Location	Low Estimate $7Q_{10}$ (cfs)	Estimated $7Q_{10}$ (cfs)	High Estimate $7Q_{10}$ (cfs)	Low Estimate $7Q_2$ (cfs)	Estimated $7Q_2$ (cfs)	High Estimate $7Q_2$ (cfs)
Libby Creek						
LB-50†	0.41	0.86	1.84	0.77	1.38	2.47
LB at CMW boundary (~LB-100)†	0.70	1.49	3.18	1.32	2.35	4.21
LB-300†	1.42	3.03	6.46	2.65	4.73	8.47
LB-800	2.81	5.99	12.75	5.18	9.27	16.58
LB-1000	4.03	8.59	18.30	7.40	13.23	23.67
LB-2	4.04	8.62	18.36	7.42	13.27	23.75
LB-2000	4.22	8.99	19.15	7.74	13.85	24.78
Libby Creek at US 2	6.27	13.36	28.45	11.44	20.46	36.61
Poorman Creek						
Poorman Creek at CMW boundary†	0.22	0.48	1.02	0.43	0.77	1.38
PM-1000	0.71	1.51	3.23	1.34	2.40	4.30
PM-1200	0.73	1.55	3.30	1.38	2.46	4.40
Ramsey Creek						
Ramsey Creek at CMW boundary†	0.52	1.12	2.38	0.99	1.77	3.17
RA-400	0.97	2.06	4.39	1.81	3.24	5.80
RA-600	0.97	2.07	4.40	1.82	3.26	5.83
Little Cherry Creek						
LC-800†	0.11	0.22	0.48	0.21	0.37	0.67
East Fork Rock Creek and Rock Creek						
EFRC-200†	0.27	0.57	1.22	0.52	0.92	1.65
RC-3†	2.67	5.70	12.14	4.92	8.80	15.74
RC-2000	4.13	8.80	18.74	7.56	13.53	24.21
East Fork Bull River						
EFBR-2†	1.37	2.93	6.24	2.56	4.57	8.18
EFBR-500†	1.74	3.71	7.90	3.23	5.77	10.33
EFBR at mouth	3.74	7.97	16.97	6.86	12.27	21.95

†Locations have drainage areas and/or precipitation values outside the range of values used to develop the equations, or are near the maximum and minimum values used in the equations, so results may be unreliable (Hortness 2006). Locations are shown on Figure 76.

3.8.3.2 Uses of Baseflow, and $7Q_2$ and $7Q_{10}$ Flows in EIS Analyses

The adits and mine workings would intercept and drain groundwater from water-bearing fractures in bedrock during all mining phases. This would reduce the amount of groundwater available to discharge to streams, springs, and lakes. The 3D numerical groundwater model simulated the changes in baseflow for each mine phase. Discharges of treated mine water would meet effluent limitations prescribed by an MPDES permit. The effluent limitations would normally be calculated using the estimated $7Q_{10}$ flow of the receiving water. The agencies used the estimated $7Q_{10}$ flows to analyze the effects of the project on streamflow, with the exception of LB-100, LB-300 and EFRC-200. Although the drainage area at LB-100 and LB-300 is greater than 3 square miles, the location fits the characteristics of upper drainages, where the estimated $7Q_{10}$ values are greater than the modeled baseflow values. The Libby Creek channel is narrow and contains limited surficial deposits above LB-300. Some avalanche chutes in the upper Libby Creek watershed contain surficial deposits that may store and transmit shallow groundwater through much of the summer depending on remaining snow pack at the head of each chute. In addition, the average annual precipitation at LB-100 and LB-300 is outside the range of the values used to develop the USGS equation. Flow rates measured during late summer/early fall in upper Libby Creek are similar to the 3D model predicted baseflows, indicating that there may be little if any contribution from surficial deposits during late summer/early fall during years with little or no late season snow pack or precipitation. The primary source of baseflow to streams in the upper reaches of the analysis area is fractured bedrock up to an elevation of between 5,000 and 5,600 feet. The drainage area and the average annual precipitation at EFRC-200 are outside the range of the values used to develop the USGS equation. The discussion and summary tables in section 3.11.4.4 use modeled baseflow at LB-100, LB-300, and EFRC-200, and estimated $7Q_{10}$ flow at other locations, to provide the total estimated streamflow change as a result of project activities during a an especially dry year.

The water balances developed for average annual precipitation and evaporation rates are provided in Chapter 2 in the *Water Use and Management* section of each mine alternative. The summary tables in section 3.11.4.4 use estimated $7Q_2$ flows to provide the total estimated change in annual low streamflow in the analysis area as a result of all mine-related activities (mine inflows, discharges, appropriations, diversions and evaporative loss). In this analysis, the agencies used $7Q_2$ flows to assess effects because the USGS method did not provide an equation to calculate $7Q_1$ flows, which are annual 7-day low flow. Although the $7Q_2$ flow would be lower than the 7-day annual low flow, it would occur with sufficient frequency (probable 2-year recurrence interval) to use in the analysis. Assuming that 15 percent of annual streamflow occurs in the baseflow period during late summer/early fall (see Appendix H), the predicted increase in annual streamflow from the existing land management activities in all the basins was proportionally estimated for the baseflow period.

3.8.4 Uncertainty, Monitoring, and Mitigation

The best available information was used to analyze the effects on water resources. While some uncertainty is inherent in all predictions, the uncertainties specific to these analyses are discussed in each of the following sections on geochemistry, hydrology, and water quality. To address these specific elements, monitoring plans have been developed and are described in Appendix C for the agencies' alternatives (Mine Alternatives 3 and 4, and Transmission Line Alternatives C-R, D-R, and E-R). A water resources monitoring plan is not needed for the Sedlak Park Substation and the loop line.

For water resources, the objective of the monitoring is to provide long-term assessment of the water resources and groundwater-dependent ecosystems that could be affected by the mine, as a basis for informing evidence-based management strategies throughout the life-of-mine. The agencies also developed mitigation designed to minimize the predicted effects. These mitigation measures are discussed in Chapter 2 in the agencies' alternatives. The following sections on geochemistry, hydrology, and water quality include a discussion on the anticipated effectiveness of the agencies' monitoring and mitigation measures.

3.9 Geology and Geochemistry

Geology is the primary framework for this environmental assessment, influencing the location of mineralization, proposed mining methods, environmental geochemistry, groundwater distribution and movement, and discharge to surface water. Together with hydrology, geology and geochemistry determine the potential impact of mining on ground and surface water resources. Geologic hazards, such as avalanches and landslides, are discussed in section 3.14, *Geotechnical Engineering.*

3.9.1 Analysis Area and Methods

The geochemical analysis area encompasses the underground zones from which ore and waste rock would be mined, and the surface locations on which waste rock or tailings would be placed. The agencies reviewed published studies of regional and local geological structure, stratigraphy, and mineralization and combined it with exploration data collected by NMC and MMC for the assessment. Much of the analysis and description of the geology of the proposed mine, tailings impoundment areas, and transmission line corridor alternatives presented in this section is based on the 1992 Montanore Project Final EIS (USDA Forest Service *et al.* 1992) and subsequent descriptions provided by MMC. These have been updated with recent literature (*e.g.*, Boleneus *et al.* 2005) and recent test results, where appropriate, but the fundamental geological description of the area and understanding of the mineral deposits has not changed since 1992. Elements of the geology that directly affect environmental geochemistry are emphasized within this description.

3.9.2 Affected Environment

3.9.2.1 Geologic Setting

3.9.2.1.1 Physiography

The Cabinet Mountains are bounded on the south by the Clark Fork River, on the east by Libby Creek, on the north by the Kootenai River, and on the west by the Purcell Trench in Idaho. The Bull River/Lake Creek valley separates the mountain range into east and west segments. The analysis area is in the southeast portion of the Cabinet Mountains and the part of the Fisher River watershed that lies between the Cabinet Mountains and Salish Mountains east of Libby. The Cabinet Mountains are a rugged northwest-trending mountain range of high relief. The maximum relief in the analysis area is about 5,000 feet. The highest elevation in the vicinity is Elephant Peak at an elevation of 7,938 feet. The lowest elevations are 3,200 feet along Libby Creek and 2,900 feet along the Fisher River. The proposed plant site in Ramsey Creek is at an elevation of 4,400 feet; the elevation of the proposed tailings impoundment in Little Cherry Creek is at about 3,500 feet; and the elevation of the proposed Sedlak Park Substation is at 3,000 feet.

Area topography (Figure 44) is a function of the underlying rock types, structure (faults and folds), and geologic history. Slopes are generally steep (more than 30 percent) except along the axis of streams and rivers. Rocks in the area are relatively competent and not easily erodible. Most rock types weather into small fragments that form a colluvial (transported by gravity) mantle overlying bedrock.

Large faults bound the Cabinet Mountains on the east, south, and west. These faults are in part responsible for the location of valleys surrounding the Cabinet Mountains. The Clark Fork River, Libby Creek, Bull River-upper East Fork Bull River, and the East Fork Rock Creek valleys are all located along faults. A number of smaller streams in the analysis area also may be located along fault and fracture structures. The major land-forming features were created by the Rocky Mountain uplift and subsequent faulting. Topography in the analysis area has been influenced by Pleistocene-age glaciation (from 2 million to 10,000 years ago). In the northern part of the analysis area, Pleistocene alpine glaciers carved the landscape into a series of glacial features characterized by nearly vertical cliffs, ledges, steep colluvial slopes, and talus fields. The high peaks of the area (St. Paul, Rock, and Elephant peaks) are glacial horns formed by glaciers. Small- to moderate-sized lakes (tarns), such as Copper and Cliff lakes, have formed in the glacial cirque basins.

Pleistocene-age glaciation sculpted the mountain peaks, scoured some lower elevation areas, and deposited a veneer of glacial deposits. Glacial lakebed deposits (silt and clay accumulations 100 or more feet thick) were deposited in low-elevation drainages. Melt-waters from glaciers in the upper part of the analysis area carried large amounts of excavated rock debris into creeks draining the higher topographic areas, filling portions of the valley bottom. Older terraces of the former valley bottoms are exposed as higher-level benches along lower portions of many of the creeks. In many areas, the creek has since down-cut into the valley fill.

Higher elevation creeks generally flow through relatively narrow canyons and then spill into wider valleys at the periphery of the wilderness area. The wider valleys have flat to rolling bottoms, with lakebed and stream deposits capping and surrounding shallow to exposed bedrock.

3.9.2.1.2 Regional Geology

The Cabinet Mountains and surrounding areas are composed of a thick series of metasedimentary rocks referred to as the Belt Supergroup. These Belt rocks were deposited in a subsiding basin about 1,450 to 850 million years ago (Harrison 1972). Originally deposited as a series of muds, silts, and sands, the deposits were metamorphosed to argillites, siltites, and quartzites, respectively.

The Belt Supergroup can be divided into four major groups. In ascending order, these are the Lower Belt, Ravalli Group, Middle Belt carbonate (Table 87), and the Missoula Group (not shown in Table 87). Regionally, the Lower Belt is represented by the Prichard Formation. The Prichard Formation consists mostly of argillites, with some interbedded siltite and quartzite units. It is the lowest formation within the Belt Supergroup in this area and is mapped as the thickest at 25,000 feet.

The Ravalli Group in this part of the Belt Supergroup basin consists of, from oldest to youngest, the Burke, Revett, and St. Regis Formations. The Burke Formation is composed primarily of siltites and its contact with the underlying Prichard Formation is gradational. The Revett Formation is a north- and east-thinning wedge of quartzite, siltite, and argillite. In the Cabinet Mountains area, the Revett is informally divided into lower, middle, and upper members on the basis of the proportions of quartzite, siltite and argillite. The lower and upper members are dominated by quartzites with interbedded siltite and argillite; the middle member is mostly siltite with interbedded argillite and quartzite. The St. Regis Formation is dominantly silty argillite and argillitic siltite.

The Middle Belt carbonate is separated into a western and eastern facies. The western facies Wallace Formation contains a conspicuous clastic component (but still contains a considerable proportion of carbonate material) and was deposited from a southern source terrain; the eastern facies Helena Formation is largely a carbonate bank (Grotzinger 1986). The two Formations

Table 87. Stratigraphy of Montanore Analysis Area.

Supergroup	Group	Formation	Member
Belt	Middle Belt Carbonate	Wallace	Upper Middle Lower
	Ravalli	Empire / St. Regis	
		Revett	Upper (See detail below) Middle Lower (ore zone)
		Burke	—
	Lower Belt	Prichard	Transition Upper Lower

Formation	Member	Bed	Deposit
Revett	Upper	**Upper quartzite**	Troy
		Upper siltite	
		Middle quartzite	
		Lower siltite	
		Lower quartzite	Troy
	Middle		
	Lower	**A**	Rock Creek-Montanore
		B	
		C	
		D	
		E	
		F	
		G	Troy
		H	
		I	

Source: Boleneus *et al.* 2005.
Shaded areas with bolded text represent ore deposits.

interfinger or overlap along a broad zone that extends from Missoula northwest toward the Canadian border just east of Libby, Montana (Harrison 1972).

Regionally, Paleozoic sediments are represented by an occasional north-northwest trending exposure of shale, sandy shale, dolomite, magnesium-rich limestone, and sandstone, some of which are fossiliferous. The exposures are along US 2, south of Libby, MT, along MT 200 near the Montana-Idaho border, and in several other localities. These sediments are mapped as narrow fault-bound blocks that were caught between eastwardly thrusted Belt strata (Johns 1970). Because of their age and diagenesis, rocks in the analysis area are unlikely to be a source of significant paleontological resources.

The mine area bedrock has been extensively folded and faulted along generally north to northwest trends. Most of this structural activity was related to complex plate interactions that occurred between 24 and 200 million years ago, and resulted in the rocks being thrust eastward along shallow dipping faults over distances of up to 100 miles (Harrison *et al.* 1992). One of several prominent structures is the Hope Fault within the Clark Fork drainage.

Quaternary age deposits are reflected in Pleistocene glacial erosion and deposition of stratified and unstratified sediments. Large areas are covered by glaciofluvial and glaciolacustrine sediments to depths up to several hundred feet. Near Libby, Montana, bluffs of glaciolacustrine silts stand up to 200 feet above the recent floodplain. Glaciolacustrine silts and clays prone to sloughing from road cuts are found at elevations between 2,900 and 4,000 feet in the two tailings impoundment areas, along the Fisher River, and along lower Miller and West Fisher creeks. During recent times, this and older materials have been eroded and reworked by stream activity.

The western Montana copper belt, first named by Harrison in 1972, hosts several large strata-bound Revett-style copper-silver deposits in permeable quartzite beds of the Revett Formation (Boleneus *et al.* 2005). Several Revett-style deposits, which occur in the upper and lower members of the Revett Formation, have been intensively studied by numerous investigators (Clark 1971; Harrison 1972; Hayes 1983; Lange and Sherry 1983; Bennett 1984; Hayes and Einaudi 1986; Hayes 1990). The Rock Creek-Montanore deposit, currently under permitting review as two separate mining operations, and the Troy Mine (Spar Lake deposit) are each hosted in the Revett Formation. The Rock Creek portion of the deposit is separated from the Montanore (Rock Lake) portion by the Rock Lake Fault. This document follows the USGS nomenclature, which distinguishes the Rock Creek-Montanore deposit from the Troy deposit, as described by Boleneus *et al.* (2005). In cases where data have been collected solely from the Rock Creek or the Montanore portion of the Rock Creek-Montanore deposit, the term sub-deposit has been used. The USGS used the term “world class deposit” to describe the relationship of the Rock Creek and Montanore deposits to other known stratabound copper-silver deposits in North America. World-class deposits are significant because production from any of them would affect the world’s supply-demand relation for the metal. World-class deposits are those that exceed the 90th percentile of discovered metal, and contain more than 2.2 million tons of copper. Only three world-class stratabound copper-silver deposits are found in North America: the Rock Creek and Montanore deposit; the Kona deposit and the White Pine deposit in Michigan (Boleneus *et al.* 2005).

3.9.2.1.3 Mineralization

There appear to have been three mineralizing events in the Belt rocks of the analysis area. Most recently, Cretaceous to early Tertiary age granodiorite and quartz monzonite plutons intruded the highly folded and faulted Belt rocks in the central and northern portions of the Cabinet Mountains. This produced the mineralization of the prospects found along the eastern and southern flanks of the Cabinet Mountains. An older event involved the Precambrian age intrusions of igneous rock high in iron and magnesium that intruded the Wallace, Burke and Prichard Formations. The Purcell Lava is an example of such an event, which created the vein-hosted deposits found in the Ten Lakes area northeast of the Cabinet Mountains. The oldest mineralizing event is the Precambrian age migration of metal-bearing solutions through select permeable zones within the Belt Supergroup, especially the Revett Formation, before or during lithification (Clark 1971; Hayes 1983; Lange and Sherry 1983).

Ore-grade stratabound copper-silver deposits in the Revett Formation (the Spar Lake deposit of the Troy Mine and the Rock Creek-Montanore deposit) exhibit the same mineral zonation patterns, with about the same volume percent sulfides in each of the mineral zones (Figure 61).

The two deposits were formed at about the same time, a billion years ago, by the same geological processes, and in the same geological host rock, sandstone. Through geological processes, sandstone is now a quartzite and finer grained interbedded siltstones and claystones are now siltites and argillites. The deposits are concentrated along a pre-mineralization pyrite-hematite interface, in relatively coarse-grained quartzite that acted as a paleoaquifer for ore-forming fluids. The pre-mineralization pyrite and hematite quartzite is of regional extent, extending from the Vermillion river to north of the Troy Mine. The gradational mineralized zones of chalcocite, bornite, and chlorite, which are the ore zones, are between a chalcopyrite-galena-sphalerite zone and a chalcopyrite zone (Figure 61). The chalcopyrite-galena-sphalerite and chalcopyrite zones do not contain copper mineralization of economic grade nor do they contain silver. Following mineralization, the mineralized rock was subsequently cemented with calcite containing iron and magnesium. Mineralization is consistent throughout the Belt basin, with minor variations between defined deposits resulting from subtle variations in the stratigraphy of the interbedded quartzite, siltite, and argillites that comprise the Revett Formation. Boleneus *et al.* (2005) provide a comprehensive summary of regional stratigraphy, lithologic characteristics, and alteration patterns of the Revett Formation.

3.9.2.2 Site Geology

Site geology is described for the locations that are evaluated for potential water quality impacts, including the mine area (underground workings and surface faculties constructed using waste rock), the tailings impoundment, and the LAD Areas.

3.9.2.2.1 Mine Area - Underground Workings and Surface Facilities

The Cabinet Mountain region was subject to folding and faulting during mountain building. Structural features trend to the northwest or north, including primary faults, which tend to parallel fold axes. The mine area is bounded on the east by the Libby thrust belt and on the west by the Moyie thrust, two major east-directed north-northwest trending structural features. The Libby thrust belt is about 9 miles east of the Cabinet Mountains and the Moyie thrust is about 12 miles west. Intervening between the two thrust systems is the west-directed Snowshoe thrust, formerly known as the Snowshoe Fault. The main Snowshoe thrust can be traced from Rock Lake to the Montana border (Fillipone and Yin 1994). The Rock Lake Fault is a north-northwest striking fault, with a highly variable but generally steep dip, with younger Belt rocks on the east against older Belt rocks on the west. The fault crosscuts west-directed structures related to the Snowshoe thrust, making the Rock Lake Fault a younger feature. The Rock Lake Fault separates the Rock Creek-Montanore deposit into two portions that are proposed to be operated as the Rock Creek and Montanore Projects, respectively. Section 3.10, *Groundwater Hydrology* discusses how faulting was incorporated into the 3D groundwater model.

Table 87 presents general stratigraphy for the analysis area, and Figure 62 is a bedrock geology map for the portion of the CMW area that overlies the sub-deposit at Montanore. The Prichard Formation is the oldest unit at Montanore and consists primarily of quartzite, with argillite, siltite, and mudstone. The Burke, St. Regis, and Empire Formations of the Ravalli Group are predominantly siltite, argillite, and quartzite. The Revett Formation, also of the Ravalli Group, is subdivided into three members based on the amount of quartzite, silty quartzite, and siltite. The Rock Creek-Montanore, stratabound copper and silver deposit is found in the A-C quartzite beds in the uppermost portion of the lower member of the Revett Formation, which consists primarily of quartzite and layers of siltite and silty quartzite. The Wallace Formation is the younger Middle Belt Carbonate group of rocks in the analysis area.

Mine Development Associates (2005) report that Montanore sub-deposit mineralization occurs in the lower limb of a north-northwest plunging, breached overturned syncline. The syncline axis trends north 45° east and opens to the northwest (Figure 63 and Figure 64). This creates a progressively wider flat-lying lower limb. The lower limb is not folded but dips about 15 degrees to the northwest. Mineralization in the Montanore sub-deposit is observable in the outcrop where the Revett Formation was discovered, located on the north shore of Rock Lake.

The west-southwest boundary of mineralization is the northwest trending, near-vertical Rock Lake Fault that produced at least 2,500 feet of vertical displacement (Figure 63). The fault trends N35° W for about 12 miles with the down-dropped side to the northeast. The USGS (1981) reports three periods of movement can be distinguished for the Rock Lake Fault. The syncline is bound on the east by several splays of the Libby Lake Fault (Figure 63).

The Rock Creek-Montanore deposit occurs in the Revett Formation, which is subdivided into the upper, middle, and lower Revett, based upon the amount of quartzite, silty quartzite, and siltite. The majority of the silver and copper mineralization occurs in the A-C quartzite beds within the upper portion of the lower Revett. The mineralization is predominantly copper and copper-iron sulfides, including bornite, chalcocite, and chalcopyrite. Silver occurs as native silver, and in copper minerals. Localized concentrations of ore minerals reflect faults and increased permeability in the quartzite beds (Boleneus *et al.* 2005). Lead sulfides (galena) and iron sulfides (pyrite and pyrrhotite) occur around the ore zone, but do not occur in any significant quantities within the ore.

The silver and copper ore zones are separated by a low-grade barren zone of disseminated and vein-hosted galena. The barren zone varies in thickness from more than 200 feet toward the west to 18 feet in the eastern portions of the mine area. The barren zone may be absent to the northeast.

Mineral zones, defined by the appearance, disappearance, and abundance of sulfide and gangue (the commercially worthless mineral matter associated with economically valuable metallic minerals in a deposit) minerals, are developed that crosscut the stratigraphic units in the Revett Formation. This zonation is consistent with similar alteration mineralogy and crosscutting relationships observed in stratabound copper and silver deposits worldwide, and define the ore zone as well as key zones of environmental significance within the Revett Formation. The distribution and extent of mineral zonation in the Revett Formation is controlled by the migration paths of mineralizing fluids, which change in response to differences in porosity between the quartzite, siltite, and argillites that are variably interbedded across the basin. These zones are important, not only for the identification of ore, but also for identification of zones enriched in sulfides that are potentially acid generating when oxidized, such as pyrite and chalcopyrite, and those that are acid consuming, such as bornite, chalcocite, and digenite.

Mineralization within the Revett Formation is consistent throughout the depositional basin. As discussed by Maxim Technologies (2003) and Enviromin (2013b), the Rock Creek-Montanore deposit was deposited within the Proterozoic Revett basin under the same conditions as the Troy deposit, which is located in a mineralogically comparable setting, but in different stratigraphic zones within the Revett Formation. The Troy deposit has been mined over the past 30 years, and a substantial amount of geological, mineralogical, and water quality data are available for this deposit that provide full-scale estimates of environmental geochemistry behavior. Analyses of drill samples from the Rock Creek-Montanore deposit have generated laboratory-based sets of mineralogical and geochemical information for comparison with the larger set of data available from the Troy Mine. Comparison of data from the Rock Creek-Montanore and Troy deposits provides useful information regarding the potential geochemical effects of development of the Montanore sub-deposit.

Mineral zonation was studied in the Troy deposit, where alteration zones were described in detail based on the dominant sulfide and distinct non-sulfide minerals present, along with color. These alteration styles include the pyrite-calcite, galena-calcite, chalcopyrite-calcite, bornite-calcite, chalcocite-chlorite, chalcopyrite-ankerite, hematite-calcite, and albite zones (Hayes and Einaudi 1986). The pyrite-calcite and chalcopyrite-ankerite boundary represents the boundary between reduced and oxidized rocks, along which ore-grade minerals, bornite-calcite and chalcocite-chlorite zones were deposited. The chalcopyrite-calcite and galena-calcite zones lie between the ore and the pyrite-calcite zone. In the Montanore sub-deposit, the barren "lead" zone associated with the ore hosts galena as a primary mineral. The location and relative magnitude of the mineral zones is generally controlled by grain-size characteristics of individual stratigraphic units, although the alteration crosscuts stratigraphic units. A broad belt of pyrite-calcite occurs in the A-D beds of the lower Revett at both Troy and Rock Creek-Montanore deposits, with some variation in zone thickness related to local changes in sediment porosity (argillite vs. quartzite), as well as displacement by more recent structural activity. Because these zones host sulfide and carbonate minerals that could affect acid generation and neutralization potential, it is important to understand their occurrence within the Montanore sub-deposit.

In the Montanore sub-deposit, rock exposed in the workings and adits would include both ore and the barren lead zone of galena-calcite alteration zone within the Revett Formation. MMC's mine plan would minimize disturbance of the barren lead zone to the extent possible. In the adits, lesser amounts of chalcopyrite-calcite and pyrite-calcite altered waste zones also may also be exposed within the lower Revett Formation, along with the Prichard and Burke formations in the Ramsey Adits. It is possible that a small amount of rock from Wallace Formation would be intercepted in the Ramsey Adits as well. Six distinct rock units would be exposed underground or mined as waste rock at the proposed mine.

MMC collected 11 representative samples from five drill holes and analyzed them for asbestos by Polarizing Light Microscopy. No asbestos fibers were detected in any sample (Jasper Geographics 2005).

3.9.2.2.2 Tailings Impoundments and LAD Areas Geology

Surficial geology at both the Little Cherry Creek and Poorman tailings impoundment sites is similar and dominated by Quaternary glacial deposits (Figure 65). Detailed geology and cross sections of the two tailings impoundment sites are provided in Figure 66. As much as 300 feet of unconsolidated silt, sand, and gravel overlie the Wallace Formation in both tailings impoundment areas. Fine-grained glacial lake (glaciolacustrine) materials dominate the center and eastern portion of tailings impoundment sites and interfinger with intermixed silt, sand, and gravel glaciofluvial materials on the western portion of the site. Based on borehole data, a buried glaciofluvial channel greater than 370 feet thick in some locations trends west to east through the center of the Little Cherry Creek Tailings Impoundment Site (Figure 66) (Klohn Crippen 2005).

Bedrock exposures are limited in the Little Cherry Creek Tailings Impoundment Site. Most of Little Cherry Creek is 50 feet or more above bedrock. Near the Little Cherry Creek Seepage Collection Pond proposed in Alternatives 2 and 4, the creek has eroded the surficial material and exposed less weathered bedrock. Weathered bedrock also was observed on the ridge where the tailings thickener plant proposed in Alternative 3. Most bedrock fractures appear to be related to sedimentary bedding planes, but drill samples also show occasional near-vertical joints and irregular fractures. The thickness of surficial sediments at the Little Cherry Creek Tailings Impoundment Site ranged from 10 feet at the South Saddle Dam to over 360 feet in a buried channel beneath the proposed Main Dam (Klohn Crippen 2005).

The surficial geology of the Poorman Tailings Impoundment Site is similar to that of the Little Cherry Creek Tailings Impoundment Site (Figure 65). Depth to bedrock is not well defined with the Poorman site. Based on a resistivity survey and limited drilling, the thickness of the unconsolidated deposits is generally 100 to 200 feet within the impoundment footprint (NewFields 2014a). The survey identified an apparent subsurface bedrock ridge that separates the two impoundment areas (Figure 66) (Chen-Northern 1989). The investigation did not identify a buried channel like those identified at the Little Cherry Creek site (Figure 66). Section 2.5.2.5.3 discusses the site investigations that MMC would conduct at the Poorman Tailings Impoundment Site during the final design process.

The two LAD Areas are located on a low, flat ridge between lower Ramsey Creek and Poorman Creek. Geology at these locations is mapped as Quaternary glacial deposits, similar to those found in the tailings impoundment sites (Figure 65). These glacial deposits begin as a thin veneer at an elevation of about 4,000 feet on the flank of the Cabinet Mountains and thicken eastward to 200 feet in thickness (USDA Forest Service *et al.* 1992). Ravalli Group bedrock is present west of the LAD Areas and rocks of the Wallace Formation lie to the east.

3.9.3 Mining History

Mineral activity in this area dates back to the 1860s with the discovery of placer gold (gold in alluvial deposits) along Libby Creek on the east side of the Cabinet Mountains (Johns 1970). Subsequent exploration in the 1880s and 1890s led to the discovery of numerous small hard-rock mineral deposits (minerals found in hard consolidated rock). Many of these hard rock mineral deposits were discovered along the east side of the Cabinet Mountains. Production from these veined deposits and the area's placer deposits was sporadic and short-lived. None of these mineral deposits is currently in production.

In the late 1890s and then in the 1920s and 1930s, several small prospects were worked west of the Cabinet Mountains divide in and around the analysis area. The Heidelberg Mine is about 1 mile south of the proposed Montanore Mine, just south of Rock Lake. Most of these old workings were driven on gold-bearing quartz veins in what is probably the southern end of the Snowshoe thrust near its junction with the Rock Lake Fault. Numerous other diggings (generally shallow) occur along the northwest-trending faults that cut the area. All of these prospects were short-lived and very little, if any, production occurred (Gibson 1948).

In the 1960s through the 1980s, three major deposits and numerous smaller deposits containing stratabound copper and silver mineralization were discovered. These discoveries were confined to the Revett Formation and situated within a narrow belt extending from the Coeur d'Alene Mining District north to about the Kootenai River. ASARCO brought the 64-million-ton Spar Lake deposit into production in late 1981, producing about 4.2 million ounces of silver and 18,000 tons of copper per year from the Troy Mine. The 145-million-ton Rock Creek sub-deposit in the CMW is the second deposit. The Rock Creek Project proposes to mine this sub-deposit. The Montanore sub-deposit, proposed for mining by the Montanore Project, is the third deposit.

3.9.4 Environmental Geochemistry

The mineralogy and geochemistry of the Montanore deposit determines the potential for acid rock drainage (ARD) and trace metal release. Facility-specific geochemistry of underground mine workings, backfilled mine waste, or surface deposits of mined rock (including tailings) determines the extent of mineral oxidation, dissolution, or nutrient release. Affected groundwater would potentially mix with ambient groundwater and undergo further reaction with downgradient minerals until it discharges to surface water. The relative volume and quality of discharge from proposed facilities would change with the water balance throughout the life- of-mine cycle.

3.9.4.1 Geochemical Assessment Methods and Criteria

An environmental geochemical assessment of the waste rock and ore that would be exposed in underground workings, surface facilities, and the tailings impoundment was completed to evaluate the potential impact on downgradient surface water and groundwater quality. The specific geochemical issues are acid generation and the potential release of metals and metalloids, regardless of acidity. The leaching of nitrate from blasting residues on ore, waste rock, and tailings is also a concern. Factors of importance in predicting long-term environmental chemistry are therefore the occurrence and relative concentrations of metal and sulfide-bearing minerals (including non-acid generating sulfides), as well as their mode of occurrence (*i.e.*, in veins, on fractures, or encapsulated within quartzite) and proposed management practices (*i.e.*, blasting, ore processing, and material placement) in terms of potential exposure to water and air.

Following a review of the mechanisms of acid production and trace element release, and a discussion of the use of the Troy deposit as a geochemical analog for the Rock Creek-Montanore deposit, the environmental geochemistry of rock is described. Data are used from the Montanore and Rock Creek sub-deposits, as well as the Troy deposit, and include static whole rock metal concentrations, acid generation potential, and metal mobility test data, as well as kinetic test and *in situ* monitoring data. Release of nitrate associated with blasting residues from mining is also discussed. The extent of sampling and methods of analysis are described. Data are summarized by project (Montanore, Rock Creek, and Troy) for ore, tailings, and waste rock.

3.9.4.1.1 Acid Rock Drainage

ARD results from weathering of chemically unstable iron-sulfide minerals in oxidizing air- and water-rich environments. Iron sulfides, particularly pyrite (FeS_2),chalcopyrite ($CuFeS_2$), and pyrrhotite ($Fe_{1-x}S$), are the most common acid-producing minerals (Price and Errington 1998; International Network for Acid Prevention 2008). Some types of sulfides, such as bornite (Cu_5FeS_4), chalcocite (Cu_2S), and digenite (Cu_9S_5), actually inhibit or decrease acidity because they either do not produce acid or consume it during oxidation (Bevilaqua *et al.* 2010; Brunesteyn *et al.* 1989).

Acid generation begins with the oxidation of sulfide to sulfuric acid (H_2SO_4) and release of ferrous iron (Fe II or Fe^{+2}).At near-neutral pH, acidity results from the primary chemical oxidation of sulfide, with biological oxidation playing only a minor role in sulfide oxidation. At low pH, ferric iron (Fe III or Fe^{+3}) produced by acid-loving, iron-oxidizing bacteria speeds up sulfide oxidation, so that the amount of acid produced increases as pH declines. Thus, if the neutralizing potential of a rock material is exhausted and pH drops below 4, iron-oxidizing bacteria will rapidly oxidize ferrous iron (Fe II) to ferric iron (Fe III), which can directly oxidize the sulfide minerals independent of oxygen. *Acidiothiobacillus ferrooxidans* is a common bacterium that makes energy by oxidizing both iron and sulfide from minerals in acid environments (below pH 4) (Schippers *et al.* 2000).

Mineralogic texture and chemistry are important factors when testing for acid generation and metal release potential. For example, decreased contact with oxygen and water due to cementation and encapsulation of reactive minerals limits oxidation. Temperature, pH, and availability of water and oxygen also affect rock-water interactions. Impurities in a sulfide crystal structure, or differences between iron sulfides and copper, zinc or lead sulfides also will affect oxidation rates and resulting changes in water quality.

The potential for ARD formation depends on the balance between the rates of acid-generating and acid-consuming reactions, which are studied using static (fixed, single point in time) or kinetic (rate measured over time) methods. ARD potential is estimated using a static acid base accounting test, which calculates the difference in total concentration of acid neutralizing and acid generating minerals, *i.e.*, acid base potential = neutralization potential - acid potential (ABP = NP - AP), in units of tons as $CaCO_3$/thousand tons of rock ($TCaCO_3$/kT). The calculated ABP is then compared to guidelines, wherein values less than -20 are considered acid producing, greater than 20 are considered non-acid generating, and values between -20 and 20 are considered to have uncertain acid generation potential. An alternative approach, comparing the ratio of NP/AP, uses criteria of less than 1 as acid producing, greater than 3 as non-acid generating, and between 1 and 3 as having an uncertain potential for acid production (Environmental Protection Agency 1994b, International Network for Acid Prevention 2008).

The net generation of acid from a rock or waste rock facility is related more to the reactivity of sulfide and neutralizing minerals than the total concentrations, so that static tests of finely ground samples may over-predict potential for acid generation. This is especially true when sulfide minerals are encapsulated in non-reactive minerals, such as silica, as is the case in the quartzites of the Revett Formation. The pH decrease associated with ARD occurs if acidity is produced at a faster rate than alkalinity or when neutralizing minerals, such as the carbonate minerals calcite and dolomite, and some silicates, are consumed by excess acid. The development of acid drainage is time-dependent and, at some sites, may form after many years of slow depletion in available alkalinity or slowly increasing sulfide oxidation (Price and Errington 1998). Kinetic test methods are used to evaluate rates of reaction when static methods suggest uncertain potential for ARD. Monitoring of long-term environmental chemistry in analogous geochemical settings also provides excellent predictive information. Microbial processes can speed up sulfide oxidation and significantly increase acid production, but also influence the attenuation of dissolved metals.

If acidity generated through these processes at the mineral surface is neutralized by buffering minerals (such as calcium carbonate), or water is not available to transport oxidation products away from the mineral surface, ARD is unlikely to develop. Where water is available, and there is insufficient neutralizing capacity (buffering) of the solution, ARD will occur.

3.9.4.1.2 Trace Element Release– Metals and Nutrients

The potential release of trace elements from mined rock is a concern regardless of the potential for acid generation because dissolved metals can remain soluble depending upon their individual sensitivity to pH and oxidation. Base metals, such as iron, lead, and copper, are most soluble at low pH and will be sorbed or precipitated from solutions with neutral to alkaline pH. Although acidic drainage presents the greatest potential for metal release, some metals (such as manganese and arsenic) can have enhanced solubility under neutral or alkaline conditions. Elevated concentrations of metals can also result from dissolution of metal-bearing salt minerals under neutral conditions.

Elevated concentrations of nutrients (nitrate and ammonia) can also occur in mine drainage, as a result of using explosives during mining. As the concentration of nitrate is determined by blasting practice and surface deposits of unconsumed agents on the surface of blasted rock, rather than the inherent characteristics of the rock itself, nitrate concentrations can only be measured empirically in blasted deposits.

The potential mobility of trace elements, both metals and nutrients, is determined by multiple variables, including dilution, potential for sorption, redox conditions, and biological activity. Due to the potential complexity of reactive transport, *in situ* monitoring data from geochemical analogs and full scale facilities provide an important “real world” basis for comparison. All data for metals or nutrients, determined in laboratory tests or *in situ* monitoring, are compared with relevant surface water and groundwater quality standards for the purposes of assessing potential risk. For potential releases from ore, tailings, or waste rock, groundwater quality standards apply to groundwater, and surface water standards apply to surface water such as streams, at the point of discharge, or at the edge of a mixing zone, if granted by the DEQ.

3.9.4.2 Troy as a Geochemical Analog for the Montanore Sub-Deposit

The Troy Mine, developed within the upper quartzites of the Revett Formation, is an excellent depositional and mineralogical analog for the zone of quartzite to be mined within the uppermost part of the lower Revett Formation of the Montanore and Rock Creek deposit. Geological analogs provide valuable models for predicting acid generation potential and/or water quality from a proposed mine site (Price and Errington 1998). This type of comparison is based on the geologic evidence that mineralization formed under comparable conditions within the same geological formation, which has undergone similar geological alteration and deformation, will have similar mineralogy and texture and, thus, similar potential for oxidation and leaching under comparable weathering conditions. Further, the ability to study environmental geochemical processes in the same rocks at full scale and under real-time weathering conditions provides a valuable basis for evaluation of laboratory test results.

Hayes (1983) and Hayes and Einaudi (1986) conducted detailed mineral studies of the Revett-style mineralization, and concluded that the geochemistry and risk for ARD from the Troy and Rock Creek-Montanore deposits are the same, as defined by the observed mineral zonation (Hayes 1995). Hayes found that the ore zones of both deposits contain no detectable amounts of pyrite. In another study, Maxim Technologies (2003) showed that the three Revett-style copper and silver deposits in northwest Montana cannot be statistically distinguished from one another based on copper or silver assay values.

Hayes reported that pyrite in the Revett Formation characteristically occurs in disseminated and encapsulated grains within the quartzite, where it is isolated from weathering, rather than on fracture surfaces. He also found that the post-sulfide cementation of quartz overgrowths on all grains resulted in an impermeable rock with little porosity. These conclusions were confirmed in independent studies of Rock Creek ore in a validation study conducted for the Forest Service in 2003 (Maxim Technologies 2003).

Four altered waste zones surrounding the ore zones in both the Troy and Rock Creek-Montanore deposits have potential to be mined as waste rock to varying degrees depending upon the geometry of underground workings at each mine. The amount of pyrite also varies within these four altered zones; therefore, potential for acid generation and trace element release varies more between the three projects for waste rock than it would for ore due to differences in the mass and type of waste rock to be mined. Other metal-bearing minerals, such as tetrahedrite(copper-antimony sulfide) and tennantite (copper-arsenic sulfide), occur in varying trace quantities, particularly at the outer periphery of the ore deposit and in surrounding altered waste zones. These minerals are potential hosts of arsenic and antimony, which have been measured in mine-affected water at the Troy Mine and the Libby Adit. The geometry of the Rock Creek subdeposit suggests the volume of waste rock to be mined from altered waste zones would be low. The consistent Revett-style Cu-Ag deposit mineralization throughout the Western Montana copper belt supports the use of the Troy deposit as a geochemical analog for the Rock Creek-Montanore deposit. This is especially true for the ore zones, which are essentially indistinguishable from one another, and for tailings. Waste rock is also similar, but shows some trace element variation within altered waste zones, particularly in arsenic, antimony, and lead. Differences among Troy, Montanore, and Rock Creek may occur due to the volumes mined from each zone due to geologic structure and mine design.

3.9.4.3 Geochemistry of Revett-style Copper and Silver Deposits in Northwestern Montana

Geochemical analyses of ore and waste rock sampled during exploration drilling at Rock Creek-Montanore (pre-2001) and during operations at Troy Mine, together with characterization of waste rock from the Montanore Libby Adit, tailings from Rock Creek metallurgical tests and Troy operations, and *in situ* water quality data from the Libby Adit and the Troy Mine comprise the environmental geochemistry baseline data for the impact analysis. These data, which address questions of acid generation and trace element and nutrient release potential, are described in part by Enviromin (2013b, 2009, 2010, 2012) and Geomatrix (2007a), and discussed in detail in the following section. They are also organized within a database that includes all known, validated environmental geochemistry data for Revett Cu-Ag deposits. The database is in the project record.

MMC presented a comprehensive summary of the available static geochemistry data characterizing rock for the proposed Montanore and Rock Creek mines by test method in tables appended to their waste rock management plan (Geomatrix 2007a), as well as in their review of waste rock characterization (MMC 2009a). Average values for acid base potential, whole rock chemistry, and assays described in a summary report by Enviromin (2013b) for this project include data reported by Balla (2002), DEQ (1996), Maxim Technologies (2003), Golder (1996), USDA Forest Service *et al.* (1992), USDA Forest Service and DEQ (2001), and Schafer and Associates (1992, 1997); these data are presented for ore and tailings in Table 88 and for waste rock in Table 89.The number and type of metal mobility and kinetic humidity cell tests is also shown. Additional data presented in this section, which were not included in the Supplemental Draft EIS, Enviromin (2013b) or Geomatrix (2007a), include Rock Creek tailings metal mobility and kinetic test results (Enviromin 2013a), and Troy I- and C-bed ore static and kinetic test results (Enviromin 2009, 2010, and 2012).

These data have been collected over time by various investigators and reflect differences in style and methods of sampling for each of the three Revett-style copper and silver deposits. For example, considerably more waste rock data were collected for the Montanore sub-deposit where it was exposed in the Libby Adit (Table 89), while tailings characterization is more comprehensive for the Rock Creek sub-deposit (Table 88). The most detailed studies of Revett-style copper and silver ore mineralization have been conducted underground at the Troy Mine, where exposures could be studied in mine workings, and the environmental geochemistry of the C and I ore zones have been thoroughly evaluated. Together, the mineralogy and chemistry of ore, tailings, and waste rock from the Rock Creek-Montanore and Troy deposits provide a fairly comprehensive baseline assessment of the rock to be mined. For these reasons, the following discussion focuses on data collected specifically for the proposed Montanore Project, but also includes information for the Rock Creek sub-deposit and Troy Mine.

3.9.4.3.1 Mine Area – Ore in Underground Workings

As discussed above, ore in the Rock Creek-Montanore deposit contains the copper sulfide minerals bornite, chalcocite, and digenite. These minerals are not acid-generating and based on delineation criteria, no pyrite occurs in the ore zone. Minor chalcopyrite and galena, with trace tennantite and tetrahedrite, occur as interbeds and in zones with calcite at the periphery of the deposit. Fewer quantitative mineralogy analyses are available for the Montanore sub-deposit than have been collected for the Rock Creek and Troy deposits, but extensive hand specimen descriptions (for thousands of described intervals, as shown in Table 88) are available in drill logs for all of the deposits, as described in Table 88. Detailed mineralogy studies indicate that 90 percent of all sulfide is encapsulated in the silica matrix of the quartzite in the Revett Formation at the Troy Mine (Enviromin 2013b). Formation of quartz overgrowths were documented for both the Troy (Hayes 1983) and Rock Creek deposits (Maxim Technologies 2003). A summary of the average sulfur and acid generation potential data characterizing ore and tailings for the Rock Creek-Montanore and Troy deposits is presented in Table 88. Further detail on the range and distribution of data is presented by Enviromin (2013b).

Acid Base Potential. Results of whole rock analyses of ore from Montanore sub-deposit are summarized in Table 88 along with results for ore samples from the Rock Creek sub-deposit and the Troy Mine. Total sulfur ranged from <0.01 to 0.78 percent (averaging 0.2 percent) at the Rock Creek sub-deposit (number of samples [n]=34), and was quite similar to Montanore, where total sulfur ranged from 0.01 to 0.95 percent and averaged 0.3 percent (n=35). Total sulfur ranged from 0.06 to 0.34 percent (averaging 0.2 percent) at the Troy Mine (n=28).

Thirty-six ABP (n= 36) tests have been provided for samples of ore from Montanore drill core. Another 34 Rock Creek and 28 Troy Mine ore samples were analyzed for acid base potential, as summarized in Table 88. The Montanore sub-deposit static test data suggest that the ore has uncertain potential to generate acid, with an average acid base potential (ABP) of -4 T $CaCO_3$/kT and an NP:AP ratio of 0.9. The Rock Creek and Troy samples both have NP/AP ratios of 3 and average ABP of 1 T $CaCO_3$/kT and 5 T $CaCO_3$/kT, respectively, despite having total sulfur contents less than 0.3 weight %. Average ore sample ABP values were significantly lower at Rock Creek (1 T $CaCO_3$/kT) and Montanore (-4 T $CaCO_3$/kT) than at Troy (5 t $CaCO_3$/kT) due to differences in both the average AP and NP at each deposit. The ABP values for Rock Creek and Montanore were not statistically different. Statistical differences, which were based on a t-test, may be due to small geochemical differences between the deposits or could be a remnant of sampling error or changes in ore/waste classification because of use of different cutoff grades.

Table 88. Geochemical Data for Ore and Tailings from Northwestern Montana Revett-Style Copper and Silver Deposits.

Test	Ore						Tailings					
	Montanore		Rock Creek		Troy		Montanore		Rock Creek		Troy	
	n	Mean	n	Mean	n	Mean	n	Mean	n	Mean	n	Mean
Static Acid Generation Potential												
ABP, T $CaCO_3$/kT rock (NP:AP ratio)	36	-4 (0.9)	34	1 (3)	28	5 (3)	No data		2	10 (10)	3	1.5 (1.5)
Total sulfur, weight %	35	0.3	34*	0.2	28*	0.2	No data		1	0.01	2	0.08
Total sulfur, weight % adjusted**	No data		34	0.08	16	0.02	No data		No data		No data	
Whole Rock/Metals												
Copper, ppm	1	7,880	36	6,623	29	5,180	No data		31	348	2	682
Silver, ppm	1	66	36	31	29	33	No data		31	9.8	2	5.5
Assay Claim Validation												
Copper, %	213	0.55	347	0.67	282	0.71						
Silver, oz/ton	213	1.4	345	1.6	282	1.4						
Sulfur, weight %, calculated from Cu	213	0.23	347	0.17	282	0.30						
Mineralogical Analysis												
Quantitative/analytical			10		>100		No data		1+		1++	
Feet drilled	1,500		3,000		11,429							
Mineralogy descriptions+	1,000		1,500		4,798							
Assays	1,500		7,255		3,799							
Metal Mobility Tests												
EP toxicity (EPA Method 1310)	No data		No data		No data		No data		No data		1	
TCLP (EPA Method 1311)	1		No data		No data		No data		No data		2	
SPLP (EPA Method 1312)	No data		No data		12		No data		1		1	
Humidity Cell Tests, final pH, s.u.	1	6.92	1	6.83	2	7.90+++	1	8.94	1	7.87	No data	

n =number of samples; ABP = Acid Base Potential; NP = Neutralization Potential; AP = Acid Potential; T $CaCO_3$/kT = tons equivalent calcium carbonate per 1,000 tons rock
TCLP = Toxicity Characteristics Leaching Procedure (EPA Method 1311); SPLP = Synthetic Precipitation Leachability Procedure (EPA Method 1312); s.u. = standard units.
Detection limit used for samples that contain below detection limit values.
[+]CAMP 2011; [++] Landefeld 2011.
[+++] Mean of the pH from the final week of the I-Bed (7.92) and C-Bed (7.88) humidity cell test tests.
* = includes samples reported as "reported non-sulfate S" as total sulfur based on the mineralogy of the deposit which lacks significant sulfate.
** = adjustment based on DEQ (1996) to remove the mass of sulfide represented by non-acid generating copper-sulfide minerals.
Data summarized includes duplicate and primary results, where known, due to differences observed between results.
Source: Balla 2000, 2002; DEQ 1996; Geomatrix 2007a; Golder 1996 (summary of two non-cement samples [RC0A and RC0B]); Maxim 2003; Schafer and Associates 1992, 1996; USDA Forest Service *et al.* 1992; USDA Forest Service and DEQ 2001.

Table 89. Geochemical Data for Waste Rock from Northwestern Montana Revett-Style Copper and Silver Deposits.

Test	Montanore		Rock Creek		Troy	
	n	Mean	n	Mean	n	Mean
Static Acid Generation Potential						
ABP, T $CaCO_3$/kT (NP:AP ratio)			24*	4 (5)	2	17 (8)
Prichard Formation	70	7 (4)	6	2 (4)	No data	No data
Burke Formation and Burke-Prichard Transition	19	15 (12)	No data	No data	No data	No data
Lower Revett Formation	72	4 (3)	10	4 (3)	2	17 (8)
Total Sulfur, weight %	No data	No data	24**	0.11	2	0.05
Whole Rock/Metals						
Copper, ppm	3	40	27	29	2	126
Silver, ppm	3	8	27	2	2	0.99
Mineralogical Analysis						
Quantitative/analytical			2		>100	
Feet drilled	2,375		4,000		45,000	
Mineralogy descriptions	2,000		3,000		22,500	
Assays	2,375		No data		No data	
Metal Mobility Tests						
EP toxicity (EPA Method 1310)	No data		3		No data	
TCLP (EPA Method 1311)	3		14		No data	
SPLP (EPA Method 1312)	No data		14		2	

n = Number of samples; ABP = Acid Base Potential; NP = Neutralization Potential; AP = Acid Potential; T $CaCO_3$/kT = tons equivalent calcium carbonate per 1,000 tons rock; TCLP = Toxicity Characteristics Leaching Procedure (EPA Method 1311); SPLP = Synthetic Precipitation Leachability Procedure (EPA Method 1312).
Detection limit used for samples that contain below detection limit values.
* = data for the "Rock Ck Waste Rock" sample (ABP = 82 T $CaCO_3$/kT) was assumed to be an outlier and was not included in the mean calculation.
** = includes the 10 samples reported by DEQ 1996 as "non-sulfate S" as total sulfur based on the mineralogy of the deposit which lacks significant sulfate.
Source: Balla 2000, 2002; DEQ 1996; Geomatrix 2007a; Golder 1996 (summary of two non-cement samples [RC0A and RC0B]); Maxim 2003; Schafer and Associates 1992, 1996; USDA Forest Service *et al.* 1992; USDA Forest Service and DEQ 2001.

Static tests of acid generation potential are based on nitric acid digestion of all available sulfide from a finely ground rock flour, which as noted previously, conservatively estimates the potential for oxidation of encapsulated sulfides, as well as the potential for sulfides to generate acid because all sulfide is assumed to be acid-generating pyrite. The use of an acid base account without adjustment thus overstates the potential for acid generation by the copper sulfide minerals and ignores the effects of encapsulation. For this reason, in its study of the Rock Creek sub-deposit, the DEQ appropriately reduced the total sulfide by the amount of sulfur that would correspond to the measured copper concentration (based on the assumption that all sulfide is chalcocite, Cu_2S, so that there is one atom of sulfide for every 2 atoms of copper) to account for non-acid generating copper sulfides (DEQ 1996). The DEQ therefore adjusted the total reactive sulfur using the copper assays, reducing the estimated sulfide content for the Rock Creek sub-deposit from an average of 0.2 weight percent to 0.08 weight percent, as shown Table 88. The average sulfide for the Troy Mine was similarly reduced from 0.2 to 0.02 percent. Because copper concentrations were not reported for the Montanore sub-deposit samples, this correction cannot be made, although the principle is equally valid for the Montanore portion of the Rock Creek-Montanore deposit and would result in a predicted average value around 0.1 percent. The difference in inferred acid generation risk with and without this important mineralogical correction to account for non-acid generating copper sulfides is evident when comparing Chart 1 and Chart 2.

The neutralization and acid generation potential of ore from the various Revett Cu-Ag deposits are compared to the regulatory NP:AP ratio guidelines (acid <1; 1:3 uncertain; >3 non-acid) in Chart 1. These data, which are based on the conservative assumptions that sulfide is equal to total sulfur less sulfate sulfur and all sulfide is acid-generating pyrite, suggest that most samples of Revett ore have potential to generate acid or are uncertain in terms of ARD risk. These calculations overestimate the acid generation potential of the Montanore sub-deposit, which would more closely resemble the trends shown in Chart 2 for the Rock Creek sub-deposit and Troy deposit when corrected to remove non-acid generating copper sulfide minerals from the acid generation potential.

Additional important data characterizing sulfide content are the thousands of ore intercepts that were assayed for copper and silver, operationally at the Troy Mine and for validation of the Montanore, Rock Creek and Troy claims. Given the very consistent copper sulfide mineralogy of the ore, it is possible to calculate the range of sulfide content based on the assumption that the copper to sulfur ratio of 2:1 for chalcocite represents the ore-grade chalcocite mineralization. Maxim compiled assay data for 213 samples of ore from Forest Service claim validation studies for the Montanore Project, along with 347 samples from the Rock Creek claims, and 282 samples from the Troy claims, as shown in Chart 3 (Maxim Technologies 2003). Very few samples have a calculated sulfide concentration more than 0.4 percent in any one of the deposits, and the average sulfide concentration is less than 0.2 percent in all of the deposits. This distribution agrees with the results reported by the DEQ (1996). Also, 88 percent, 91 percent, and 89 percent of samples (for the Troy, Montanore, and Rock Creek, respectively) have total sulfide concentrations less than 0.3 percent, which is a commonly accepted cutoff value below which potential acidification is typically not of concern (Jambor *et al.* 2000, Price *et al.* 1997). In other words, although concentrations above this commonly accepted threshold of 0.3 percent do occur, they represent a consistently small fraction of the samples from both the Troy and Rock Creek-Montanore deposits.

Acid Generation Rates. The rate of potential acid generation from the Montanore sub-deposit was tested for an ore composite in a standard humidity cell test (Schafer and Associates 1992). This ore composite, which had an uncertain acid generating potential with an ABP of -14.5 T $CaCO_3$/kT, showed a low amount of oxidation with a final pH of 7 and low concentrations of sulfate and acidity. In the composite leachate analyzed in week 6, a low copper concentration was detected; both copper and manganese were detected in week 12. Results of this analysis support the conclusion that Montanore ore would not be acid-generating but may release small amounts of trace elements at a near-neutral pH.

Chart 1. Acid Generation Potential of Ore using non-sulfate sulfur to calculate AP.

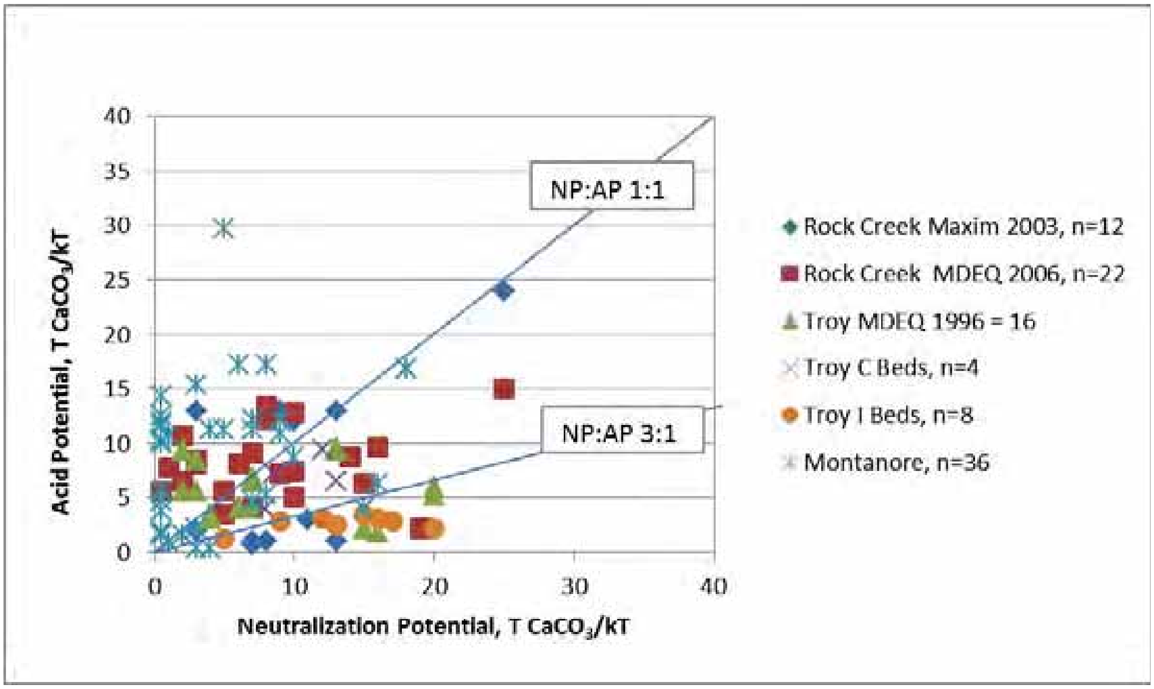
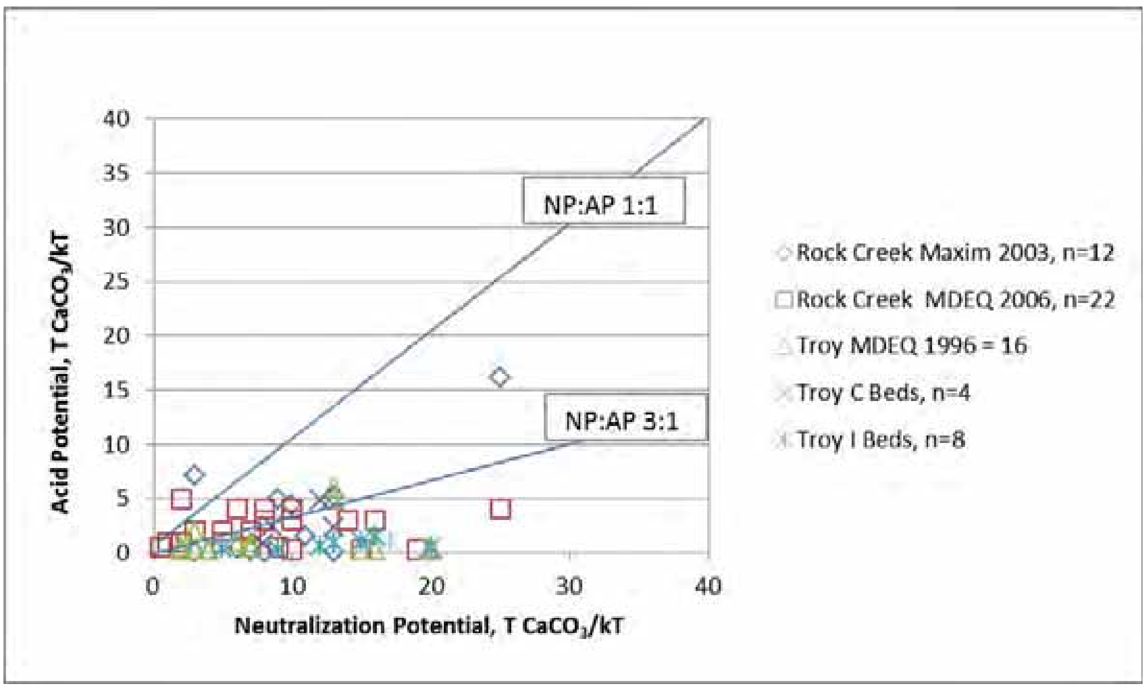


Chart 2. Acid Generation Potential of Ore using non-sulfate sulfur adjusted to remove copper sulfide from calculated AP.



Note: Montanore acid base accounting data did not include sulfur data and therefore, adjustment to remove copper sulfide data could not be performed on the Montanore dataset.

The rate of potential acid generation for the proposed Rock Creek Project was also tested for an ore composite in a standard humidity cell test (Schafer and Associates 1997). The sample, which had an uncertain static acid generating potential with an ABP of 4 T $CaCO_3$/kT, showed a low amount of oxidation with a final pH of 6.83 and low concentrations of sulfate and acidity. In the composite leachate analyzed in week 20, only manganese was detected at 0.05 mg/L. All other metals, including antimony, arsenic, barium, cadmium, chromium, copper, iron, lead, mercury, selenium, silver, thallium, and zinc, were below detection. The humidity cell data for two samples from the Rock Creek-Montanore deposit therefore agree with empirical water quality data from ore exposed in the Troy Mine, which show no ARD, near-neutral pH, and low concentrations of copper and manganese.

Metal Content. Whole rock analyses were completed for 12 Rock Creek ore samples (Maxim Technologies 2003), with copper, lead, silver and zinc concentrations reported for an additional 22 ore samples from Rock Creek (Table 90). Twelve whole rock analyses were also completed for samples from the C-bed (n=4) and I-bed (n=8) ore zones in the lower Revett that are mined at Troy, together with another 16 copper, lead, silver and zinc analyses. These data indicate that ore from these deposits is enriched in copper, silver, and lead, with some variation in antimony, arsenic, cadmium, nickel, and zinc, consistent with the style of mineralization. One additional whole rock analysis was conducted for ore from the Montanore sub-deposit (Enviromin 2013b), which generally agreed with the results for Troy and Rock Creek as shown in Table 90.

Metal Release Potential. Two additional sources of metal mobility data for ore are from the proposed Montanore Project. The sample tested in a humidity cell (described above) indicated copper concentrations between 0.02 and 0.04 mg/L and manganese concentrations of 0.03 mg/L (Schafer and Associates 1992). In another test of Revett ore from the Montanore deposit using the EPA Method 1311 (Toxicity Characteristic Leaching Procedure, TCLP) analysis, copper and lead were detected in the leachate at concentrations greater than the groundwater standard. The TCLP analysis is a conservative test designed more for landfill waste classification than for prediction of meteoric water leachate from mined rock, which is expected to yield higher metal concentrations due to the acidic (fixed pH 5) conditions created in the test. Because of differences in acidity, reactive surface area, and different rock:water ratios in the TCLP and SPLP methods, these results are better suited to identify the list of metals that may be mobile than they are to providing quantitative predictions of future field chemistry.

Table 90. Average Whole Rock Geochemistry for Rock Creek/Montanore Subdeposits and Troy, for Ore, Tailings, and Waste Rock.

Whole Rock Type	Ore										Tailings		Tailings Paste		Waste Rock							
Project	**Rock Creek**				**Troy**				**Montanore**		**Rock Creek**		**Troy**		**Rock Creek**				**Troy**		**Montanore**	
Source	Maxim		DEQ RC		Enviromin		ASARCO		NMC		Maxim and Balla		Golder		Maxim various lithotypes		DEQ various lithotypes		Enviromin Revett Fm		MMI Revett Fm	
Method	MEMS 61		EPA 3050A		MEMS 61		EPA 3050A		alkali fusion		MEMS 61		6010A/ 7131/7041		MEMS 41		EPA 3050A		MEMS 61		alkali fusion	
Metal	Ave.	n	Ave.	n	Ave.	n	Ave.	n	Ave.	n	Ave.	n	Ave.	n	Ave.	n	Ave.	n	Ave.	n	Ave.	n
Aluminum	4.2	12	No data		3.61	12	No data		3.53	1	3.14*	30	736	2	0.8	14	No data		5.48	2	4.23	3
Antimony	0.9	12	No data		19	12	No data		2.5	1	73	31	0.4	2	0.2	14	No data		1.3	2	<5	2
Arsenic	1.9	12	No data		11	12	No data		7	1	200	31	2.7	2	1.8	14	No data		1.7	2	8	3
Barium	574	12	No data		672	12	No data		520	1	442	31	1,830	2	91.8	14	No data		750	2	633	3
Cadmium	0.1	12	No data		0.05	12	No data		2.5	1	0.2	31	0.02	2	0.07	14	No data		0.07	2	<5	3
Copper	4,760	12	7,600	22	3,330	12	6,500	16	7,880	1	348	31	819	2	38	14	21	10	126	2	40	3
Lead	23*	11	19*	21	32	12	17	16	50	1	82	31	44.4	2	61	14	93	10	98.0	2	120	3
Manganese	351	12	No data		437	12	No data		310	1	5,380†	31	226	2	276	14	No data		650	2	452	3
Nickel	5	12	No data		4.0	12	No data		36	1	21	31	No data	0	14	14	No data		10	2	40	3
Silver	44	12	23	22	41.3	12	26	16	66	1	9.8	31	285	2	0.1	14	<5	10	0.99	2	8.3	3
Zinc	29	12	21	22	30	12	7	16	22	1	54	31	3.8	2	47	14	39	10	91	2	77	2

n = number of samples; ave.= average; < = all values used in average calculation are below detection limit.

All units are mg/kg, except for aluminum, which is percent for all data except Troy Tailings Paste data.

*Single outlier concentration of 9,040 ppm removed from the Maxim lead average; an outlier concentration of 9,200 ppm removed from the DEQ lead average; an outlier concentration of 421 ppm removed from the Maxim aluminum average.

†Sixteen values above range of method detection (>10,000 ppm).

Detection limit used for samples with concentrations above or below the detection limit when calculating averages.

Analytical Method: MEMS 41—ALS Chemex aqua regia digestion; MEMS 61—ALS chemex 4-acid digestion with ICP; EPA 3050—Total metal content extraction, comparable to MEMS-41.

Source: Balla 2002; DEQ 1996; Enviromin 2009, 2012; Geomatrix 2007a; Golder 1996 (summary of two non-cement samples [RC0A and RC0B]); Maxim 2003; Mines Management 2005.

Table 91. Metal Mobility Data for Revett Cu-Ag Deposits, for Ore, Tailings, and Waste Rock Compared to Montana Water Quality Standards.

Metal	Ore		Tailings		Waste Rock			Montana Water Quality Standards†	
Method—>	SPLP Ave.	SPLP Ave.	SPLP	SPLP	SPLP	SPLP	SPLP Ave.		
Project—>	Troy	Troy	Rock Creek	Troy	Troy	Troy	Rock Creek		
Material—>	C-bed ore	I-bed ore	Tailings	Tailings paste	C-bed waste	I bed waste	Revett, St. Regis and Prichard	Groundwater	Surface Water
# of samples—>	4	8	1	1*	1	1	14		
Aluminum	**2.91**	**2.56**	No Data	No Data	**4.2**	**3.1**	No Data	none	0.087
Antimony	**0.008**	0.0045	<0.003	<0.001	<0.003	<0.003	<1	0.006	0.0056
Arsenic	0.006	<0.003	<0.001	0.005	<0.003	<0.003	<1	0.01	0.01
Barium	0.080	0.11	No Data	0.362	0.183	0.117	<3	1	1
Cadmium	<0.00008	0.00009	**0.0004**	<0.0001	<0.00008	<0.00008	<0.05	0.005	0.000097
Chromium	0.009	0.004	No Data	<0.002	0.019	0.003	<0.3	0.1	0.1
Copper	**0.257**	**0.16**	**0.134**	**0.09**	**0.026**	0.01	<0.05	1.3	0.00285
Fluoride	0.3	<0.1	No Data	No Data	0.2	<0.1	No Data	4	4
Iron	**1.1**	1.0	No Data	0.202	**1.84**	**1.63**	0.2	none	1
Lead	**0.025**	**0.005**	**0.025**	0.005	**0.0028**	**0.0253**	<0.3	0.015	0.000545
Manganese	0.080	0.082	0.070	<0.011	0.074	0.104	No Data	none	none
Mercury	<0.02	0.00002	<0.0006	<0.0002	<0.02	<0.00001	<0.001	0.002	0.00005
Nickel	<0.01	<0.01	No Data	No Data	<0.01	<0.01	<0.3	0.1	0.0161
Phosphorus	0.03	0.009	No Data	No Data	0.04	<0.006	No Data	none	none
Selenium	<0.001	<0.001	<0.001	<0.005 J	<0.001	<0.001	<1	0.05	0.005
Silver	**0.0060**	**0.003**	<0.003	<0.003	<0.0005	<0.0005	<0.3	0.1	0.000374
Thallium	<0.0004	<0.0006	No Data	No Data	<0.0002	<0.0005	<1	0.002	0.00024
Uranium	0.00037	0.00033	No Data	No Data	0.00025	0.00022	No Data	0.03	0.03
Zinc	<0.1	<0.1	0.02	<0.014 J	<0.1	<0.1	<0.5	2	0.037

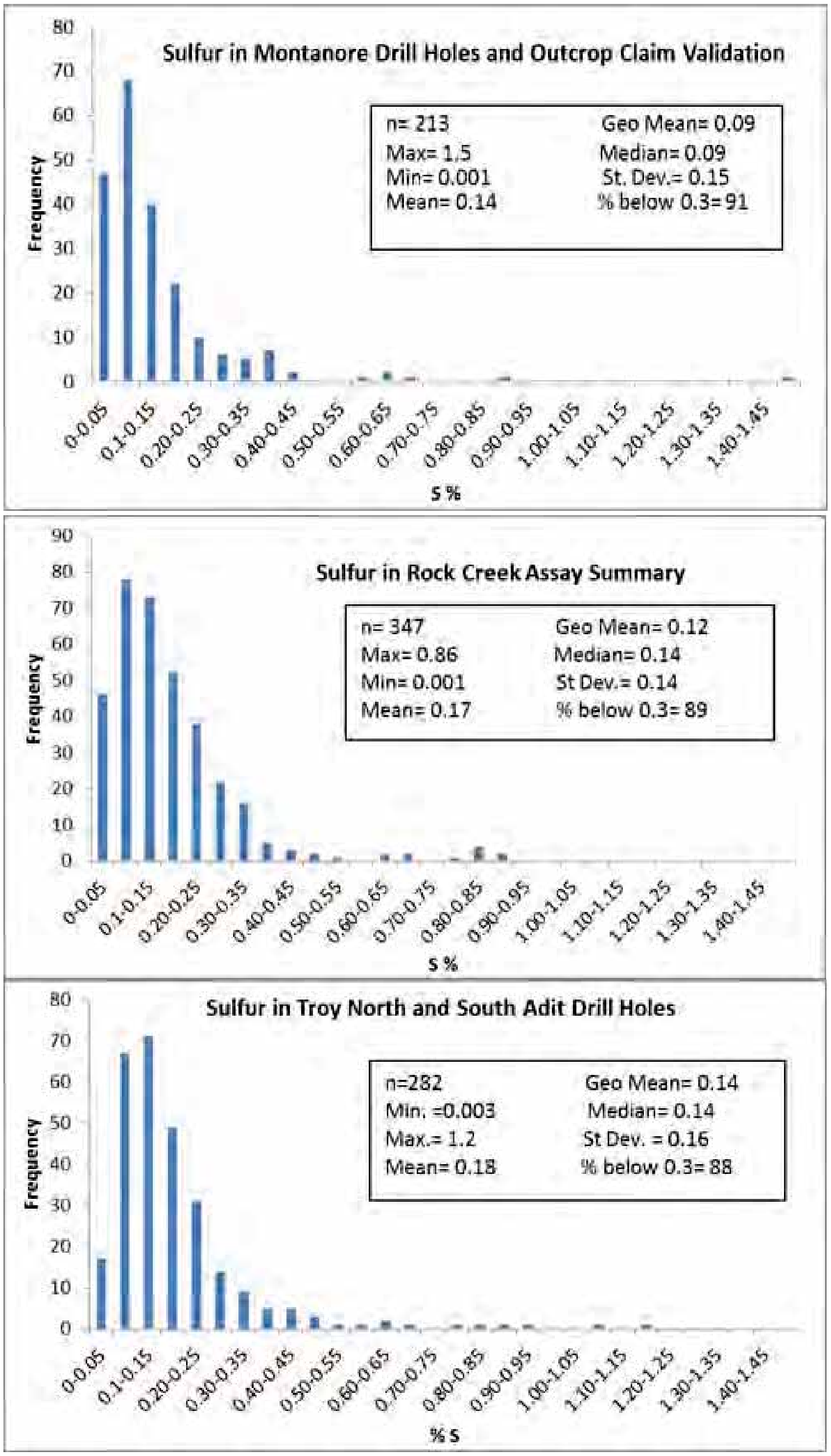
See next page for footnotes

Table 91. Metal Mobility Data for Revett Cu-Ag Deposits, for Ore, Tailings, and Waste Rock Compared to Montana Water Quality Standards. (cont'd)

Metal	Ore	Tailings	Waste Rock				MT Water Quality Standards†	
Method—>	TCLP	TCLP	TCLP Ave.	TCLP	TCLP	TCLP		
Project—>	Montanore	Troy	Rock Creek	Montanore	Montanore	Montanore		
Material—>	Raw Ore	Tailings Paste	Revett	Revett Footwall	Revett Hanging Wall	Lower Revett Waste Zone	Groundwater	Surface Water
# of samples—>	1	2*	14	1	1	1		
Aluminum	No Data	No Data	No Data	No Data	No Data	No Data	none	0.087
Antimony	No Data	0.002	<1	No Data	No Data	No Data	0.006	0.0056
Arsenic	<0.004	<0.002	<1	<0.004	<0.004	<0.004	0.01	0.01
Barium	0.1	**3.33**	<3	0.4	0.3	<0.1	1	1
Cadmium	<0.01	**0.0001**	<0.05	<0.01	<0.01	<0.01	0.005	0.000097
Chromium	<0.02	0.003	<0.3	<0.02	<0.02	<0.02	0.1	0.1
Copper	**1.4**	**20.2**	**0.08**	**0.04**	**0.06**	**0.05**	1.3	0.00285
Fluoride	No Data	No Data	No Data	No Data	No Data	No Data	4	4
Iron	No Data	**5.00**	**6.9**	No Data	No Data	No Data	none	1
Lead	**0.26**	**0.521**	**0.37**	**0.05**	**0.09**	**0.64**	0.015	0.000545
Manganese	No Data	4.91	No Data	No Data	No Data	No Data	none	none
Mercury	<0.01	<0.0002	No Data	<0.01	<0.01	<0.01	0.002	0.00005
Nickel	No Data	No Data	<0.3	No Data	No Data	No Data	0.1	0.0161
Phosphorus	No Data	No Data	No Data	No Data	No Data	No Data	none	none
Selenium	<0.025	<0.005	<1	<0.025	<0.025	<0.025	0.05	0.005
Silver	<0.01	<0.003	<0.3	<0.01	<0.01	<0.01	0.1	0.000374
Thallium	No Data	No Data	<1	No Data	No Data	No Data	0.002	0.00024
Uranium	No Data	No Data	No Data	No Data	No Data	No Data	0.03	0.03
Zinc	No Data	**0.125**	<0.5	No Data	No Data	No Data	2	0.037

All units are mg/L
Ave.=average; < = all values used in average calculation are below detection limit; J = estimated value
Detection limit used for samples with concentrations below the detection limit when calculating averages
†Surface water values are the lower of the human health standards and acute and chronic aquatic life standards
*summary of non-cement samples (RC0A and RC0B)
Bolded values are those detected concentrations that exceeded a Montana water quality standard. For potential releases from ore, tailings, or waste rock, standards apply to the receiving water at the point of discharge, or, if granted by the DEQ, at the edge of a mixing zone.

Chart 3. Distribution of Sulfide Calculated Based on Copper Assays for Montanore, Rock Creek, and Troy Deposits.



Source: Enviromin 2013b.

Composites of ore from the Troy C-bed and I-bed zones were also tested in kinetic humidity cell tests (Enviromin 2010, 2012). Both tests showed no potential for acid production, with final pH values of 7.88 (C-bed) and 7.92 (I-bed), low sulfate, and available alkalinity throughout the tests. The four composited C-bed ore samples have a range in total sulfur concentration from 0.15 to 0.34 weight percent with a positive average ABP of 3 T $CaCO_3$/kT and an average NP/AP ratio of 1.6 The eight composited I-bed samples have a range in total S content from 0.06 to 0.12 weight percent, with an ABP of 10 T $CaCO_3$/kT and an average NP/AP ratio of 5. In spite of the lack of acid generation potential, both composites of ore released concentrations of antimony and copper above aquatic standards. Antimony exceeded the relevant groundwater standard as well. The C-bed also released cadmium, lead, and silver at concentrations that exceeded aquatic standards in some weeks, but that did not exceed groundwater standards. The trends in metal concentrations for the C-bed and I-bed humidity cell tests are shown in Chart 4 through Chart 7.

In-Situ Water Quality Data. None of the Revett ore zone has been exposed in the Libby Adit at Montanore, but *in situ* water monitoring in the Troy workings provides a useful measure of potential trace metal release from ore and waste rock exposed together in underground workings. Comparison of dissolved and total metal concentrations in water from the Troy workings (where ore was exposed underground) shows that low concentrations of some dissolved metals (copper, manganese, lead, and silver) are detected in mine water, but the majority of detected total metals (aluminum, arsenic, barium, copper, lead, manganese, silver, and zinc) are associated with suspended sediment and thus detected only in total recoverable analyses (Enviromin 2013b).

At Troy, the use of explosives underground has influenced nutrient concentrations in mine water, with detectable nitrate in all samples and measurable ammonia present in eighty-seven percent of monitoring samples (Table 92). As measured in the adit pipe and ditch samples collected during restart of mining activities (Service Adit P and Service Adit D), nitrate plus nitrite ranged from 0.70 to 20 mg/L, while ammonia was detected at concentrations ranging from 0.070 to 10.7 mg/L.

Table 92. Nutrient Concentrations Measured in Troy Mine Water.

Troy Service Adit Pipe and Ditch	Ammonia (mg/L)	Nitrate+Nitrite (mg/L)
# of samples	16	16
Detections	14	16
Minimum Detected	0.070	0.70
Maximum Detected	10.7	20
Representative Concentration	<1.6	3.1

Additional data discussion provided in Appendix K-7.
Source: Hydrometrics 2013.

Chart 4. Metal Concentrations in Humidity Cell Effluent from the Troy C-bed Ore Zone.

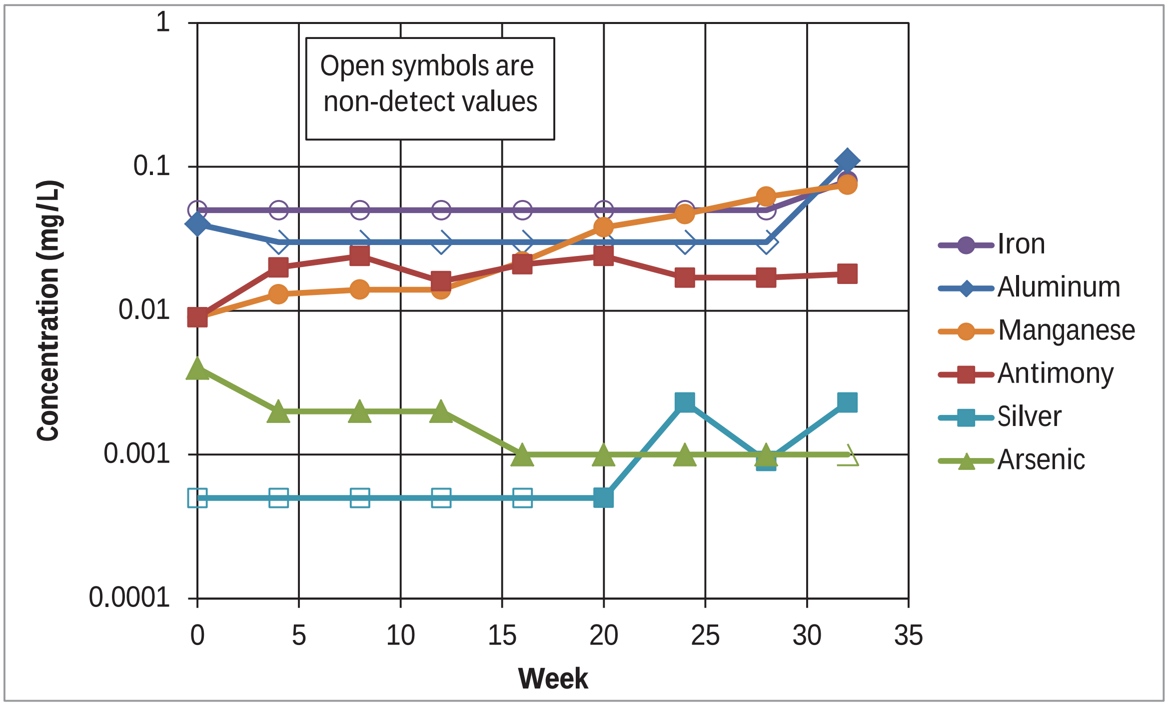


Chart 5. Metal Concentrations in Humidity Cell Effluent from the Troy C-bed Ore Zone.

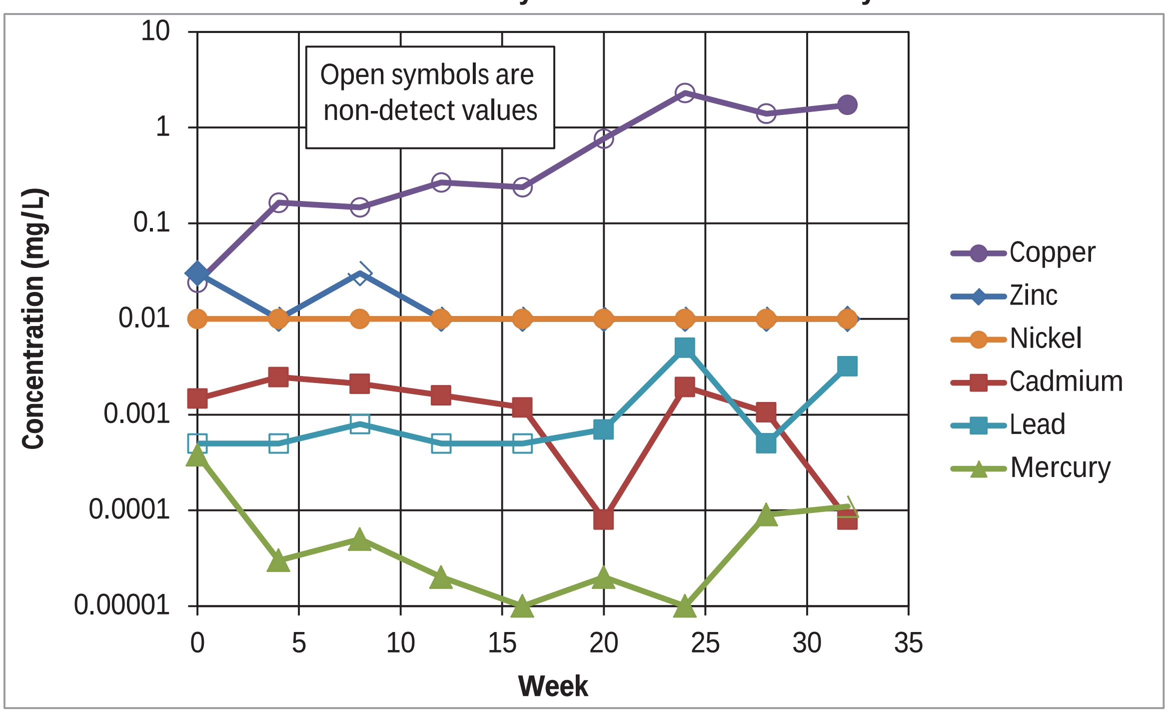


Chart 6. Metal Concentrations in Humidity Cell Effluent from the Troy I-bed Ore Zone.

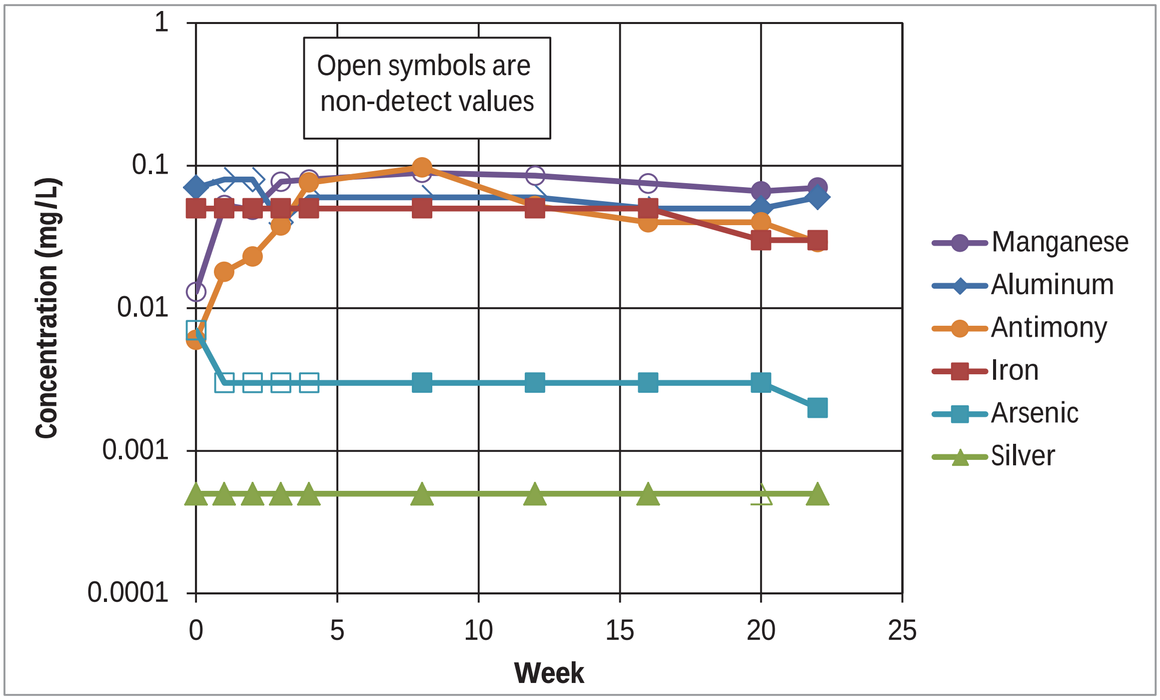
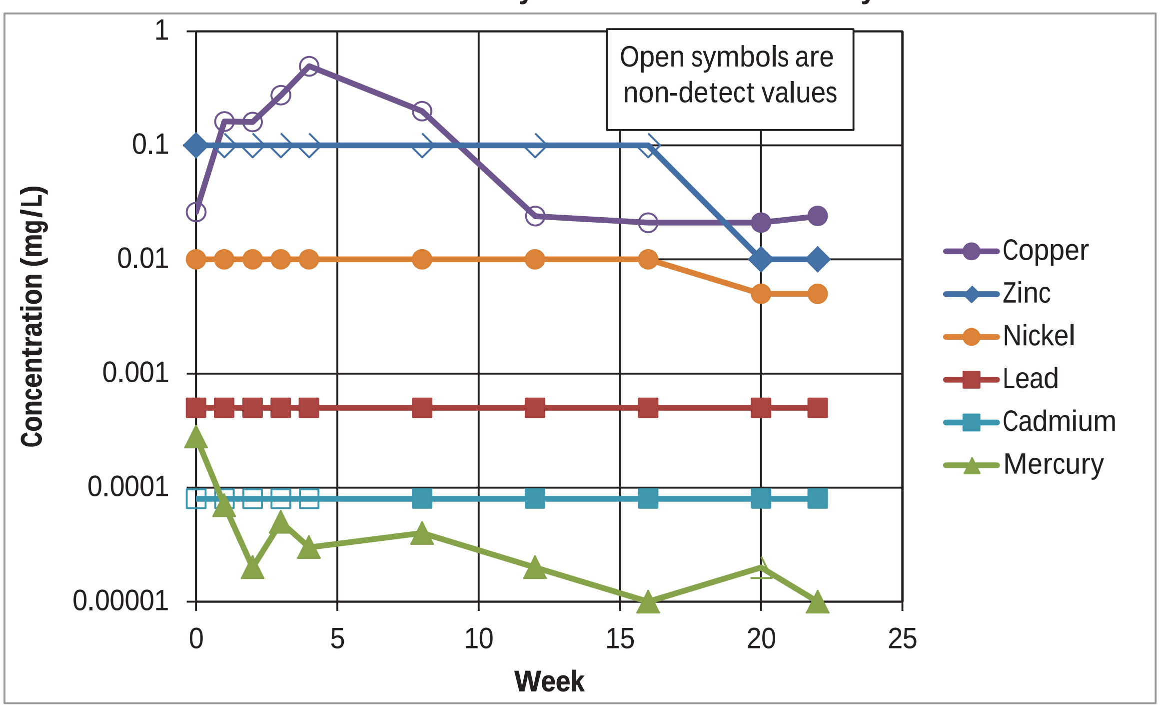


Chart 7. Metal Concentrations in Humidity Cell Effluent from the Troy I-bed Ore Zone.



Ore Summary. Collectively, the geochemical data characterizing ore from the Montanore subdeposit as well as the Rock Creek subdeposit and Troy Mine indicate uncertain potential for acid generation based on static test results, which is not supported by mineralogy, kinetic leach testing, or *in situ* monitoring at Troy Mine or the Libby Adit. The presence of silica encapsulated, nonacid-producing copper sulfide minerals in the ore zone, and the neutral to alkaline pH conditions observed in leach tests and water monitoring data indicate a very low risk of acid production in spite of uncertain static test results. Metal mobility tests from Troy, together with *in situ* monitoring, indicate potential for a release of low levels of aluminum, antimony, copper, iron, lead, manganese, silver, and thallium from the ore zone where it would be exposed underground, in spite of the negligible risk of acid production. Remaining uncertainties, including specifics of metal mobility at relevant detection limits for samples of ore from Montanore, are addressed in the Geochemistry Sampling and Analysis Plan for the evaluation adit program in Appendix C.

3.9.4.3.2 Mine Area – Tailings

Tailings chemistry is dominated more by the metallurgical process of sulfide and metal removal than by minor differences in the sulfide mineral content of ore, particularly within the very narrow range of sulfide content observed in Revett-style deposits. The process MMC proposes to use at the Montanore mill would involve conventional flotation of rock ground to a range of particle sizes comparable to that in use at the Troy mill and proposed for the Rock Creek Project (MMI 2005a, MMC 2008). The ore would be finely ground, so that surface area available for interaction between the ground ore and water is greater than in the intact quartzite matrix, to optimize sulfide recovery during flotation.

Acid Base Potential. Total sulfur measured in 15 samples from Rock Creek averaged 0.02 weight percent sulfur. A total sulfur value of 0.01 weight percent was reported for a tailings composite tested in a humidity cell test for the Montanore Project, which had an ABP of 8T $CaCO_3$/kT with a NP/AP ratio of 25.8 (Schafer and Associates 1992). Values reported by Golder (1996) for Troy mill tailings had a lower average ABP value of 1.5 T $CaCO_3$/kT. Both the tailings effluent for the Montanore ore sample and water from the Troy tailings pond show neutral pH values and comparable (generally low) concentrations of major cations and anions, with excess alkalinity (ERO Resources Corp. 2011c). These results agree with those obtained during humidity cell tests, which show near-neutral pH and low level metal release. Metal release humidity cell test data for tailings composite samples from Rock Creek are shown in Chart 8 and Chart 9.

The measured total sulfur values reported for tailings in Table 88 range from 0.01 to 0.08 percent. Additional testing of tailings generated through metallurgical testing of ore from archived Rock Creek core indicated copper recovery ranging from 75 to 99 percent with an average of 91 percent and sulfide recovery ranging from 80 to 99.2 percent, with an average of 94 percent (Maxim Technologies 2003). Whole rock analysis of sulfur in the Rock Creek tailings subsamples was at or below detection at 0.01 percent in 13 of 14 samples; the 14^{th} sample had a sulfur content of 0.02 percent. Although sulfide recovery was not measured for the Montanore ore metallurgical test, the copper recovery reported for the Montanore ore ranged from 86 to 97.5 percent and averaged 93 percent, implying good agreement with the results reported for Rock Creek. Removal of 90 percent of the sulfur shown for the Montanore ore in Chart 3 (Table 88) suggests that less than 0.03 percent sulfur (average) would remain in the tailings. The total sulfide content of rock in the ore zone ranges from below detection to 1.4 percent with the majority of samples below 0.4 percent. Removal of 90 percent of the sulfide during processing yields a limited range of sulfide values between 0.002 and 0.15 percent, values which would have essentially no acid generation potential (Jambor *et al*. 2000). Similarly, the copper and silver content of the ore also would be reduced to one-tenth of the original concentrations, similar to the reduction in whole rock concentrations described for Rock Creek and Troy in Table 88. The overall risk of ARD formation by tailings from Montanore is therefore estimated to be low (Klohn Crippen 2005).

Although the NP/AP ratios for the Troy tailings ranged from <0.2 to 3.33, with an average value of 2.0, which suggests potential for ARD formation, the sulfur concentration measured in tailings was less than 0.1 percent. Such a low concentration of sulfide is unlikely to generate acid. The reported ratio values therefore reflect the sensitivity of ratios calculated for low NP and AP values, which can vary when values in the numerator or denominator are small, and do not necessarily indicate acid generation potential. Further, water from the Troy tailings impoundment is not acidic after nearly 20 years of monitoring (ERO Resources Corp. 2011c).

Acid Generation Rates. The similar mineralogy and range of silver and copper assay values for the Rock Creek-Montanore and Troy deposits, as well as the use of the same flotation method for all three mills, implies that tailings chemistry would be comparably alkaline at the three mines. This is confirmed by results of humidity cell tests of ore (prior to removal of sulfide by flotation) from the Montanore and Rock Creek ore, which were not acid generating and released little to no trace metal (Schafer and Associates 1992, 1997).

Similar results were observed in a humidity cell test of bulk tailings that was produced by Hazen in a 2003 metallurgical test of Rock Creek ore (Table 88). This composite is the same rock that was tested in the SPLP analysis described for Rock Creek tailings in Table 91, which had a total Sulfur content of 0.01 weight percent with an ABP of 9 T $CaCO_3$/kT and a NP/AP ratio of more than 30. The humidity cell test was conducted over a 96-week period with effluent pH being alkaline during the duration of the test, an oxidizing redox potential, minimal iron and sulfate release, and acidity not detected in any weekly extract. During the first 2 weeks of the test, cadmium, copper, lead, manganese, mercury and silver were detected above their respective surface water standard. Between weeks 3 and 20, copper, lead, and manganese were detected above their respective surface water standard. At week 24, copper and manganese were detected above their respective surface water standard and arsenic was detected above both the groundwater and surface water standard. Based on the arsenic concentration of 0.013 mg/L detected at week 24, the test was resumed after having been stopped at week 20. Arsenic varied cyclically, with modest increases to concentrations below the surface water and groundwater standard of 0.010 mg/L followed by drops to concentrations at or near detection (0.001 mg/L). Following week 52, the arsenic concentration stabilized between 0.001 and 0.003 mg/L up to the termination of the test at week 96. Between week 24 and 46, except for arsenic, no metals were analyzed in the effluent. From week 46 to week 96, aluminum was the only metal detected above its respective surface water standard. Enviromin (2013a) details the Rock Creek tailings humidity cell test.

To better understand the arsenic detections, a mineral liberation analysis using electron microscopy/energy dispersive spectroscopy of non-weathered Rock Creek tailings and the weathered tailings sample from week 53 of the humidity cell test (Enviromin 2013a). The arsenic-bearing minerals arsenopyrite, tennantite, and scorodite were identified in the non-weathered samples at concentrations less than 0.01 weight percent but were not found in the weathered sample. Although the arsenic-bearing minerals are relatively low in abundance, they are sufficient enough to produce measureable changes in effluent arsenic concentrations.

Metal Content. Tailings have significantly reduced copper, silver, and sulfide concentrations (Table 88), but otherwise comparable to that reported for ore. Multi-element analyses of the tailings were reported in detail by Maxim Technologies (2003) for Rock Creek.

Metal Release Potential. No metal mobility tests of Montanore tailings were conducted. SPLP testing of tailings from Troy indicates that tailings seepage would not yield highly elevated metal-enriched leachate, although the metals arsenic, barium, copper, iron, and lead were detected at low concentrations (Golder 1996; Table 91). TCLP analyses of Troy tailings from the Golder study of paste technology indicated potential for higher concentrations of barium, copper, and lead to exceed groundwater standards, and for zinc to exceed aquatic standards, presumably due to the more strongly acidic character of the test. Analysis of tailings liquids obtained in bench scale flotation tests of Rock Creek ore indicated a similar suite of detectable total recoverable aluminum, cadmium, copper, iron, lead, manganese, and silver (ASARCO 1992).

In situ Monitoring. Nutrient loading has been associated historically with the tailings impoundment at Troy. In the Troy decant pond, nitrate plus nitrite and ammonia were detected in the majority of samples collected. Following the restart of mining activities in the late 2005, nitrate plus nitrite concentrations ranged from 5.7 to 37.5 mg/L and ammonia concentrations ranged from 0.39 to 10.4 mg/L (Table 93).

Table 93. Troy Decant Pond Water Quality 2006-2010.

Parameter	N	n-BDL	Minimum Detected	Maximum Detected	Representative Concentration
pH, s.u.	17	0	7.1	8	7.8
Ammonia, mg/L	18	0	0.39	10.4	4.4
Nitrate/Nitrite, mg/L	17	0	5.71	37.5	13
Aluminum, mg/L	6	4	0.12	0.18	<0.13
Antimony, mg/L	8	0	0.0080	0.062	0.023
Arsenic, mg/L	8	4	0.0013	0.0020	<0.0017
Cadmium, mg/L	7	4	0.00091	0.00126	<0.00097
Copper, mg/L	8	0	0.006	0.043	0.026
Iron, mg/L	8	0	0.010	0.38	0.050
Lead, mg/L	7	5	0.0026	0.010	<0.0030
Manganese, mg/L	8	0	0.101	0.791	0.51
Silver, mg/L	8	8	-	-	<0.0018
Zinc, mg/L	8	6	0.006	0.02	<0.010

n = Number of samples; n-BDL = Number of samples with concentrations below the detection limit; s.u. = standard units; mg/L = milligrams per liter.
< = one or more below detection values were included in the representative concentration determination
Metals data based on dissolved sample fraction.
Additional data discussion provided in Appendix K-7.
Source: Hydrometrics 2013.

Summary. A comparison of the various laboratory test results with the chemistry of water measured in the Troy tailings decant pond supports the conclusion that any water affected by tailings during operations would have neutral pH, with low but detectable concentrations of metals. The suite of metals detected in metal mobility and kinetic humidity cell leach tests of tailings agree well with those observed in the Troy impoundment.

The potential for changes in metal concentration, as observed in tailings water and monitored groundwater below the Troy impoundment, would be the same for the Montanore tailings impoundment. MMC would collect tailings seepage using pumpback wells, returning it to the impoundment followed by treatment, during operations and at closure, until it met BHES Order limits or applicable nondegradation criteria in receiving waters.

As additional ore samples became available for metallurgical testing during final exploration and early operations, a more representative tailings sample would be tested. Additional testing of acid generation and metal release potential would be required to supplement available test data and long-term monitoring data from the Troy tailings impoundment. In particular, future analysis would address any preferential concentration of reactive minerals (such as pyrite) due to use of a cyclone to separate coarse and fine fractions. This would allow any necessary modification of planned treatment for tailings decant water before the start of processing. Any analyses based on pilot scale metallurgical tests would be more consistent than is expected under processing plant conditions, where variations in efficiency and recovery are not only anticipated but documented daily. Such operational monitoring can be used to check for changes in sulfide content of tailings as well.

Chart 8. Metal Concentrations, Rock Creek Tailings Composite Humidity Cell Test.

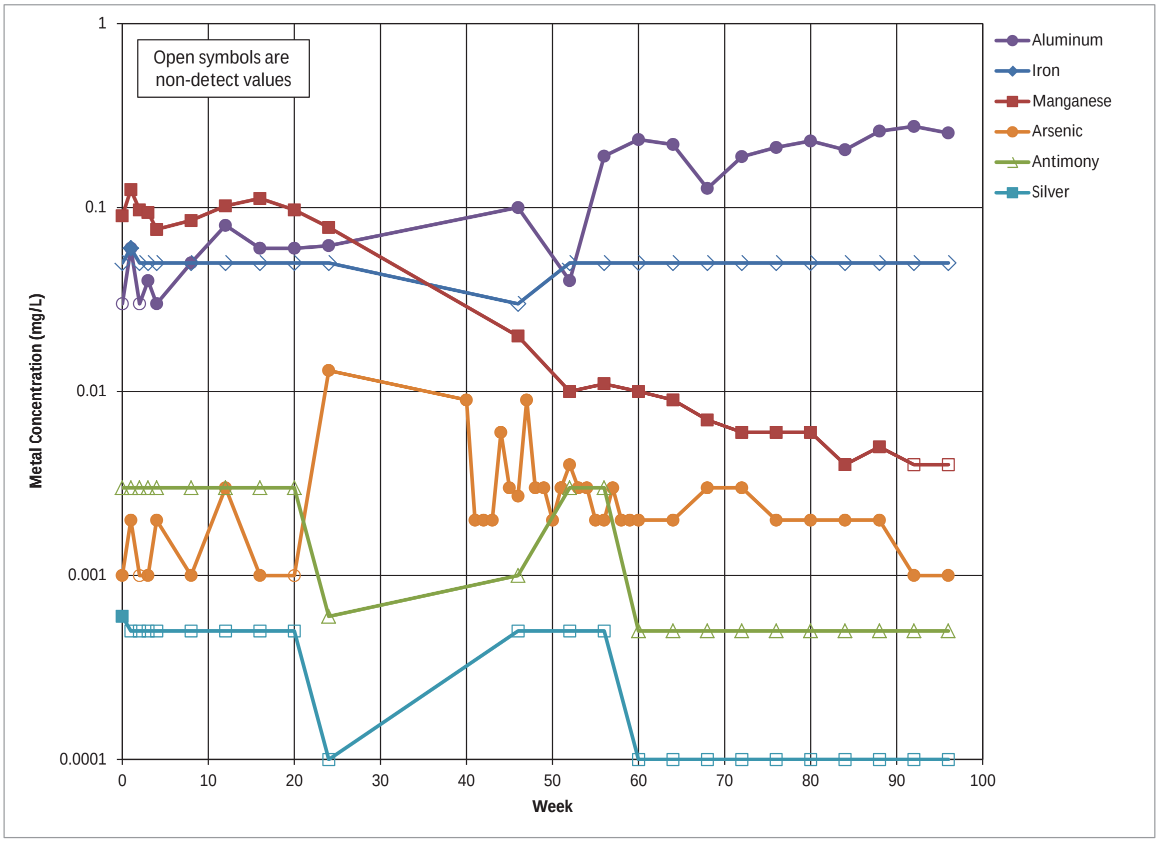
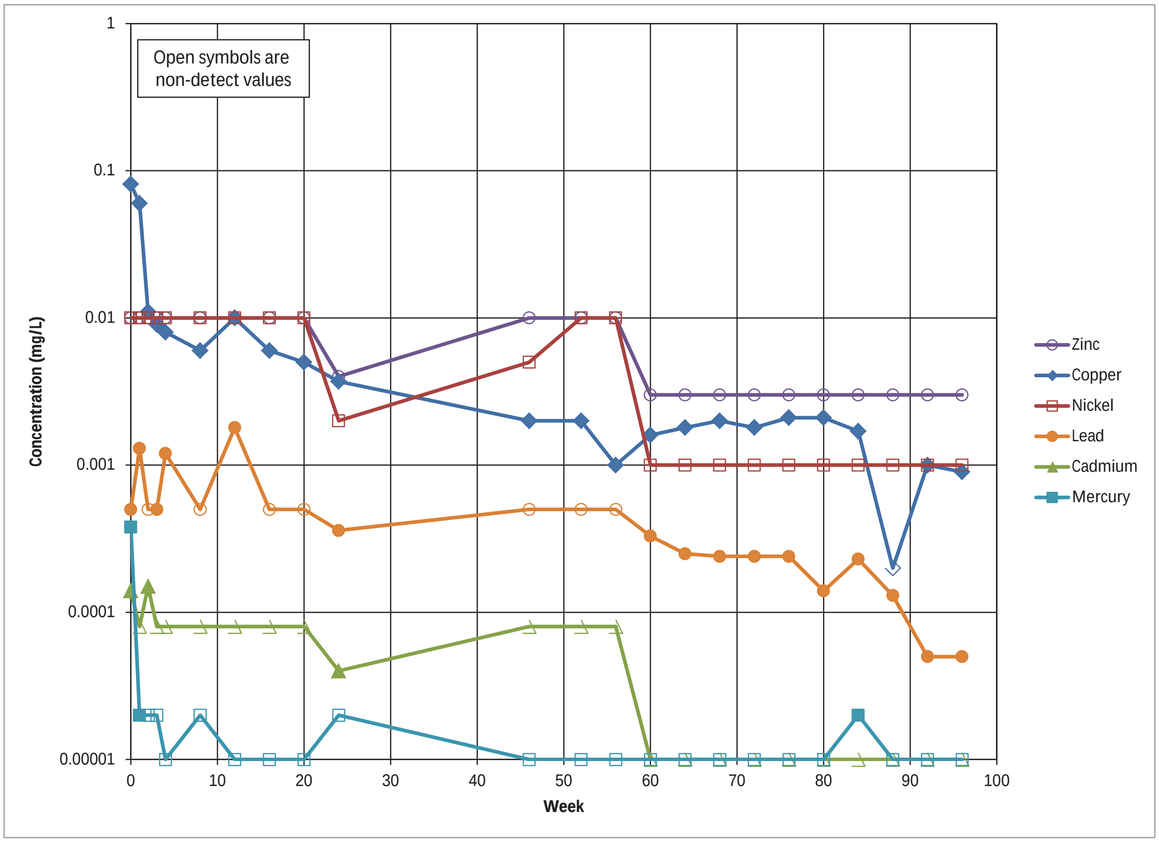


Chart 9. Metal Concentrations, Rock Creek Tailings Composite Humidity Cell Test.



3.9.4.3.3 Mine Area – Waste Rock in Surface Facilities and Backfill

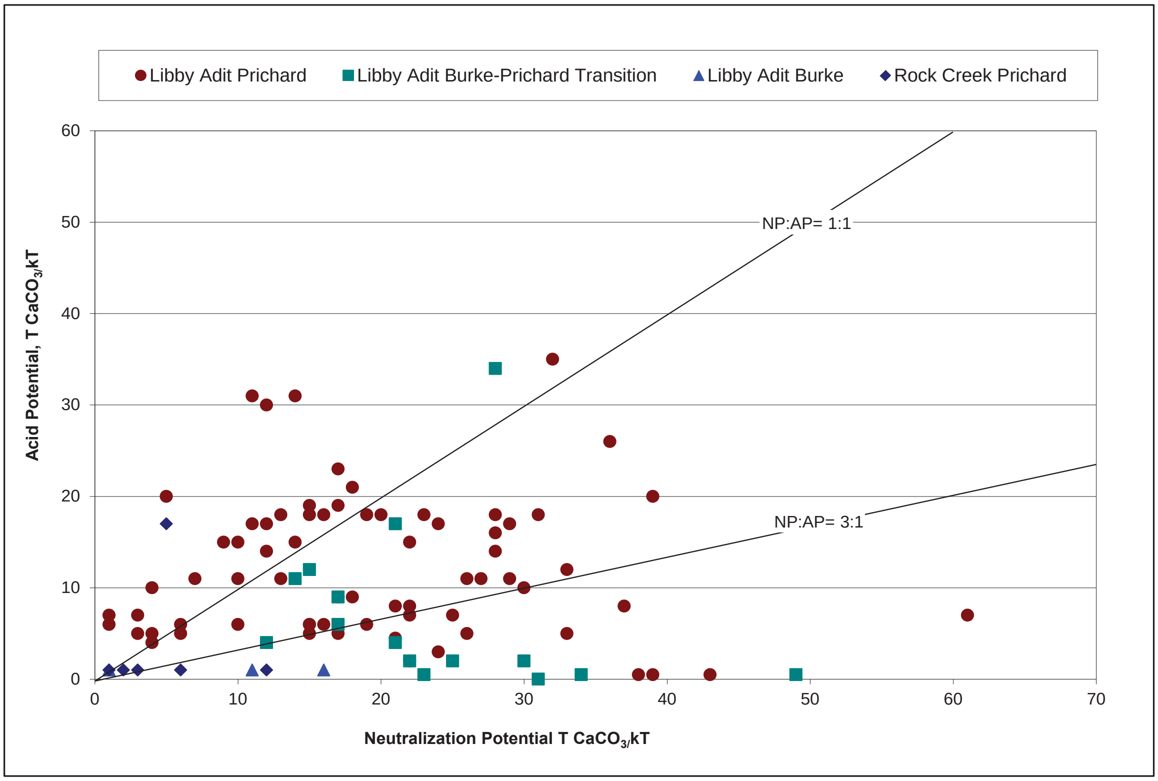
According to MMC, 3.9 million tons (MT) of waste rock would be generated by the Montanore Project throughout mine life (Geomatrix 2007a; Table 21 in Chapter 2). MMC estimates that, in addition to the 0.42 MT of Prichard and Burke already on the pad at the Libby Adit, 0.54 MT of combined Revett waste rock would be produced during the Evaluation Phase. Another 2.25 MT of waste rock would be produced during construction, from the Prichard Formation (1.16 MT), the Burke Formation (0.15 MT), and the lower Revett Formations (0.93 MT). Another 0.68 MT of rock would be mined from the Revett Formation as waste rock during mining operations. About 75 percent of this rock would be used for tailings impoundment dam construction, with the remaining 25 percent used underground as backfill. Waste rock also would be used to construct portal patios and the plant site in Alternative 2. Waste rock used for construction would be stockpiled temporarily at LAD Area 1 in Alternative 2 (or within the footprint of the tailings impoundment under Alternatives 3 and 4) along with ore produced during development work. A detailed description of waste rock production, and MMC's proposed handling, placement, and management is provided in MMC's waste rock management plan (Geomatrix 2007a) and summarized in the Geochemistry Sampling and Analysis Plan provided in Appendix C.

The first waste rock (0.5 MT) to be produced would come from the Burke and lower Revett Formations, where they would be exposed in the Libby Adit. Waste rock from the zones of the lower Revett Formation in these workings would presumably include rock from the chalcopyrite-calcite and pyrite-calcite altered waste zones, as well as the galena-calcite zone (barren lead zone), although the proposed mining method would minimize production in the barren lead zone operationally. The exact thickness of the altered waste zones has not yet been described and their relative tonnage is unknown. About 1.2 MT of additional waste rock would be mined from the Prichard, Burke and Wallace Formations during construction of the Ramsey Adits, which may have variable mineralogy and chemistry between the Rock Creek-Montanore and Troy deposits. Six geologically distinct units would therefore be mined as waste rock, assuming three altered waste zones within the Revett Formation and one each from the remaining formations, which are listed above. An estimated 0.95 MT of lower Revett Formation waste rock would be generated during preproduction development. Much of this rock would be used for constructing portions of the tailings dam. Of this rock, 0.14 MT would be produced from the barren lead zone, which would be placed on a lined facility or as backfill. Remaining waste rock would remain underground in mined-out areas (Geomatrix 2007a).

Of the three Montana Revett-style mine projects, the majority of waste rock characterization was completed for the Montanore Project. Most data for the Prichard and Burke Formations are from data collected for the 1992 Montanore Project Final EIS from the Libby Adit (USDA Forest Service *et al.* 1992). A total of 155 acid base account analyses have been reported as shown in Table 89. A smaller number of waste rock samples (n=24) also were characterized for the Rock Creek sub-deposit, which included 10 samples of lower Revett, 2 samples of upper/middle Revett, and 6 samples each of the Prichard and St. Regis. Two composites of waste rock from the Revett Formation, one from the C-bed and one from the H-bed, have been characterized for acid generation potential, metal content, and SPLP at Troy (Enviromin 2009 and 2012).

Prichard and Burke Formations Waste Rock. ABP data comparing Prichard and Burke waste samples from Montanore Libby Adit are shown in Chart 10. The ABP reported for the Prichard at Rock Creek (n=6) is 2 T $CaCO_3$/kT with a NP/AP ratio of 4.0. Acid generation and neutralization potential data for 89 samples of Prichard and Burke formations waste rock from the Libby Adit at Montanore (Chart 6) suggest these waste rock lithologies have variable potential to generate acid and release trace elements at a near-neutral pH. The Prichard Formation ABP varies from -20 to 54 T $CaCO_3$/kT (NP:AP 0.1 to 43), with an average of 7 T $CaCO_3$/kT (NP/AP 3.7) for 70 samples. The Burke Formation (which in this summary includes the Burke-Prichard transition zone) has an ABP that varies from -6 to 49 T $CaCO_3$/kT (NP:AP 0 to 49), with an average ABP of 15 T $CaCO_3$/kT (average NP/AP equals 12) for 19 samples. The Burke and the Prichard at Rock Creek appear to have low potential for acid generation based on these data, while the more extensive sample population from the Prichard at Montanore indicates a range of acid generation potential, with the majority of samples having uncertain or potential to generate acid based on static tests. More detailed analysis of these data is provided in a geochemistry technical summary report (Enviromin 2013b).

Chart 10. Acid Generation Potential of Waste Rock, Libby Adit, Montanore.



Two humidity cell tests of Prichard Formation waste rock from the Montanore sub-deposit were reported by Schafer and Associates (1992) and are summarized by Geomatrix in Tables B-1, B-2, and B-3 (Geomatrix 2007a). One sample of Prichard Formation waste rock had a moderately low ABP value of -2 T $CaCO_3$/kT, while the second had a higher ABP of 18 T $CaCO_3$/kT. Although pH of effluent started at about pH 7 for both cells, final pH was 6.9 with low conductivity and sulfate concentrations for both cells. The humidity cell test with lower ABP produced more sulfate over the life of the test, along with higher acidity which exceeded alkalinity late in the week 20 of the 20-week test.

These kinetic test data, which do not indicate acid generation from the Prichard Formation, agree with the monitoring data from the Libby Adit, where sulfide oxidation does not appear to be occurring in the exposed portions of the Prichard and Burke Formations within the Libby Adit after 20 years of monitoring (ERO Resources Corp. 2011c). Sulfate concentrations reported in 1997, 1998, and 2007 were less than 23 mg/L, indicating that few reactive sulfides are oxidizing to form sulfate. The average pH in the Libby Adit water has remained consistently neutral. In 1993, the reported pH was 7.7, while in 1997 pH ranged from 6.6 to 7.9 and averaged 7.4. In 1998, pH ranged from 7 to 8.6 and averaged 7.6. Elevated nitrate concentrations and two low mercury concentrations in 1997 decreased to near background concentrations or were not detected in 1998. Together with the humidity cell data, these *in situ* data suggest that static tests may over-predict acid generation potential for the Prichard Formation.

Apart from the kinetic work, there are no metal mobility tests of waste rock samples from the Prichard and Burke Formations for the Montanore sub-deposit. Metal concentrations in humidity cell effluent for two tests of the Prichard Formation waste rock from Montanore showed low, but detectable concentrations of arsenic, iron, manganese, and zinc (Schafer and Associates, 1992). Occasional low concentrations of iron, manganese, and zinc were detected in Libby Adit water during 1997 and 1998 (ERO Resources Corp. 2011c). Low dissolved metal concentrations were also measured in Libby Adit water collected in 2007.

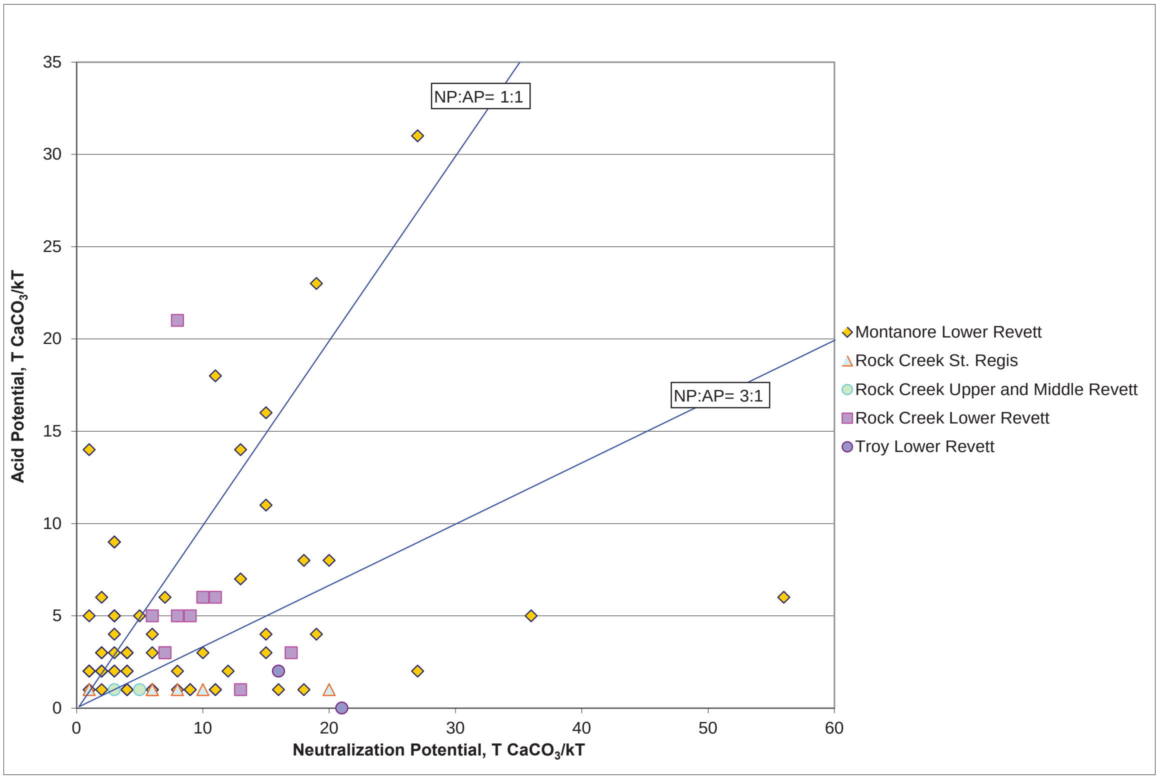
Prichard and Burke waste rock was stockpiled on the portal pad outside the Libby Adit, and MMC has monitored the quality of water collected in the sump at that location. Elevated concentrations of nitrate and ammonia were detected immediately following placement of this rock, and the concentrations dropped substantially since that time (Table 94). Metals were also detected in water collected from the waste rock sump include aluminum, antimony, arsenic, copper, lead, and manganese, a portion of which exceeded relevant surface water standards (ERO Resources Corp. 2011c).

Due to the moderate acid generation potential in some static tests of acid base potential, as well as the need for more complete analysis of metal release potential, the agencies would require additional sampling and analysis during the Evaluation and Construction Phases. This sampling and analysis would support kinetic testing of the Prichard to confirm previous results and updated metal mobility characterization of both the Prichard and Burke formations, as discussed in Appendix C. Samples of the silty carbonate-rich Wallace Formation, which has not been characterized in terms of acid generation or trace metal release potential, would be obtained for testing during adit construction.

Lower Revett Formation Waste Rock. Whole rock data for three representative samples from the lower Revett Formation waste rock and an average for three samples collected from the Rock Creek waste rock (analysis by previous unknown method) are summarized by Geomatrix (2007a). Whole rock data are presented for 14 additional samples of Revett Formation waste rock from the Rock Creek sub-deposit by Maxim Technologies (2003). These samples are variably enriched in copper, iron, lead, and zinc, depending upon style of alteration.

ABP data comparing Lower Revett waste samples from Montanore, Rock Creek, and Troy are shown in Chart 11. At Montanore, average acid base potential for waste rock in the lower Revett Formation ranges from 3 to 60 T $CaCO_3$/kT with NP/AP values ranging from 2.2 to 4.6 (Chart 11). The average ABP for the lower Revett Formation waste rock at Montanore was 4, with an NP/AP ratio of 3 for 72 samples. Because of the silica encapsulation of sulfide minerals within the Revett quartzite, static numbers are most likely conservative in estimating the true acid generation potential of the rock. Additional ABP analyses of composites of lower Revett Formation waste rock are described by Geomatrix (2007a).

Chart 11. Acid Generation Potential of Revett Waste Rock.



Metal mobility for samples of Revett Formation waste rock was evaluated using multiple test methods. The DEQ collected and analyzed 10 additional samples of waste rock from the Rock Creek sub-deposit (DEQ 1996). Half of these samples fall into the uncertain range based on NP/AP criteria ((acid <1; 1:3 uncertain; >3 non-acid), and all of the samples fall into that category based on ABP (acid < - 20; -20 to 20 uncertain; > + 20 non-acid) criteria. The non-sulfate sulfur concentration (which, effectively, represents the total concentration of sulfur in this very low sulfate rock) is low, ranging from 0.01 to 0.20 weight percent and averaging less than 0.1 percent in the 10 samples collected by DEQ.

During a third-party geochemical review of the Rock Creek Project funded by the Forest Service, analyses of acid generation potential, whole rock metal content, and metal release potential were conducted to supplement the analyses originally provided for samples of waste rock from the Revett Formation (Maxim Technologies 2003). As shown in Table 89; these samples have an average ABP of 4 T $CaCO_3$/kT, with an NP/AP ratio of 5. A summary table comparing waste rock from the Rock Creek and Montanore sub-deposits is provided as Table A-7 by Geomatrix (2007a). The data illustrate the strong similarity in acid base potential and NP/AP ratios for waste rock to be mined from the two projects proposed for development within the Rock Creek-Montanore deposit. A portion of the rock to be mined from the lower Revett has potential to generate acid, based on static tests, which would be further evaluated during the Evaluation Phase of the project.

Humidity cell tests of two samples of Revett Formation waste rock from Montanore also were reported by Schafer and Associates (1992). These represent the hanging wall (with an ABP of -15 T $CaCO_3$/kT) and the barren lead zone (with an ABP of -1 T $CaCO_3$/kT). The hanging wall sample showed low sulfate release with an ending pH over 8, while the barren lead zone was consistently lower at pH 6. Both tests showed rates of acid production that exceeded alkalinity throughout the test and data indicate that these rocks, particularly the barren lead zone, have potential to generate acid. These samples had low but detectable concentrations of copper and manganese. The lead-rich barren zone also produced elevated concentrations of lead and zinc. Portions of the barren zone have elevated concentrations of lead, and soluble copper and lead also were detected in weak-acid extracted samples of the lower Revett Formation. The suite of trace elements run for these samples was limited and should be expanded during operational validation, by testing for a more complete suite of regulated trace elements.

Composites of lower Revett waste rock from the C and H beds at Troy contained 0.04 and 0.05 weight percent sulfur, respectively. These samples had an average ABP of 17 T $CaCO_3$/kT and an NP/AP ratio of 8. SPLP tests of these samples indicated potential for release of copper, iron, lead, and manganese (Table 91) at concentrations exceeding groundwater and surface water standards.

Three TCLP analyses of Revett waste composited from samples of footwall, hanging wall, and barren lead zone waste rock were reported by ASARCO in the 1992 Montanore Project Final EIS. Results shown in Table 91 indicate potential release of copper, iron, and lead from Revett waste rock. These results are similar to results reported for the SPLP (EPA method 1312), and TCLP (EPA method 1311) metal mobility tests that were completed for the 14 Rock Creek waste rock samples described above (as reported by Maxim Technologies 2003 in Enviromin 2013b) (Table 89 and Table 91). Apart from calcium and magnesium, no metals were detected in SPLP extracts of the waste rock.

Concentrations of copper and lead in the waste rock were detected in the more strongly acidic TCLP extractions, although at considerably lower concentrations than reported for the ore zone. Iron was also detected at a relatively high concentration (up to 29 mg/L) in the TCLP extraction (buffered pH 5 organic acid). In contrast, of the unbuffered SPLP analyses of the same waste rock, only one had a detectable iron concentration of 0.2 mg/L, well below the applicable standard. This indicates that the TCLP, a test designed for the identification of hazardous wastes rather than measurement of metal mobility, overestimates potential metal mobility.

In the Troy Mine, the overlying galena zone and the pyrite zone were not mined and are therefore not exposed in the workings, due to site-specific geological factors influencing mine facility design. Undisturbed, these zones are not creating acid rock conditions, as samples of the underground mine water following seepage through these zones consistently show neutral to slightly alkaline pH values between 7.2 to 7.4. The Troy Mine has modestly elevated levels of metals and nutrients at near-neutral pH. None of the lower Revett rock was exposed in the Libby Adit, so it is not possible to evaluate its weathering chemistry using those monitoring data.

In situ measurements of the nutrients ammonia, nitrate, and nitrite illustrate how nutrient release has been associated with prior mining of waste rock. At Montanore, in the Libby Adit, waste rock has been exposed following blasting for almost 20 years. In water quality data reported following limited blasting for sumps in 2008, concentrations were highest immediately after blasting and declined significantly during the following year to concentrations near background concentrations. A summary of ammonia, nitrate and nitrite data from samples collected in the Libby Adit Water Treatment Plant inflow, Libby Adit Waste Rock Sump, and groundwater beneath the Libby Adit is shown in Table 94. The highest nutrient data were collected from Libby Adit Waste Rock Sump located outside the Libby Adit where waste rock was stockpiled on a liner while nutrient concentrations were low in groundwater beneath the Libby Adit, as a result of the containment provided by the lined pad (Table 94). The waste rock sump samples represent a small volume of waste rock excavated from the existing Libby Adit when MMC began dewatering the adit. Water samples from the waste rock sump were collected from 2008 through 2012. After initially high ammonia and nitrate plus nitrite concentrations were measured, water samples from the waste rock sump were collected at an increased frequency, with 6 nitrate plus nitrite samples and 10 ammonia samples collected during the month of October 2008. During that time, ammonia and nitrate plus nitrite concentrations were at their peak, ranging from 1.47 to 12.1 mg/L for ammonia and from 118 to 419 mg/L for nitrate plus nitrite. Sampling was decreased in frequency the following month to only three sample events, and the ammonia decreased to a low of 0.64 mg/L and nitrate plus nitrite concentration decreased to a low of 21.7 mg/L. From 2009 to 2012, ammonia concentrations averaged about 0.05 mg/L and nitrate plus nitrite concentrations averaged about 0.9 mg/L and sample frequency was reduced to about monthly. Emulsions were not used by MMC during the blasting that created the waste rock.

Table 94. Nutrients Measured in Water Samples from Libby Adit and Associated Waste Rock Sump.

Facility	Variable	Ammonia (mg/L)	Nitrate (mg/L)	Nitrite (mg/L)	Nitrate + Nitrite (mg/L)
Libby Adit Untreated Water[1]	# of Samples	69	58	57	60
	# of Detections	17	50	14	60
	Minimum Detected	0.010	0.015	0.00080	0.017
	Maximum Detected	0.566	2.73	1.6	2.73
	Representative Concentration	<0.050	<0.12	<0.010	0.045
Libby Adit Waste Rock Sump[2]	# of Samples	50	48	48	40
	# of Detections	32	39	24	39
	Minimum Detected	0.010	0.0096	0.0026	0.010
	Maximum Detected	21.9	687	40	419
	Representative Concentration	<1.8	<87	<2.5	<54
Libby Adit Groundwater[3]	# of Samples	120	120	122	101
	# of Detections	26	102	13	99
	Minimum Detected	0.010	0.020	0.00050	0.020
	Maximum Detected	0.549	1.6	0.444	1.6
	Representative Concentration	<0.040	<0.16	<0.010	<0.17

[1]Additional data discussion provided in Appendix K-6.
[2]Additional data discussion provided in Appendix K-10.
[3]Additional data discussion provided in Appendix K-4.
Source: MMC 2008, 2009b, 2010, 2011b, 2012g, 2013.

Waste Rock Summary. The majority of waste rock would be produced from the Prichard and Revett formations, portions of which have an uncertain potential to generate acid, as well as potential to release metals including arsenic. For this reason, these rocks require further characterization during the Evaluation Phase, as described in Appendix C. The Burke Formation has low potential to generate acid, but little is known about its potential to release metals. The

Burke Formation would be evaluated during the Evaluation Phase of the project, as discussed in Appendix C.

3.9.4.3.4 Geochemistry Summary

The risk of acid generation for rock exposed in underground workings or tailings at Montanore would be low, with some potential for release of select metals under near-neutral pH and release of nitrate due to blasting. Low acid generation potential exists for some of the waste rock from the Prichard Formation, with moderate potential suggested by static tests for a portion of this rock. *In situ* monitoring of Prichard Formation, where it is exposed underground in the Libby Adit, does not support acid drainage risk. Moderate potential for ARD exists within the altered waste zones of the Revett Formation (particularly of the barren lead zone), which MMC proposes to mitigate through selective handling and backfilling of underground workings. It is likely that the volume of rock to be produced from the Revett altered waste zones would be very small. Further sampling and analysis of weathering characteristics for Prichard and Revett waste rock would allow refinement of the waste rock management plan, and additional detail on trace metal release potential of tailings would guide water treatment design. Results of Evaluation and Operations Phase testing would be used for long-term predictions of water quality for closure design. Criteria to be used for evaluation of individual sample results include comparison of whole rock analyses with standard crustal abundance for elements of concern and comparison of metal mobility results with water quality standards.

3.9.4.4 Irreversible and Irretrievable Commitments

Up to 120 million tons of ore would be removed by the Montanore Project, with the remainder of the ore body left for structural support of the mine workings. The future recovery of the remaining metals left for structural support would be unlikely.

3.10 Groundwater Hydrology

Groundwater occurs in fractures of the bedrock formations beneath the analysis area and in unconsolidated glacial and alluvial sediments along and adjacent to drainages throughout the analysis area. Although hydraulically connected in many areas, the two water-bearing geologic materials behave differently because of their respective hydraulic characteristics. Conceptual and numerical models (as defined in section 3.10.3.1.2, *Conceptual Hydrogeological Model of the Montanore Mine Area*) of the mine area hydrogeology have been developed to understand the characteristics of the groundwater flow system and evaluate potential impacts of the proposed project on the environment.

3.10.1 Regulatory Framework

The Organic Administration Act authorizes the Forest Service to regulate the occupancy and use of National Forest System lands. The Forest Service's locatable minerals regulations are promulgated at 36 CFR 228, Subpart A. The regulations apply to operations conducted under the U.S. mining laws as they affect surface resources on National Forest System lands under the jurisdiction of the Secretary of Agriculture. One of the mineral regulations (36 CFR 228.8) requires that mining activity be conducted, where feasible, to minimize adverse environmental impacts on National Forest surface resources. All waters within the boundaries of National Forests may be used for domestic, mining, or irrigation purposes, under applicable state laws. 36 CFR 228.8(h) states that "certification or other approval issued by state agencies or other federal agencies of compliance with laws and regulations relating to mining operations will be accepted as compliance with similar or parallel requirements of these regulations."

The Wilderness Act allows mineral exploration and development under the General Mining Law to occur in wilderness to the same extent as before the Wilderness Act until December 31, 1983, when the Wilderness Act withdrew the CMW from mineral entry, subject to valid and existing rights. 36 CFR 228.15 provides direction for operations within the National Forest Wilderness. Holders of validly existing mining claims within the National Forest Wilderness are accorded the rights provided by the U.S. mining laws and must comply with the Forest Service Locatable Minerals Regulations (36 CFR 228, Subpart A). Mineral operations in the National Forest Wilderness are to be conducted to protect the surface resources in accordance with the general purpose of maintaining the wilderness unimpaired for future use and enjoyment as wilderness and to preserve the wilderness character consistent with the use of the land for mineral development and production.

The DEQ is responsible for administering several water quality statutes, including the Public Water Supply Act, Montana Water Quality Act, and the Montana Water Use Act. Water quality is discussed in detail in section 3.13, *Water Quality*.

3.10.2 Analysis Area and Methods

3.10.2.1 Analysis Area

The groundwater analysis area includes all areas around the proposed mine facilities: mine, adits, LAD Areas, and tailings impoundment sites. The transmission line, the proposed Sedlak Park Substation, and the loop line area would not affect groundwater and is not discussed further in this section. The groundwater analysis area includes a large area around the facilities, bounded by

US 2 to the east, Bull River and Clark Fork River on the west and southwest, Big Cherry Creek to the north, and Silver Butte Fisher River to the southeast. The analysis area is depicted in Figure 67.

3.10.2.2 Baseline Data Collection

Limited bedrock groundwater observations were noted in the area overlying the ore body during an exploration drilling program in the 1980s. Exploration data included observations of groundwater and depth to water in a limited number of core holes that encountered groundwater. NMC collected additional bedrock groundwater data between 1990 and 1998, before sealing the Libby Adit. The adit data included water discharge records, detailed descriptions of fractures and faults intersecting the adit, and groundwater quality (Geomatrix 2011a; MMC 2008, 2009b, 2010, 2011b, 2012g, 2013). In December 2008, MMC dewatered the Libby Adit to the 7200-foot level and began collecting periodic adit groundwater inflow data. The “7200 foot level” is defined as 7,200 feet along the adit from the portal. MMC completed seven hydraulic tests in the Libby Adit between September and November of 2009 to characterize the hydraulic properties of underground fracture systems (Geomatrix 2011a). In late 2010, MMC began to continuously record hydraulic head data in one of the piezometers located at the 5200 foot level, and reported the data for 1 year. MMC completed a GDE surveys in the mine area between 2009 and 2013 and continued monitoring of the GDEs in 2010 through 2013 (Geomatrix 2009a, 2010b, 2011b; NewFields 2013a, MMC 2014d). Selected water samples for isotope analyses were collected by MMC and DEQ since 2010, and by Gurrieri (2001) in 1999 (Gurrieri 2013).

Considerable groundwater data were collected at the Little Cherry Creek Tailings Impoundment site, including distribution of groundwater heads, aquifer characteristics of the various hydrostratigraphic units, and water quality (Geomatrix 2006c). Eight monitoring wells, and several test pits were installed in the area of the proposed Poorman Tailings Impoundment in 1988 (Chen-Northern 1989). The data were used to define groundwater flow direction and subsurface geology; four wells were tested to determine hydraulic conductivity. This information was supplemented with a resistivity survey to determine depth to bedrock beneath the surficial deposits.

The basic hydrogeology data are representative of current conditions, based on comparison of pre-2003 and 2005 data to the current conditions. Although depth to groundwater may have changed slightly due to seasonality or changing climate cycles, the fundamental direction of groundwater flow has not changed. The aquifer characteristics measured in the 1980s and 1990s are not expected to change within the timeframe of the project.

3.10.2.3 Impact Analysis

For each alternative, an impact analysis was conducted for groundwater hydrology during five phases of mine life—evaluation, construction, operations, closure, and post-closure, as defined in section 3.8.2, *Project Water Balance, Potential Discharges, and Impact Assessment Locations.*

3.10.2.3.1 Mine Area Groundwater Hydrologic Models

Because bedrock groundwater hydrology data from the proposed mine area are limited, the agencies relied on two separate numerical groundwater models to evaluate and refine the site conceptual model and to evaluate potential hydrology impacts. A hydrogeology committee consisting of representatives from the KNF, DEQ, MMC, and ERO Resources Corp., the agencies’ EIS contractor, was established to guide the development of the agencies’ 2-

dimensional (2D) numerical model. The results of the agencies' 2D model were provided in the Draft EIS (USDA Forest Service and DEQ 2009). Subsequently, MMC prepared a more complex and comprehensive 3D model of the same analysis area. The results of both models were used to evaluate the site hydrogeology and analyze potential impacts due to mining. Although the results of the two models were similar, the 3D model provides a more detailed analysis, by incorporating known or suspected fault behavior with respect to hydrology; more recent underground hydraulic testing results; a more comprehensive calibration process, and better simulation of vertical hydraulic characteristics of the geologic formations to be encountered during the mining process. A complete description of the agencies' 2D model, including assumptions, results, and calibration is provided in a *Final Hydrogeology Technical Report* (ERO Resources Corp. 2009). A complete description of the 3D model is provided in Geomatrix (2011a). A second, site-specific, 3D model was used by MMC to analyze potential pumping rates and tailings seepage capture for the pumpback well system that would be located below the Poorman Tailings Impoundment.

For the purpose of analyzing the effects of possible mitigations, MMC simulated two options: grouting, during Operations Phase, of the sides of the three uppermost mine blocks and corresponding access ramps, as well as installing two bulkheads in two mining blocks in the mine at Closure. Geomatrix (2011a) describes the specific assumptions regarding how the mitigations were simulated. The agencies considered the modeling of the bulkheads to be an equivalent simulation of the agencies' mitigation of leaving a barrier, if necessary, during the Operations Phase and constructing bulkheads at the access openings at closure. The effectiveness of MMC's modeled mitigation is discussed in section 3.10.4.3.6, *Effectiveness of Agencies' Proposed Monitoring and Mitigation*. The following discussion describes the predicted baseflow reductions for each of the drainages with and without MMC's modeled mitigation. MMC also completed two additional model runs to simulate grouting along the ceilings of the mine workings and along the ceilings and walls of the adits. The agencies did not use these additional model runs because of concerns about technical feasibility, long-term effectiveness of extensive grouting of a room-and-pillar mine, and the nature of the model simulation. Effects presented with MMC's modeled mitigation do not include mitigation measures not provided in MMC's 3D model report such as increasing buffer zones or using multiple plugs in the adits during closure. Such mitigation would be evaluated after additional data were collected during the Evaluation Phase.

3.10.2.3.2 Tailings Impoundment Areas Groundwater Hydrology

MMC developed a groundwater model of the Little Cherry Creek watershed using a 2D finite element program, SEEP/W (Klohn Crippen 2005). The SEEP/W program models mounding of the groundwater beneath water retention structures such as tailings impoundments and changes in pore-water conditions within earth slopes due to infiltration from the structures. The agencies independently performed a SEEP/W analysis, using the geologic and hydrologic model developed by MMC with various inputs (USDA Forest Service 2008). Because the geologic and hydrologic conditions at the Poorman Tailings Impoundment Site are similar to the Little Cherry Creek Tailings Impoundment Site, the agencies used the results from the Little Cherry Creek Tailings Impoundment Site SEEP/W analysis to assess potential seepage losses at the Poorman Tailings Impoundment Site. A SEEP/W analysis of the Poorman site would be completed during final design.

In addition to the seepage analysis, MMC evaluated a pumpback well system designed to capture all seepage from the tailings impoundment that would not otherwise be collected by the under-drain system (Geomatrix 2010c). The Poorman Impoundment in Alternative 3 was modeled. The analysis consisted of developing a 3D groundwater model that incorporated the known hydrogeologic characteristics of the Poorman Impoundment Site to provide a preliminary well field design capable of capturing all groundwater from beneath the impoundment site.

3.10.3 Affected Environment

3.10.3.1 Mine Area

3.10.3.1.1 Site Hydrogeology

Bedrock in the mine area consists of metamorphosed sediments known as the Belt Supergroup. The sediments were originally deposited as a series of muds, silts, and sands which were subsequently metamorphosed to argillites, siltites, and quartzites, respectively. The primary porosity and permeability (intergranular porosity and permeability) of the bedrock is very low. The primary hydraulic conductivity may be as low as 10^{-11} cm/sec (2.8 x 10^{-8} ft/day) with the primary effective porosity approaching zero (Stober and Bucher 2000). All bedrock units are fractured and faulted to various degrees, depending on proximity to large fault structures and depth. Fractures and faults result in secondary hydraulic conductivity and secondary porosity values that are much higher than primary hydraulic conductivity values. Secondary hydraulic conductivity may range from 10^{-4} to 10^{-6} cm/sec (0.0028 to 0.28 ft/day) (Gurrieri 2001). Various estimates of the bulk hydraulic conductivity (which considers both the primary and secondary hydraulic conductivities) have been made (Gurrieri 2001; Klohn Crippen 2005; Geomatrix 2006c).

The agencies' 2D numerical model of the site hydrogeology was calibrated using a bulk or average hydraulic conductivity of the bedrock in the mine area of 1 x 10^{-7} cm/sec (ERO Resources Corp. 2009). The 3D model domain was divided into seven vertical layers, each with decreasing hydraulic conductivity. For the layers above and below the ore body, the 3D model used bulk hydraulic conductivities of 2 x 10^{-7} to 6 x 10^{-8} cm/sec. The 3D model assigned hydraulic conductivities to specific formations and structures (Geomatrix 2011a). Within the area of the Libby Adit, the MMC model used specific hydraulic conductivity values for the fractured and unfractured rock, based on the hydraulic testing results from within the adit.

The Rock Lake Fault bounds the western side of the mine area and extends northwest and southeast through the mine area. The fault is a major structure with as much as 2,500 feet of vertical displacement (USGS 1981). The fault zone is 7 to 16 feet wide where exposed and contains strongly striated fine-grained breccia and clay gouge. The abundance of veins and fragmented wall rocks in the fault zone indicates the brittle nature of the fault. Filled extension gashes indicative of dilation across the fault zone are present as much as 165 feet from the main fault trace (Fillipone and Yin 1994). North of St. Paul Pass, 7 to 8 miles of the Rock Lake Fault is generally coincident with the drainage of the East Fork Bull River.

The two numerical groundwater models were used to explore the fault's role in the mine area hydrogeology. Various hydraulic conductivity values were assigned to the fault zone, as reported in ERO Resources Corp. (2009) and Geomatrix (2011a). The fault zone may contain areas of higher or lower hydraulic conductivities along its length. The 3D model was able to more definitively explore the conductance of groundwater along its length than the 2D model, specifically in the Rock Creek and East Fork Bull River drainages. The 3D model also included several other faults mapped within the Libby Adit (Figure 63). Both models used hydraulic conductivities for the faults higher than the surrounding rock and decreased hydraulic conductivity with depth. The hydraulic conductivity of fractures and joints tends to decrease with depth, due to confining pressures of the rock reducing the fracture apertures (Snow 1968). In brittle crystalline rock such as the Belt Supergroup, fracture apertures can be maintained to considerable depths. This was evidenced by inflows during the construction of the Libby Adit and also by reports of groundwater inflows from numerous deep hardrock mines around the world. This phenomenon is particularly true when the fractures are associated with large structures (Galloway 1977), such as the Rock Lake Fault.

As is typical for mountainous areas, the potentiometric surface generally follows topography. A water level contour map for the mine area cannot be constructed because water level data are limited. Available data and observations suggest a potentiometric surface exists within much of the mine area. For example, the depth to water was measured in a few of the exploration boreholes (HR-19 and HR-26) with a consistent water surface elevation of about 5,000 to 5,600 feet (Chen-Northern 1989). The depth to water in exploration boreholes adjacent to Rock Lake (HR-7, 8, 9, and 10) and St. Paul Lake (HR-29) was the same elevation as the lake (Chen-Northern 1989). Several borehole logs did not report a depth to groundwater or that groundwater was encountered.

NMC began Libby adit construction in February 1990 and ceased construction in November 1991. The adit is nearly 14,000 feet long; the first 700 feet were excavated in colluvium and the remainder in fractured bedrock, primarily the Prichard Formation. The initial 700 feet is nearly horizontal and the remainder of the adit declines at a 6 percent slope. NMC extensively grouted in advance of the face in portions of the adit, primarily in the first 5,000 feet of the Libby Adit. Between December 27, 1991 and January 4, 1992, NMC drilled ten boreholes into water-bearing zones in bedrock between PR3590 and PR12800, 3,590 and 12,800 feet from the portal, respectively (Table 95). The objectives of the borings were to characterize water-bearing zones and to identify a source of water for adit/mine construction. The two boreholes with highest flow rates were flow-tested for a minimum of 1 hour. Beyond about PR8000, the drilling did not identify any sources of water at distances of 84 to 168 feet from the adit. The water producing structures encountered in the first three boreholes listed in Table 95 were either not encountered by the adit or if encountered, the structures had different hydraulic characteristics so that less water was produced to the adit than measured in the piezometers. NMC also measured water pressure in the piezometers that produced water. The reported pressure readings do not include a narrative as to when the measurements were taken with respect to the flow testing.

MMC recorded some hydraulic pressures in piezometers at six locations in the Libby Adit between PR3110 and PR5220 in 2009 and 2010 (MMC 2012e). Pressures ranged from 123 feet at PR3110 to 427 feet at PR5220. MMC began recording hydraulic pressure in piezometer PR5220 on September 10, 2010, about 2 years after MMC began dewatering the Libby Adit. MMC reported pressure data through October 3, 2011. Although the pressure data represent pressure heads after the local potentiometric surface had been drawn down for about 2 years, and the data were reported for 1 year, the data provide information regarding the seasonal nature of the potentiometric surface and minimum pressure head elevations under dewatering conditions.

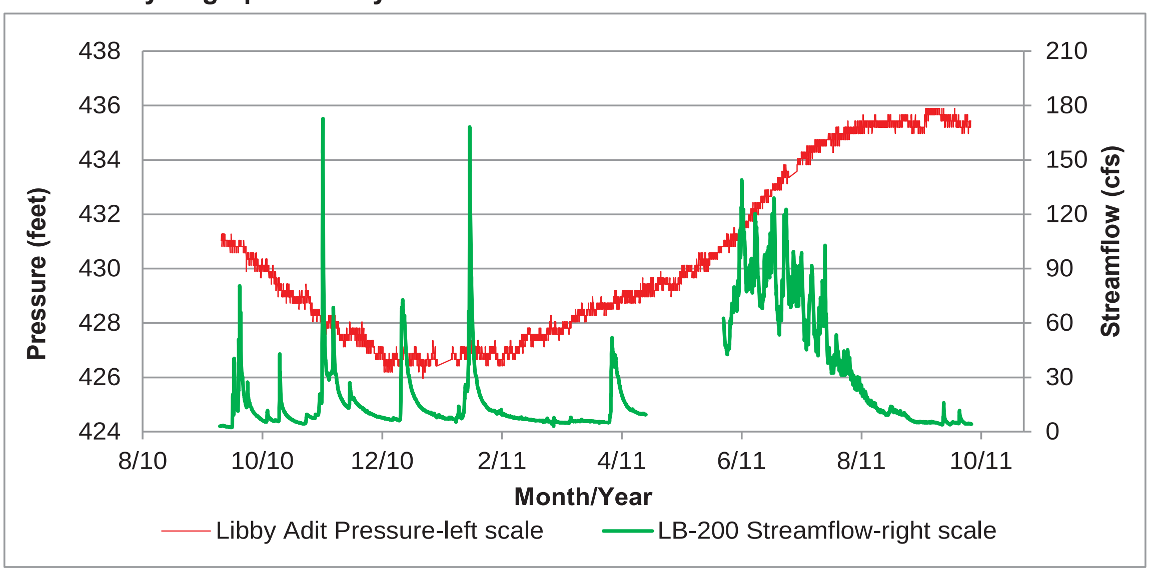
Table 95. Summary of NMC's Post-Construction Boreholes in Libby Adit.

Location	Approximate Date of Construction	Date of Test	Total Depth (feet)	Target	Inflow (gpm)
PR3590	6/90	12/91 to 1/92	92	Fault/fracture	60
MB5300	11/90	12/91 to 1/92	132	Fault	120
PR7945	3/91	12/91 to 1/92	104	Fault	8
PR8005	3/91	12/91 to 1/92	168	Fault	0
PR8953	4/91	12/91 to 1/92	108	Fault	0
PR9300	5/91	12/91 to 1/92	84	Fault	0
PR9343	5/91	12/91 to 1/92	108	Fault/fracture	0
PR9520	6/91	12/91 to 1/92	96	Fault	8
PR10843	7/91	12/91 to 1/92	156	Fractures	0
PR12800	10/91	12/91 to 1/92	118	Fault/fracture	0

Source: Adkins 1992 in Geomatrix 2011a, Appendix B.

The recorded pressure data exhibit a seasonal trend with the lowest pressure occurring during the winter months, increasing during the spring and summer, and reaching a peak pressure during late summer/early fall (Chart 12). The total pressure variation was about 10 feet during the 2010-2011 recording period. Because only 1 year of data has been reported, it is not possible to conclude whether the observed pressure range is typical or whether the apparent seasonal cycle represents recharge and discharge for the same time period. Based solely on the available data, groundwater in bedrock fractures at the depth of the piezometer at PR5220 (1,330 feet below ground surface) appears to respond relatively quickly to seasonal trends in precipitation and runoff at the surface.

Chart 12. Hydrograph of Libby Adit 5220-Piezometer and LB-200 Streamflow.



Source: MMC 2012b.

Piezometer PR5220 is located at an elevation of about 3,771 feet, which is about 1,330 feet vertically below ground surface. As of October 2011, the elevation of the water surface above this piezometer was 4,207 feet, or about 890 feet below the ground surface. Because pre-dewatering water level data do not exist, it is not possible to determine how much drawdown above the adit has occurred as a result of dewatering. The potentiometric surface elevation, as measured in PR5220 as of October 2011, appears to be at essentially the same elevation as Libby Creek, located south of the trace of the Libby Adit. This geometry is likely the result of Libby Creek and its alluvium providing recharge to the ongoing dewatering of the Libby Adit. As a result, Libby Creek appears to be behaving as a hydrologic boundary or area of fixed head, which maintains local water level elevations, despite the ongoing dewatering. This observation, as well as the apparent seasonal variation in head (similar to the seasonal variation in Libby Creek flows), implies that sufficient hydraulic conductivity exists between Libby Creek and Libby Adit to move water from the Libby Creek drainage to the adit. Section 3.10.4.3 provides a comparison of model predicted drawdown and Libby Adit water level data. Chart 12 provides a comparison between groundwater pressure measured from within the Libby Adit and flow in Libby Creek. Small duration fluctuations in creek flow are dampened out in the relatively low permeability bedrock and there appears to be a 2-month delay between peaks of the two data sets. Otherwise, both data sets show a similar seasonal response.

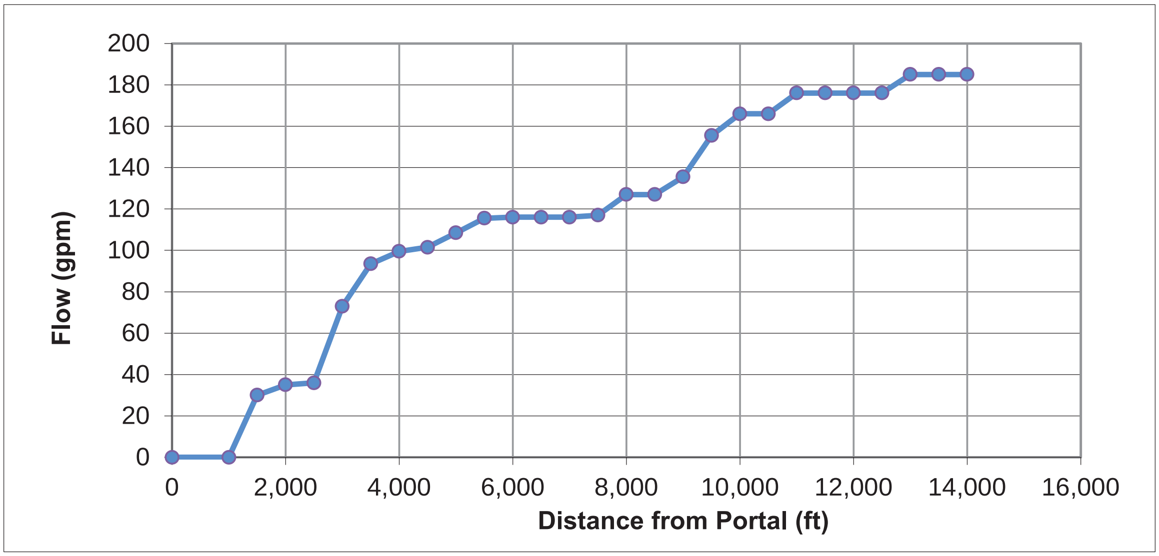
Specific isotopes of oxygen and hydrogen can be used to evaluate the relationship between surface water and groundwater. Water samples from the analysis area were collected since 1999 by various entities, including MMC and the DEQ, for isotope analysis (Gurrieri 2013). The oxygen and hydrogen isotope results were plotted along with the 70 sample results from Gurrieri and Furniss (2004). The oxygen and hydrogen isotope results for two water samples collected from the Libby Adit near the portal and down to PR1920 (which is about 500 feet below the ground surface) are similar to recent snow and surface water samples. This indicates that inflow into the adit down to at least the 1920 level is from recent snowmelt. Water samples collected from deeper in the adit plot along with results from other groundwater sources.

In addition to the oxygen and hydrogen isotopes, the water samples were analyzed for tritium. Because the only source of tritium to the atmosphere is from nuclear explosions, primarily during the 1950s and 60s, tritium can be used as an indicator of the water's age, relative to the those events. Gurrieri (2013) concluded that water collected in the adit near the portal is modern (post - 1952) water, as are samples from snow and surface water sources. Water collected from deeper in the adit appear to be a combination of modern water and pre-1952 water. Of the deeper samples, the deepest sample from the 5220 level contains the highest proportion of modern water to pre-1952 water. This result indicates that groundwater does not necessarily become older the deeper the fracture, but rather that the source of water at depth is dependent on the hydraulic conductivity and continuity of the individual fractures. This observation is consistent with the pressure response from the same level and apparent connection to the Libby Creek drainage, as described previously.

Chart 13 provides a cumulative flow record of adit inflows measured during construction of the adit. The inflow data indicate that most of the total inflow was observed in the first 10,000 feet of the adit, with a stretch between 10,500 and 13,000 feet that produced little inflow, and a slight increase in inflow between 13,000 and 14,000 feet. Between 2009 and 2013, the average annual adit inflow rate ranged decreased from 125 gpm in 2009 to 53 gpm in 2013, based on the volume of water delivered to the Water Treatment Plant. The total annual adit inflow ranged from

27,659,419 to 65,621,930 gallons during the same time period (MMC 2009b, 2010, 2011b, 2012g, 2013, 2014b).

Chart 13. Cumulative Water Inflow Rates in Field Sections Reported During Adit Construction.



Source: Geomatrix 2007c.

Based on observation, springs and perennial portions of streams in the mine area generally start at elevations of 5,000 to 5,600 feet (USGS 1983; Wegner, pers. comm. 2006b). The depth to water measurements and site observations indicate that a water table or potentiometric surface exists at a depth of about 500 feet below land surface in the higher areas, and near or at the surface in areas below an elevation of about 5,000 to 5,600 feet. A September 2007 field review by the agencies located a perennial bedrock spring (SP-41, renumbered from SP-31 in the Draft EIS and Supplement Draft EIS to avoid conflict with springs in the Poorman Impoundment Site) in the East Fork Rock Creek drainage (Figure 68) at an elevation of 5,625 feet, slightly above the estimated range of 5,000 to 5,600 feet. MMC completed an initial survey of East Fork Rock Creek and found perennial flow started at an elevation of about 5,600 feet (NewFields 2013a). Based on the geology and characteristics of this spring, its elevation is considered to be within the estimated range for intersection of the potentiometric surface with the ground surface.

The source of water to springs in the analysis area is groundwater from either fractured bedrock or from unconsolidated deposits. Based on the conceptual model (see section 3.10.3.1.2, *Conceptual Hydrogeological Model of the Montanore Mine Area*) and the results of the numerical models, springs that overlie the ore body at elevations greater than about 5,600 feet (or greater than 5,625 feet) are most likely associated with a shallow groundwater flow path in weathered bedrock, glacial or alluvial deposits, or shallow fractures or bedding planes. While observations, such as discharge during the dry season, indicate that springs could issue from bedrock fractures connected to a deeper groundwater flow path, but there are no data to support this possibility. Springs located below an elevation of about 5,600 feet are likely the result of discharge from shallow weathered bedrock or glacial/alluvial deposits. At lower elevations the shallow and deeper flow paths are most likely hydraulically connected, and some component of the total spring flow may be from the deeper flow path. The ratio of deep and shallow groundwater issuing as springs probably varies between springs and may vary seasonally. Numerous springs were identified in the analysis area by MMC (Geomatrix 2006b, 2006d, 2009a, 2009b, and 2010b). Nine identified springs are within the CMW, with estimated discharge ranging from less than 5 gpm to 50 gpm (Figure 68, Table 96).

Table 96. Flow Measurements and Elevations for Identified Springs in the CMW.

Spring ID	Elevation (feet)	Flow Rate (gpm)	Number of Measurements	Date Range of Measurements
SP-1R	4,900	<0.01-20	10	10/98 – 10/13
SP-2R	4,850	4	1	10/98
SP-4R	6,490	5	1	9/05
SP-05/3R	4,200	5, 22	2	8/98 – 10/98
SP-16	4,600	40-50 (estimated)	1	Unknown
SP-41	5,625	27	4	9/07 - 9/13
SP-42	5,400	22	1	8/21/13
Spring 8	4,360	22	3	9/10 – 9/12
Spring 13	4,520	1-2	1	Unknown

gpm = gallons per minute.
Source: Geomatrix 2006b, 2006d, 2009a, 2010b, 2011b; NewFields 2013a, MMC 2014d, McKay, pers. comm. 2007; September 2007 agencies' field review of Rock Lake area.

One of the objectives of the GDE surveys and ongoing monitoring is to determine the source of water to each spring. The agencies' September 2007 field review identified that spring SP-05/3R (Figure 68), uphill from the Heidleberg Adit in the East Fork Rock Creek drainage, discharges from the Rock Lake Fault. The agencies considered the observed thickness of surficial material above the spring to be insufficient to support an estimated discharge rate of 30 to 40 gpm during a period of little to no precipitation. This spring was reported to have had a flow rate of 5 and 22 gpm during the late 1990s (Table 96). A previously unidentified spring (SP-41) or a series of springs along East Fork Rock Creek above Rock Lake at an elevation of up to 5,625 feet produced a total flow of about 40 to 50 gpm from the fracture zone associated with the Rock Lake Fault. Also, the stream bed above the spring consisted of exposed bedrock (no alluvium), indicating that there was no surface water or shallow groundwater contribution to the springs from higher elevations in the drainage upstream of SP-41.

Springs SP-41 and SP-42 are located along the Rock Lake Fault in the upper East Fork Rock Creek and East Fork Bull River drainages, respectively (Figure 68). Springs SP-41 and SP-42 were re-numbered in the Draft EIS and Supplement Draft EIS to avoid conflict with springs in the Poorman Impoundment Site. Spring SP-41 discharges groundwater directly from the fault or fractures associated with the fault. During the late summer and early fall of typical precipitation years, SP-41 may be the only source of water to Rock Lake (other than direct discharge of groundwater to the lake). Spring SP-42 discharges groundwater from along the Rock Lake Fault at a similar elevation as SP-41, but on the north side of St. Paul Pass.

During normal to dry years when winter snows have completely melted, deeper groundwater discharge from the Rock Lake Fault may be the only source of water to St. Paul Lake during late summer to early fall. Because St. Paul Lake is on a relatively permeable glacial moraine, the lake is reported to be dry during extended periods of low or no precipitation. This indicates that the lake drains at a faster rate than input from groundwater.

The 700-foot long Heidelberg Adit, located in the East Fork Rock Creek drainage below Rock Lake, discharges water to East Fork Rock Creek. During a geotechnical evaluation of the Heidelberg Adit (Morrison-Knudsen Engineers, Inc. 1989b), groundwater flow in the adit was estimated to be 80 gpm and during a hydrologic investigation, Chen-Northern (1989) reported a flow of 40 to 50 gpm. Gurrieri (2001) reports adit flows ranging from 49 to 128 gpm. Discharge from the adit appears to vary seasonally, suggesting the flow may be a combination of shallow and deep groundwater. The shallow groundwater contribution to the adit is more responsive to seasonal changes in precipitation. During the agencies' September 2007 field review, the estimated flow from the adit was between 40 and 50 gpm. NewFields (2013) reported measured flows from the adit ranging from 84 to 164 gpm between 1999 and 2012. The two measured flows in July and October 2012 are consistent with the concept that flows from the Heidelberg adit vary seasonally.

Recent observations inside the Heidelberg Adit in 2011 by MMC show that the first section of adit (450 feet) closest to East Fork Rock Creek was dry. At 450 and 685 feet, the adit intersected narrow fracture or shear zones that strike north-south, with minor dripping at 450 feet, and about 15 gpm flowing at 685 feet. A drill hole just beyond 685 feet was producing about 50 gpm flow; length of the drill hole is unknown. The adit was dry from the drill hole to the face at 705 feet, except for another smaller drill hole in the middle of the face that was producing about 5 gpm. Therefore, about 75 percent of water discharging from the Heidelberg adit is coming from two drill holes that appear to intersect north-south trending fracture/shear zones related to the Rock lake Fault. The remaining 25 percent of flow was coming directly from exposed fractures. Rock between the fracture/shear zones was completely dry, similar to what has been observed in the Libby Adit.

3.10.3.1.2 Conceptual Hydrogeological Model of the Montanore Mine Area

A conceptual hydrogeological model is a commonly used tool for extending knowledge beyond what is specifically known about a hydrogeologic system. With the conceptual model approach, the response of the hydrogeologic system to changes that may occur due to proposed mining activities can be predicted or estimated. Specifically, the conceptual model can be the basis for a numerical model that can integrate known hydrologic data to determine potential impacts on groundwater levels and groundwater contributions to surface water flow. The conceptual hydrogeological model for Montanore is based on the following key components:

- Metasedimentary rocks in the mine area have very low primary permeability (hydraulic conductivity)
- Fractures and other structures provide pathways for groundwater movement
- Fracture or secondary permeability is greater than primary permeability

Unfractured bedrock within the metasediments of the Belt Supergroup has minimal primary porosity and is relatively impermeable. Therefore, groundwater flow in bedrock is primarily through interconnected fractures. Where the fractures are sparse and interconnection is poorly developed, the hydraulic conductivity approaches the rock matrix conductivity (very low, but not zero). Conversely, areas with a higher degree of interconnected fractures, the fractures dominantly control the hydraulic conductivity and the rock matrix permeability provides a relatively small contribution to the bulk hydraulic conductivity. If fracture zones are intercepted by voids, water would initially drain from storage, but because they are not connected with other fractures that transmit water, the long-term water yield would be low. Site-specific data indicate that near-surface bedrock, which is subject to freeze/thaw and may be experiencing unloading or decompression (as evidenced by the presence of talus slopes at the base of exposed bedrock), is more densely fractured than the deeper bedrock. The weathered and fractured near-surface bedrock is expected to transmit water more rapidly via secondary permeability (fracture flow).

Geologic structure may play a significant role in groundwater flow in bedrock. Faults can act as conduits for flow, barriers to flow, or both. The hydraulic characteristics of major structures, such as the Rock Lake Fault, have not been investigated. NMC obtained some information regarding the hydraulic behavior of the fractured rock during advancement of the Libby Adit, and MMC obtained additional information by performing hydraulic tests in discrete fractures in the Libby Adit. The data indicate that the hydraulic conductivity of the fractured rock decreases with depth and that the hydraulic conductivity of the relatively unfractured rock between fractures is very low.

The 3D model incorporated the assumption that mapped faults near the mine area have greater hydraulic conductivity than the surrounding bedrock. Faults incorporated into the model include the Moyie Thrust System (including Rock Lake Fault), Hope Fault, Snowshoe Fault and primary splay, Libby Lakes Fault and primary splay, Copper Lake Fault, and Moran Fault. Each fault was assigned decreasing permeability values with depth. The fault widths vary somewhat based on element size, but in general were between 150 and 330 feet (~50 and 100 meters) in width. The widths represented the fault core and adjacent damage zone based on geologic mapping of the surface and within the Libby Adit. Where information was available, faults were simulated in the 3D model with a plunging angle; otherwise, the faults were simulated as vertical and extending through all layers. Approximate plunge angles were taken from a cross-section along the Libby Adit for the Snowshoe Fault (53°) and Libby Lakes Fault (45°) (Geomatrix 2011a). Minor faults and fracture zones were represented by the bulk permeability used in the model.

The source of all water (surface water and groundwater) in the Cabinet Mountains is precipitation that falls within the mountain range. There are no regional aquifers beneath the range that derive their water from outside the range. Groundwater in the area is recharged by precipitation and snow melt that infiltrates to the subsurface through unconsolidated colluvial, glacial and alluvial deposits, and through open fractures and joints in exposed bedrock. Due to the topographic relief, the occurrence of more permeable surficial geologic deposits, and the low overall hydraulic conductivity of the bedrock, a significant component of the recharge migrates laterally through more permeable shallow flow systems that discharge to adjacent drainages. A small percentage of the total recharge percolates vertically to the deeper groundwater-bedrock system. It is likely that the more fractured rock associated with the prominent northwest trending regional fault zones provide preferential pathways for groundwater recharge to the deeper bedrock.

Recharge rates vary seasonally in response to snow melt and wetter and drier periods. The seasonal nature of recharge would result in variable flow rates in the higher permeability shallow fracture systems and surficial materials. Flow in deeper fractures would be less affected by variable recharge. At elevations higher than about 5,000 to 5,500 feet, the surficial deposits are nonexistent or relatively thin and discontinuous, but they may store and discharge infiltrated precipitation over the course of a year. In typical or dry precipitation years, it is likely that all groundwater drains from the deposits by the end of the summer season. In wetter years, groundwater may not fully drain by the end of the season.

In the upper Libby and Ramsey creek drainages, there are surficial deposits within some of the avalanche chutes that may store and transmit shallow groundwater through much of the summer, depending on residual snow pack at the head of each chute. Flow rates measured late in the season from upper Libby Creek are similar to the model predicted baseflow, indicating that there may be little if any contribution from surficial deposits late in the season of some years. This condition would vary from year to year, depending on snow pack and late season precipitation.

Two groundwater flow paths with different characteristics are assumed to be present in the analysis area: a deep path and a shallow path. The two paths likely result from the contrast between the very low hydraulic conductivity of the deeper fractured bedrock and the higher hydraulic conductivity of the shallow weathered bedrock and/or surficial deposits, and the difference between the infiltration rates of the deeper bedrock and shallow surficial material. The shallow and deeper flow paths do not appear to be hydraulically connected via a saturated zone above an elevation of about 5,000 to 5,600 feet. Groundwater may leak at low rates from the shallow more conductive deposits through vertically-oriented fractures that extend downward into fractured bedrock and eventually enter the deep groundwater flow path.

The observation that analysis area streams become perennial and bedrock springs occur consistently at an elevation of about 5,000 to 5,600 feet in the mine area indicates that a potentiometric surface has developed within interconnected fractures and the potentiometric surface appears to intersect the ground surface at an elevation of about 5,000 to 5,600 feet. The potentiometric surface most likely slopes upward beneath areas above 5,600 feet, subparallel to topography and may be 500 feet or more deep beneath the highest areas in the range (Figure 69). Springs exist above and below 5,000 to 5,600 feet elevation range. Those springs above this elevation range are assumed to be part of the shallow flow path and those below this elevation range are assumed to be connected to both flow systems. Below an elevation of between 5,000 and 5,600 feet, there are two distinct groundwater flow paths due to very different hydraulic conductivities, but the two flow paths are hydraulically connected. Shallow groundwater flows through shallow weathered and fractured bedrock and surficial material where present, and deeper groundwater flows through fractures in unweathered bedrock. In general, the deep, unweathered fractured bedrock has a much lower hydraulic conductivity than the shallow materials (Freeze and Cherry 1979). Figure 69 provides a 3D view of the mine area with typical groundwater flow directions.

Baseflow is defined as the volume of flow in a stream channel that is not derived from surface runoff but rather from groundwater seepage into the channel. Streams in the area may be at baseflow for about 1 to 2 months between mid-July to early October; periods of baseflow may also occur during November through March. Baseflow is maintained during the driest part of each year in the upper perennial reaches of each drainage by groundwater flowing from bedrock fractures. In the lower, flatter areas, groundwater also flows from thicker surficial deposits to stream channels. In the flatter areas, groundwater flowing from surficial deposits accounts for a much higher contribution to baseflow than that from bedrock fractures in the upper reaches. During the year, the ratio of the contribution of shallow groundwater to deeper bedrock groundwater to any one stream varies. When higher than normal precipitation occurs in later summer/early fall and/or when residual snow pack continues to melt through late summer/early fall, streamflow in the analysis area would contain surface runoff in addition to baseflow. Without continuous flow measurements, it may not be possible to know whether streamflow is reduced to only the baseflow contribution in any given year.

The agencies' field review of the East Fork Rock Creek drainage during the driest portion of 2007 (September) indicated that stream flow in East Fork Rock Creek above Rock Lake was the result of groundwater from bedrock springs. During the review, there was no surface water runoff or evidence that shallow springs maintained by snowmelt and/or recent rainfall had contributed any water directly to the drainage. At least one small spring was observed flowing down a bedrock wall near St. Paul Pass; the source of the spring's water was likely a small snowfield high on Rock Peak. It appeared that water from the spring did not enter the East Fork Rock Creek drainage as surface water, indicating that the spring water was either consumed by evapotranspiration and never reached the Rock Creek drainage or infiltrated via fractures into the bedrock, or some combination of both. Precipitation records from the SNOTEL site near Bear Mountain, Idaho, which is the site most representative of the upper Cabinet Mountains, indicate that the summer of 2007 had the second longest period (51 days) without precipitation since continuous precipitation data collection began in 1983. A bedrock spring from the Rock Lake Fault zone along the East Fork Rock Creek drainage above Rock Lake accounted for 100 percent of the flow in the stream, which was estimated at 30 to 40 gpm. No flow was observed in the drainage above this spring. Groundwater discharge to the stream started at an elevation of about 5,625 feet. At the time of the field review, bedrock groundwater appeared to be the sole source of water to Rock Lake. Streamflow gradually increased downstream from an estimated 40 to 50 gpm below Rock Lake to an estimated 1 cfs (450 gpm) within 0.5 miles and 2 cfs before the stream enters Rock Creek Meadows. Between Rock Lake and upstream from Rock Creek Meadows along the channel, there are few if any surficial material deposits. Other sources of water to Rock Creek Meadows include a tributary than joins East Fork Rock Creek from the southeast and possibly surficial deposits on the south side of the channel. These observations are consistent with the conceptual model of the mine area that deeper bedrock groundwater is connected to shallow groundwater and surface water at elevations below about 5,600 feet.

3.10.3.2 Tailings Impoundment Areas and LAD Areas

3.10.3.2.1 Site Hydrogeology

Groundwater occurs within the valley-fill deposits of the narrow mountain valleys. The deposits contain colluvial, alluvial, and glacial materials in a heterogeneous mixture of clay, silt, sand, and larger-sized particles. Valley-fill deposits follow the valley bottoms, are not extensive, and are discontinuous because bedrock crops out along the stream channel bottoms. Geophysical surveys indicate that the valley-fill deposits are 30 to 70 feet thick at the Libby Adit Site, and 24 to 70 feet thick at the Ramsey Plant Site. Groundwater was encountered within the valley-fill deposits during drilling, at depths of 12 to 16 feet at the Libby Adit Site and at 22 feet at the Ramsey Plant Site.

The valley-fill systems are recharged by precipitation, streamflow, and subsurface discharge from bedrock groundwater systems. Groundwater flow follows the topography along the valley bottoms. The valley-fill discharges to surface water, or to more extensive glaciofluvial and glaciolacustrine deposits, along the mountain front.

At the tailings impoundment sites, the Libby Plant Site, and the LAD Areas, groundwater occurs as saturated zones in the surficial deposits, and as a regional water table in the underlying bedrock. The saturated zones in the unconsolidated glaciofluvial and glaciolacustrine deposits are subject to varying degrees of confinement. Perched saturated zones are the result of interfingering of relatively impervious clayey silt within more pervious sediments (Morrison Knudsen Engineers 1990). The thickness of surficial sediments at the Little Cherry Creek Tailings

Impoundment Site ranged from 10 feet at the South Saddle Dam to over 360 feet in a buried channel beneath the proposed Main Dam (Klohn Crippen 2005). Depth to bedrock is not well defined with the Poorman site. Based on a resistivity survey and limited drilling, the thickness of the unconsolidated deposits generally is 100 to 200 feet within the Poorman Impoundment footprint (NewFields 2014a).The glacial deposits form a wedge along the eastern flank of the Cabinet Mountains, beginning at an elevation of about 4,000 feet and increasing in depth away from the mountains. The glaciofluvial and glaciolacustrine deposits are interfingered (having a boundary that forms distinctive wedges, fingers or tongues between two different rock types) and, at many locations, glaciolacustrine deposits overlie glaciofluvial deposits. The glaciolacustrine deposits are finer-grained than glaciofluvial deposits and act as a barrier to groundwater flow, and therefore behave locally as a confining layer. In the Little Cherry Creek Tailings Impoundment Site, a buried preglacial valley underlies the glaciolacustrine deposits. This valley is filled with over 370 feet of fluvial sediments similar to the glaciofluvial deposits.

The glaciofluvial/glaciolacustrine groundwater system at both impoundment sites is recharged by precipitation, discharge from fractured bedrock, and streamflow along the flank of the mountains. Groundwater flow at both potential impoundment sites is generally easterly following the surface topography (Figure 70). Surface topography appears to be controlled by a subsurface bedrock surface, which according to geophysical surveys performed in the two impoundment areas (Chen Northern 1989), is very similar to the surface topography. As a result, the low permeability bedrock influences groundwater flow direction, such as the apparent subsurface bedrock ridge that separates the two impoundment areas (Chen Northern 1989). Corresponding to the subsurface bedrock ridge, there appears to be a groundwater divide that separates groundwater flow to the north and south of the ridge.

The water table or potentiometric surface gradient (hydraulic gradient) is low in both the Little Cherry Creek and Poorman Tailings Impoundment sites (0.05 and 0.07, respectively). Groundwater flow in the impoundment sites is to the east, following the surface topography. Groundwater at the Little Cherry Creek Tailings Impoundment Site discharges to Little Cherry Creek and eventually to the alluvium of Libby Creek. Some flow may discharge to Libby Creek via the deep buried alluvial channel. Groundwater beneath the Poorman Tailings Impoundment Site also flows to the east along topography and discharges to the alluvium of either Libby or Poorman creeks. Both sites have areas of potential artesian flow in the lower portions of the impoundment footprints due to low permeability clay layers. Some of the water flowing beneath the Little Cherry Creek Impoundment Site discharges as springs in the proposed site and downstream along Little Cherry Creek. Springs also are found at the Poorman Impoundment Site, upgradient of the Main Dam crest.

In addition to those along the Little Cherry Creek channel, groundwater discharge from the glacial deposits in the lower portion of the valley supports large areas of wetland vegetation. Groundwater discharges as discrete springs, many of which have been identified, and as diffuse flow over larger areas where the water table intersects the ground surface. The groundwater supported wetland areas are the result of discharge from both shallow perched groundwater and deeper confined water-bearing zones where the confining layer is thin or missing due to erosion. Similar springs are in the Poorman Impoundment Site, but they are less numerous and do not appear to support extensive wetland areas, as observed in the Little Cherry Creek drainage. The difference may be the result of steeper topography and less seasonally reliable groundwater discharge to the surface.

Groundwater in the LAD Areas discharges to Ramsey, Poorman, or Libby creeks. Of the wells established in the LAD Areas, one exhibited artesian heads above the ground surface. Based on the available groundwater data, the hydraulic gradient in the LAD Areas is about 0.06.

Aquifer tests were conducted in the glaciofluvial deposits and in the filled channel in the tailings impoundment sites. The hydraulic conductivity of the glaciofluvial deposits in the Little Cherry Creek watershed ranges from 1×10^{-6} to 1.9×10^{-3} cm/sec (0.0028 to 5.3 ft/day) (Geomatrix 2006c). Estimates of the hydraulic conductivity of channel fill (alluvium along Libby Creek) range from 0.053 to 0.18 cm/sec (150 to 500 ft/day) (Geomatrix 2006c). In the Poorman Tailings Impoundment Site, the hydraulic conductivity of the glaciofluvial deposits ranges from 1.3×10^{-4} to 6.8×10^{-3} cm/sec (0.37 to 19.4 ft/day) and averages 2.6×10^{-3} cm/sec (7.35 ft/day), based on six aquifer tests reported by Chen-Northern (1989).

The glaciofluvial deposits are capped by relatively impermeable glaciolacustrine units. The deposits allow hydraulic pressures to build and create the confined or artesian flow conditions observed at the Poorman and Little Cherry Creek Tailings Impoundment sites. The water levels observed in monitoring wells at the tailings impoundment sites are quite variable, ranging from beneath the bedrock-soil contact to above the ground surface, indicating artesian conditions along the lower portions of the valleys. It is not known whether the low permeability fine-grained material in the Poorman Tailings Impoundment Site is laterally connected to the glaciolacustrine type deposits found in the Little Cherry Creek drainage, but the units appear to function in the same manner.

Hydraulic conductivities of the glaciolacustrine deposits in the Little Cherry Creek Tailings Impoundment Site range from 1×10^{-6} to 2.6×10^{-5} cm/sec (0.003 to 0.075 ft/day) (Geomatrix 2006c). Although saturated, the fine-grained glaciolacustrine deposits did not yield measurable water in the boreholes. No aquifer tests were performed on the fine-grained deposits in the Poorman Tailings Impoundment Site. Due to similarities in subsurface geology, the range of hydraulic conductivity values in the Poorman area is probably similar to those measured in the Little Cherry Creek drainage.

Most of the springs identified in the proposed facility areas occur in the Little Cherry Creek and Bear Creek drainages, or the Poorman Tailings Impoundment Site between Little Cherry Creek and Poorman Creek (Table 97 and Figure 69). All of the identified springs have measured flows of less than 5 gpm, except for the spring near the Libby Adit that was measured at 9 gpm. Some of the springs cease flowing in mid- to late-summer. Ten additional springs or seeps not shown in Table 97 (SP-31 through SP-40 shown on Figure 69) were identified in the Poorman Tailings Impoundment site in 2011 (Kline Environmental Research 2012). The flow rate of these springs has not been measured and they are not included in Table 97. Additional springs may be identified in the upper portions of the watershed during future GDE surveys (see Appendix C).

Table 97. Flow Measurements and Elevations for Springs in the Proposed Facility Areas.

Spring ID	Location	Elevation (feet)	Flow Rate (gpm)	Number of Measure-ments	Date Range of Measure-ments
SP-01	North of Little Cherry Creek Impoundment Site	3,500	2-3 (estimated)	1	6/88
SP-02	Little Cherry Creek Impoundment Site	3,320	1-2 (estimated)	1	6/88
SP-10	Little Cherry Creek Impoundment Site	3,350	1 (estimated)	1	Unknown
SP-11	Near Bear Creek	3,370	0.5 (estimated)	1	Unknown
SP-12	Little Cherry Creek Impoundment Site	3,390	Seep	1	Unknown
SP-13	Little Cherry Creek Impoundment Site	3,410	Unknown	1	Unknown
SP-14	Near Libby Creek	3,350	0.2 (estimated)	1	Unknown
SP-15	Little Cherry Creek Impoundment Site	3,420	1.5-2 (estimated)	1	Unknown
SP-17	Little Cherry Creek Impoundment Site	3,560	0.5 (estimated)	1	Unknown
SP-18	Little Cherry Creek Impoundment Site	3,550	2 (estimated)	1	Unknown
SP-19	North of Libby Plant Site	3,950	Dry to 9	2	1992 – 09/09
SP-20	Near Ramsey Creek south of LAD Area	3,850	<1-4	1	Unknown
SP-21	Between LAD Areas	3,800	1	1	8/07
SP-22	Ramsey Adit Site	4,240	<3	1	Unknown
SP-23	Little Cherry Creek Impoundment Site	3,680	<5	1	Unknown
SP-24	Little Cherry Creek Impoundment Site	3,450	<3	1	Unknown
SP-25	South of Libby Plant Site	3,840	3-5	2	8/07 – 9/09
SP-26	Poorman Impoundment Site	3,320	0.5-10	2	8/07 and 10/12
SP-27	Poorman Impoundment Site	3,840	2	1	8/07
SP-28	Poorman Impoundment Site	3,500	4	1	8/07
SP-29	Poorman Impoundment Site		10	1	10/12
SP-30	Poorman Impoundment Site	3,420	5	1	8/07

gpm = gallons per minute.
Springs in the Little Cherry Creek or Poorman Impoundment Sites are shown on Figure 69.
Source: Geomatrix 2006b, 2006d, 2009b, 2010b; NewFields 2013a; McKay, pers. comm. 2007.

3.10.3.2.2 Conceptual Hydrogeological Model for the Proposed Tailings Impoundments Areas

Groundwater that occurs in the proposed impoundment areas is the result of infiltration of precipitation within each watershed and groundwater flow from the underlying fractured bedrock into the surficial deposits. For pumpback well analysis, Geomatrix (2010c) used an infiltration rate of 14 percent. The majority of the total precipitation either runs off as surface water or percolates into the soil where it is either evaporated or transpired by vegetation. The portion of the infiltrated water that continues to move downward eventually reaches the saturated zone where groundwater moves downhill from the upper elevations to areas of lower elevation along the drainages.

An unconfined saturated zone develops in the glaciofluvial gravels within the upper and middle reaches of each impoundment area. As the groundwater flows beneath the younger glacio-lacustrine silts, the groundwater system changes from an unconfined potentiometric surface to a confined system, due to the low vertical hydraulic conductivity of the fine-grained silts. Due to the confinement, artesian pressures develop, such that groundwater would flow vertically upward to the surface via wells and springs. Springs probably occur where the glaciofluvial deposits are thin or discontinuous due to erosion. Short-lived springs (those that only flow during high precipitation periods or during periods of snowmelt) may be the result of groundwater perched above the glaciolacustrine deposits. The finer grained deposits not only restrict upward vertical groundwater flow but also downward vertical flow, and therefore may perch groundwater locally.

3.10.3.3 Groundwater Use

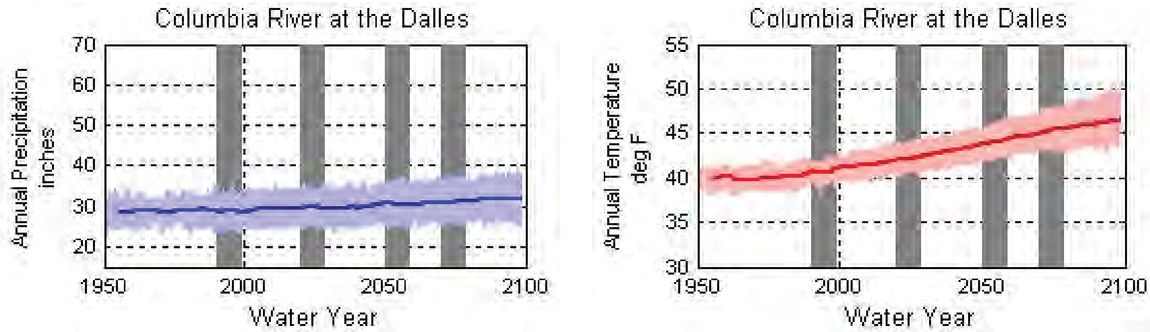
Private land immediately within the Little Cherry Creek Tailings Impoundment Site in Alternatives 2 and 4 is owned by MMC. Private land immediately downgradient of LAD Area 2 in Alternatives 2 and 4 and downgradient of the Poorman Impoundment Site in Alternative 3 is not owned by MMC. No groundwater users have been identified in the analysis area. Section 3.12, *Water Rights* discusses analysis area water rights.

3.10.3.4 Climate Change

Climate models considered in the KIPZ Climate Change Report are unanimous in projecting increasing average annual temperatures over the coming decades in the Pacific Northwest. The KIPZ Climate Change Report indicated annual temperatures will increase 2.2° F by the 2020s and 3.5° F by the mid-21st century, compared to the average for 1970 to 1999. Temperature increases are projected to occur during all seasons, with the greatest increases projected in summer. Beyond mid-century, model projections diverged substantially, with increases in average annual temperature ranging from 5.9°F to 9.7°F in the Pacific Northwest by the end of the 21st century. Projected changes in Pacific Northwest precipitation are more variable among models, but generally suggest no substantial change in the average annual precipitation from the variability experienced during the 20th century. Given the variability in results among models, projections of precipitation are considered less certain than temperature projections. Most of the models project decreases in summer precipitation, increases in winter, and little change in the annual mean (USDA Forest Service 2010a).

Reclamation’s synthesis was similar; air temperatures throughout the Columbia River Basin may increase steadily, with basin-average mean-annual temperature predicted to increase by 6 to 7°F by the end of the 21st century (Chart 14). Variation in annual air temperatures also is projected to increase slightly through time. Increased air temperatures may increase water temperatures (Reclamation 2011c). Mean annual precipitation, averaged over the Columbia River basin, is not expected to change significantly through the 21st century. Precipitation is projected to remain relatively static during the early 21st century and then slightly increase during the last half of the 21st century (Chart 14). Variation in annual precipitation also is projected to increase slightly through time (Reclamation 2011c).

Chart 14. Simulated Annual Climate Averaged over the Columbia River Basin.



Annual conditions represent spatially averaged results over the basin. Darker colored lines indicate the median-annual condition through time, sampled from 112 climate simulations, and then smoothed using a 5-year running average. Lighter-colored areas represent the time-series range of 10th to 90th percentile annual values from simulated 1950 through simulated 2099.
Source: Bureau of Reclamation 2011c.

For the Columbia River Basin in general, warming is expected to diminish the accumulation of snow during the cool season (late autumn through early spring) and the availability of snowmelt to sustain runoff during the warm season (late spring through early autumn). Increased rainfall in December through March is expected to increase runoff during those months. Decreased snowpack volume could result in decreased groundwater infiltration, decreased spring/summer snowpack runoff, increased rain-on-snow events, and ultimately decreased contribution to baseflow in streams (USDA Forest Service 2010a; Reclamation 2011c).

Decreases in snowpack are expected to be more substantial in the portions of the basin where existing cool season temperatures are closer to freezing thresholds and more sensitive to projected warming. Runoff effects would vary by location, depending on baseline climate and the predicted temperature and precipitation changes (Reclamation 2011a). In the more northern subbasins, increases in precipitation, either as rainfall or snowfall, may offset the effects of decreased warm season runoff due to warming. The projected slight increase in precipitation in the last half of the 21st century may offset changes in baseflow in areas sufficiently cold to experience projected warming without loss of snowpack, such as the northern and higher elevation eastern portions of the basin (Reclamation 2011c).

3.10.4 Environmental Consequences

3.10.4.1 Alternative 1 – No Mine

The No Mine alternative would not change groundwater levels or baseflow. Disturbances on private land at the Libby Adit Site and changes in baseflow and groundwater levels would remain until the adits were plugged and the site reclaimed in accordance with existing permits and approvals. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land that did not affect National Forest System lands.

3.10.4.2 Alternative 2 – MMC's Proposed Mine

3.10.4.2.1 Evaluation through Operations Phases

Mine Area

In all action alternatives, the mine plan would include an underground mine and three adit declines. The mine void would be the same in all action alternatives. In Alternative 2, two adits would originate in the Ramsey Creek drainage, and the existing Libby Adit would be used for ventilation. The mine and adits would intersect saturated fractures and faults in the bedrock and, therefore, would produce groundwater at various rates. Mine and adit inflows would be pumped from underground structures and used for processing ore.

Possible effects of Alternative 2 on groundwater hydrology are lowering of groundwater levels and changes in baseflow in adjacent drainages. A detailed discussion of the effects of Alternative 2 on the hydrogeology was provided in the Draft EIS, based on the agencies' 2D numerical model. Subsequent analyses (the MMC 3D model) were based on facilities associated with Alternative 3. With respect to the hydrogeology of the mine area, the only difference between Alternatives 2 and 3 would be the location of the adits. In Alternative 3, all of the adits would be constructed in the Libby Creek drainage, rather than locating two adits in the Ramsey Creek drainage. A discussion of the effects of mining on the hydrogeology is provided in the discussion of Alternative 3 (section 3.10.4.2.3). The effect of Alternative 3 would be very similar to the effects of Alternative 2, with one exception. Alternative 2 would result in more drawdown in the Ramsey Creek watershed and less drawdown in the Libby Creek watershed upstream of Ramsey Creek. As a result, the predicted change in baseflow due to mine dewatering would be slightly greater in Ramsey Creek and slightly less in Libby Creek upstream of Ramsey Creek than predicted for Alternative 3.

Tailings Impoundment Area

Groundwater Drawdown and Changes in Baseflow

The Little Cherry Creek Tailings Impoundment is designed with an underdrain system to collect seepage from the tailings and divert intercepted water to a Seepage Collection Pond downgradient of the impoundment. After being discharged into the impoundment, the tailings would consolidate, and water would pool in a reclaim water pond within the tailings impoundment. Water from the reclaim water pond would be pumped back to the mill, but some would percolate downward and be captured by the underdrain system. Some of the percolating water would seep into the underlying fractured bedrock aquifer. Geotechnical investigations near the Seepage Collection Pond indicate that bedrock is fractured at the surface in the Little Cherry Creek channel beneath the proposed Seepage Collection Dam and farther downstream (Morrison-Knudsen Engineers, Inc. 1990). The Seepage Collection Pond may intercept some of the tailings seepage in the fractured bedrock aquifer. Because bedrock crops out downstream of the proposed dam location, tailings seepage in the fractured bedrock aquifer not intercepted by the Seepage Collection Pond or captured by a pumpback well system, depending on its design, would likely flow into the former Little Cherry Creek channel (USDA Forest Service 2008). Some of the seepage may flow to Libby Creek via a buried channel beneath the impoundment site. Klohn Crippen (2005) estimated 80 percent of the existing groundwater flows toward Little Cherry Creek and 20 percent flows toward Libby Creek via the buried channel. Any tailings seepage is likely to follow existing groundwater flow paths if not intercepted.

Tailings seepage not collected by the underdrain is expected to flow to groundwater at a rate of about 25 gpm and, after the impoundment is reclaimed, slowly decrease to 5 gpm (Klohn Crippen 2005). The operational seepage estimate was verified by the lead agencies in their independent analysis (USDA Forest Service 2008). The estimated groundwater flux (volume per unit time) beneath the impoundment was estimated to be about 35 gpm (Geomatrix 2007b) using a DEQ standard mixing zone thickness of 15 feet (ARM 17.30.517) and a hydraulic conductivity for the impoundment area of 0.4 ft/day. A conductivity value of 0.4 ft/day is higher than the mean values reported by Klohn Crippen (2005) to estimate tailings seepage for glacial till beneath the Little Cherry Creek Impoundment Site (0.1 ft/day) and for fractured bedrock (0.3 ft/day). The saturated zone beneath the impoundment would be able to accommodate the addition of about 25 gpm from seepage and would respond with a rising water table (slightly increasing the hydraulic gradient) to convey the additional water from beneath the impoundment. Little Cherry Creek appears to be a gaining stream downgradient of the proposed impoundment based on limited streamflow measurements and the occurrence of numerous springs.

MMC committed to implementing seepage control measures, such as pumpback recovery wells, if required to comply with applicable standards. Seepage pumpback wells could be installed along the downstream toe of the tailings dam. Given the heterogeneity of the foundation soils, additional wells could be required to ensure that all flow paths were intercepted. The wells may require active pumping, depending on the artesian pressures within the wells (Klohn Crippen 2005). The presence of a buried channel in the Little Cherry Creek site and the construction of saddle dams adjacent to the Little Cherry Creek Diversion Channel would likely require a more complex pumpback well system than required at the Poorman site. Drawdown resulting from a pumpback well system would also reduce baseflow in adjacent streams, such as Bear Creek and the diverted Little Cherry Creek. The estimated depletion to the Libby Creek drainage from the pumpback wells, based on the estimated pumping rate for the Poorman Impoundment Site, would be 0.55 cfs. The actual depletion would be directly related to the actual pumping rate, which would be determined after performing additional aquifer tests.

Springs and Seeps

Numerous springs and seeps were identified in the area surrounding the Little Cherry Creek Impoundment Site (Figure 70) (Geomatrix 2006b, 2009b; Kline Environmental Research 2012). Springs SP-15, 23, and 24 would be covered by the impoundment, and a fourth spring (SP-10) would be covered by the Seepage Collection Pond. Three other springs would be in the disturbance area. Seeps in Little Cherry Creek also would be covered by the impoundment. A pumpback well system required to capture seepage not collected by the underdrain system would lower groundwater levels and reduce groundwater discharge to springs, seeps, and wetlands surrounding of the impoundment. Ten known springs outside of the disturbance area may be affected by the pumpback well system. Operation of a pumpback well system, if installed, may not affect water levels and five of the springs south of Little Cherry Creek because of an apparent subsurface bedrock ridge that separates groundwater flow between the watershed of Little Cherry Creek from those of Drainages 5 and 10 in the Poorman Impoundment Site (Chen Northern 1989).

LAD Areas

MMC anticipates the LAD Areas would be able to receive 558 gpm of water (Geomatrix 2007b). There are several considerations for disposal of water on the LAD Areas to avoid runoff from the

LAD Areas and minimize the risk of developing springs and seeps downgradient of the LAD Areas. The two basic issues are:

- The maximum application rate that would not result in runoff from the site given site characteristics.
- The maximum application rate that could be conveyed away from the LAD Areas by the existing groundwater system.

The EPA (2006b) and the Corps (1982) published guidelines for the design and operation of LAD Areas that address the first issue. The guidelines provide recommended design percolation rates that consider long-term issues such as wetting and drying cycles, clogging of the soil, etc. Using the guidelines, the maximum application rate that would not result in surface runoff for the LAD Areas is 344 gpm.

The existing groundwater flux beneath the LAD Areas was estimated to determine the capacity of the underlying shallow aquifer to receive and transport additional water. The agencies initially estimated a groundwater flux of 141 gpm, based on the following assumptions:

- Maximum saturated thickness of 56 feet (as reported in well logs), which is greater than the 15 feet using the dispersion assumptions in ARM 17.30.517 for standard mixing zones, but represents actual conditions to the maximum drilled depth
- Mixing zone width beneath the LAD Areas of 6,860 feet, which is increased to 8,060 feet using the dispersion assumptions in ARM 17.30.517 for standard mixing zones, where the mixing zone width is equal to the width plus the distance determined by the tangent of 5 degrees times the length of the LAD Area on both sides
- Existing hydraulic gradient of 0.06 (Geomatrix 2007b)
- A hydraulic conductivity value of 1 ft/day reported by Geomatrix (2007b)

The estimated groundwater flux using the reported hydraulic conductivity value requires an unrealistic net infiltration of precipitation rate of about 52 percent of annual precipitation to maintain the groundwater flux of 141 gpm through the defined cross sectional area. It is likely that the average hydraulic conductivity value used in the calculation is too high and does not reflect site conditions. The groundwater flow direction is generally perpendicular to surface topography contours or downslope and, therefore, groundwater recharge is local and discharge is to the adjacent streams. A small fraction of the total net infiltration may travel along deeper flow paths in the fractured bedrock.

The hydraulic conductivity of 1 ft/day is the only value in the flux calculation that was not directly measured, but rather was selected by MMC as being more representative of the LAD hydraulic conductivity than the value derived from pit tests. The agencies reduced the hydraulic conductivity value slightly to achieve a groundwater flux that is consistent with a reasonable net infiltration rate. The agencies considered 10 percent to be a reasonable net infiltration value to use in the flux calculation for three reasons. In the tailings impoundment design report, Klohn Crippen (2005) indicated “groundwater recharge from infiltration [at the Little Cherry Creek Impoundment Site] was estimated to be 10 percent of yearly precipitation. Infiltration rates could be as low as 5 percent and are not expected to be greater than 12 percent. The relatively low precipitation and forest cover suggest that 10 percent should be the maximum infiltration.” MMC also used a 10 percent infiltration rate in the SEEP/W analysis (Klohn Crippen 2005) to model seepage from the Little Cherry Creek Tailings Impoundment; the agencies' used the same rate in their independent SEEP/W analysis (USDA Forest Service 2008). The LAD Areas are 2 miles south of the Little Cherry Creek Tailings Impoundment and have similar geology. A 10 percent infiltration rate in areas of less than 30 percent slope also was used in the agencies' numerical groundwater model (ERO Resources Corp. 2009).

An infiltration rate of 10 percent would support a groundwater flux of 31 gpm for the LAD Areas. This is similar in magnitude to what was calculated by MMC for the groundwater flux through a similar cross sectional area beneath the Little Cherry Creek Tailings Impoundment (35 gpm). Using a groundwater flux of 31 gpm (rather than 141 gpm) requires the hydraulic conductivity to be lower (0.22 ft/day) because the other variables in the equation are fixed (gradient and cross sectional area). A conductivity value of 0.22 ft/day is slightly higher than the mean value for glacial till beneath the Little Cherry Creek Impoundment Site (0.1 ft/day) reported by Klohn Crippen (2005).

The agencies calculated the maximum amount of water that could be conveyed away from the site using a hydraulic conductivity value of 0.22 ft/day, and assuming the water table could rise to within about 10 feet of the surface beneath the LAD Areas. The agencies assumed the water table should remain 10 feet below ground surface beneath the LAD Areas so there would be sufficient unsaturated zone to receive the percolating applied water. Because the cross-sectional area and aquifer characteristics would not change during LAD operation, the hydraulic gradient would steepen to allow more water to flow away (downgradient) from the LAD Areas. The increased gradient is estimated to be 0.122. The calculated gradient value of 0.122 is assumed to be the maximum possible gradient with a depth to groundwater of 10 feet beneath the LAD Areas. The agencies estimate the groundwater flux (preexisting groundwater flux plus infiltrated application water) is about 63 gpm, or about 32 gpm of LAD applied water (the difference between maximum possible flux (63 gpm) and the pre-application groundwater flux (31 gpm)). Factoring in precipitation and evapotranspiration, the total maximum application rate to the LAD Areas would be about 130 gpm for a LAD Area of 200 acres (Appendix G).

The estimated application rate of 130 gpm that could be conveyed from the LAD Areas is more restrictive than 344 gpm, a rate the agencies calculated using the WashEPA and Corps guidelines to avoid runoff (Environmental Protection Agency 2006b; Corps 1982). To reduce the likelihood that springs and seeps would develop downgradient of the LAD Areas or that the water table would come to the surface in the LAD Areas, the agencies estimate the maximum application rate would be 130 gpm (for the 200 acres proposed by MMC for land application at LAD Areas 1 and 2). MMC's proposed application rate of 558 gpm would likely result in surface water runoff and increased spring and seep flow on the downhill flanks of the LAD Areas.

The agencies estimated a groundwater velocity and travel time between the LAD Areas and the nearest surface water body to aid in planning downgradient groundwater monitoring. Using a range of effective porosity values of 1 to 10 percent, ground velocity is calculated to range from about 100 feet per year to 1,000 feet per year. Assuming the nearest stream is about 800 feet downhill from the LAD Areas, the groundwater travel time is estimated to be between less than 1 year and 8 years. This calculation does not consider the existence of preferential flow paths that would allow for higher groundwater velocities, and a possible shorter travel time.

MMC proposed an alternate set of values for hydraulic conductivity (0.3 ft/day) and cross-sectional width (15,000 feet) in calculating the maximum application rate (Geomatrix 2008a).

Because of the limited subsurface data available for the LAD Areas, it is not possible to refine the estimated application rate beyond what is presented in this EIS. Therefore, the analysis presented in this EIS uses more conservative assumptions versus what was suggested by MMC. The maximum application rate would depend on the site conditions, and would have to be determined on a performance basis by monitoring both water quality and quantity changes to the existing groundwater system. It is possible that monitoring would determine that the maximum application rate would be higher or lower than estimated by this analysis. The LAD application rates would be selected to ensure that groundwater did not discharge to the surface as springs between the LAD Areas and downgradient streams.

The discharge rate of the existing spring (SP-21 shown on Figure 70) between the two LAD Areas may increase as a result of land application of excess water. The proposed application rate of 558 gpm would likely result in increased flow from springs and seeps located downhill of the LAD Areas. The analysis described above indicates that the LAD Areas could not accept the proposed application rate of 558 gpm without a risk of runoff from the site and increased spring flow due to rising water levels. If the LAD Areas were operated at the maximum application rate of 130 gpm, as indicated by this analysis, and the evaporation and precipitation rates assumed in the calculation were representative of site conditions, the number of springs and/or seeps downgradient of the LAD Areas should not increase. Springs or seeps could develop because of unidentified geologic heterogeneities that would result in preferential flow paths to the surface. An increase in groundwater levels beneath the LAD Areas as a result of applying a maximum of 130 gpm would have no adverse impacts, with the exception of possible preferential flow paths that could result in increased spring activity.

Make-up Water Wells

If total mine/adit inflow were not adequate to supply water for process purposes, MMC would likely install groundwater wells for make-up water. MMC has not identified specific well locations; the most likely location would be along a major drainage, such as Libby Creek. The amount of make-up water required would depend primarily on mine inflows, water production from tailings impoundment pumpback wells, and precipitation at the impoundment site. The water balance for Alternative 2 indicates that up to 150 gpm of additional water on an annualized basis would be required during the Operations Phase to meet mill needs (Table 14). MMC would not be able to beneficially use any diversions from Libby Creek whenever flow was less than 40 cfs at LB-2000. Consequently, additional diversions for make-up water beyond that shown in Table 14 would be needed to avoid adversely affecting senior water rights. Because MMC would not withdraw any surface water (via groundwater pumping) for operational use whenever flows at the point of withdrawal were less than the average annual low flow, groundwater pumping would likely be restricted to the period between April and July, and would pump at rates up to 450 gpm.

Groundwater withdrawals from Libby Creek alluvium would decrease groundwater level near the pumping wells while the wells were in operation. Because of the relatively high hydraulic conductivity of the alluvium and the hydraulic connection with the active stream, groundwater levels in the alluvium is expected to fully recover between periods of pumping. Groundwater levels downgradient of the pumping wells would decrease while the wells were pumped. Appropriately designed, located and operated make-up wells providing up to 450 gpm would not substantially reduce upgradient alluvial groundwater levels. If the well field were located in the vicinity of the proposed pumpback well system, the make-up wells would increase the area and magnitude of the predicted drawdown cone, when in operation.

3.10.4.2.2 Closure and Post-Closure Phases

Mine Area

A detailed discussion of drawdown during the Post-Closure Phase for Alternative 2 predicted by the 2D model was provided in the Draft EIS. Because MMC's 3D model analysis was developed for Alternative 3, a detailed discussion of closure and post-closure drawdown is provided in the Alternative 3 section (section 3.10.4.2.3). The predicted post-closure drawdown for Alternative 2 would be slightly greater than with the agencies' mitigation incorporated into Alternatives 3 and 4. The time it would take for water levels to reach equilibrium or steady state conditions would be shorter than Alternatives 3 and 4.

Tailings Impoundment Area

During the Closure and Post-Closure Phases, the seepage collection and pumpback well systems would continue to operate until any ongoing seepage met BHES Order limits or applicable nondegradation criteria in all receiving water. After seepage met BHES Order limits or nondegradation criteria of all receiving waters, operation of the pumpback wells would be terminated and the wells plugged and abandoned. Groundwater levels would fully recover in a relatively short period of time (on the order of weeks to a few months). After groundwater levels recovered, springs that were buried by the impoundment, such as SP-23 and SP-24, may again flow, but into the impoundment's gravel underdrain system. Any springs outside of the impoundment footprint affected by the pumpback wells would likely return to pre-mine conditions and may contribute to baseflow to channels outside of the impoundment.

LAD Areas

The LAD Areas would continue to be operated during the Closure Phase, if necessary, to dispose of excess water in the impoundment. Operation of LAD Areas during the Closure Phase would be consistent with guidelines and requirements developed during the Operations Phase. The length of time that these activities would occur is not known, but may be decades or more. After disposal of excess water was no longer necessary, the LAD Areas would be reclaimed and water levels would return to pre-mine conditions.

3.10.4.2.3 Climate Change

Due to the range in possible effects of climate change on the water resources and the many factors that could affect that outcome, quantifying the impacts of Alternative 2 and climate change was not feasible. It is difficult to predict how the hydrologic systems in the Montanore Project analysis area would respond to the forecasted regional effects of climate change. The Bureau of Reclamation (2011c) states that "the projected changes have geographic variation; they vary through time, and the progression of change through time varies among climate projection ensemble members" and that "some geographic complexities of climate change emerge over the Columbia River Basin when climate projections are inspected location by location." The KIPZ Climate Change Report (USDA Forest Service 2010a) described several key sources of uncertainty associated with estimating hydrologic responses of individual sub-basins and watersheds to projected climate changes, including:

- "Hydrologic models often rely on output from global and regional climate models to evaluate potential hydrologic effects. Global climate models have relatively poor skill in simulating regional and local-scale precipitation, due in part to their coarse spatial resolution and limited ability to account for local topographic influences on the hydrologic processes of small to medium sized watersheds (e.g., 6th and 5th hydrologic unit codes).
- There is limited availability of locally-specific field data and analyses on the relative influence of temperature, precipitation, elevation, dust, and black soot on observed snowmelt and runoff trends in mountainous areas.
- We currently lack multiple, high-resolution regional climate models that can resolve fine-scale circulation patterns, snow-albedo feedback, and other environmental features that influence hydrologic processes."

The following paragraph describes potential effects of Alternative 2 and climate change for a range of trends.

Depending on the extent and location of reduced snowpack, groundwater infiltration could decrease in some parts of the analysis area, which could lower the groundwater table and potentially reduce groundwater flow to wilderness lakes. Decreased groundwater infiltration could reduce the project's mine and adit inflows. Because baseflow to streams may also decrease, the percentage change to stream baseflow may remain the same. If mine and adit inflows decreased, discharges to Libby Creek would be less and makeup water requirements would increase. The Bureau of Reclamation (2011c) predicted that climate change would reduce the accumulation of snow and increase runoff in the winter and reduce summer and fall runoff and baseflow in the Columbia River Basin. If climate change did not reduce infiltration enough to change mine and adit inflows from those projected without climate change, any increase in winter flows due to climate change would moderate the effect of mine inflows during the winter low flow periods, and any decrease in fall flows would magnify the effect of mine inflows during the fall low flow periods. As described in Appendix C, MMC would monitor mine inflows and monitor changes in baseflow at potential impact area sites and benchmark sites (similar to project area sites, but outside the area of potential mine impacts) to evaluate baseflow trends due to mining compared to trends due to non-mining effects such as climate change.

3.10.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

The following discussion for Alternative 3 describes mining activities and their potential impacts on the site groundwater hydrology through the five phases of mining and closure. In some cases, phases are combined in the discussion because of the similarities in effects between sequential phases. The 3-D hydrologic analysis was performed with and without two specific mitigations (partial grouting and bulkheads). The effectiveness of grouting, installing bulkheads, and leaving barrier pillars with limited constructed bulkheads at access openings, and other possible mitigations, such as increased buffer zones between Rock Lake and the Rock Lake Fault, are discussed in section 3.10.4.3.6, *Effectiveness of Agencies' Proposed Monitoring and Mitigation*.

In general, the effects on the groundwater hydrology and related changes in stream baseflow would gradually increase through the Construction, and Operations Phases, as mine inflow increased due to increased mine void volume. Also, because of the low overall permeability of the bedrock, the groundwater system would be somewhat slow to respond to dewatering. Impacts on groundwater hydrology, as indicated by drawdown and related changes in stream baseflow are predicted to reach a maximum after mining ceased (in the Post-Closure Phase) and then slowly recover, reaching steady state conditions 1,150 to 1,300 years after mining ended.

3.10.4.3.1 Evaluation through Operations Phases

Mine Area

The two numerical models were used to approximate where and to what degree groundwater drawdown could occur, and to estimate changes in baseflow for drainages flowing from the area to be mined. The 3D model was configured to simulate the location of mine void and adits proposed in Alternative 3.

Mine and Adit Inflows

As mining activity progressed through the Evaluation, Construction, and Operations Phases, the average mine inflow would increase with predicted short-term spikes in flow as new adits and mine areas were opened (Figure 71). At full build out, the 2D numerical groundwater model predicted that the total steady state inflow to the mine and adits would be about 450 gpm (for the fault scenario, as defined in the 2D model). The 3D model provides considerable detail concerning predicted inflows during the various phases of mining, providing both average and stabilized dewatering rates. The dewatering rate at full mine build out during the 22-year life of mine (Evaluation through Operations Phases) is predicted by the 3D model to be about 370 gpm, with possible short-term inflow peaks of nearly 800 gpm during the mine Construction Phase (Figure 71). The short-term peak of 800 gpm assumes instantaneous development of two new adits and therefore over-estimates peak inflows.

Blasting during development of the adits and mine void and the presence of a mine void may result in stress redistribution that could affect local groundwater flow in fractures around the mine and adits. The stress redistribution may open some fractures and close others, depending on the actual stress regime. It is unlikely this would result in a change in the steady state inflows to the mine and adits. It is possible that changes to the fracture network resulting from the stress redistribution could affect (increase or decrease) drawdown beneath local areas and alter inflow to specific portions of the mine void and adits, but it is not possible to predict if or where this may occur.

Groundwater Drawdown

Both the 2D and 3D models provided estimates of drawdown during various phases of mining (ERO Resources Corp. 2009 and Geomatrix 2011a, respectively). The accuracy of the 2D model drawdown prediction is limited by the various assumptions described in the *Final Hydrogeology Technical Report* (ERO Resources Corp. 2009). Because the 3D model was able to include a more representative simulation of the known geologic structure, the 3D model's predicted extent of drawdown is considered to be more accurate than that of the 2D model.

The 3D model predicted that groundwater drawdown would be greatest along the trend of the adits, ranging between 10 and greater than 500 feet by the end of the Operations Phase. The greatest drawdown would occur along fault and fracture trends (generally northwest-southeast) that are intersected by the mine and adits. Near the mine void, the 3D model predicted that without mitigation, drawdown would generally be between 10 and greater than 100 feet, with an area between 100 and 500 feet in the upper portion of Rock Creek, upstream of Rock Lake. Drawdown exceeding 10 feet and less than 100 feet would extend about 1 mile from the mine and adits along the Rock Lake Fault, Libby Lakes fault, and Snowshoe fault (Geomatrix 2011a).

The pressure data collected from a piezometer at PR5220 in the Libby Adit provides some insight as to how groundwater levels may respond to dewatering, in comparison to the 3D model-predicted drawdown. As described in Section 3.10.3.1.1, *Site Hydrogeology,* water pressure was measured for 1 year in a piezometer located about 1,330 vertical feet from the surface. Because pre-dewatering data are not available, the amount of drawdown due to dewatering of the Libby Adit cannot specifically be determined. The 3D model predicted that the maximum drawdown in the vicinity of the eastern (shallower) half of the Libby and adjacent adits would be between 100 and 500 feet. If the potentiometric surface was at or near the ground surface before dewatering, then 440 feet of drawdown could have occurred as a result of the recent Libby Adit dewatering. Libby Creek may be acting as a fixed head boundary, supplying water to the ongoing dewatering of the Libby Adit, and preventing any additional drawdown. A fixed head boundary is one in which the potentiometric head or water table is held constant by some external force (a source of water) such as a river or lake. The calculated 440 feet of actual drawdown is a maximum possible value, because the elevation of the potentiometric surface before dewatering is unknown, the maximum possible drawdown value suggests that the 3D model predictions are a reasonable estimate of possible drawdown in the Libby Adit area.

Applying this information to other areas, the apparent hydraulic connection between the Libby Creek drainage and the adit via fractures 1,330 feet below the ground surface confirms that it is possible for mine dewatering to intercept surface water where faults or fractures have sufficient hydraulic conductivity and continuity. This observation supports the basic concepts developed in the numerical models. The specific location and frequency of occurrence of these structures are not currently known.

Changes in Baseflow

The effects of groundwater drawdown due to dewatering of the mine and adits are best expressed by estimating changes to baseflow (see section 3.8 for a discussion of baseflow). As part of the 2D and 3D numerical model calibration process, the model-predicted baseflow values were compared to measured flows considered to be baseflow in streams in the analysis area. In general, streamflow measurements were from gaging stations located on the periphery of the numerical model domain (Figure 67). Flow data from the upper reaches of the various streams are insufficient to quantify baseflow at these locations. Because the models were calibrated to flow data at the periphery of the model domain and to several other direct observations, the baseflow predictions at various locations along the streams are considered reasonable estimates of actual baseflow. There is considerable uncertainty regarding the annual variability of baseflow in the drainage reaches where baseflow has not been directly measured. The model results are also based on the assumption that the predicted baseflow is representative of a typical precipitation year. During a field review in September 2007, the agencies estimated that baseflow in the upper reaches of East Fork Rock Creek (above and just below Rock Lake) was similar to that predicted by the 2D and 3D numerical models. Precipitation records discussed in section 3.10.3.1.2, *Conceptual Hydrogeological Model of the Montanore Mine Area* indicated that the summer-fall period in 2007 was particularly dry.

Baseflow for the three periods (pre-mining, operations, and closure/post-closure) was modeled for locations along five streams (Libby, Ramsey, East Fork Rock, and Rock creeks, and East Fork Bull River) using the 2D numerical model (ERO Resources Corp. 2009). The same analysis was performed using the MMC 3D model, except slightly different locations along the streams were reported and the time periods used were also slightly different (Geomatrix 2011a). Geomatrix also included a location on the Bull River in its cumulative effects analysis. For consistency, the results of the baseflow analysis are reported for similar locations along three streams that originate in the analysis area (East Fork Rock Creek, East Fork Bull River, and Libby Creek); at or near the Forest Service gaging station, at the CMW boundary, and within the wilderness (Table 98). For two other creeks located farther from the mine and adits (Ramsey and Poorman), only predicted changes at the CMW boundary are reported (Figure 67).

Baseflow is predicted to start changing during the Evaluation and Construction Phases (Geomatrix 2011a). Because of the characteristics of the site groundwater hydrology, dewatering of the mine and adits would decrease groundwater levels (or cone of depression) that would slowly expand away from the mine openings, intercepting groundwater that would otherwise discharge to area streams. At the end of the Evaluation Phase, the 3D model predicted small reductions in baseflow of less than 3 percent in Libby Creek, East Fork Rock Creek, and East Fork Bull River. At the end of the Construction Phase, the baseflow reductions in Libby Creek increase to 12 percent at LB-300 and 9 percent at the CMW boundary, primarily due to adit dewatering. Baseflow reductions in the other streams are predicted to remain low through the Construction Phase. The Libby Adit was originally dewatered by NMC in late 1991 and allowed to reflood starting in late 1997. Once reflooded, water within the adit exited the adit via colluvium near the portal at an unknown flow rate until MMC reopened the adit and partially dewatered the Libby Adit beginning in 2008. Based on the historical information for the adit, it is inferred that the potentiometric head in the vicinity of the adit never fully recovered after the initial dewatering in 1991 and was farther drawn down with the subsequent MMC dewatering.

The 3D model used the calibrated heads as the initial head condition and apparently did not consider the actual head conditions in the vicinity of the adit. This situation may affect the predicted timing of impacts on the Libby Creek baseflow, but the magnitude of the changes would likely be unaffected. For example, the current adit dewatering has likely resulted in a reduction in Libby Creek baseflow upstream of the current point of discharge for the Water Treatment Plant but the effect is not detected because either the reduction is very small and/or there are insufficient pre-Libby Adit baseline data for comparison to current conditions.

Libby, Ramsey, and Poorman Creeks. The numerical model-predicted changes in baseflow in Libby and Ramsey creeks at the end of the Operations Phase would increase from the previous Phases (Table 98). The estimated baseflow reductions along Libby Creek would range from 14 percent in the wilderness to 22 percent at the CMW boundary. With MMC's modeled mitigation, the baseflow reductions would be slightly less (0.01 cfs) in the wilderness, but would otherwise be the same. Ramsey and Poorman creeks would have slightly less baseflow reduction at the CMW boundary with MMC's modeled mitigation.

Rock Creek and East Fork Rock Creek. The 3D model-predicted baseflow for the upper reaches of East Fork Rock Creek (above and below Rock Lake) is consistent with streamflow observed by the agencies during a September 2007 field review. In September 2007, no surface runoff was contributing to the stream. All of the observed flow was likely from deep bedrock groundwater discharge to the drainage. The flow rate out of Rock Lake was similar to the flow from East Fork Rock Creek above the lake. Additional monitoring proposed in Alternatives 3 and 4 (see Appendix C) would assess the source of flow in upper East Fork Rock Creek.

Table 98. Predicted Changes to Baseflow – End of Operations Phase.

Drainage and Location (Figure 67)	Model-Predicted Pre-mining Baseflow (cfs)	Without MMC's Modeled Mitigation			With MMC's Modeled Mitigation		
		Model-Predicted Baseflow (cfs)	Predicted Change in Baseflow (cfs)	Percent Change in Baseflow	Model-Predicted Baseflow (cfs)	Predicted Change in Baseflow (cfs)	Percent Change in Baseflow
Rock Creek and East Fork Rock Creek							
At mouth (RC-2000)	7.70	7.64	-0.06	-1%	7.64	-0.06	-1%
CMW Boundary (EFRC-200)	0.29	0.23	-0.06	-21%	0.24	-0.05	-17%
In CMW (EFRC-50)	0.04	0.03	-0.01	-25%	0.03	-0.01	-25%
East Fork Bull River							
At mouth (Lower East Fork Bull River)	11.34	11.25	-0.09	-1%	11.27	-0.07	-1%
CMW Boundary (EFBR-500)	4.36	4.29	-0.07	-2%	4.29	-0.07	-2%
In CMW (EFBR-300)	0.29	0.24	-0.05	-17%	0.24	-0.05	-17%
Libby Creek							
Libby Creek at US 2	19.83	19.56	-0.27	-1%	19.57	-0.26	-1%
LB-300	1.22	1.02	-0.20	-16%	1.02	-0.20	-16%
CMW Boundary (~LB-100)	0.54	0.43	-0.12	-22%	0.43	-0.11	-20%
In CMW (LB-50)	0.28	0.24	-0.04	-14%	0.25	-0.03	-11%
Ramsey Creek							
CMW Boundary (~RA-100)	0.38	0.34	-0.04	-11%	0.35	-0.03	-8%
Poorman Creek							
CMW Boundary (PM-100)	0.12	0.11	-0.01	-8%	0.12	0.00	0%

cfs = cubic feet per second ("cfs" is the accepted unit for reporting streamflow. Because it is a large unit (1 cfs = 448.8 gpm), predicted changes in terms of cfs appear to be very precise (*i.e.* reported to 0.01 cfs). If the results were converted to gallons per minute, they would be reported to the nearest 5 gpm. Section 3.11.4.4.6. *Uncertainties Associated with Detecting Streamflow Changes due to Mine Activities* discusses streamflow variability and measurability.

With the data currently available, the model results provide a potential range of dewatering rates and streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. Both 3D groundwater flow models would be refined and rerun after data from the Evaluation Phase were incorporated into the models (see section C.10.4, *Evaluation Phase* in Appendix C). Following additional data collection and modeling, the predicted impacts on surface water resources in the analysis area, including simulation of mitigation measures, may change and the model uncertainty would decrease. See section 3.10.4.3.5, *Groundwater Model Uncertainty* for more discussion of model uncertainty.

Source: Geomatrix 2011a.

The 3D model predicted that changes in baseflow at the end of mining due to mine dewatering would reduce the deeper groundwater contribution to East Fork Rock Creek above the lake by about 0.01 cfs or about 25 percent and 21 percent at the CMW boundary (Geomatrix 2011a) (Table 98). With MMC's modeled mitigation, the reduction would be slightly less at the CMW boundary.

East Fork Bull River. The same effects predicted in the upper reaches of East Fork Rock Creek are predicted by the two numerical models for the upper reaches of the East Fork Bull River drainage. The DEQ reported spring (SP-42) discharge in a drainage above St. Paul Lake near the trace of the Rock Lake Fault at about 200 feet lower in elevation than the spring (SP-41) observed in the East Fork Rock Creek drainage (McKay, pers. comm. 2007). During normal to dry years when winter snows have completely melted, deeper groundwater discharge may be the only source of water to St. Paul Lake during late summer to early fall. Spring SP-42 has not been confirmed to flow during the late summer baseflow period, so it is uncertain whether this spring contributes water to St. Paul Lake during the late summer season. Because St. Paul Lake is located on a relatively permeable glacial moraine, the lake is reported to be completely dry during extended periods of low or no precipitation. This indicates that the lake drains at a faster rate than input from groundwater during the late season, and the lake level is maintained by runoff from snowmelt early in the season.

The 3D model predicted the baseflow at the end of mining in the upper reaches of East Fork Bull River (below St. Paul Lake) would be reduced by about 0.05 cfs or by 17 percent (Geomatrix 2011a). The baseflow reductions would be the same with MMC's modeled mitigation during this phase.

Springs and Seeps

Based on the results of the numerical models, groundwater drawdown would occur around the mine as a result of dewatering of the mine void and adits. Flow from springs hydraulically connected to the deeper groundwater flow path would be reduced. Because springs located below an elevation of about 5,000 to 5,600 feet may derive their water from both shallow and deep groundwater flow paths at various ratios, it is not possible to predict the amount (if any) of flow reduction for any one spring. Some springs and seeps in the mine area have been inventoried, but the inventory has not yet identified the specific groundwater source for each spring or seep. The GDE monitoring described in Appendix C would require that specific analyses be performed to determine the source of water to specific springs.

Tailings Impoundment Area

Groundwater Drawdown and Changes in Baseflow

The Poorman Tailings Impoundment proposed in Alternative 3 would be between the Poorman Creek and Little Cherry Creek drainages. The available hydrogeologic data from the impoundment location indicate that the Poorman site is similar to the Little Cherry Creek site with the exception of having generally higher hydraulic conductivity than the Little Cherry Creek site. The effects of Alternative 3 would be similar to Alternative 2 (see section 3.10.4.2.1, *Evaluation through Operations Phases*), with the following differences:

- Based on available data, the Poorman site does not appear to have a buried channel, as does the Little Cherry Creek site, which reduces the concern of having a very deep, high hydraulic conductivity conduit beneath an impoundment that could become a preferential flow path for seepage from the impoundment.
- The Poorman Impoundment would be located directly upslope from Libby Creek. Consequently, the predominant groundwater flow direction from beneath the impoundment is to the east toward Libby Creek, rather than toward the much smaller Poorman Creek.

A pumpback well system would be installed downgradient of the impoundment and designed to capture all seepage from the impoundment that was not collected by the underdrain system. The pumpback well system would consist of a series of groundwater extraction wells designed to provide 100 percent capture of all groundwater moving from beneath the footprint of the impoundment. A preliminary pumping well system has been designed, based on existing site data, that has 16 extraction wells pumping at a combined rate of 247 gpm (Geomatrix 2010c). Geomatrix constructed a 3D groundwater model of the Poorman Impoundment Site to assist in design of the system. To establish full capture of the impoundment seepage, a drawdown cone would be created by the 16 extraction wells. Water levels from north of Ramsey Creek to north of Little Cherry Creek are predicted to be reduced (Figure 73). As a result of lower groundwater levels, the model predicted that operation of the pumpback well system would reduce baseflow in Poorman Creek by 0.18 cfs (81 gpm), Little Cherry Creek by 0.04 cfs (18 gpm), and in Libby Creek downstream of the confluence of Little Cherry Creek by 0.55 cfs (247 gpm). During the Operations Phase, water removed by the pumpback well system would be pumped to the impoundment for use in the mill.

The 3D model for the pumpback well system included an apparent subsurface bedrock ridge between the Little Cherry Creek and Poorman Creek watersheds. The low permeability bedrock ridge appears to separate groundwater flow between the watershed of Little Cherry Creek from those of Drainages 5 and 10 in the Poorman Impoundment Site (Chen Northern 1989). The bedrock ridge and resulting groundwater divide were interpreted from a resistivity survey performed on behalf of NMC and from drill logs, as interpreted by Klohn Crippen (2005). All available geologic and hydrogeologic data from the Little Cherry Creek and in the Poorman Impoundment areas were reviewed and discussed in detail by NewFields (2014a). NewFields concluded that the bedrock ridge would limit drawdown in the Little Cherry Creek watershed, but drawdown could still extend between watersheds unless the bedrock ridge provided a complete barrier to cross-boundary groundwater flow. According to NewFields (2014a), perched groundwater conditions occur beneath most wetlands in the Little Cherry Creek and Poorman impoundment areas and the hydrologic support for the wetlands appears to be direct precipitation and upgradient runoff water that infiltrates into the subsurface. NewFields concluded the operation of the pumpback wells would have little or no effect on most wetlands in the Little Cherry Creek watershed. If NewFields' interpretation proved to be accurate, it is likely that groundwater drawdown from pumping in the Poorman Impoundment Site would have limited effect on surface resources in the Little Cherry Creek drainage. The pumping rate required to capture all seepage would potentially be lower without recharge from the Little Cherry Creek watershed. Because geologic and hydrologic data from the area between the Little Cherry Creek and Poorman drainages are limited, they are not sufficient to eliminate the possibility of the pumpback well system adversely affecting surface resources, particularly groundwater-supported wetlands.

Additional subsurface data, such as aquifer pumping tests, from this area would be collected during the final design process of the Poorman Impoundment (see section 2.5.2.5.3, *Final Tailings Impoundment Design Process* in Chapter 2 and Appendix C). Site data to be collected would include an assessment of artesian pressures and their potential influence on impoundment stability, an assessment of a subsurface bedrock ridge between Little Cherry Creek and the effect it may have on pumpback well performance, aquifer pumping tests to refine the impoundment groundwater model and update the pumpback well design, and site geology to identify conditions such as preferential pathways that may influence seepage collection system, the pumpback well system, or impoundment stability. MMC also would complete aquifer testing at the Poorman Impoundment Site and finalize the design of the pumpback well system. After the system was designed, at least seven groundwater monitoring wells would be installed downgradient of the pumpback wells before construction of any of the impoundment facilities (see Figure C-7 in Appendix C). At least four of these wells would be constructed as nested pairs to monitor both shallow and deeper flow paths from the impoundment. The wells would be located so that the cross-sectional area below the impoundment was adequately covered by the monitoring wells. If any preferential flow paths were encountered during the construction of the impoundment or installation of monitoring wells, they would be monitored independently. The installation of pairs of nested wells is intended to monitor a reasonable vertical thickness of the saturated zone. These data would be used to confirm the geophysical results and the MMC's hydrogeologic interpretation. The 3D model would be rerun to evaluate the site conditions with the additional data. MMC would update the pumpback well design and analysis using the additional data, with a focus on minimizing drawdown north of impoundment.

In Alternative 2, MMC indicated make-up water may be necessary (see Table 14 in Chapter 2). For analysis purposes, the agencies identified a possible location for alluvial groundwater wells to supply make-up water to the mine, should mine inflow and water from the pumpback well system be inadequate for process purposes.

Section 2.5.4.3, *Water Use and Management* discusses a different water management approach for Alternatives 3 and 4. To provide adequate water for ore processing when Libby Creek water could not be used beneficially (whenever Libby Creek flow at LB-2000 was less than 40 cfs), MMC would, under Alternative 3, install an infiltration gallery along Libby Creek and divert up to 760 gpm of water during periods of high flow (April through July). The infiltration gallery would be along Libby Creek northeast of the Poorman Tailings Impoundment (Figure 26). The amount of make-up water required would depend on mine inflows, water production from tailings impoundment pumpback wells, and precipitation at the impoundment site. MMC would not withdraw any water for use whenever flows at the point of withdrawal were equal to or less than 40 cfs. Water rights are discussed in detail in section 2.5.4.3.2, *Water Rights* and section 3.12, *Water Rights*.

Groundwater withdrawals from Libby Creek alluvium would decrease groundwater level near the infiltration gallery while the gallery was in operation. Because of the relatively high hydraulic conductivity of the alluvium and the hydraulic connection with the active stream, groundwater levels in the alluvium is expected to fully recover between periods of pumping. Groundwater levels downgradient of the infiltration gallery would decrease while diversions were made. Appropriately designed, located and operated infiltration gallery providing up to 760 gpm would not substantially reduce upgradient alluvial groundwater levels. If the infiltration gallery were located in the vicinity of the proposed pumpback well system, the infiltration gallery may increase the area and magnitude of the predicted drawdown cone, when in operation.

Springs and Seeps

Numerous springs were identified in the area surrounding the Poorman Impoundment Site (Figure 70). Thirteen known springs are within the Alternative 3 impoundment disturbance area; five other springs would be outside of the disturbance area, but may be affected by the pumpback well system. As in Alternative 2, it is possible that the increase in hydraulic head over the springs by placement of saturated tailings would prevent future flow from the springs. Alternately, the springs could discharge to the underdrain system beneath the impoundment and be collected by the Seepage Collection System. The flow from springs located outside of the impoundment main dam may be affected by the pumpback well system. The predicted area of groundwater drawdown extended northward to Little Cherry Creek and beyond. Springs that could be affected by the pumpback well system are SP-10, 14, 15, 24 and 38 (Figure 73). Four of the springs potentially affected by the pumpback well system are north of a bedrock ridge that may limit drawdown effects north of it. Effects on wetlands are discussed in section 3.23, *Wetlands and Other Waters of the U.S.*

LAD Area

Alternative 3 does not include the use of LAD for disposal of mine wastewater and groundwater in the LAD Areas would not be affected. The capacity of the Water Treatment Plant would be expanded in Alternatives 3 and 4. If there was the need to dispose of water from the tailings impoundment during the Operations Phase in excess of the water treatment system capacity, MMC would use enhanced evaporation techniques within the footprint of the impoundment.

3.10.4.3.2 Closure Phase

Mine Area

The Closure Phase would start at the end of mining (Year 22) and extend through completion of site reclamation (Year 30). The years discussed in this and other sections are used for analysis purposes, and may vary from actual mining phases. The modeling of MMC's modeled mitigation assumed the construction of bulkheads in the year mining ceased (Year 22) when mine closure would actually take several years to implement. In addition, the following discussion is based on the results of the 3D model that did not consider multiple plugs in the adit for water rights mitigation. During the Closure Phase, dewatering of the mine void and adits would cease, the adits would be plugged, and the voids would begin to fill with groundwater. Plugging of the adits during the Closure Phase would result in recovery of baseflow in the Libby, Ramsey, and Poorman watersheds, after reaching a maximum baseflow reduction soon after the adits were plugged (between Years 22 and 25). Groundwater levels in the mine area are not expected to recover during this phase because groundwater would continue to flow into the dewatered mine void. Groundwater levels in the mine area would continue to decrease as water continued to flow into the mine void. Changes to baseflow in the East Fork Rock Creek and East Fork Bull River would continue to decrease, reaching a maximum during the early Post-Closure Phase, with the exception of East Fork Rock Creek above Rock Lake that would reach a maximum reduction during the Closure Phase (Table 99).

In addition to the grouting mitigation analyzed for the Operations Phase, a second mitigation would be implemented during the Operations and Closure Phases. During the Operations Phase, MMC would leave one or more low permeability barrier pillars at appropriate locations within the mine void to compartmentalize the large void into smaller sections if necessary to minimize post-mining changes in East Fork Rock Creek and East Fork Bull River streamflow and water quality.

If pillars were left in place, concrete bulkheads would be constructed at any access opening through the barrier pillars. For the Closure and Post-Closure Phase analyses, the mitigated results assumed both grouting during the Operations Phase and the barrier pillars were in place after mining ceased. The process for determining the need for barrier pillars is discussed in Chapter 2 (see p. 137 for Evaluation Phase, p. 156 for Operations Phase, and p. 172 for Closure Phase).

Based on the 3D model simulation and not considering water rights mitigation, the portal area of the adits would be plugged soon after the Operations Phase ended (Year 22). drawdown would reach a maximum in the area above the adits between Years 22 and 25 and groundwater levels would begin recovering as the adits filled with water. Maximum baseflow reductions in Libby, Ramsey, and Poorman creeks are predicted to occur soon after the adits were plugged. As groundwater levels rose, the impact on baseflow in the Libby Ramsey, and Poorman watersheds would begin to decrease from the maximum soon after the adits were plugged. Table 98 provides predicted baseflow changes for Year 22 (end of Operations Phase) and Table 99 provides predicted baseflow changes for Year 25 (Closure Phase without multiple adit plugs). The trend of increasing water levels is predicted to continue until groundwater levels reached steady state in Year 1,172 without MMC's modeled mitigation (Table 102). Mitigation implemented during the Operations Phase (grouting and low permeability barriers) and at closure (bulkheads at access openings in the barriers (unmined ore); multiple adit plugs), would reduce impacts on baseflow slightly in all streams and may change the timing of maximum impact, as described in the footnotes to Table 100.

To avoid adversely affecting senior water rights in the Libby Creek and Ramsey Creek drainages, MMC would install plugs at the base of each adit soon after mining operations ceased. Because the adits would then be hydraulically isolated from the mine void, groundwater levels would begin to recover. Steady state groundwater conditions would occur in the Libby Creek and Ramsey Creek drainages within an estimated 10 to 20 years. The estimate is based on an inflow rate to the adits of 100 to 200 gpm to all three adits, the assumption that during 8 months of the year water would be pumped from the adit for water rights mitigation, and filling of the adits from the mine void to the ground surface. Actual length of time would depend on location of the initial plugs and adit inflow rate at Closure. The time to fill the adits could be reduced to a few years if MMC used water diverted from Libby Creek during high flows to fill the adits during the Closure Phase. Baseflow changes in Libby Creek and Ramsey Creek would be similar to those shown in Table 99, but the effects would decline more rapidly with multiple adit plugs. Multiple adit plugs would not affect predicted baseflow changes in the East Fork Rock Creek and East Fork Bull River shown in Table 99.

Tailings Impoundment Area

The effects at the tailings impoundment area are discussed in the following Post-Closure Phase.

Table 99. Predicted Changes to Baseflow – Closure Phase.

Drainage and Location (Figure 67)	Model-Predicted Pre-mining Baseflow (cfs)	Without MMC's Modeled Mitigation			With MMC's Modeled Mitigation		
		Model-Predicted Baseflow (cfs)	Predicted Change in Baseflow (cfs)	Percent Change in Baseflow	Model-Predicted Baseflow (cfs)	Predicted Change in Baseflow (cfs)	Percent Change in Baseflow
Rock Creek and East Fork Rock Creek							
At mouth (RC-2000)	7.70	7.51	-0.19	-8%	7.54	-0.16	-2%
CMW Boundary (EFRC-200) at outlet of Rock Lake	0.29	0.11	-0.18	-62%	0.14	-0.15	-51%
In CMW (EFRC-50)	0.04	0.00	-0.04	-100%	0.00	-0.04	-100%
East Fork Bull River							
At mouth (Lower East Fork Bull River)	11.34	11.22	-0.12	-1%	11.25	-0.09	-1%
CMW Boundary (EFBR-500)	4.36	4.20	-0.16	-4%	4.21	-0.15	-3%
In CMW (EFBR-300)	0.29	0.17	-0.12	-41%	0.18	-0.11	-37%
Libby Creek							
Libby Creek at US 2	19.83	19.58	-0.25	-1%	19.58	-0.25	-1%
LB-300	1.22	1.03	-0.19	-16%	1.04	-0.18	-15%
CMW Boundary (~LB-100)	0.54	0.44	-0.10	-19%	0.44	-0.10	-19%
In CMW (LB-50)	0.28	0.24	-0.04	-14%	0.25	-0.03	-11%
Ramsey Creek							
CMW Boundary (~RA-100)	0.38	0.35	-0.03	-7%	0.35	-0.03	-7%
Poorman Creek							
CMW Boundary (PM-100)	0.12	0.12	0.00	0%	0.12	0.00	0%

Effects shown do not include mitigation measures not provided in MMC's 3D model report such as increasing buffer zones or using multiple plugs in the adits during closure. Such mitigation would be evaluated after additional data were collected during the Evaluation Phase.

cfs = cubic feet per second ("cfs" is the accepted unit for reporting streamflow. Because it is a large unit (1 cfs = 448.8 gpm), predicted changes in terms of cfs appear to be very precise (*i.e.* reported to 0.01 cfs). If the results were converted to gallons per minute, they would be reported to the nearest 5 gpm. Section 3.11.4.4.6. *Uncertainties Associated with Detecting Streamflow Changes due to Mine Activities* discusses streamflow variability and measurability.

Baseflow changes reported for Year 25 for all locations.

With the data currently available, the model results provide a potential range of dewatering rates and streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. Both 3D groundwater flow models would be refined and rerun after data from the Evaluation Phase were incorporated into the models (see Section C.10.4, *Evaluation Phase* in Appendix C). Following additional data collection and modeling, the predicted impacts on surface water resources in the analysis area, including simulation of mitigation measures, may change and the model uncertainty would decrease. See section 3.10.4.3.5, *Groundwater Model Uncertainty* for more discussion of model uncertainty.

Source: Geomatrix 2011a.

Table 100. Predicted Changes to Baseflow – Post-Closure Phase (Maximum Baseflow Change).

Drainage and Location (Figure 67)	Model-Predicted Pre-mining Baseflow (cfs)	Without MMC's Modeled Mitigation			With MMC's Modeled Mitigation		
		Model-Predicted Baseflow (cfs)	Predicted Change in Baseflow (cfs)	Percent Change in Baseflow	Model-Predicted Baseflow (cfs)	Predicted Change in Baseflow (cfs)	Percent Change in Baseflow
Rock Creek and East Fork Rock Creek							
At mouth (RC-2000)	7.70	7.05	-0.65	-8%	7.55	-0.15	-2%
CMW Boundary (EFRC-200) at outlet of Rock Lake	0.29	0.00 (-0.15)[§]	-0.29 (-0.44)[§]	-100%	0.12	-0.17	-59%
In CMW (EFRC-50)	0.04	0.00	-0.04	-100%	0.00	-0.04	-100%
East Fork Bull River							
At mouth (Lower East Fork Bull River)	11.34	11.01	-0.33	-3%	11.02	-0.32	-3%
CMW Boundary (EFBR-500)	4.36	3.96	-0.40	-9%	3.97	-0.39	-9%
In CMW (EFBR-300)	0.29	0.00	-0.29	-100%	0.01	-0.28	-97%
Libby Creek							
Libby Creek at US 2	19.83	19.72	-0.11	-1%	19.73	-0.10	-1%
LB-300	1.22	1.10	-0.12	-10%	1.10	-0.12	-10%
CMW Boundary (~LB-100)	0.54	0.47	-0.07	-12%	0.48	-0.06	-11%
In CMW (LB-50)	0.28	0.24	-0.04	-14%	0.25	-0.03	-11%
Ramsey Creek							
CMW Boundary (~RA-100)	0.38	0.36	-0.02	-4%	0.36	-0.02	-4%
Poorman Creek							
CMW Boundary (PM-100)	0.12	0.12	0.00	0%	0.12	0.00	0%

[§]Negative value represents reduction of baseflow to zero and loss of water from storage in Rock Lake without MMC's modeled mitigation. The baseflow change of -0.44 cfs would result from a change in baseflow of 0.29 cfs plus a reduction in lake storage at the rate of 0.15 cfs.

cfs = cubic feet per second ("cfs" is the accepted unit for reporting streamflow. Because it is a large unit (1 cfs = 448.8 gpm), predicted changes in terms of cfs appear to be very precise (*i.e.* reported to 0.01 cfs). If the results were converted to gallons per minute, they would be reported to the nearest 5 gpm. Section 3.11.4.4.6. *Uncertainties Associated with Detecting Streamflow Changes due to Mine Activities* discusses streamflow variability and measurability.

With and Without MMC's modeled mitigation - maximum model predicted baseflow reductions occur at Year 38 for the Rock Creek drainage and Year 52 for the East Fork Bull River drainage. East of the divide, the maximum model predicted baseflow reductions in the Libby Creek watershed would occur between Year 22 (as reported in Table 98) and Year 25 (as reported in Table 99). Baseflow changes for east slope watersheds in this table are for Year 38. Effects shown do not include mitigation measures not provided in MMC's 3D model report such as increasing buffer zones or using multiple plugs in the adits during closure. Such mitigation would be evaluated after additional data were collected during the Evaluation Phase.

With the data currently available, the model results provide a potential range of dewatering rates and streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. Both 3D groundwater flow models would be refined and rerun after data from the Evaluation Phase were incorporated into the models (see Section C.10.4, *Evaluation Phase* in Appendix C). Following additional data collection and modeling, the predicted impacts on surface water resources in the analysis area, including simulation of mitigation measures, may change and the model uncertainty would decrease. See section 3.10.4.3.5, *Groundwater Model Uncertainty* for more discussion of model uncertainty.

Source: Geomatrix 2011a; East Fork Bull River results from Geomatrix, pers. comm. 2011c.

3.10.4.3.3 Post-Closure Phase

The 3D model predicted the effect of the agencies' mitigation would be most noticeable in the Post-Closure Phase. Table 101 summarizes the difference in effects with and without mitigation. The following sections describe effects predicted by the 3D model, with and without mitigation.

Mine Area

Groundwater Drawdown without Mitigation

The Post-Closure Phase would begin in about Year 31 after all active reclamation activities were completed. Without mitigation, the mine void would continue to fill with water and groundwater levels would begin to recover around the deepest part of the mine void. Groundwater levels above the shallow end of the mine void (south end) would continue to decline, as the deep end of the mine void filled with water. Maximum drawdown is predicted to occur about 30 years after mining, with a maximum drawdown of more than 1,000 feet over the mine void north of Rock Lake (Figure 72). Water levels over the mine void closest to Rock Lake (in mining block 18) are predicted to reach maximum drawdown in Year 38, or 16 years after mining ceased (Chart 15).

Geomatrix (2011a) reported that the 3D model predicted that without mitigation the mine void and adits would require 493 years (or Year 515) to fill to an elevation of 4,800 feet (Chart 15). MMC proposed to maintain a 500-foot buffer from Rock Lake, which has an elevation of 4,958 feet. Although the upper mine void elevation would be less than 500 feet below the lake's elevation, the mine void would be 500 feet laterally from the lake. The upper mine void elevation may be less than 4,800 feet with a 500-foot buffer (Figure 11). Much of the mine void would be substantially filled in less time, but as the mine void filled, the inflow rate would decrease, requiring a predicted 493 years to completely fill the mine void to an elevation of 4,800 feet.

Chart 15. Predicted Water Levels Above Mine Void over Mining Block 18 Near Rock Lake, Without Mitigation.

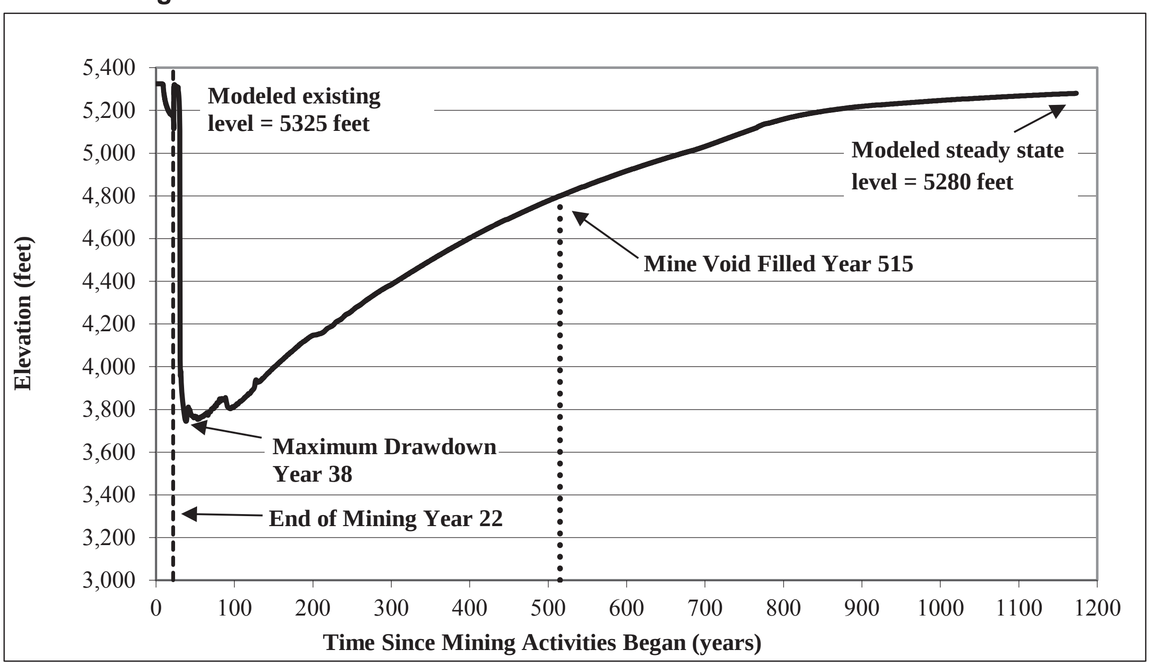


Table 101. Comparison of Groundwater Changes with and without Agencies' Mitigation.

Characteristic	Without Agencies' Mitigation	With Agencies' Mitigation
Mitigation		
Mine void barriers	None	Two or more barriers of unmined ore with bulkheads at access openings, if necessary
Mining buffer zones	500 feet from Rock Lake and 100 feet from Rock Lake Fault (Figure 11)	1,000 feet from Rock Lake and 300 feet from Rock Lake Fault (Figure 11)
Adit plugs	One plug near adit portal	Two or more plugs: one near mine void and one near adit portals
Grouting	None	Grout the sides of the three uppermost mine blocks and corresponding access ramps; additional grouting as necessary
3D Model Predictions		
Timing of maximum drawdown	16 years after mining for East Fork Rock Creek (Year 38) and 30 years after mining for East Fork Bull River(Year 52)	Similar to the without mitigation scenario
Timing of maximum drawdown in mining block 18 (closest to Rock Lake)	16 years after mining (Year 38)	2.8 years after mining (Year 25)
Timing of steady state conditions in groundwater levels over entire mine void	1,150 years after mining (Year 1,172)	1,300 years after mining (Year 1,322); multiple adit plugs not modeled but would increase time required to reach steady state
Timing of steady state conditions in groundwater levels over mining block 18 (closest to Rock Lake)	1,150 years after mining (Year 1,172) (Chart 15)	40 years after mining (Year 62)
Permanent effect on water levels overlying mining block 18	45 feet below pre-mine conditions (Chart 15)	Return to near pre-mine conditions
Timing of steady state conditions in groundwater levels over adits	130 years after mining	10 to 20 years after mining
Permanent effect on water levels overlying adits	Between 10 and 100 feet in some locations (Figure 74)	Not modeled; less than shown in Figure 74
Baseflow change in upper East Fork Rock Creek at maximum drawdown	0.29 cfs reduction at CMW boundary; 0.15 cfs loss of water from Rock Lake (Table 100)	0.17 cfs reduction at CMW boundary; no loss of water from Rock Lake (Table 100)
Baseflow change in upper East Fork Bull River at maximum drawdown	0.40 cfs reduction at CMW boundary (Table 100)	0.39 cfs reduction at CMW boundary (Table 100)
Baseflow change in upper East Fork Rock Creek at steady state	0.03 cfs reduction at CMW boundary (Table 102)	No change at CMW boundary (Table 102)
Baseflow change in East Fork Bull River at steady state	0.05 cfs increase at mouth (Table 102)	0.01 cfs reduction at mouth (Table 102)

With the data currently available, the model results provide a potential range of dewatering rates and streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. Both 3D groundwater flow models would be refined and rerun after data from the Evaluation Phase were incorporated into the models (see Section C.10.4, *Evaluation Phase* in Appendix C). Following additional data collection and modeling, the predicted impacts on surface water resources in the analysis area, including simulation of mitigation measures, may change and the model uncertainty would decrease. See section 3.10.4.3.5, *Groundwater Model Uncertainty* for more discussion of model uncertainty.
cfs = cubic feet per second.

After the mine void and adits filled, water levels in fractures overlying the mine void and adits would continue to return to pre-mine conditions. Groundwater levels overlying the mine void and adits are predicted to reach equilibrium or steady state conditions in about Year 1,172 without MMC's modeled mitigation. Water levels are predicted without MMC's modeled mitigation to permanently remain greater than 100 feet below pre-mine conditions over portions of the mine void and between 500 and 1,000 feet in a small area 1,800 feet north of Rock Lake (Figure 74). Without mitigation, water levels overlying mining block 18 (the block closest to Rock Lake) are predicted to remain 45 feet below pre-mine conditions (Chart 15). Because of model uncertainties due to limited data, the time required for mine void refilling and the time required to reach steady state would be re-evaluated during the Evaluation Phase when more hydrogeologic data were available.

Groundwater Drawdown with Mitigation

With MMC's modeled mitigation as modified by the agencies, one or more barrier pillars would be left if necessary to minimize post-mining changes to East Fork Rock Creek and East Fork Bull River streamflow and water quality. The barrier pillars, if retained, would create two or more "compartments" within the mine void, with each filling at a rate controlled by the hydraulic conductivity of the surrounding rock. With the agencies' mitigation, groundwater levels above each compartment of the mine would continue to decline, as water filled each compartment created by the low permeability barriers. Because the hydraulic conductivity likely decreases with depth, the shallowest compartments of the mine void would fill sooner than the deeper sections. The shallowest compartments (those closest to Rock Lake) with mitigation would fill sooner than without mitigation. For example, lowest water table elevation over mining block 18 at the south end of the mine void is predicted, with MMC's modeled mitigation, to occur 2.8 years after closure, or 25 years after the onset of mining. With the agencies' mitigation of increased buffer of 1,000 feet, the highest mine void elevation would be several hundred feet deeper and the mining block closest to Rock Lake would fill within 10 to 20 years (Appendix G in Geomatrix 2011a). The agencies' mitigation in the mine area would reduce the maximum drawdown and the maximum change to baseflow.

As result of the water rights-related mitigation implemented during the Closure Phase, the adits would recover much sooner than predicted by the 3D model. Because the adits would be hydraulically isolated from the mine void, the adits would reflood and groundwater levels in the Libby, Ramsey, and Poorman creek drainages would reach steady state conditions independently from water levels over the mine void, within an estimated 10 to 20 years after operations ceased. The effect would be reduced to a few years if MMC used water diverted from Libby Creek during high flows to fill the adits during the Closure Phase. The residual drawdown in the Libby Creek drainage with the agencies' mitigation would be less than that shown in Figure 74.

With MMC's modeled mitigation, much less post-mining drawdown would be propagated to the water table on the south end of the mine void. Water levels closest to Rock Lake (overlying mining block 18) are predicted to return to near pre-mine conditions in about 40 years after mining (Appendix G in Geomatrix 2011a). Groundwater levels over the entire mine void are predicted to reach equilibrium or steady state in about Year 1,322 with MMC's modeled mitigation. Groundwater levels with MMC's modeled mitigation are predicted to take longer to reach steady state conditions because the rate of filling in the deeper sections would be slower than the average rate over the entire mine void without mitigation. Multiple adit plugs, which are a component of the agencies' mitigation that were not simulated in the model, would also increase the time to reach steady state conditions over the mine void because adit inflows would not fill the void. Because of model uncertainties due to limited data, the time required for mine void refilling and the time required to reach steady state would be re-evaluated during the Evaluation Phase when more hydrogeologic data were available.

Changes in Groundwater Storage

Assuming a reasonably range of storage values for the bedrock, such as those used in the 3D model, groundwater storage in the flooded mine void and adits would be significantly larger than groundwater stored in fractures in the same area before mining. If 120 million tons of ore and 3.2 million tons of waste rock were mined, the estimated increase in groundwater storage would be about 11.3 billion gallons or 34,600 acre feet of water without mitigation. With mitigation of increased buffers and barrier pillars, if necessary, the mine void and the increase in groundwater storage would be slightly smaller.

Changes in Baseflow

The predicted reductions presented in Table 102 would be permanent changes to pre-mining baseflow because groundwater levels would be at steady state and below pre-mine levels (Figure 74). Residual drawdown near the upgradient end of the mine is predicted to be greater along the Rock Lake, Libby Lake, and Snowshoe faults. As discussed in the Closure Phase section, a second mitigation of leaving barrier pillars, if necessary, would be designed using all available hydrologic data collected during mining and implemented during the Operations and Closure Phases.

The following discussion provides a summary of baseflow changes in the affected drainages during the Post-Closure Phase. Section 3.11.4.4.6, *Uncertainties Associated with Detecting Streamflow Changes due to Mine Activities* discusses streamflow variability and measurability.

The 3D model simulation of the Post Closure Phase indicates that effects on baseflow in the east slope drainages would reach a maximum during the Closure Phase and continue well into the Post-Closure Phase (hundreds of years without MMC's modeled mitigation). At steady state, the model predicted no impact on baseflows in the east slope drainages. The 3D model did not consider water rights mitigation that would greatly shorten the recovery time for the east slope groundwater levels, and therefore, stream baseflows. The adit plugging mitigation, as described in section 2.5.4.3.2, *Water Rights* and section 3.12, *Water Rights*, would hydraulically isolate the adits from the mine void and significantly reduce the refilling time of the adits. As a result, stream baseflow is expected to return to pre-mining rates within 10 to 20 years of the end of the Operations Phase, or within the first few years of the Post Closure Phase. The effect would be reduced to a few years if MMC used water diverted from Libby Creek during high flows to fill the adits during the Closure Phase.

As described previously, the groundwater levels above the mine void would continue to decline after dewatering ceased because the mine void would continue to draw from groundwater as it began to fill. As a result, the maximum drawdown in the area above the south end of the mine void would occur, without MMC's modeled mitigation, about 16 years after the adits were plugged (about Year 38) (Table 100). Starting some time before Year 38, the baseflow in upper East Fork Rock Creek (above Rock Lake, and at the outlet of Rock Lake in the vicinity of EFRC-200) would be reduced to zero. Without MMC's modeled mitigation, the 3D model also predicted that, in addition to 100 percent baseflow reduction to Rock Lake, the potentiometric surface

Table 102. Predicted Changes to Baseflow – Post-Closure Phase (Steady State).

Drainage and Location (Figure 67)	Model-Predicted Pre-mining Baseflow (cfs)	Without MMC's Modeled Mitigation			With MMC's Modeled Mitigation		
		Model-Predicted Baseflow (cfs)	Predicted Change in Baseflow (cfs)	Percent Change in Baseflow	Model-Predicted Baseflow (cfs)	Predicted Change in Baseflow (cfs)	Percent Change in Baseflow
Rock Creek and East Fork Rock Creek							
At mouth (RC-2000)	7.70	7.67	-0.03	-0.4%	7.71	0.01	0.1%
CMW Boundary (EFRC-200) at outlet of Rock Lake	0.29	0.26	-0.03	-10%	0.29	0.00	0%
In CMW (EFRC-50)	0.04	0.02	-0.02	-50%	0.03	-0.01	-25%
East Fork Bull River							
At mouth (Lower East Fork Bull River)	11.34	11.39	0.05	0.4%	11.33	-0.01	-0.1%
CMW Boundary (EFBR-500)	4.36	4.35	-0.01	-0.2%	4.35	-0.01	-0.2%
In CMW (EFBR-300)	0.29	0.27	-0.02	-7%	0.27	-0.02	-7%
Libby Creek							
Libby Creek at US 2	19.83	19.83	0.00	0%	19.83	0.00	0%
LB-300	1.22	1.22	0.00	0%	1.22	0.00	0%
CMW Boundary (~LB-100)	0.54	0.54	0.00	0%	0.54	0.00	0%
Wilderness (LB-50)	0.28	0.28	0.00	0%	0.28	0.00	0%
Ramsey Creek							
CMW Boundary (~RA-100)	0.38	0.38	0.00	0%	0.38	0.00	0%
Poorman Creek							
CMW Boundary (PM-100)	0.12	0.12	0.00	0%	0.12	0.00	0%

cfs = cubic feet per second ("cfs" is the accepted unit for reporting streamflow. Because it is a large unit (1 cfs = 448.8 gpm), predicted changes in terms of cfs appear to be very precise (*i.e.* reported to 0.01 cfs). If the results were converted to gallons per minute, they would be reported to the nearest 5 gpm. Section 3.11.4.4.6. *Uncertainties Associated with Detecting Streamflow Changes due to Mine Activities* discusses streamflow variability and measurability.
Steady state conditions predicted to occur at Year 1,172 without MMC's modeled mitigation and at Year 1,322 with MMC's modeled mitigation.
With the data currently available, the model results provide a potential range of dewatering rates and streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. Both 3D groundwater flow models would be refined and rerun after data from the Evaluation Phase were incorporated into the models (see Section C.10.4, *Evaluation Phase* in Appendix C). Following additional data collection and modeling, the predicted impacts on surface water resources in the analysis area, including simulation of mitigation measures, may change and the model uncertainty would decrease. See section 3.10.4.3.5, *Groundwater Model Uncertainty* for more discussion of model uncertainty.
Source: Geomatrix 2011a.

would be sufficiently lowered to cause water in storage in Rock Lake to move into the groundwater system at the rate of 0.15 cfs. The water balance developed by Geomatrix (2011a) for Rock Lake indicates the lake receives water directly from the groundwater system, which is an indication that the lake is hydraulically connected to the groundwater system. Predicted impacts on Rock Lake are discussed in section 3.13.4, *Surface Water Hydrology*.

Because the baseflow reduction along East Fork Rock Creek would occur in the area overlying the predicted drawdown cone of depression (Figure 72), most if not all of the baseflow reduction would occur between EFRC-50 and upstream of Rock Creek Meadows. Based on the 3D model, groundwater discharges to the creek, and therefore baseflow, just upstream of the Rock Creek Meadows are predicted to be reduced by 0.29 cfs, without MMC's modeled mitigation.

As groundwater levels began to recover during the Post-Closure Phase (after Year 38), the changes in baseflow would decrease, reaching steady state by Year 1,172 without MMC's modeled mitigation. Because the 3D model predicted that groundwater levels would not recover to pre-mining levels, there would be a permanent loss of baseflow in upper East Fork Rock Creek (above Rock Lake) and a permanent reduction in baseflow in East Fork Rock Creek and Rock Creek (Table 102).

The primary predicted effect of MMC's modeled mitigation on the Rock Creek drainage during maximum baseflow reduction would be the elimination of the loss of water from storage in Rock Lake and a reduction in the change in baseflow in the vicinity of the lake by about half. Because groundwater levels would not recover to pre-mining levels, there would be permanent changes to baseflow in the Rock Creek drainage, but the effects would be smaller than those predicted without MMC's modeled mitigation.

Based on the results of both numerical models, reduced baseflow would persist during the Post-Closure Phase for a portion of the East Fork Bull River drainage until the mine void refilled with water and the regional potentiometric surface stabilized. As the regional potentiometric surface reached steady state conditions (Year 1,172 without MMC's modeled mitigation), both numerical models predict a slight increase in groundwater contribution to portions of the East Fork Bull River compared to pre-mining conditions (ERO Resources Corp. 2009 and Geomatrix 2011a). A change in groundwater flow path would occur because the mine void would interconnect the two watersheds, resulting in the diversion of groundwater from the East Fork Rock Creek to the East Fork Bull River drainage. The groundwater exchange rate between drainages is predicted to be very small (0.07 cfs). The only difference between the predictions of the two models is the location along East Fork Bull River where this may occur. The 3D model predicted the increase flow would occur mostly in the lower portion of the river below the CMW boundary, whereas the 2D model predicted the increased flow would occur in the upper reaches of the river within the wilderness.

As with the 2D model, the MMC 3D model also predicted, without MMC's modeled mitigation, that a potential for groundwater to flow from the East Fork Rock Creek watershed to the East Fork Bull River watershed via the mine void because of the void that would connect to the watersheds. Whether this occurred would depend on the location of sufficiently permeable faults and/or fractures between the distal end of the mine void and the Rock Lake Fault because the mine void would be located about 3,000 feet below the drainage. The 2D and 3D models showed that low permeability barriers within the completed mine void would control the level to which groundwater levels would recover, and therefore the direction of groundwater flow within the mine void.

There is uncertainty regarding the nature and extent of the Rock Lake Fault in the vicinity of East Fork Bull River. There is not sufficient mapping data to determine whether the near vertical normal Rock Lake Fault terminates within the East Fork Bull River, extends northward beyond the drainage, or transitions to a mapped thrust fault that extends down the drainage. This uncertainty in the 3D model simulation of the faults in this area would not impact any other part of the simulation or predictions of that model. The location of the discharge within East Fork Bull River is only relevant for the analysis of possible impacts on water quality from mine void water (see section 3.13.4.2.3, *Closure and Post-Closure Phases (Years 25+)*).

With MMC's modeled mitigation, the maximum reduction in baseflow along East Fork Bull River would be somewhat less (Table 100). The primary difference between the mitigated and unmitigated scenarios would be in the reversal of the hydraulic gradient at steady state, minimizing the flow of water from the mine void to East Fork Bull River. There would be a small permanent loss of baseflow to the river with MMC's modeled mitigation. The potential direction of post-mining groundwater flow direction within the mine void would be better defined using all hydrologic data collected during mining. The low permeability barrier design would be based on an analysis of these data.

Tailings Impoundment Area

At the beginning of the Closure Phase, the mill would cease operation and the tailings impoundment would no longer receive tailings. Because the mill would no longer use water from the impoundment, impoundment seepage collected by the seepage collection system and the pumpback well system would be treated at the Water Treatment Plant before discharging it. If the total rate collected by the two systems exceeded the capacity of the treatment system, MMC would pump any water in excess of the treatment system capacity back to the impoundment. Current Water Treatment Plant capacity is 500 gpm, which would be increased in Alternatives 3 and 4. Once all of the standing water was removed from the impoundment, the surface of the impoundment would be reclaimed. The seepage collection and pumpback well systems would continue to operate until flow from the impoundment met BHES Order limits or applicable nondegradation criteria of all receiving waters. As adjacent compliance wells met applicable standards, individual pumpback wells may be shut down and adjacent compliance wells still monitored. As long as the pumpback well system operated, its operation would reduce baseflow to Libby, Poorman, and Little Cherry Creek and reduce flow to springs and wetlands within the area of groundwater drawdown. When operating, the pumpback well system would pump at a rate necessary to maintain full capture of seepage from the impoundment. After flow from the impoundment met BHES Order limits or applicable nondegradation criteria of all receiving waters, operation of the seepage collection system and the pumpback wells would be terminated and the wells plugged and abandoned. Assuming pumpback wells operated at 250 gpm until all pumping ceased, groundwater levels would mostly recover in 13 years after pumping ceased with an estimated residual flow depletion to Libby Creek of 0.1 cfs (50 gpm) and fully recover in about 25 years (NewFields 2013a). Groundwater levels may recover sooner if pumping rates were reduced during the Closure Phase in response to tailings consolidation and impoundment reclamation. As groundwater levels recovered, springs that were buried by the impoundment, such as SP-26 and SP-28, may again flow, but into the impoundment's gravel underdrain system. Springs outside of the impoundment footprint that were affected by the pumpback wells would likely return to pre-mine conditions and may contribute to baseflow to channels outside of the impoundment.

3.10.4.3.4 Climate Change

The effects of climate change in combination with Alternative 3 would be the same as Alternative 2.

3.10.4.3.5 Groundwater Model Uncertainty

Both the 2D and 3D model reports include a discussion of the respective model's sensitivity to a range of hydrologic characteristics (ERO Resources Corp. 2009; Geomatrix 2011a). The sensitivity analysis for the 3D model indicates that varying hydraulic conductivity of the various layers by one order of magnitude (10 times) in either direction provides results that may be considered feasible, but the model calibration was poorer than for the selected values for hydraulic conductivity. The sensitivity analysis of varying hydraulic conductivity using the 3D model resulted in a range of mine inflows of 130 to 1,800 gpm. Based on historical and current inflow data from the Libby Adit, steady state mine inflows of 130 or 1,800 gpm are unlikely, indicating that the hydraulic conductivity values used in the calibrated model run provide a reasonable estimate of mine inflow, groundwater drawdown, and changes to baseflow within the constraints of other parameters used in the models.

Each model report discusses overall uncertainty of the respective model results. There is uncertainty associated with the hydraulic properties of the bedrock and faults; predictions of mine inflows and impacts on water resources are sensitive to permeability of major fault zones. With the data currently available, the model results provide a potential range of mine dewatering and pumping (in the case of the tailings impoundment model) rates and streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. Both 3D groundwater flow models (mine area and tailings impoundment area) would be refined and rerun after data from the Evaluation Phase were incorporated into the models (see section C.10.4, *Evaluation Phase* in Appendix C). Following additional data collection and modeling, the predicted impacts on surface water resources in the analysis area, including simulation of mitigation measures, may change and the model uncertainty would decrease.

To avoid confusion, this EIS uses the activity years reported in the 3D model report. The 3D model report assigns predictions to the nearest year, such as Year 22 or Year 1172. There is uncertainty as to the actual year any specific event would occur, particular for those events that would occur beyond end of mining.

In addition to model uncertainty, there is also the issue of measurability. The numerical models predict baseflow changes at various locations along streams draining the mine area, but the models do not consider what is possible to detect or measure. Other factors should be considered when reviewing and interpreting predicted baseflow. For example, baseflow at any one location along a stream may not be easily defined within the range of the model-predicted changes. Impacts from dewatering the mine and adits may be expressed in other ways, such as changing the elevation at which streams began to flow. Mine dewatering (and resultant groundwater drawdown) may cause this elevation to be lower in a drainage. Section 3.11.4.4.6. *Uncertainties Associated with Detecting Streamflow Changes due to Mine Activities* discusses streamflow variability and measurability.

3.10.4.3.6 Effectiveness of Agencies' Proposed Monitoring and Mitigation

Monitoring

Groundwater Levels

The most effective method for monitoring groundwater levels would be the installation of piezometers in the area overlying the ore body. This method is typically used to establish baseline groundwater conditions and monitor changes due to mine activities. Because the ore body is located within the CMW, the Forest Service did not include the installation of piezometers in the CMW in the agencies' alternatives. Drilling in the CMW would have required the use of helicopter supported drilling in an important grizzly bear corridor. To avoid affecting the bear from drilling in the CMW, the agencies developed a detailed underground monitoring program, provided in Appendix C. Underground monitoring would be effective if implemented as discussed in Appendix C.

In Alternatives 3 and 4, MMC would monitor groundwater level changes from numerous locations from within the mine and adits (Appendix C). This information would be effective in establishing seasonal and long-term trends resulting from mine dewatering, and in understanding the hydrogeology to be used in refining the 3D model. Because the underground piezometers would be installed after the dewatering process had started, this monitoring would not fully characterize pre-mining conditions. Also, once mining ended, the monitoring locations would not be accessible for collecting groundwater recovery data.

Groundwater levels downgradient of the tailings impoundment would be monitored both continuously using data loggers and by hand at an established frequency (Appendix C). Water quality monitoring in adjacent compliance wells also would be monitored. Monitoring data would be effective in establishing whether all groundwater flowing from beneath the impoundment was captured by the pumpback well system. Additional monitoring locations may be required if review of the initial monitoring network indicated that capture could not be confirmed due to inadequate data. This performance-based approach would require that the pumpback well system be modified, as necessary, to ensure that all tailings seepage was captured.

Changes in Spring Flow

The agencies would require that MMC collect flow data from springs in the area predicted by the groundwater model to be affected by groundwater drawdown due to mine dewatering. The monitoring would be initiated before the Evaluation Phase and would continue through the Operations and Closure Phases (Appendix C). Springs selected for flow measurement would be those that derive most or all of their water from bedrock sources, such as SP-41. Flow of the selected springs would be measured at least annually when accessible (typically early July through October), and others would be recorded continuously during the same time period.

With annual flow measurements of springs, many years of data collection would be required to identify potential spring flow decreases due to mine dewatering. Because of natural variability and flow measurement precision, it would be difficult to identify any flow changes other than large, obvious decreases in flow. To improve the effectiveness of spring flow measurements, the agencies would require that reference springs be identified in areas not expected to be affected by mine dewatering (Appendix C). The flow trends from the reference springs would be used to identify background trends that would otherwise complicate interpretation of flow measurements. Even with reference springs, it would be difficult to discern mine impacts from natural variability.

Changes in Stream Baseflow

The agencies would require that MMC collect flow data from stream reaches predicted to be affected by mine dewatering. The monitoring would be initiated before any additional dewatering of the Libby Adit for areas east of the Cabinet Mountains divide and before implementation of the Evaluation Phase for areas west of the divide. Monitoring would continue through the Operations and Closure Phases (Appendix C). Continuous data recorders would be used at some monitoring locations, where feasible, to obtain stream flow, particularly during periods of low flow. Because periods of high flow are dominated by surface water runoff, they are of less interest to this monitoring program. This monitoring requirement would be effective in obtaining year-to-year flow data, but because of natural variability, it would be less effective in identifying impacts on stream baseflow in any one year. Effectiveness would increase as data from multiple years were evaluated to establish long-term trends in baseflow.

Mitigation

Buffers

The 3D modeling was performed using buffers of 100 and 500 feet from the Rock Lake Fault and Rock Lake, respectively, and the data were reported to the agencies as requested. MMC did not report to the agencies the results of any additional modeling with larger buffers. Based on preliminary estimates of hydraulic properties of the bedrock and Rock Lake Fault, Evaluation Phase mining activities would be limited to within 300 feet of the Rock Lake Fault and 1,000 feet of Rock Lake to minimize the risk of high water inflow rates and resulting reduction in groundwater levels. To increase the effectiveness of this requirement, the agencies would re-evaluate the hydrogeology with the 3D model after obtaining additional hydraulic data from underground monitoring during the Evaluation Phase (as required in Appendix C). The evaluation would be used to increase or decrease the buffer zones between the Rock Lake Fault and Rock Lake, as necessary to reduce the risk of high mine inflows and excessive impacts. The agencies also would monitor underground mine development relative to the proscribed buffers (see section C.7.2 in Appendix C).

Grouting

For the purpose of analyzing the effects of possible mitigations, MMC simulated two options: grouting, during Operations Phase, of the sides of the three uppermost mine blocks and corresponding access ramps, as well as installing two 20-foot thick concrete pressure grouted wall bulkheads with a hydraulic conductivity of 1 x 10^{-9} cm/sec in two mining blocks across the mine void at Closure.

Because this mine would be of room-and-pillar design, grouting of fractures would be difficult, but technically feasible. Historically, grouting of fractures in the Libby Adit has been effective in reducing inflows, and MMC would be able to maintain grouting in the mine void and adits during construction and operations. With proper maintenance, grouting would be effective in reducing mine and adit inflows. Should certain threshold inflow rates be observed, as described in Appendix C, MMC would be required to report the conditions and the agencies would evaluate whether specific actions would be required, such as grouting. The effectiveness of grouting over the long term (i.e., 100 years or more) is uncertain. Limited information is available on the functionality of fracture grouting in mines once mining is completed, and there are no data on the design life of grout in an underground flooded environment. The uncertainty of constructed concrete bulkheads also would apply to fracture grouting.

Grouting during the Operations Phase, particularly in mining blocks closest to Rock Lake, would be a possible mitigation to reduce changes in baseflow in nearby watersheds, particularly East Fork Rock Creek. Implementation of this mitigation during the Operations Phase is predicted to result in minimal improvement in the predicted baseflow changes (Table 98). Other mitigation, such as increasing the buffer zones between the mine void and Rock Lake Fault, and the mine void and Rock Lake, may be more effective than MMC's modeled mitigation. In addition to increased buffers, additional grouting of other mining blocks would be possible, but the long-term effectiveness of this mitigation has not been established. Additional mitigation measures would be evaluated with the 3D model after obtaining additional hydraulic data from underground monitoring during the Evaluation Phase.

Barrier Pillars with Bulkheads at Access Openings

In the agencies' 2D model, a bulkhead was simulated to assess the effect of a low-permeability barrier on groundwater conditions at closure. In MMC's 3D model, a similar simulation was completed, with the bulkheads being described as concrete pressure-grouted wall bulkheads in two mining blocks in the mine at closure. The long-term effectiveness of constructed low permeability bulkheads is not documented as there are no available data on service life for time horizons commensurate with the Post-Closure modeling scenario. Current bulkhead design guidelines were developed principally to address water management problems in operating mines, and they emphasize design, construction and maintenance for ongoing operations. A common bulkhead design frequently involves a combination of a constructed barrier, usually made of concrete, along with grouting of the bedrock around the bulkhead perimeter. While bulkheads and grouting have quantifiable and measurable results, the success of these types of mitigations depends on the ability to monitor the bulkheads and to take remedial action, such as supplemental grouting, to stem any persistent inflows. Much of the information pertaining to the use of hydraulic barriers in underground mining comes from applications in operating coal mines (Harteis *et al.* 2008, Chekan 1985, Environmental Protection Agency 1977). There is limited information on functionality of hydraulic barriers once mining is completed, and there are no data on the design life of these structures. The agencies concluded that they cannot confirm the long-term effectiveness of constructed bulkheads across the entire mine void and their ability to maintain a very low hydraulic conductivity across the entire mine void over time. With constructed bulkheads across the entire mine void, baseflow may increase from the East Fork of Rock Creek drainage toward the East Fork of Bull River drainage as predicted by the 3D model. Werner (2014) describes the agencies' evaluation of the effectiveness of constructing bulkheads across the mine void in more detail.

As an alternative to constructed bulkheads with unknown long-term efficacy, the agencies propose to leave barrier pillars across the entire width of the deposit at strategic locations to divide the deposit into discrete compartments to minimize changes in pre-mining groundwater conditions, which would minimize movement of water between the watersheds of the East Fork Rock Creek and East Fork Bull River. There would be a limited number of access points through the barrier pillars for ore haulage, personnel and equipment access. At closure, bulkheads would be placed across these access points. The bulkheads would differ from those described in the modeling reports in that their dimensions would be on the order of feet rather than entire width of the mine void (up to 2,400 feet wide). Leaving barrier pillars overcomes some of the limitations associated with constructed bulkheads, such as long-term effectiveness (Werner 2014). Although a constructed bulkhead would be made of concrete and grout and a barrier pillar would be made of in-place unmined rock, they both would function in a similar manner to reduce the hydraulic conductivity between sections of the mine void. Consequently, the agencies considered the modeling of the bulkheads to be an equivalent simulation of the agencies' mitigation of leaving one or more barriers, if necessary, during the Operations Phase and constructing bulkheads at the access openings at closure.

Because the constructed concrete bulkheads would represent a relatively small proportion of the total bulkhead cross section that would mostly consist of unmined rock, the long-term effectiveness of the constructed bulkhead would be less of a concern, than if the entire mine void opening were plugged with a constructed bulkhead. The long-term effectiveness of constructed low permeability bulkheads is not documented as there are no available data on service life for the time horizon considered with the Post-Closure modeling scenario. The constructed bulkhead may begin to leak at some point in the future, but small increases in hydraulic conductivity as a result of leakage would not likely significantly increase the groundwater flow rate along the mine void. As water levels in the mine void recover on either side of a barrier, the pressure differential would decrease, reducing the flow rate through an intact barrier or through a partially failed constructed bulkhead. Because groundwater flow is proportional to both the hydraulic conductivity and groundwater pressure, groundwater flow through a barrier/bulkhead during the later stages of groundwater level recovery would decrease as the pressure differential decreases. Any increase in the hydraulic conductivity of the barrier/bulkhead due to small failures of a man-made bulkhead during the later stages of groundwater level recovery would be offset by decreases in the differential pressure. This would be particularly true because the man-made barriers would represent a relatively small proportion of the total mine void cross-sectional area.

The agencies' evaluation concluded that man-made concrete bulkheads within a larger barrier created by leaving unmined rock or pillars in place would likely provide the necessary mitigation during much of the groundwater level recovery period. Eventual failure of the constructed portion of the bulkhead would not likely result in significant increases in the total groundwater flow through the mine void.

By the fifth year of operations, MMC would assess the need for barrier pillars to minimize post-mining changes in East Fork Rock Creek and East Fork Bull River streamflow and water quality. If needed, MMC would submit a revised mine plan with one or more barrier pillars with constructed bulkheads at access openings to the agencies for approval. One or more barriers would be maintained underground, if necessary, after the plan's approval. Implementation of this mitigation would decrease the hydraulic head in the north end of the mine void and reduce the maximum baseflow changes at the CMW boundary along East Fork Rock Creek during the Post-Closure Phase from those predicted for the unmitigated baseflow changes. This mitigation is predicted to eliminate the loss of water from storage in Rock Lake during the same time period. The potential direction of post-mining groundwater flow direction within the mine void would be better defined using all hydrologic data collected during mining. The low permeability barrier design would be based on an analysis of these data to improve its effectiveness.

Multiple Adit Plugs

MMC proposed that a single water-retaining plug (bulkhead) would be installed in competent bedrock near the opening of each adit. In the agencies' alternatives, MMC would place two or more plugs in each of the three mine adits. The plugs would be located to isolate the adits hydraulically from the mine void and to ensure any groundwater tributary to Libby and Ramsey creeks would flow into the adits, and remain within the Libby Creek and Ramsey Creek watersheds during the period of groundwater recovery. Without multiple plugs, as simulated by the 3D model, a considerable amount of time (hundreds of years) would be required for the adits to resaturate because any water produced in the adits would flow downhill toward the mine void. A plug at the base of the adits would be effective in hydraulically isolating the adits from the mine void. Without these plugs, as simulated by the 3D model, a considerable amount of time (hundreds of years) would be required for the adits to resaturate because any water produced in the adits would flow downhill toward the mine void. Plugs would prevent adit inflow water from leaving the adits, and allow the adits to reach steady state conditions independently from water levels over the mine void, within an estimated 10 to 20 years after operations ceased. The effect would be reduced to a few years if MMC used water diverted from Libby Creek during high flows to fill the adits during the Closure Phase. Two or more plugs in each adit would provide additional confidence that the plugs would continue to be effective while groundwater levels recover beyond that provided a single plug. Multiple low permeability plugs within an adit would reduce the total groundwater pressure on the bottom plug by segmenting the open adit into compartments, increasing the overall effectiveness of the plugging approach. As groundwater levels recovered, both in the adits and the mine void, the differential pressure between compartments separated by a plug would decrease, which would decrease the potential for failure of a plug and decrease the potential for flow of groundwater through a plug, even if a plug partially failed.

Groundwater Pumpback Well System at Impoundment Site

A groundwater pumpback well system downgradient of the tailings impoundment can be an effective means of collecting seepage from the impoundment that may bypass the underdrain system (estimated to be about 25 gpm). To be effective, a pumpback system would have to be designed to accommodate likely heterogeneities in the groundwater system beneath and down-gradient of the impoundment and be properly monitored to make adjustments in well placement and pumping rates. The goal of a pumpback system would be to establish and maintain complete hydraulic capture of all groundwater moving downgradient from the impoundment, as confirmed by measuring water levels at strategically located monitoring wells. The actual performance of the capture system would be determined by monitoring water quality downgradient of the capture zone. Should water quality changes attributable to tailings seepage be observed, the pumpback well system would be adjusted to improve hydraulic capture.

3.10.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

3.10.4.4.1 Evaluation through Post-Closure Phases

Mine Area

Alternative 4 would have the same effects and uncertainties on groundwater levels and springs and seeps overlying the ore body and baseflow in East Fork Rock, Libby, Ramsey, and Poorman creeks and East Fork Bull River as Alternative 3 (section 3.10.4.3.1, *Evaluation through Operations Phases*). The effects of the Libby Adits would be the same as Alternative 3. The effect of make-up wells on groundwater levels in Alternative 4 would be the same as Alternative 2.

Tailings Impoundment Area

Numerous springs and seeps were identified in the area surrounding the Little Cherry Creek Impoundment Site (Figure 70) (Geomatrix 2006c, 2009b; Kline Environmental Research 2012). Springs SP-15, 23, and 24 would be covered by the impoundment, and a fourth spring (SP-10) would be covered by the Seepage Collection Pond. Two other springs would be in the disturbance area. Seeps in Little Cherry Creek also would be covered by the impoundment. A pumpback well system required to capture seepage not collected by the underdrain system would lower ground-water levels and reduce groundwater discharge to springs, seeps, and wetlands surrounding of the impoundment. Eleven known springs outside of the disturbance area may be affected by the pumpback well system. Operation of a pumpback well system may not affect water levels and six of the springs south of the Little Cherry Creek watershed because of an apparent subsurface bedrock ridge that separates groundwater flow between the watershed of Little Cherry Creek from those of Drainages 5 and 10 in the Poorman Impoundment Site (Chen Northern 1989). Additional subsurface data from this area would be collected during the final design process of the Little Cherry Creek Impoundment to confirm the geophysical results. A 3D model of the pumpback well system would be developed to evaluate the effect of the wells.

During final design, MMC would collect whatever data were necessary to develop a 3D model for a pumpback well system. The additional data would include investigation of a subsurface bedrock ridge that may exist between the Little Cherry Creek and Poorman Creek watersheds. The low permeability bedrock ridge may separate groundwater flow between the watershed of Little Cherry Creek from those of Drainages 5 and 10 in the Poorman Impoundment Site (Chen Northern 1989). If a ridge and hydrologic divide separates the two areas, it is unlikely that pumping in the Poorman Impoundment Site would affect groundwater levels in the Little Cherry Creek drainage. The pumping rate required to capture all seepage would potentially be lower without recharge from the watersheds of the drainages in the Poorman Impoundment Site, such as Drainages 5 and 10.

The amount of seepage collected by the seepage collection facilities may be increased compared to Alternative 2 by locating the Seepage Collection Pond with respect to the local geologic conditions. Geotechnical investigations at the Little Cherry Creek Impoundment Site were conducted on behalf of NMC between 1988 and 1990. NMC reported that bedrock is exposed in the Little Cherry Creek channel and bedrock extends about 800 feet downstream of the proposed Seepage Collection Dam (Morrison-Knudsen Engineers, Inc. 1990). Groundwater modeling conducted by MMC (Klohn Crippen 2005) and independently verified by the agencies (USDA Forest Service 2008) assumed that the fractured bedrock in the Little Cherry Creek drainage is the primary aquifer for groundwater flow at the site. The modeling indicated that any tailings seepage not intercepted by the seepage collection and pumpback well systems would likely discharge to the Little Cherry Creek watershed through the fractured bedrock aquifer (USDA Forest Service 2008). If not intercepted, some of the seepage may flow to Libby Creek via a buried channel beneath the impoundment site. Klohn Crippen (2005) estimated 80 percent of the existing groundwater flows toward Little Cherry Creek and 20 percent flows toward Libby Creek via the buried channel. Any tailings seepage is likely to follow existing groundwater flow paths. Consequently, siting the Seepage Collection Dam at or below the location where bedrock outcrops in the Little Cherry Creek drainage would increase the likelihood that the seepage would be collected by the dam. In Alternative 4, MMC would conduct additional geotechnical work near the Seepage Collection Dam during final design and site the dam lower in the drainage if technically feasible.

Other effects in the tailings impoundment area would be the same as Alternative 2. The potential impacts on Libby Creek alluvial groundwater from appropriations during high-flow periods would be the same for Alternatives 3 and 4.

LAD Areas

The use of LAD Areas is not proposed for Alternative 4 and groundwater in the LAD Areas would not be affected.

3.10.4.4.2 Climate Change

The effects of climate change in combination with Alternative 4 would be the same as Alternative 2.

3.10.4.5 Cumulative Effects

3.10.4.5.1 Past and Current Actions

The Heidelberg Adit is a horizontal tunnel that was constructed in the 1920s. The adit extends about 790 feet into a cliff face located along East Fork Rock Creek about 850 vertical feet below Rock Lake. Groundwater flow from the adit is reported to range from 45 to 135 gpm (Gurrieri 2001). During the agencies' September 2007 field review, flow from the adit was estimated to be 50 gpm and, because of dry conditions at the time of the site visit, this rate is considered to be baseflow from bedrock. Because flow data were apparently not collected before construction of this adit, it is not known if the adit outflow affected baseflow in nearby East Fork Rock Creek.

The Libby Adit was constructed between 1990 and 1991 by NMC and is about 14,000 feet long and slopes downward toward the ore body at a 6 percent slope. Groundwater inflow to the adit increased as the adit was driven, peaking at 239 gpm. The steady state flow from the adit was 150 gpm. Surface flow monitoring was insufficient to identify possible reductions in baseflow in Libby Creek. No groundwater piezometers were installed at the time the adit was constructed to identify changes in groundwater levels near the adit as result of dewatering.

3.10.4.5.2 Rock Creek Project

The two Montanore numerical groundwater models (2D and 3D) were used to assess the cumulative effects of the Montanore and Rock Creek mines. The approximate footprint of the Rock Creek Mine was used in both models. The models were used to predict the effects of simultaneous operation of the two mines by predicting the amount of drawdown in the region during the Post-Closure Phase and the resulting reduction in groundwater contribution to surface water.

The Montanore 3D numerical model predicted that the combined drawdown from the Rock Creek and Montanore mines would merge in a small area beneath the East Fork Bull River watershed (Figure 75). As a result, there would be a small incremental reduction in the baseflow (about 2 percent) to East Fork Bull River at the CMW boundary and a 1 percent decrease in baseflow at the mouth of East Fork Rock Creek as a result of a cumulative effect during the Post-Closure Phase (Table 103). The model predicted that most of the cumulative effect would occur in the lower reaches of the drainages. Streams in the Libby Creek watershed would not be cumulatively affected.

A Rock Creek 3D model prepared by Hydrometrics (2014) on behalf of Rock Creek Resources provided results specifically for the proposed Rock Creek Mine. The model simulation included more site specific detail concerning the mine, geologic structures, and mine operation than was available during preparation of the Montanore 3D for the same area. Adding the results from the Rock Creek Resources and Montanore models for the period of greatest drawdown, assuming these periods would occur at the same time for the two mines, the predicted cumulative baseflow impacts from the two mines would be 0.2 to 0.3 cfs greater in Rock Creek and East Fork Bull River than predicted by the cumulative analysis performed by Montanore.

In addition, during the period of maximum drawdown, based on the Montanore 3D model, the Montanore Mine is predicted, without mitigation, to reduce baseflow in East Fork Rock Creek at the CMW boundary by 0.29 cfs (100 percent of the predicted baseflow) and reduce storage in Rock Lake by 0.15 cfs (for a total "demand" of 0.44 cfs). The Rock Creek 3D model predicted a baseflow at the CMW boundary of 0.7 cfs compared to 0.29 cfs from the Montanore model. Because the Montanore model predicted a total "demand" from mine dewatering of 0.44 cfs, 0.15 cfs (0.44 minus 0.29 cfs) would come from Rock Lake storage. If the baseflow were greater than 0.44 cfs (as predicted by the Rock Creek 3D model), all of the Montanore "demand" would come from baseflow, rather than a combination of baseflow and lake storage. In such a scenario, cumulative baseflow reduction at the mouth of Rock Creek would be 0.15 cfs greater than what is reported in Table 103 because all of the Montanore "demand" would be met from baseflow, rather than lake storage.

3.10.4.5.3 Other Reasonably Foreseeable Actions

Two reasonably foreseeable mining operations, Libby Creek Ventures drilling plans, and the Wayup Mine would not affect groundwater conditions and would not have cumulative effect with the Montanore Project. No other reasonably foreseeable actions would have cumulative effects on groundwater flow.

3.10.4.6 Regulatory/Forest Plan Consistency

3.10.4.6.1 Organic Administration Act and Forest Service Locatable Minerals Regulations

The Forest Service is responsible for ensuring that mine operations on National Forest System lands comply with Forest Service locatable mineral regulations (36 CFR 228 Subpart A) for environmental protection. One of these regulations (36 CFR 228.8) requires that mining activity be conducted, where feasible, to minimize adverse environmental impacts on National Forest System surface resources. Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8 because MMC did not propose to implement feasible measures to minimize adverse environmental impacts on surface resources. The agencies' alternatives (Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R) would incorporate additional feasible measures to minimize adverse environmental impacts on National Forest System surface resources. The measures would include increasing mining buffer zones, installing multiple adit plugs at closure, grouting, and, if necessary, leaving mine void barriers. Using thickened tailings would reduce MMC's appropriation from the Libby Creek and minimize effects on Libby Creek streamflow. The agencies' alternatives expanded MMC's proposed monitoring plans and would include action levels on mine inflows and changes in surface water flow and lake levels that would trigger corrective measures to be implemented by MMC (see Appendix C).

3.10.4.6.2 Wilderness Act

All mine alternatives have the potential to indirectly affect wilderness qualities. Mitigation measures identified in Chapter 2 for Alternatives 3 and 4 and monitoring required for Alternatives 3 and 4 (Appendix C) would be implemented to minimize potential changes in wilderness character. Mitigation measures such as increasing the buffer zones near Rock Lake and the Rock Lake Fault, and the agencies' monitoring coupled with final design criteria submitted for the agencies' approval, would reduce the risk of subsidence and measurable hydrological indirect effects to the surface within the wilderness.

Table 103. Predicted Cumulative Changes to Baseflow – Post-Closure (Maximum Baseflow Change).

Drainage and Location (Figure 67)	Model-Predicted Pre-mining Baseflow (cfs)	Without MMC's Modeled Mitigation			With MMC's Modeled Mitigation[†]		
		Model-Predicted Baseflow (cfs)	Predicted Change in Baseflow (cfs)	Percent Change in Baseflow	Model-Predicted Baseflow (cfs)	Predicted Change in Baseflow (cfs)	Percent Change in Baseflow
Rock Creek and East Fork Rock Creek							
At mouth (RC-2000)	7.70	7.02	-0.68	-9%	7.51	-0.19	-2%
CMW Boundary (EFRC-200)	0.29	0.00 (-0.15)[§]	-0.29 (-0.44)[§]	-100%	0.12	-0.17	-59%
In CMW (EFRC-50)	0.04	0.00	-0.04	-100%	0.00	-0.04	-100%
East Fork Bull River							
At mouth (East Fork Bull River)	11.34	10.98	-0.36	-3%	10.99	-0.35	-3%
CMW Boundary (EFBR-500)	4.36	3.88	-0.48	-11%	3.91	-0.47	-11%
In CMW (EFBR-300)	0.29	0.00	-0.29	-100%	0.01	-0.28	-97%
Based on RCR's Model Results*							
Rock Creek at mouth (RC-2000)	7.8	6.7	-1.1	-14%			
East Fork Bull River at CMW Boundary (EFBR-500)	1.9	1.0	-0.9	-47%			
East Fork Bull River at mouth	10.4	9.6	-0.8	-8%			

[†]Geomatrix 2011a did not report cumulative effects with mitigation nor did it report Year 52 reductions for East Fork Bull River. The agencies determined the incremental unmitigated cumulative effect and added that effect on the direct mitigated effect.

[§]Negative value represents reduction of baseflow to zero and loss of water from storage in Rock Lake without MMC's modeled mitigation. The baseflow change of -0.44 cfs would result from a change in baseflow of 0.29 cfs plus a reduction in lake storage at the rate of 0.15 cfs.

[*]RCR did not model effects with mitigation.

cfs = cubic feet per second ("cfs" is the accepted unit for reporting streamflow. Because it is a large unit (1 cfs = 448.8 gpm), predicted changes in terms of cfs appear to be very precise (*i.e.* reported to 0.01 cfs). If the results were converted to gallons per minute, they would be reported to the nearest 5 gpm. Section 3.11.4.4.6. *Uncertainties Associated with Detecting Streamflow Changes due to Mine Activities* discusses streamflow variability and measurability.

With and without MMC's modeled mitigation - maximum model predicted baseflow reductions occur at Year 52 for East Fork Bull River, Year 38 for the Rock Creek drainage. Effects shown do not include mitigation measures not provided in MMC's 3D model report such as increasing buffer zones or using multiple plugs in the adits during closure. Such mitigation would be evaluated after additional data were collected during the Evaluation Phase.

With the data currently available, the model results provide a potential range of dewatering rates and streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. Both 3D groundwater flow models would be refined and rerun after data from the Evaluation Phase were incorporated into the models (see Section C.10.4, *Evaluation Phase* in Appendix C). Following additional data collection and modeling, the predicted impacts on surface water resources in the analysis area, including simulation of mitigation measures, may change and the model uncertainty would decrease. See section 3.10.4.3.5, *Groundwater Model Uncertainty* for more discussion of model uncertainty.

Source: Geomatrix 2011a; East Fork Bull River results based on Geomatrix, pers. comm. 2011c.

Mitigation measures and monitoring requirements in Alternatives 3 and 4 are reasonable stipulations for protection of the wilderness character and are consistent with the use of the land for mineral development. Alternatives 3 and 4 would be conducted to protect the surface resources in accordance with the general purpose of maintaining the wilderness unimpaired for future use and enjoyment as wilderness and to preserve the wilderness character consistent with the use of the land for mineral development and production in compliance with 36 CFR 228.15 and the Wilderness Act. The agencies' mine and transmission line alternatives would comply with the Wilderness Act. Alternatives 3 and 4 would minimize adverse environmental impacts on surface resources within the wilderness, and thereby comply with the regulations (36 CFR 228, Subpart A) for locatable mineral operations on National Forest System lands.

36 CFR 228.8(h) states that "certification or other approval issued by state agencies or other federal agencies of compliance with laws and regulations relating to mining operations will be accepted as compliance with similar or parallel requirements of these regulations." DNRC's permit decision and associated conditions on beneficial water use permits would constitute compliance with Montana groundwater use requirements.

3.10.4.7 Irreversible and Irretrievable Commitments

Most of the total precipitation that falls in the Cabinet Mountains flows from the mountains as surface water and groundwater. The total water yield varies from year-to-year as a function of the total precipitation and varying amounts of evapotranspiration. Some water would be used consumptively by the project, reducing the total yield of the region by that amount. Relative to the total yield of the affected watersheds, the consumptively used volume would be small. The reduction in yield would be an irretrievable commitment of resources.

In addition to water consumptively used, the estimated increase in groundwater storage due to the mine void would be about 34,600 acre feet, assuming 120 million tons of ore and 3.2 million tons of waste rock were mined. With mitigation of increased buffers and barrier pillars, if necessary, the mine void and the increase in groundwater storage would be slightly smaller. This volume of groundwater required to fill the mine void would be an irretrievable commitment of resources.

After the mine void filled, the total water yield of the region would return to pre-mining conditions, but because of the large mine void, the distribution of water produced along the headwaters of the four major streams that drain the area would be permanently changed. Without mitigation, the large mine void with an infinitely high hydraulic conductivity would permanently change the groundwater flow paths from the East Fork Rock Creek watershed toward the East Fork Bull River watershed. Mitigation would be designed to minimize post-mining changes in East Fork Rock Creek and East Fork Bull River streamflow and water quality. Without mitigation, the change in groundwater flow paths would be an irreversible commitment of resources.

Because of the potential for permanent change in groundwater flow paths, there may be slight changes in the relative contribution of deeper and shallow groundwater to surface water bodies such as Rock Lake. Springs would be irreversibly covered by the tailings impoundment in all action alternatives.

3.10.4.8 Short-term Uses and Long-term Productivity

As described above, there would be a short-term reduction in available water from this portion of the Cabinet Mountains equal to the consumptive use of the mine. Given the overall flow rate of streams from this area, the total short-term change would be small. Long-term, water availability of this area would not be reduced, but the distribution among the four major drainages may be slightly altered.

3.10.4.9 Unavoidable Adverse Environmental Effects

The consumptive use of groundwater by the project would unavoidably reduce the total water yield from this portion of the Cabinet Mountains. The anticipated consumptive use would be small relative to the total water yield of this area. Water yield would remain reduced until the project no longer consumptively uses water, and then slowly return to the pre-mining yield as the mine void filled, which would require about a predicted 493 years and longer with the agencies' mitigation. Without mitigation, water levels over portions of the mine void would permanently remain greater than 100 feet below pre-mine conditions and between 500 and 1,000 feet in a small area north of Rock Lake. Without mitigation, water levels closest to Rock Lake (in mining block 18) are predicted to remain 45 feet below pre-mine conditions, and less with mitigation. Total yield would be the same after the mine void reached steady state conditions, when recharge equaled discharge.

3.11 Surface Water Hydrology

This section provides information on analysis area streams, springs and lakes, and potential consequences to streamflow, spring flows, and lake levels resulting from the mine and transmission line alternatives. Surface water quality is discussed in section 3.13, *Water Quality*.

3.11.1 Regulatory Framework

3.11.1.1 Federal Requirements

The Organic Administration Act authorizes the Forest Service to regulate the occupancy and use of National Forest System lands. The Forest Service's locatable minerals regulations are promulgated at 36 CFR 228, Subpart A. The regulations apply to operations conducted under the U.S. mining laws as they affect surface resources on National Forest System lands under the jurisdiction of the Secretary of Agriculture. One of the mineral regulations (36 CFR 228.8) requires that mining activity be conducted, where feasible, to minimize adverse environmental impacts on National Forest surface resources. 36 CFR 228.8 also requires that mining operators comply with applicable state and federal water quality standards including the Clean Water Act; take all practicable measures to maintain and protect fisheries and wildlife habitat which may be affected by the operations; and reclaim the surface disturbed in operations by taking such measures as preventing or controlling onsite and off-site damage to the environment and forest surface resources. All waters within the boundaries of National Forests may be used for domestic, mining, or irrigation purposes, under applicable state laws. 36 CFR 228.8(h) states that "certification or other approval issued by state agencies or other federal agencies of compliance with laws and regulations relating to mining operations will be accepted as compliance with similar or parallel requirements of these regulations."

The Wilderness Act allows mineral exploration and development under the General Mining Law to occur in wilderness to the same extent as before the Wilderness Act until December 31, 1983, when the Wilderness Act withdrew the CMW from mineral entry, subject to valid and existing rights. 36 CFR 228.15 provides direction for operations within the National Forest Wilderness. Holders of validly existing mining claims within the National Forest Wilderness are accorded the rights provided by the U.S. mining laws and must comply with the Forest Service Locatable Minerals Regulations (36 CFR 228, Subpart A). Mineral operations in the National Forest Wilderness are to be conducted to protect the surface resources in accordance with the general purpose of maintaining the wilderness unimpaired for future use and enjoyment as wilderness and to preserve the wilderness character consistent with the use of the land for mineral development and production.

The Federal Water Pollution Control Act (Clean Water Act) is designed to protect and improve the quality of water resources and maintain their beneficial uses. Proposed mining activities on National Forest System lands are subject to compliance with Clean Water Act Sections 401, 402 and 404 as applicable. The DEQ, EPA, and the Corps all have regulatory, compliance and enforcement responsibilities under the Clean Water Act.

Executive Order 11988, Floodplain Management requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. The order applies to impacts on 100-year floodplains designated by the Federal Emergency Management Agency (FEMA).

The KFP contains standards related to streamflow and floodplains. A floodplain/wetland analysis will be made for all management actions involving wetlands, streams, or bodies of water. Projects involving significant vegetation removal will require a watershed cumulative effects feasibility analysis to ensure that water yield or sediment will not increase beyond acceptable limits. Appendix 18 of the KFP contains guidelines concerning peak flow increases.

3.11.1.2 State Requirements

3.11.1.2.1 Nondegradation Rules

All of the waters in the analysis area are high quality waters. High quality waters are those waters whose quality is higher than the established standards (high quality state waters are defined in the Montana Water Quality Act (75-5-103(13), MCA)). The Montana Water Quality Act prohibits degradation of high quality waters unless the DEQ issues an authorization to degrade. The current nondegradation rules were adopted in 1994 in response to amendments to Montana's nondegradation statute in 1993 and apply to any activity that is a new or increased source that may degrade high quality water. These rules do not apply to water quality parameters for which an authorization to degrade was obtained prior to the 1993 amendments to the statute. NMC, MMC's predecessor, obtained an authorization to degrade in 1992 for certain water quality parameters. For those parameters, the limits contained in the authorization to degrade apply. For those parameters not covered by the authorization to degrade, such as flow, the applicable nonsignificance criteria established by the 1994 rules, and any subsequent amendments, apply (ARM 17.30.715), unless MMC obtained an authorization to degrade under the current statute.

The Montana Water Quality Act defines "degradation" as a change in water quality that lowers the quality of high-quality waters for a parameter, unless the change is nonsignificant. Current nondegradation rules provide that if an activity increases or decreases the mean monthly flow of a stream by less than 15 percent or the 7-day, 10-year ($7Q_{10}$) low flow of a stream by less than 10 percent such changes are not significant for purposes of the statute prohibiting degradation of state waters (ARM 17.30.715(1)(a)). Notwithstanding compliance with the nonsignificance criteria in ARM 17.30.715(1), the DEQ may determine under ARM 17.30.715(2) that a change in water quality is degradation based on the following criteria: a) cumulative impacts or synergistic effects; b) secondary byproducts of decomposition or chemical transformation; c) substantive information derived from public input; d) changes in flow; e) changes in the loading of parameters; f) new information regarding the effects of a parameter; or g) any other information deemed relevant by the DEQ and that relates to the criteria in ARM 17.30.715 (1). Under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA which is: i) potential for harm to human health, a beneficial use, or the environment; ii) strength and quantity of any pollutant; iii) length of time the degradation will occur; and iv) the character of the pollutant so that greater significance is associated with carcinogens and toxins that bioaccumulate or biomagnify and lesser significance is associated with substances that are less harmful or less persistent. Such a determination would be submitted for public comment before making a decision. Under the Montana Water Quality Act, no authorization to degrade may be obtained for outstanding resource waters, such as surface waters within a wilderness.

3.11.1.2.2 Other State Requirements

Under the Montana Floodplain and Floodway Management Act, the DNRC regulates flood-prone lands and waters to prevent and alleviate flooding threats to life and health and reduce private and public economic losses. The following uses are prohibited within floodways and floodplains, unless a variance is obtained:

- A structure or excavation that would cause water to be diverted from the established floodway, cause erosion, obstruct the natural flow of water, or reduce the carrying capacity of the floodway
- The construction or permanent storage of objects subject to flotation or movement during flood events (76-5-403, MCA)

Some mine facilities would be located in a floodplain, based on conceptual designs presented in Chapter 2. Transmission line facilities are not subject to the Montana Floodplain and Floodway Management Act. If at final design mine facilities would be in a floodplain, a variance application would be submitted to the DNRC that provides details on the obstruction or use of a floodway/ floodplain and a permit would be required before construction. DNRC's permit issuance is based on the danger to life and property downstream, availability of alternate locations, possible mitigation to reduce the danger, and the permanence of the obstruction or use (76-5-405, MCA).

The MFSA directs the DEQ to approve a facility if, in conjunction with other findings, the DEQ finds and determines that the facility would minimize adverse environmental impacts considering the state of available technology and the nature and economics of the various alternatives. A floodplain permit would not be needed for the transmission line if a MFSA certificate was issued.

The Montana Natural Streambed and Land Preservation Act requires a 310 Permit for any activity that physically alters or modifies the bed or bank of a perennially flowing stream (see section 1.6.2.4, *Montana Department of Natural Resources and Conservation* in Chapter 1). The permit application must be submitted to the local Conservation District. The project must be designed and constructed to minimize adverse impacts on the stream, minimize erosion, retain the original stream length or otherwise provide hydrologic stability, protect streambank vegetation, and minimize impacts on aquatic life.

3.11.2 Analysis Area and Methods

3.11.2.1 Analysis Area

The analysis area for surface water hydrology, water rights, and water quality includes all areas where surface water may be measurably affected either by the construction, operations or closure of the mine the transmission line or Sedlak Park Substation and loop line. The analysis area consists of four major watersheds and their tributaries: Libby Creek and its tributaries Howard Creek, Ramsey Creek, Poorman Creek, Midas Creek, Little Cherry Creek, Bear Creek and its tributary Cable Creek, Big Cherry Creek, and Swamp Creek; the Fisher River and its tributaries Sedlak Creek, West Fisher Creek and its tributary Standard Creek, Miller Creek, and Hunter Creek; Rock Creek and its tributary East Fork Rock Creek; and East Fork Bull River and its tributaries Placer Creek and Isabella Creek (Figure 76). Three other streams, Flower Creek, Copper Gulch, and West Fork Rock Creek, are briefly described in the Affected Environment section because they may be used for bull trout mitigation. Streams located outside the analysis area, such as the Bull River, may be affected by the project, but effects would be negligible.

Swamp Creek and Wanless Lake, both on the west side of the Cabinet Mountains, would not be affected by the project and would serve as benchmark monitoring locations. Lakes in the analysis area include Howard Lake, Ramsey Lake, Rock Lake, St. Paul Lake, Isabella Lake, and Libby Lakes; some of these lakes are not expected to be affected by the project. Other lakes in the CMW, such as Cliff and Copper lakes, are outside the analysis area because the 3D model did not predict they would be affected by the project.

3.11.2.2 Baseline Data Collection

Surface water investigations included a review of previous permits and authorizations, existing water use, an analysis of the watersheds potentially impacted by the project, floodplain mapping, streamflow, spring flow, peak streamflow calculations, lake levels and surface water quality sampling. Water resource baseline investigations were initiated in the analysis area by U.S. Borax in 1986 and 1987, continued by NMC in 1988 through 1994 and by MMC in 2004, 2005, and 2007 to 2013. In addition, the DEQ collected water resources information in the CMW in 1998 to 2000, followed by additional surface water data collection in the CMW by MMC in 2005. Streamflow measurements were collected in the analysis area by the KNF between 1960 and 2010. Additional streamflow measurements also were collected by NMC and MMC from 1998 through 1995 and 2001 through 2013 and by the DEQ in 1998 to 2000. Streamflow monitoring stations are shown on Figure 76. KNF gaged streamflow sites are on Libby Creek at US 2, West Fisher Creek, Miller Creek, lower East Fork Bull River, and lower Rock Creek. Four gaged sites also are on the Fisher River. MMC began continuously measuring the flow of upper Libby Creek in the summer of 2009. MMC also began continuously measuring the level of Rock Lake in the summer of 2009. Gurrieri (2001) and Gurrieri and Furniss (2004) measured and reported lake stage, surface inflows and outflows, and precipitation at Rock Lake in 1999 to complete a lake water balance. Available data collected by these various entities through 2013 are included in the EIS analysis.

3.11.2.3 Impact Analysis Methods

3.11.2.3.1 Streamflow

Streamflow changes may occur due to mine and adit dewatering, pumpback well system operation around the impoundment, evaporative losses from a tailings impoundment or LAD Areas (in Alternative 2), water appropriations from the Libby Creek watershed during high flows, discharges from a Water Treatment Plant or to the LAD Areas (the latter in in Alternative 2), vegetation clearing, and potable water use. To determine changes in streamflow and lake levels that may occur during the five mine phases, the capture, use, and discharges of water within each affected watershed for each mine alternative were evaluated. In addition, because the mine would intercept groundwater that may be a source of water to springs, lakes, and streams, the effects on surface water from underground mining also were evaluated.

A 2D numerical model of the mine area was developed to assess mine inflow and changes to baseflow (ERO Resources Corp. 2009). The primary objective of using a 2D model was to establish a hydrogeologic framework that could be used to evaluate potential mine impacts and develop possible impact mitigation. The baseflow of the mine area streams was modeled, as was the interaction of stream baseflow with the groundwater system. The agencies used the 2D model results for the basis of the hydrology effects analysis in the Draft EIS. Subsequently, MMC prepared a more complex 3D model of the analysis area (Geomatrix 2011a). The 3D model used the facility configuration in Alternative 3 in the analysis. Although the results of the two models are similar, the 3D model better represents the anticipated effects on streamflow and the 3D model results are used for the effects analysis. Similarly, the results of a 3D model of a pumpback well system at the Poorman Impoundment Site were used to assess effects of groundwater pumping on streamflow (Geomatrix 2010c). The effects on streamflow of Alternatives 2 and 4 have not been quantified and would be similar to effects described for Alternative 3 for east side streams and the same as Alternative 3 for west side streams. The effects of Alternatives 2 and 4 are discussed qualitatively and the effects of Alternative 3 are discussed quantitatively.

Sensitivity analyses were performed for each of the groundwater models and the results provided in ERO (2009) and Geomatrix (2011a). In addition, each model report discusses overall uncertainty of the respective model results. There is uncertainty associated with the hydraulic properties of the bedrock and faults; predictions of mine inflows and impacts on water resources are sensitive to permeability of major fault zones. With the data currently available, the model results provide a potential range of dewatering rates and streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. Both groundwater flow models would be refined and rerun after data collected during the Evaluation Phase were incorporated into the models (see section C.10.4, *Evaluation Phase* in Appendix C). Following additional data collection and modeling, the predicted impacts on surface water resources in the analysis area, including simulation of mitigation measures, may change and the model uncertainty would decrease.

Streamflow effects are described for four different flow periods: estimated $7Q_{10}$ flow, or in the case of higher elevation sites, baseflow, estimated $7Q_2$ flow, average flow, and peak flow. As discussed in section 3.8.3, 7-day, 10-year ($7Q_{10}$) low flow and 7-day, 2-year ($7Q_2$) low flow were derived for specific stream locations and the estimated $7Q_{10}$ and $7Q_2$ flow used to analyze the effects of mine activities on streamflow. The $7Q_{10}$ and $7Q_2$ low flows were estimated using a USGS method developed for ungaged watersheds (Hortness 2006). The equations used to estimate the $7Q_{10}$ and $7Q_2$ low flows used drainage area and mean annual precipitation as the location-specific variables (Hortness 2006). The estimated range of the $7Q_2$ and $7Q_{10}$ flows for analysis area streams is provided in Table 86 in section 3.8.3. With the exception of EFRC-200, LB-100, and LB-300, the estimated $7Q_{10}$ flow for the stream locations used in the streamflow analysis is lower than modeled baseflows. At EFRC-200, LB-100, and LB-300, where the estimated $7Q_{10}$ flow is greater than the modeled baseflow, the agencies used the lower modeled baseflow instead of the estimated$7Q_{10}$ flow to analyze effects. The use of estimated $7Q_2$ and $7Q_{10}$ flow (and modeled baseflow in lieu of $7Q_{10}$ flow at EFRC-200 and LB-300) provides an analysis of project effects when such effects would be most measurable.

The agencies used eight different locations to summarize streamflow effects from mine activities (Table 108 through Table 113); these locations are shown on Figure 76. The East Fork Rock Creek site, EFRC-200, is at the outlet of Rock Lake at the CMW boundary. The Rock Creek site, RC-2000, is at the mouth of Rock Creek above the confluence of the Clark Fork River. The East Fork Bull River site, EFBR-500, is at the CMW boundary. The sites on Little Cherry, Poorman, and Ramsey creeks are near the confluences of these creeks with Libby Creek. Two sites are on Libby Creek: LB-300 below the Libby Adit Site, and LB-2000 just above the confluence with Bear Creek. The effect on baseflow at LB-100 near the CMW boundary due to mine inflows was also evaluated.

these locations (Figure 76). One site is on Libby Creek (LB-2), located about 1 mile upstream of Little Cherry Creek, where the pumpback wells would reduce streamflow. Another site on the East Fork Rock Creek (RC-3) is about 1 mile upstream of the confluence with the West Fork Rock Creek, and the third site on the East Fork Bull River (EFBR-2) is at the confluence with Isabella Creek in the CMW. Effects due to mine inflows were predicted using the 3D groundwater model. In August through October 2012, KNF hydrologists collected stream cross-section measurements and measured stream velocity during various flow regimes at LB-2, RC-3, and EFBR-2. These data were used to calculate stream discharge at these locations and develop a relationship during low flows between the wetted cross section area (a total of 25 or more width and water depth measurements taken across a stream cross section, each multiplied and then added to derive total wetted perimeter at the cross section) and discharge. The wetted perimeter-discharge relationship for each site was used to estimate changes in the wetted cross-sectional area of the stream at these locations due to the project (ERO Resources Corp. 2012a). Additional data collection at RC-3 and EFBR-2 during low flows (proposed in the Appendix C Water Resources Monitoring Plan) would provide a more precise estimate of the relationship between discharge and wetted perimeter.

For all alternatives, construction of the tailings impoundment would alter the size of the watershed and the direction of runoff within the existing watersheds. Some of the runoff would be redirected by the configuration of the tailings impoundment to a watershed different from that of pre-mining conditions. To assess the effects of streamflow changes resulting from these changed watershed boundaries, the agencies analyzed the changes in watershed areas as an indicator of possible streamflow changes (ERO Resources Corp. 2010a in Appendix H). NewFields (2014b) completed a similar analysis for the watersheds in which the Poorman Impoundment would be constructed. NewFields analysis used for detailed LIDAR topographic mapping to assess changes in the Poorman Impoundment Site watersheds, and consequently the watershed sizes vary slightly. The differences between the two analyses were negligible. The agencies assumed that watershed area is directly related to streamflow in the receiving stream of each watershed. Use of watershed or drainage area is consistent with the Hortness (2006) method of estimating $7Q_2$ and $7Q_{10}$ flows at ungaged, unregulated streams. The agencies also assumed any differences in runoff due to elevation, soil type, vegetation cover, slope, and aspect are negligible across the analysis area. Within the small watersheds of the tailings impoundment sites (2.6 square miles in Alternatives 2 and 4, and 1.2 square miles in Alternative 3), these differences are likely small. The existing footprints for the tailings impoundments and associated facilities were plotted over the watershed boundaries. Changes to all watersheds were either added or subtracted from the existing watershed area, depending on whether the change would increase or decrease watershed area, and therefore water, to the watershed. Calculations were completed for the three alternatives for Operations and Post-Closure Phases. The watershed analysis is presented in Appendix H and summarized in the Environmental Consequences section for each alternative.

The KFP contains water yield guidelines based on instream resource values (Appendix 18, KFP, USDA Forest Service 1987a). Forest clearing for roads or other activities can alter normal streamflow dynamics, particularly the volume of peak flow and baseflow. The degree to which streamflow changes depends on the road density, percentage of total tree cover removed from the watershed, and the amount of soil disturbance caused by the harvest, among other things. For example, if harvest activities remove a high percentage of tree cover and cause light soil disturbance and compaction, rain falling on the soil would infiltrate normally. Due to the loss of tree cover, evapotranspiration (the loss of water by plants to the atmosphere) would be lower than before. The combination of normal water infiltration into the soil and decreased uptake of water by tree cover results in higher streamflow. In general, timber clearing on a watershed scale results in water moving more quickly through the watershed because of decreased soil infiltration and evapotranspiration. Water yield estimates for the analysis area were determined using the KNF Equivalent Clearcut Acres Calculator (ECAC) (KNF 2012a). The ECAC model was designed as a tool to estimate the potential effects of ground disturbing activities such as road, transmission line, and other land clearing disturbances. The ECAC model results are provided in Appendix H. The effects of project discharges and the pumpback wells on peak flow would be very small (less than 1 percent of peak flow) and are not discussed further.

The removal of vegetation on a landscape has been shown to also increase annual water yields. Annual water yield predictions for the Montanore Project were based on both water yield modeling programs (ECAC and WATSED) used by the KNF. The ECAC model is a peak-flow centric model used by the KNF to evaluate potential impacts from land management. The ECAC model is based entirely on the outputs from relationships developed from the R1-WATSED model. Numerous WATSED model outputs have shown that based on similar watershed characteristics, annual water yield increases can be estimated from the predicted peak flow increase. The agencies completed an annual water yield analysis for all project alternatives (Appendix H). WATSED was not designed, nor is it used to develop exact estimates of flow. The utility of the model is that it provides a consistent method for comparing alternatives. The values generated by the model are used, in concert with other water resource information, to interpret the potential effects on a stream channel as a result of implementing a proposed land management activity. Effects are analyzed with regard to normal or average conditions. Episodic climatic events such as rain-on-snow, high intensity thunderstorms, mass soil movement, or short-duration peak flows cannot be addressed in the model. Analysis of these types of events, where needed, must be completed using professional judgment or other models (USDA Forest Service 2011d).

3.11.2.3.2 Lake Levels and Volume

Potential changes in Rock Lake volume, level, and surface area without and with MMC's modeled mitigation (partial grouting in the mine near Rock Lake and installing two bulkheads post-mining) were quantitatively estimated using the 3D model results (ERO Resources Corp. 2012b). Gurrieri (2001) developed an estimate of the volume of Rock Lake and a relationship of volume to lake level and surface area. Uncertainties in the volume/stage/surface area relationships result from the low number of soundings collected at the lake, the inexact method of locating the soundings on the map, and the fact that few, if any, soundings were collected in the shallow areas of the lake near the shoreline (where the predicted effects on Rock Lake discussed in section 3.11.4 would occur). The 3D model predicted that as a result of a decline in the potentiometric surface due to mine inflows, the supply of bedrock groundwater to Rock Lake would decrease during all phases of mining (Geomatrix 2011a). The effects on Rock Lake during the mine phases and post-mining were quantified for a 2-month late summer/early fall period when the only source of supply to Rock Lake is assumed to be deep bedrock groundwater. The effect on the lake was also quantified for a 7-month winter period when Rock Lake is frozen and the only source of supply is assumed to be deep bedrock groundwater.

To be able to quantify the effects during the 2-month late summer/early fall period, the agencies assumed that without the effect of the mine, the lake is in equilibrium (lake inflow=lake outflow), no runoff from precipitation or snowmelt occurs during the 2-month period, and the lake is full at the start of the period. The reductions in groundwater flow to Rock Lake provided for each mine phase and after mine closure in the 3D model were used to estimate the change in lake volume and corresponding change in lake level for the 2-month period.

For the 7-month winter period, to quantify the effect of the mine post-closure, the agencies assumed the lake is in equilibrium (lake inflow=lake outflow), the lake is frozen for the entire period and no water evaporates from the lake, and water flows out of the lake downstream in a rate equal to groundwater flow into the lake. Due to late fall precipitation, Rock Lake was assumed to be full at the beginning of the 7-month winter period. The only change expected to occur during the 7-month winter period would be a change in water stored in Rock Lake when the potentiometric surface would be lower than the surface of the lake.

The analysis of effects on Rock Lake is based on the conceptual model of the groundwater flow systems used in both the 2D and 3D numerical models. Based on the conceptual model and the results of the 3D model, the agencies developed a water balance for Rock Lake that included groundwater inflow to the lake, evaporation, and surface inflow and outflow. A previous investigation (Gurrieri 2001) of Rock Lake used a different approach to develop a water balance for the lake. Using measured surface water inflow and outflow and water chemistry, Gurrieri developed a water balance that had an estimated groundwater outflow component. Using this water balance, Gurrieri analyzed the effects to Rock Lake of mine dewatering. The effects of the Gurrieri analysis were slightly greater, but within the range of model-predicted effects (Table 114 and Table 115).

Based on the following information, other lakes in the analysis area were dismissed from detailed analysis. St. Paul Lake is located within glacial moraine material, which causes the lake level to fluctuate to a much greater extent than does Rock Lake. Another difference between the two lakes is that the watershed above St. Paul Lake is north facing (Rock Lake's is south facing), and the snowpack above St. Paul Lake melts more slowly. St. Paul Lake may be affected by mining, but effects may be difficult to separate from the large, natural lake level variations. If deep groundwater was a component of the inflow to St. Paul Lake, mine dewatering would unavoidably reduce this source of water to the lake, and the lake level may lower more quickly during dry years when the only source of water to the lake was bedrock groundwater. Because the Libby Lakes and Isabella Lake are at an elevation of about 7,000 feet, and perched above the regional potentiometric surface, they likely would not be affected by mining dewatering. The KNF began monitoring the level of Lower Libby Lake in 2010; the recorder housing failed in 2013 and it was replaced in 2014. MMC would continue monitoring the water level of Lower Libby Lake (see Appendix C). Howard Lake is at an elevation of 4,100 feet southeast of the Libby Adit, and would be too far from mine dewatering to be affected. Ramsey Lake, near the proposed Ramsey Plant Site and the Ramsey Adits proposed in Alternative 2, is at an elevation of about 4,450 feet. Ramsey Lake is fed mostly by snowmelt and water flowing in shallow surface deposits in the Ramsey Creek drainage (Wegner, pers. comm. 2008). In September 2012, no flow was observed into the lake and an estimated 1 to 2 gpm was flowing out of the lake (NewFields 2013a). The Ramsey Lake level varies substantially and changes in the lake level due to mine inflows probably would not be detectable. Effects on Isabella Lake, St. Paul Lake, the Libby Lakes, Howard Lake, and Ramsey Lake are not discussed further. Effects on springs are discussed in section 3.10.4, *Groundwater Hydrology*.

3.11.2.3.3 Floodplains and Stream Crossings

To determine if mine or transmission line facilities would be located within 100-year floodplains designated by the FEMA, a GIS analysis was completed by overlaying the proposed facilities over the FEMA floodplain data for Sanders and Lincoln counties. GIS analysis for the transmission line alternatives included comparing the stream and floodplain crossings required for the mine and transmission line alternatives, providing the watershed acreage for Class 1 and 2 streams where roads would be built or trees cleared for other purposes, and determining the acreages of disturbance for impaired streams. The Alternative 2 and 4 tailings impoundments would be located with the floodplain of Little Cherry Creek, which has not been designated as a 100-year floodplain by FEMA. Kline Environmental Research (2005a) provided the approximate area of floodplain that would be affected by the Little Cherry Creek tailings impoundment in Alternatives 2 and 4.

3.11.3 Affected Environment

3.11.3.1 Relationship of Surface Water and Groundwater

Lakes and streams that exist above an elevation ranging between 5,000 and 5,600 feet within the analysis area are likely not connected hydraulically to deeper bedrock groundwater, but rather are supplied by surface runoff, snowmelt and/or drainage from unconsolidated, discontinuous surface deposits that store precipitation and snowmelt water. Streams located below the range of 5,000 to 5,600 feet generally are perennial, supplied by surface runoff, shallow groundwater, and groundwater from deeper bedrock fractures that intersect the ground surface. Some sections of these streams flow intermittently during some parts of the year due to the loss of surface flows into the underlying alluvium. At both tailings impoundment sites, the plant sites and the LAD Areas, groundwater occurs in unconsolidated glaciofluvial and glaciolacustrine deposits. The deposits range in thickness from 0 feet at bedrock outcroppings near the Little Cherry Creek impoundment site to more than 200 feet thick at the Poorman Impoundment Site. Groundwater discharges from these deposits to springs, alluvium, and Libby, Poorman and Ramsey creeks. Section 3.10.3*, Affected Environment* of the *Groundwater Hydrology* section discusses the relationship of groundwater, springs and streams in the analysis area. Chart 16 and Chart 17 portray conceptually the relationship of the various components of streamflow in watersheds in the analysis area.

3.11.3.2 Watersheds, Floodplains and Water Sources

Underground mining would occur beneath a divide separating three drainages: East Fork Rock Creek, East Fork Bull River, and Libby Creek. Except for a small ventilation adit near Rock Lake, proposed surface mine facilities in all mine alternatives would be located in the Libby Creek drainage. The mine area is drained on the east by Libby Creek and its tributaries: Ramsey, Poorman, Little Cherry, and Bear creeks (Figure 76). Libby Creek flows north from the analysis area to its confluence with the Kootenai River near Libby. The East Fork Rock Creek flows southwest, joining West Fork Rock Creek to form Rock Creek, which flows into the Clark Fork River downstream of Noxon Reservoir. The East Fork Bull River flows northwest into the Bull River. Several alpine lakes occur in the analysis area (Figure 76). Many of these lakes are located in glacial cirques that act as collection basins for runoff and snowmelt.

Chart 16. Typical Relationship of Various Components of Annual Streamflow in Analysis Area Watersheds.

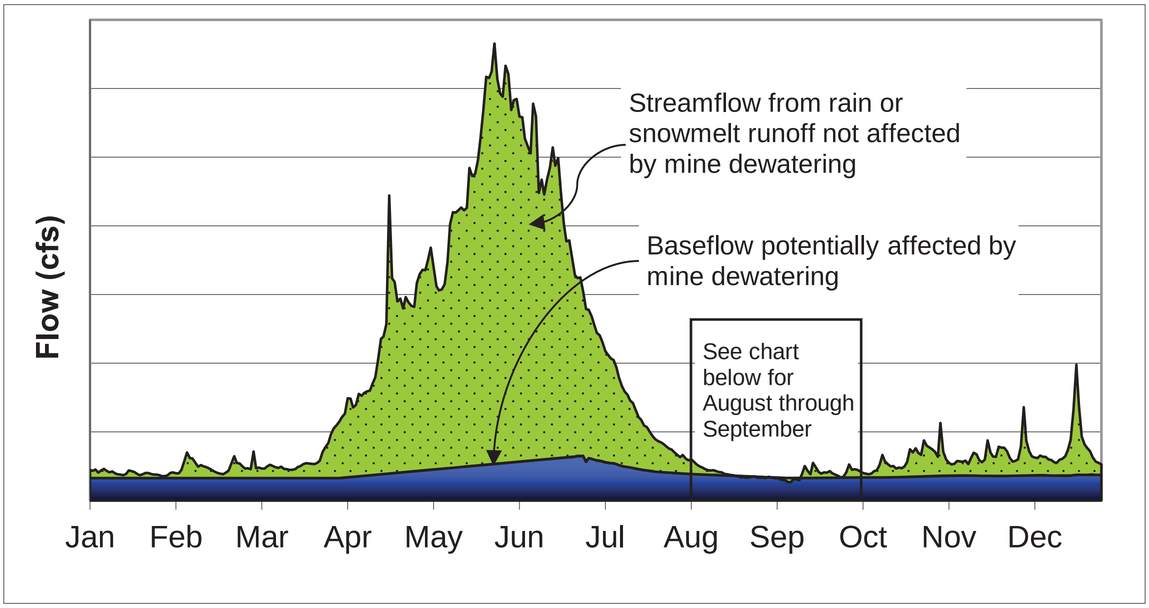
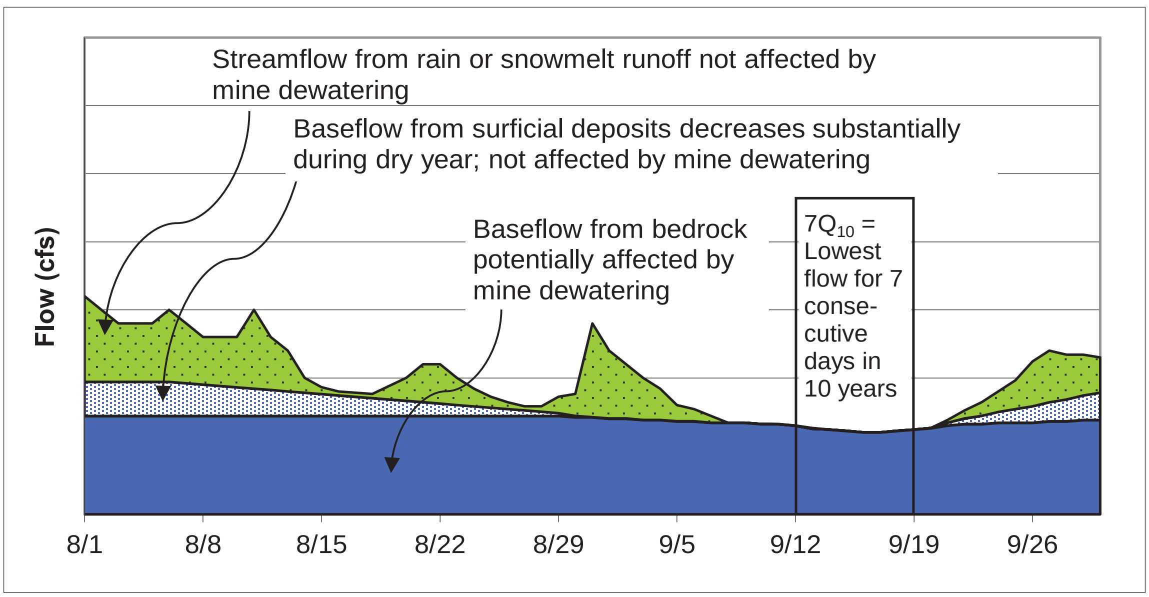


Chart 17. Typical Relationship of Various Components of Streamflow during $7Q_{10}$ Flow in Analysis Area Watersheds.



The transmission line corridor area is drained by the Fisher River and its tributaries: Sedlak Creek, Hunter Creek, Standard Creek, West Fisher Creek, and Miller and North Fork Miller creeks; and by Libby Creek and its tributaries: Howard Creek, Midas Creek, and Ramsey Creek, all perennial streams. Numerous unnamed ephemeral streams also drain the analysis area (Figure 76). One hundred-year floodplains have been designated along the Fisher River, Miller Creek, an unnamed tributary to Miller Creek, Ramsey Creek, and Libby Creek (Power Engineers, Inc. 2006a).

Snowmelt, rainfall, and groundwater discharge are the main sources of supply to streams, lakes, and ponds in the analysis area. Precipitation ranges from 100 inches per year at higher elevations in the Cabinet Mountains to about 30 inches per year at the tailings impoundment site. The highest precipitation occurs in November through February and the lowest in July through October.

Baseflow is the contribution of near-channel alluvial groundwater and deeper bedrock groundwater to a stream channel. Baseflow does not include any direct runoff from rainfall or snowmelt into the stream. Because the near surface geology varies between the upper and lower reaches of streams in the analysis area, the source of groundwater to streams also varies. The sources in the analysis area are unconsolidated deposits (alluvium and colluvium), weathered bedrock, and fractured bedrock. In some of the upper stream reaches, little if any alluvium, colluvium, or weathered bedrock are present. Other reaches, such as in the upper Libby and Ramsey creek drainages, contain surficial deposits within avalanche chutes that may store and transmit shallow groundwater through much of the summer depending on remaining snow pack at the head of each chute. Flow rates measured during late summer/early fall in upper Libby Creek are similar to the 3D model predicted baseflows, indicating that there may be little if any contribution from surficial deposits during late summer/early fall during years with little or no late season snow pack or precipitation. The primary source of baseflow to streams in the upper reaches is fractured bedrock up to an elevation in the analysis area of between 5,000 and 5,600 feet. Drainages above an elevation of about 5,000 to 5,600 feet are above the regional potentiometric surface and receive water from surface water runoff and from limited perched shallow groundwater in unconsolidated deposits such as talus. The shallow groundwater is from precipitation and drains quickly. The smallest, highest first order streams are ephemeral, while the second order channels (such as upper Libby Creek) into which the first order streams flow are generally intermittent. Second order channels become perennial when they intersect the regional potentiometric surface below between 5,000 and 5,600 feet. In general, the thickness of the unconsolidated surficial deposits increases in a downstream direction, and the deposits can store more groundwater where they are thicker. The fractured bedrock is hydraulically connected to the weathered bedrock and surficial deposits, so it is difficult to separate the individual sources of groundwater flow to streams in the middle and lower reaches of the drainages. Baseflow in the lower reaches is likely dominated by groundwater flow from the thicker surficial deposits. During the year, there is probably an ever-changing ratio between shallow groundwater (from the surficial deposits and weathered bedrock) and deeper bedrock groundwater contributions to any one stream. Streams in the analysis area do not reach baseflow every year.

Few streamflow data from the upper reaches of most analysis area streams draining the CMW are available. It is likely that during non-baseflow periods, streamflow is probably much greater than during the baseflow period, but actual flow rates are unknown. The agencies reviewed the hydrograph from three perennial stream locations (Granite Creek and Flower Creek, located near Libby, Montana, and Boulder Creek, near Leonia, Idaho) where between 22 and 50 years of continuously recorded annual flow data exist (ERO Resources Corp. 2009). Based on these three streams, which are analogous to streams in the lower reaches of the Montanore Project analysis area, it appears that perennial streams in the area with a baseflow component may flow at baseflow for about 1 to 2 months sometime between mid-July to early October. The stream hydrographs indicate that periods of baseflow also may occur during November through March.

3.11.3.2.1 Watershed Descriptions

Libby Creek and Libby Lakes

Libby Creek is the primary watershed within the analysis area. Libby Creek flows northward and joins the Kootenai River near the town of Libby. Libby Creek is rated as outstanding (Class 1) for fisheries habitat by the FWP (FWP 2012). Within the analysis area, the primary tributaries to Libby Creek are Ramsey, Poorman, Little Cherry, and Bear creeks (Figure 76). The highest elevation of the Libby Creek watershed is 8,740 feet. Libby Creek originates in a steep, glacial-carved basin, and discharges to the Kootenai River 29 miles downstream at an elevation of 2,060 feet. Libby Creek drains an area of about 68 square miles upstream of where the stream crosses US 2. The first 0.5 mile of Libby Creek flows intermittently. The Libby Creek valley widens downstream, where more erodible alluvial, glaciolacustrine, and glaciofluvial deposits are encountered. Where Libby Creek is perennial, flow is sustained by groundwater discharge. The average slope of upper Libby Creek is 6.6 percent (up to 30 to 40 percent near the top), and the creek contains pools, glides, riffles, rapids and cascades (Kline Environmental Research and NewFields 2012). The creek is a third-order stream near the proposed mine facilities. It is primarily restricted to a narrow channel flowing through bedrock canyons, erodible valley fill material, and glaciolacustrine sediment. Unstable stream channel characteristics in the Libby Creek drainage can be attributed, in part, to historical placer mining by hand (late 1800s), hydraulic and dredge mining (early to mid-1900s), and logging/clearcutting (early to mid-1900s).

The Libby Lakes are small and lie within closed depressions along the crest of the Cabinet Mountains. Drainage from Upper Libby Lake is tributary to the East Fork Rock Creek above Rock Lake and Middle and Lower Libby Lakes are tributary to Libby Creek.

A FEMA-designated 100-year floodplain is mapped along Libby Creek, from 4,000 feet above the confluence with Howard Creek to US 2.

Ramsey Creek and Ramsey Lake

The highest elevation of the Ramsey Creek watershed is 7,940 feet. Ramsey Creek is 5.3 miles long, and discharges to Libby Creek at an elevation of 3,425 feet. Its entire length is rated as outstanding (Class 1) for fisheries habitat by the FWP (FWP 2012). The total drainage area for Ramsey Creek is about 6.5 square miles. The upper part of the creek has two tributaries, one from the north and one from the south. The southern tributary originates at 5,598 feet, is 3,200 feet in length, and has a slope of 43 percent (Kline Environmental Research and NewFields 2012). The northern tributary is not in the GDE inventory area. The upper watershed is poorly drained and contains both a marshy area and Ramsey Lake, a small lake of about 2 acres (Figure 76). Water in the marsh flows through a series of ponds and meanders through grassy, wet meadows. Downstream of the meadows, Ramsey Creek is a high-energy stream flowing through a series of narrow bedrock canyons and glacial moraine material. Ramsey Creek is a perennial stream with heavily forested banks. The mainstem of Ramsey Creek is a second-order stream, is fairly flat and contains glides, pools and riffles (Kline Environmental Research and NewFields 2012).

A FEMA-designated 100-year floodplain is mapped along 4,000 feet of headwaters of Ramsey Creek near the CMW boundary.

Poorman Creek

The highest elevation of the Poorman Creek watershed is 7,655 feet. Poorman Creek is 5.3 miles long, and joins Libby Creek at an elevation of 3,320 feet. Its entire length is rated as outstanding

(Class 1) for fisheries habitat by the FWP (FWP 2012). The drainage area is about 6 square miles. Poorman Creek is a small, perennial stream located south of the Poorman Tailings Impoundment Site and north of the LAD Areas. Near the proposed mine facilities, Poorman Creek is a second-order stream. In the uppermost reach, which originates at 5,574 feet, the creek is steep (gradient typically between 25 and 40 percent), and cascades over bedrock. When the gradient decreases, there are glides and pools in the creek. The creek flows in a narrow, straight channel with several small intermittent tributaries, heavily forested banks, and a boulder, cobble, and gravel bed. Streamflow is relatively constant both upstream and downstream (Kline Environmental Research and NewFields 2012).

Little Cherry Creek

The highest elevation of the Little Cherry Creek watershed is 7,040 feet. Little Cherry Creek is a perennial stream that drains about 1.9 square miles, and flows 3.1 miles to its confluence with Libby Creek at an altitude of 3,120 feet. Its entire length is rated as outstanding (Class 1) for fisheries habitat by the FWP (FWP 2012). Streambed material ranges from boulders to sand and silt. Little Cherry Creek is incised into glaciolacustrine and glaciofluvial sediment, with a steep gradient reach where bedrock crops out in the lower section near its confluence with Libby Creek. The most complete synoptic flow data collected in Little Cherry Creek (Table 105) indicate that the creek gains water from groundwater discharges throughout its length (Geomatrix 2008b). Little Cherry Creek is a second-order stream.

The upper portion of the watershed is forested and the lower portion has been logged. In logged areas, stream banks are collapsed, and small shrubs and forbs have become established. The average bankfull width of upper Little Cherry Creek is 8 feet and 14 feet in the lower creek. Bankfull width is the width of the stream when carrying the 1.5- to 2-year peak flow (Rosgen 1996). The floodplain is estimated to range from 0 to 33 feet wide in the lower mile of the creek, and 33 to more than 100 feet wide above that location (Kline Environmental Research 2005a). The floodplain identified by Kline Environmental Research is not a FEMA-designated 100-year floodplain.

Bear Creek

Bear Creek is the largest tributary of Libby Creek in the analysis area, draining a 15-square mile area. The highest elevation of the Bear Creek watershed is 7,200 feet. Originating in a glacial basin, Bear Creek flows perennially 8.2 miles, converging with Libby Creek at an elevation of 3,050 feet. Its entire length is rated as outstanding (Class 1) for fisheries habitat by the FWP (FWP 2012). Bear Creek is incised into lake bed (glaciolacustrine) silt, although small areas of exposed bedrock occur in portions of the channel area. Most of the watershed is heavily forested. The streambed material is composed primarily of cobbles and gravels.

Cable Creek

Cable Creek is a tributary to Bear Creek, with headwaters in the CMW. The highest elevation of the Cable Creek watershed is 7,195 feet, and enters Bear Creek at 3,650 feet in elevation. The entire 4.2 miles of Cable Creek is rated as outstanding (Class 1) for fisheries habitat by the FWP (FWP 2012). The agencies expect that streamflow in Cable Creek would not be affected by the mine or transmission line, and it is not discussed further in this section.

Big Cherry Creek

The highest elevation of the Big Cherry Creek watershed is 8,740 feet, and its lowest elevation is 2,150 feet where it enters Libby Creek. Big Cherry Creek originates in a 5-acre lake and flows 19.2 miles to Libby Creek about 2 miles upstream of the Kootenai River. The stream shifts and braids within a wide, unvegetated cobble floodplain. Its entire length is rated as outstanding (Class 1) for fisheries habitat by the FWP (FWP 2012). The agencies expect that streamflow in Big Cherry Creek would not be affected by the mine or transmission line, and it is not discussed further in this section.

Howard Creek and Howard Lake

Howard Creek is a tributary to Libby Creek. The highest elevation of the Howard Creek watershed is 6,870 feet and enters Libby Creek at 3,570 feet in elevation. Howard Lake is located near the headwaters of Howard Creek at an elevation of 4,100 feet and is 33 acres in size. The lake is adjacent to a KNF campground. All of the transmission line alternatives would cross lower Howard Creek and two of the transmission line alternatives would cross upper Howard Creek at its headwaters. The drainage area is about 2.3 square miles, and the watershed begins at about 5,380 feet. The creek is about 2.8 miles long. The entire length of Howard Creek is rated as outstanding (Class 1) for fisheries habitat by the FWP (FWP 2012).

Midas Creek

The highest elevation of the Midas Creek watershed is 5,600 feet. Midas Creek is a tributary to Libby Creek that flows from the southeast into Libby Creek at an elevation of 3,290 feet a short distance downstream of Poorman Creek. The North Miller and Modified North Miller transmission line alternatives would cross into the upper Midas Creek watershed. The drainage area is about 6 square miles, and the watershed begins at about 5,750 feet. The creek is about 3.3 miles long. The entire length of Midas Creek is rated as outstanding (Class 1) for fisheries habitat by the FWP (FWP 2012).

Swamp Creek

The highest elevation of the Swamp Creek watershed is 5,850 feet. It flows 10.4 miles to its confluence with Libby Creek near US 2 at an elevation of 2,720 feet. In Alternatives 3 and 4, MMC would acquire a 67-acre parcel along US 2 through which Swamp Creek flows for wetland mitigation. The agencies expect that the streamflow and water quality in Swamp Creek would not be affected by the mine or transmission line. Swamp Creek is not rated by the FWP for fisheries habitat (FWP 2012).

Fisher River

The Fisher River is a tributary to the Kootenai River. The river is formed by two tributaries, Silver Butte Fisher River and Pleasant Valley Fisher River. Miller Creek and West Fisher Creek flow into the river 3 to 4 miles below the confluence of the two tributaries. The river is 63 miles long and has a watershed area of 838 square miles. The highest elevation of the watershed is 7,565 feet and joins the Kootenai River at 2,115 feet in elevation just downstream from Libby Dam. In the analysis area, the river is rated as substantial (Class 3) for fisheries habitat (FWP 2012). A FEMA-designated 100-year floodplain is mapped along all segments of the Fisher River in the analysis area.

Miller Creek

Miller Creek is a tributary to the Fisher River located southeast of the mine area. Segments of three transmission line alignment alternatives are in the Miller Creek watershed. The drainage area is about 12 square miles; the highest elevation of the watershed is 5,595 feet and it joins the Fisher River at 2,885 feet in elevation. Its entire 6.2-mile length is rated as moderate (Class 4) for fisheries habitat by the FWP (FWP 2012). Sections of Miller Creek in the lower reaches near the confluence with the Fisher River are dry most of the year where water in the channel sinks below the channel bottom. The stream connects with the Fisher River only during spring high flows, or during rain-on-snow events. The transmission line alignment in Alternatives B and C-R would parallel an unnamed tributary to Miller Creek that flows from the north into Miller Creek. The drainage area of this tributary is 1.9 square miles, the top of the watershed begins at about 5,400 feet, and the length of the tributary is about 2.4 miles. A FEMA-designated 100-year floodplain is mapped along Miller Creek and its unnamed tributary, from 2,000 feet above the confluence of the two drainages to Miller Creek's confluence with the Fisher River.

West Fisher Creek

West Fisher Creek is also southeast of the mine area and is a tributary to the Fisher River. The West Fisher Creek transmission line alignment generally parallels the creek for about 5 miles. It has a large drainage area (44 square miles); the highest elevation of the watershed is 7,610 feet (in the CMW) and the lowest elevation is 2,900 feet where it joins the Fisher River. The creek has several lakes in its headwaters and numerous tributaries. Its entire 13.3-mile length is rated as moderate (Class 4) for fisheries habitat by the FWP (FWP 2012). A FEMA-designated 100-year floodplain is mapped along West Fisher Creek, from 2,000 feet above the confluence with Lake Creek to its confluence with the Fisher River. All transmission line alternatives except Alternative B would cross the creek.

Hunter Creek

Hunter Creek, a tributary of the Fisher River, has a small drainage area (1.64 square miles) that originates east of US 2. The highest elevation of the watershed is 5,345 feet with its lowest elevation at 2,910 feet where it joins the Fisher River. Alternative B is the only transmission line alternative that would cross the creek. Most of the watershed is on Plum Creek lands. Hunter Creek's 2-mile length is rated as moderate (Class 4) for fisheries habitat by the FWP (FWP 2012).

Sedlak Creek

The Sedlak Creek watershed is immediately south of Hunter Creek. Sedlak Creek flows into the Pleasant Valley Fisher River about 1,000 feet east of the proposed Sedlak Park Substation Site. Sedlak Creek has a small drainage area (1.04 square miles); the highest elevation of the watershed is 4,440 feet and its lowest elevation is 2,995 feet where it joins the Pleasant Valley Fisher River. Most of the watershed is on Plum Creek lands. Sedlak Creek's 2-mile length is rated as moderate (Class 4) for fisheries habitat by the FWP (FWP 2012).

Standard Creek

Standard Creek, a tributary to West Fisher Creek, drains a portion of the transmission line corridor area and would not be affected by the mine or by construction and maintenance of the transmission line. The highest elevation of the watershed is 6,870 feet and its lowest elevation is 3,450 feet where it joins West Fisher Creek. Short segments of the Miller Creek and West Fisher Creek transmission line alternatives would be within the Standard Creek watershed, but the line and any associated access roads would be located more than 1 mile from the creek. The agencies expect that streamflow and water quality in Standard Creek would not be affected, and it is not discussed further.

Rock Creek Watershed

Rock Creek is formed by the convergence of the east and west forks of the creek, which drain an area of about 33 square miles of steep, high-elevation terrain. In its uppermost ephemeral reaches, the source of water supply to the East Fork Rock Creek is surface water runoff, but where the stream becomes perennial, bedrock groundwater is also a source of water to the creek. The reach above Rock Lake is 0.4 mile in length, has a gradient between 10 and 20 percent, and cascades over boulders and bedrock. Below Rock Lake, the East Fork Rock Creek to the confluence with the West Fork Rock Creek is 5.3 miles long, has an average slope of 8 percent, and contains pools, glides, riffles, rapids and cascades (Kline Environmental Research and NewFields 2012).

Underground mining would occur under the headwaters of the East Fork Rock Creek. The highest elevation of the East Fork Rock Creek watershed is 7,610 feet and its lowest elevation is 2,770 feet where it joins the West Fork of Rock Creek to create the mainstem of Rock Creek. The East Fork Rock Creek and Rock Creek are rated as outstanding (Class 1) for fisheries habitat by the FWP (FWP 2012). The East Fork Rock Creek flows perennially, but loses water near the confluence with the West Fork (USFWS 2007a).

Rock Creek Meadows is a 50-acre wetland outside the CMW where the topography flattens along the East Fork Rock Creek drainage. Several tributaries to the East Fork Rock Creek drain directly to Rock Creek Meadows; the drainage area of these tributaries is 2,970 acres. The drainage area of the East Fork Rock Creek upstream of the Meadows is 1,070 acres. The wetlands, when observed during an agency field review during a very dry period in September 2007, had a visibly high water table, and an inflow from the East Fork Rock Creek of about 2 cfs.

The West Fork Rock Creek flows 3.5 miles to the mainstem of Rock Creek. The substrate is dominated by gravel and rubble, with high amounts of fine sediment. The drainage is subject to high flow events and intermittent flow. West Fork Rock Creek may be used for bull trout mitigation. The agencies expect that the streamflow and water quality in West Fork Rock Creek would not be affected by the mine or transmission line, and it is not discussed further in this section.

Rock Creek downstream of the confluence of the East and West forks has a gradient of about 2 percent, and contains pools, glides, riffles, and rapids (Kline Environmental Research and NewFields 2012). Rock Creek flows into the Clark Fork River below Noxon Reservoir. Rock Creek is characterized by high velocities and large flow volumes during snowmelt runoff. The creek flows intermittently during baseflow periods, except for short reaches where perennial flow is maintained by alluvial groundwater and discharge from Engle Creek, Orr Creek, and alluvial groundwater from Big Cedar Gulch (Salmon Environmental Services 2012). The perennial flow downstream of Engle Creek is maintained by a bedrock spur about 3,000 feet upstream of MT 200. The bedrock probably prevents surface flow from entering the coarse subsurface alluvium, and may also force alluvial groundwater back into the channel. The surface flow becomes intermittent again when it reaches alluvium about 2,000 feet upstream from MT 200.

The Forest Service has been continuously gaging Rock Creek at RC-2000, located about 100 feet upstream of MT 200, since May 2011 (KNF 2011b, 2014a, 2014b). The estimated bankfull flow is 900 cfs. The highest flow measured was 782 cfs on May 13, 2013. During 2011, 2012 and

2013, streamflows peaked in mid-May. Flows of 100 cfs or greater occurred in 2011 during most days between mid-May and to the first week of July. 2012 and 2013 were wetter years, with flows of 100 cfs or greater starting at the end of March/beginning of April and occurring during most days through early to mid-July. Flows declined to less than 1 cfs or less in 2011 from September 20 through January 4, 2012, in 2012 from September 20 to October 19, and in 2013 from September 4 to September 23. Flows were also low (typically 2 to 5 cfs) in January to early March.

Rock Lake, at an elevation of 4,958 feet, has a 1.43 square mile watershed, a 58-acre surface area, a mean depth of 30 feet, and a maximum depth of 70 feet. The estimated volume of Rock Lake is 1,302 acre-feet (Gurrieri, pers. comm. 2011). Due to the steep, rocky shoreline, Rock Lake has a narrow, rocky littoral zone with very little littoral zone vegetation, based on the agencies' September 2007 site visit and review of aerial photographs. Rock Lake is included in the GDE inventory area described in Appendix C.

Rock Lake is located along the Rock Lake Fault and is fed by a short perennial stream. Water sources include snowmelt (particularly during the spring and early summer), rainfall (particularly in October and November), and groundwater via a shallow flow path during the runoff period and deeper bedrock groundwater throughout the year (Gurrieri 2001). The Rock Lake watershed receives an estimated average 78 inches of precipitation annually (ERO Resources Corp. 2012c). The volume of groundwater inflow to Rock Lake is a small fraction of the annual hydrologic budget; the annual water balance is dominated by surface water (Gurrieri 2001). The residence time of the lake water is very short during the spring snowmelt period (a few days), and lengthens significantly later in the year. The lake is a flow-through system; the lake gains water from surface runoff, from groundwater from the springs above it that flow to the lake, and directly from bedrock groundwater surrounding it. The lake loses water via evaporation, a surface outlet, and possibly groundwater outflow. Stage changes in Rock Lake were measured from mid-June through mid-October in 1999; the total decrease in lake level during that time was 1.29 feet (Gurrieri 2001). Lake stage measurements have been collected occasionally since 1999, and MMC began continuously recording lake stage changes in 2009. The lake measurements show that the lake level generally rises in late April to May as the snowpack melts, begins to decline in August, increases in October, and then remains relatively constant during the winter (NewFields 2013a, MMC 2014d). During the 2009 to 2013 period, the lake level fluctuated by about 2 feet (MMC 2014d).

East Fork Bull River Watershed

The East Fork Bull River has several tributaries that drain an area of about 26 square miles of the CMW. The highest elevation of the East Fork Bull River watershed is 7,940 feet and its lowest elevation is 2,290 feet where it enters the Bull River. Its entire 8-mile length is rated as outstanding (Class 1) for fisheries habitat by the FWP (FWP 2012).

In its uppermost ephemeral reaches, the source of water supply to the East Fork Bull River basin is surface water runoff, but where flow becomes perennial at an elevation of about 5,400 feet, flow from a spring (EFBR-10), which may be associated with the Rock Lake Fault, is a source of bedrock groundwater to the stream. St. Paul Lake, elevation 4,715 feet, is located along the Rock Lake Fault near the top of the East Fork Bull River watershed. Five tributaries, one of which runs along the trace of the Rock Lake Fault, flow into the lake. The eastern tributary has two branches, one that originates at 5,589 feet and one that originates at 5,348 feet. Another tributary originates at 5,595 feet and is 2,950 feet in length. The tributaries are primarily bedrock-controlled cascades, with average gradients ranging from 17 to 34 percent (Kline Environmental Research and NewFields 2012). St. Paul Lake is perched on a moraine at the junction of two mountain valleys. The glacial moraine material beneath the lake is very coarse. Outflow from the lake is through the glacial gravels to the East Fork Bull River drainage. Flow resurfaces at a small wetland 330 feet northwest of St. Paul Lake at an elevation of 4,706 feet (Kline Environmental Research and NewFields 2012) (Figure 76).

St. Paul Lake has a 9-acre surface area and a drainage area of 1.5 square miles. The major source of water to the lake is snowmelt. Seasonal stage changes have not been measured in St. Paul Lake; the lake level has been observed to fluctuate to a much greater extent than does Rock Lake due to leakage through the relatively high permeability moraine material (Gurrieri, pers. comm. 2008). St. Paul Lake can become completely dry during extended periods of little to no precipitation.

Below St. Paul Lake, the river is steep (average 12 percent gradient), with rapids and cascades. After the gradient begins to flatten, there are also pools, glides and riffles in the river (Kline Environmental Research and NewFields 2012). Two tributaries that join the East Fork Bull River within the CMW are 1.8-mile long Isabella Creek, and 1.2-mile long Placer Creek. Placer Creek drains a small watershed east of St. Paul Lake, and Isabella Creek drains a larger watershed along the mountain divide. Isabella Lake is small and lies within a closed depression along the crest of the Cabinet Mountains. Isabella Lake has no defined stream channel from the lake to Isabella Creek.

The flow of the East Fork Bull River just upstream of the confluence with the Bull River has been gaged by the Forest Service since May 2009 (KNF 2011c, 2011d, 2011e, 2012b, 2014c). The estimated bankfull flow at the gage is 694 cfs. During the 2009 to 2013 period, streamflows peaked in mid-May, with the highest flow (820 cfs) occurring on May 16, 2011. Peak flows also occurred due to rain-on-snow events that occurred in December 2009 (740 cfs) and January 2011 (672 cfs). During spring runoff, flows exceeding 100 cfs occurred for 22 days in May 2009, from April 20 to July 5 in 2010, from May 5 to July 27 in 2011, from April 12 to July 21 in 2012, and from April 2 to 13 and April 27 to July 6 in 2013. During the period of record, lowest flows (15 cfs or less) occurred in the last week of August, September, and October, and at times during the winter months.

Swamp Creek and Wanless Lake

On the west side of the Cabinet Mountains, Swamp Creek flows 14.7 miles from Wanless Lake to the Clark Fork River. The highest elevation of the Swamp Creek watershed is 7,610 feet and its lowest elevation is 2,350 feet where it enters the Clark Fork River. The creek is rated as substantial (Class 3) for fisheries habitat (FWP 2012). Wanless Lake, elevation 5,100 feet, is slightly larger than Rock Lake, has a slightly larger watershed with similar topography, is located within the Revett Formation, and is bisected by the Rock Lake Fault. Swamp Creek and Wanless Lake are outside the area of predicted effects from mining, and would be used as benchmark monitoring sites (see Appendix C, Section C.10).

Copper Gulch

Copper Gulch flows 4.6 miles to Bull River. Its entire length is rated as outstanding (Class 1) for fisheries habitat by the FWP (FWP 2012). The highest elevation in the watershed is 7,714 feet and the lowest elevation is 2,270 feet where it enters the Bull River. Channel stability in the lower reach has been adversely affected by extensive stream channelization and subsequent channel maintenance. Factors affecting fish habitat included stream channelization, riparian alteration, channel clearing, and the high gradient nature of the drainage. The lower reach upstream of the confluence with Bull River is subject to seasonally intermittent flows. Copper Gulch may be used for bull trout mitigation. The agencies expect that the streamflow and water quality in Copper Gulch would not be affected by the mine or transmission line, and it is not discussed further in this section.

3.11.3.2.2 Streamflow

Instantaneous and Continuous Streamflow Measurements

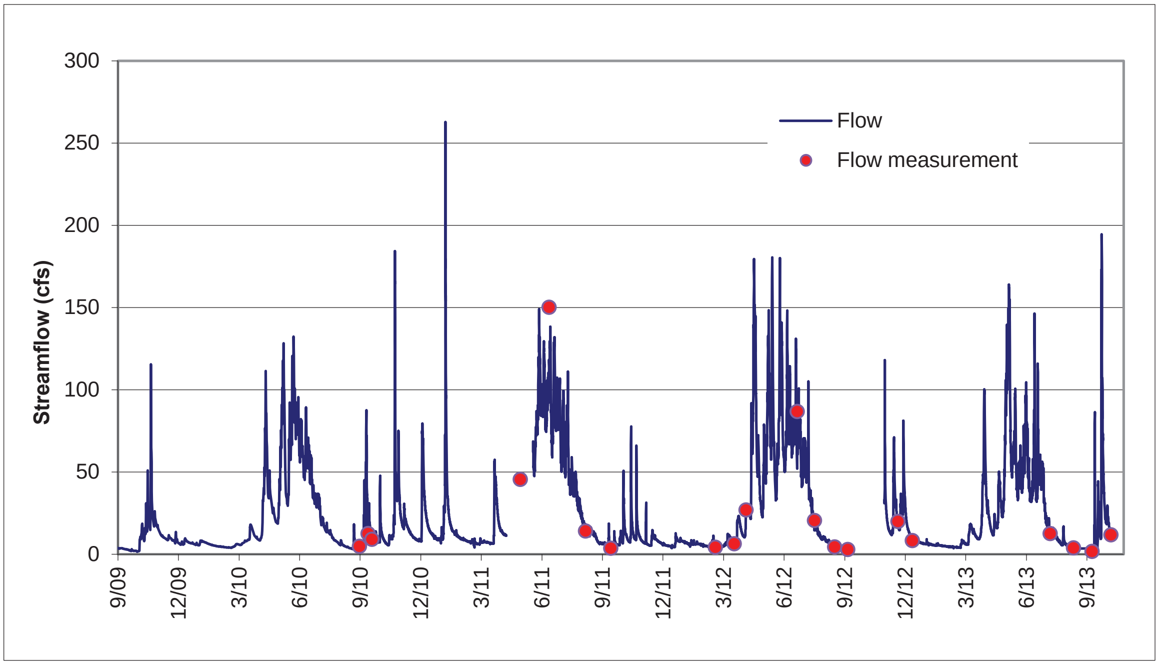
Instantaneous and continuous streamflow in the analysis area has been collected using a flow meter at measured stream cross-sections, mostly at lower elevations and outside of the CMW. None of the streams within the analysis area have been continuously gaged on a long-term basis; without such data, hydrographs cannot be developed to determine baseflow, average low flow, or peak flow.

In all of the streams measured (Libby Creek, Ramsey Creek, Poorman Creek, Little Cherry Creek, Bear Creek, Miller Creek, West Fisher Creek, Rock Creek, and the East Fork Bull River), the highest annual flows typically occur between April and June, with the highest flows most often occurring in May, then secondly in April. There are typically smaller, short-term increases in streamflow in October through March due to precipitation and snowmelt events. Lowest flow occurs most often from mid-August to mid-September and may occur for up to 2 months during late summer to early fall and also may occur during November through March. Streamflow in the analysis area was often not measured during November through February. Other streamflow peaks occurred in the spring and early summer of 2010 as a result of both precipitation and snowmelt runoff. Highest and lowest measured flows are provided for each stream in Table 104. Some of the lowest measured flows were close to or lower than the lower range of estimated $7Q_{10}$ flow shown in Table 86 in section 3.8.3.

The analysis area is sometimes subjected to strong warm-frontal storms between November and mid-April that bring heavy rain, warm temperatures, and strong winds. Rain-on-snow events occur about every 6 years east of the Cabinet Mountain divide (Wegner, pers. comm. 2006c) and every year on the west side of the Cabinet Mountains (Neesvig 2010). Depending on storm intensity and soil and snowpack moisture conditions, these storms can produce very high streamflow. For example, a major rain-on-snow event occurred in December 2004. The KNF measured a flow of 560 cubic feet per second (cfs) at the West Fisher Creek site and a flow of 549 cfs in Libby Creek at US 2 (Wegner, pers. comm. 2006d). In addition to causing high streamflow, channel migration, and the movement of large materials within the stream channels, the high rate of water to the soil can generate unstable conditions on hill slopes. During such high flows, landslides can occur and stream channels may be altered by bank erosion, down cutting, and redistribution of sediment and large woody debris. These events caused extensive damage to road drainage and stream crossing structures throughout the KNF. Channel alterations caused by ice flows associated with these events occurred to most stream systems in the analysis area and resulted in streambed scouring. The rain-on-snow event that occurred in February 1996 resulted in down cutting of most perennial channels by about 2 to 3 inches.

Beginning in September 2009, MMC began continuously measuring stage in Libby Creek at LB-200, upstream of the Libby Adit. The stage readings were used to develop a stage-discharge relationship at LB-200; the resulting streamflows are provided in Chart 18. At LB-200, large precipitation events in October 2009, November 2010, January 2011, and September 2013 increased streamflow significantly during a typically low-flow period.

Chart 18. Streamflow at LB-200, September 2009 to October 2013.



Source: MMC 2014d.

The estimated $7Q_{10}$ flow at LB-200 using the USGS method is 2.35 cfs, with an estimated range of 1.11 cfs to 5.05 cfs. Measured flow averaged less than 2.35 cfs for seven consecutive days between October 5, 2009 and October 14, 2009. The lowest 7-day average flow was 1.90 cfs on October 14. Based on the Poorman SNOTEL site, 2009 was the driest year in the past 10 years in the project area (Natural Resources Conservation Service 2014).

At LB-2000, numerous streamflow measurements were collected between 1988 and 2009. Flows during all months were very variable, with low flows of 2 cfs or less occurring every month, average monthly flows ranging from 4 cfs in September to 80 cfs in May, and maximum monthly flows ranging from 23 cfs in September to nearly 420 cfs in June. Flows exceeding 200 cfs occurred infrequently; seven measurements greater than 200 cfs occurred in April through June, and one occurred in February.

In September 2012, MMC measured flow in Ramsey Creek 500 feet above the CMW boundary (RC-10) and 4,000 feet downstream of the boundary (RC-20). Flow was 1.15 cfs at the upper location and 1.59 cfs at the lower location. In 2013, MMC measured flow at RC-10 in August, September and October; flows ranged from 1.40 cfs in September to 4.02 cfs in October (MMC 2014d).

Table 104. Measured High and Low Flows in Analysis Area Streams.

Stream	Station	Sampling Period	Minimum Measured Streamflow (cfs)	Maximum Measured Streamflow (cfs)	Number of Measure-ments
Libby Creek	LB-100	4/88 to 10/13	0.77	50.7	32
	LB-200[†]	4/88 to 10/13	0.77	262	Numerous
	LB-300[£]	9/89 to 7/12	1.6	148	80
	LB-500	4/88 to 7/12	0.47	173	81
	LB-800	4/88 to 8/07	2.9	250	37
	LB-1000	2/91 to 4/12	2.9	122	34
	LB-2000	9/88 to 4/12	0.1	418	Numerous
	LB-3000[§]	4/88 to 4/12	10.6	319	Numerous
	US 2[‡]	3/99 to 9/09	4.0	1,076	53
Ramsey Creek	RA-100	4/88 to 10/93	0	60.9	18
	RA-200	4/88 to 10/93	0.5	62.8	24
	RA-600	4/88 to 10/09	1.2	119.5	41
Poorman Creek	PM-500	4/88 to 10/93	0.5	85.4	24
	PM-1000	4/88 to 4/12	0.7	62	50
Little Cherry Creek	LC-100	4/63 to 9/65; 4/88 to 10/07	0.1	15	64
	LC-USFS	4/63 to 9/65	0.2	15	30
	LC-600	4/88 to 6/05	0.2	13.2	12
	LC-800	4/91 to 4/10	0.2	11.9	24
Bear Creek	BC-100	4/88 to 10/88	1.8	98.1	9
	BC-USFS	11/60 to 9/65	5.0	230	31
	BC-500	4/91 to 4/12	2.8	110	25
East Fork Rock Creek	EFRC-50	7/12 to 9/13	<0.01	10.4	5
	EFRC-100 (Rock Lake inflow)	10/98 to 10/13	0.01	10.4	9
	EFRC-200 (Rock Lake outflow)	10/98 to 10/13	<0.01	27.3	20
	EFRC-300	9/88 to 10/88	0.4	6.5	2
Rock Creek	RC-2000	1984-1993, 2011-2013	<1	782	Numerous
East Fork Bull River	EF Bull River above confluence with Bull River	1974-2000, 2009-2013	4.6	820	Numerous
Miller Creek	Miller Creek	5/78 to 4/82	10.6	63.5	3
West Fisher Creek	West Fisher Creek	10/01 to 8/08	8.6	669	34

[†]LB-200 water level stage measured continuously by MMC beginning September 2009.
[£]LB-300 flow includes discharge from the Libby Adit between 1990 to 1998 and 2008 to present. Flow at other Libby Creek sites downstream of LB-300 also may have been influenced by discharge from the adit during the same time periods.
[§]LB-3000 flow measured with a continuous recorder in 1988 and 1989.
[‡]The KNF measured flow at the US 2 bridge until September 2009. The monitoring station was moved about 2 miles downstream due to safety concerns. The new station is outside of the analysis area.
Station locations are shown on Figure 76.
cfs = cubic feet per second; < = less than.
Source: NewFields 2013a; MMC 2008, 2009b, 2010, 2011b, 2012g, 2013; Neesvig, pers. comm. 2006, 2010 and 2011; Wegner, pers. comm. 2006d; Boyd, pers. comm. 2010.

In July to October 2013, MMC measured flow in the upper East Fork Bull River at EFBR-50 monthly measured stage continuously using a pressure transducer (MMC 2014d). The flow ranged from 0.02 cfs in mid-September to 0.22 cfs in mid-October. The transducer data showed a drop in stream stage from July through early September, with a couple of short increases during that period due to precipitation events. The stream stage was lowest in early September, and remained fairly steady for about two weeks, so the flow of 0.02 cfs may represent baseflow conditions. In mid-September, stream stage increased due to fall precipitation. MMC measured a flow of 0.05 cfs in August 2013 at EFBR-10, located at an elevation of 5,400 feet upstream of EFBR-50 where flow was observed to begin in that channel. MMC also measured flow in three of the four other channels that flow into St. Paul Lake in September 2013. Flow in SPL-1, SPL-4, and SPL-11 ranged from 0.01 to 0.03 cfs; these flows may represent baseflow conditions.

MMC installed a pressure transducer in the East Fork Rock Creek at EFRC-100 (inflow to Rock Lake) in August 2013. The continuous stage measurements were fairly steady through mid-September, which may represent baseflow conditions, which was measured in mid-September 2013 as 0.05 cfs. Stream stage increased in mid-September due to fall precipitation.

MMC measured the flow at the outlet of benchmark lake Wanless Lake to Swamp Creek (in Sanders County) in July, August and September 2013. The site (WL-2) is a benchmark monitoring site (outside the range of influence of expected mine or adit inflows) comparable to EFRC-200, the outlet of Rock Lake. The flow at EFRC-200 was measured within 1 to 2 days of flow measurements collected at WL-2, and were similar. Highest flows (5.3 cfs at EFRC-200 and 5.7 cfs at WL-2) were measured in mid-July 2013, and lowest flows (0.3 cfs at EFRC-200 and 0.4 cfs at WL-2) were measured in mid-September 2013.

MMC also measured flow in Swamp Creek (in Lincoln County) at the proposed wetland mitigation site adjacent to US 2. Flow measurements collected at three locations at the site between May and September 2011 and June and August 2012 ranged from 1.37 in September to 31.8 cfs in May. Flow in a tributary channel from a spring (#2) ranged from 6.19 cfs in May 2011 to 1.01 cfs in August 2012 (NewFields 2013a).

Synoptic Streamflow Measurements

MMC completed synoptic streamflow measurements in late August 2005 at selected locations along Ramsey Creek, Poorman Creek, Little Cherry Creek, and Libby Creek (Table 105). These data indicate that the three tributaries to Libby Creek along nearly all of their reaches are gaining streams with inflow from groundwater. Some of the flow in Libby Creek between stations LB-500 and LB-800 apparently infiltrates into the alluvium, because the increase in flow from 1.6 to 2.8 cfs does not account for the 2.8 cfs coming in from Ramsey Creek (RA-600) and unknown flow from Howard Creek. Libby Creek below LB-800 apparently gains some flow from groundwater.

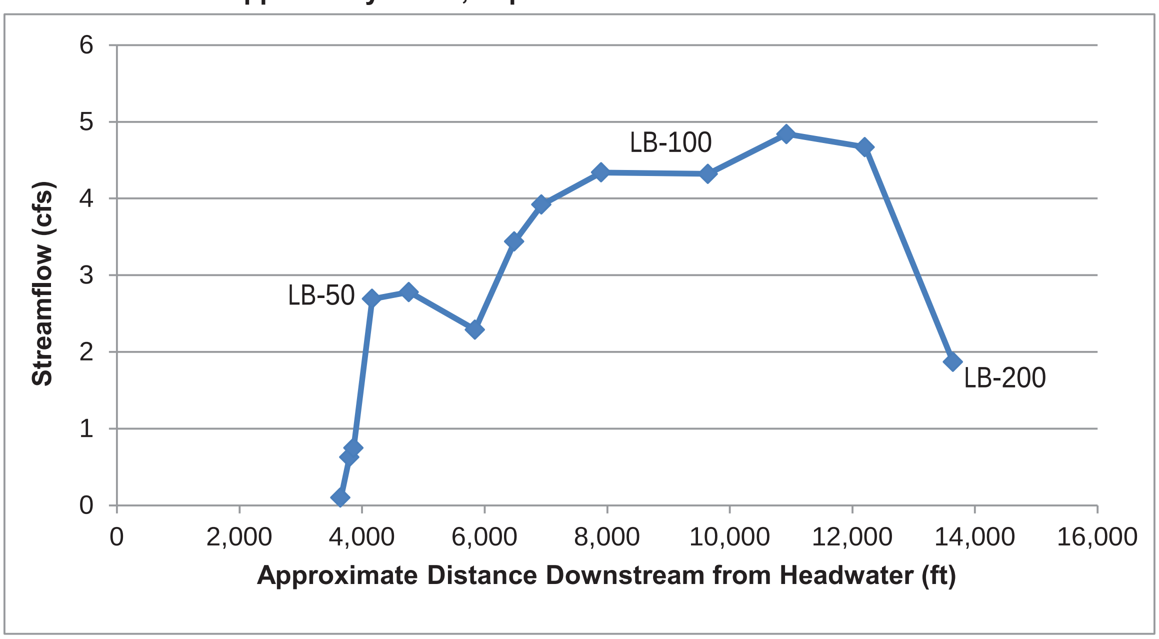
Table 105. August 2005 Synoptic Streamflow Measurements.

Ramsey Creek	Poorman Creek	Little Cherry Creek	Lower Libby Creek
RA-1 = 1.79	PM-500 = 1.07	LC-100 = 0.16	LB-500 = 1.55
RA-2 = 1.93	PM-1 = 0.76	LC-1 = 0.17	LB-800 = 2.82
RA-3 = 2.26	PM-2 = 1.03		LB-2000 = 8.86
RA-4 = 2.34	PM-3 = 1.5	LC-100 = 0.11*	
RA-600 = 2.79	PM-4 = 0.91	LC-1 = 0.33*	
	PM-1000 = 0.77	LC-800 = 1.82*	
	PM-5 = 1.93		
		LC-1 = 0.37**	
		LC-800 = 0.31**	

All flows are in cubic feet per second.
Measurements made August 24-26, 2005, except data with (*) measured June 25-26, 2005 or data with (**) measured July 30-31, 2005.
Source: Geomatrix 2006b.

On September 3, 2010, MMC completed synoptic flow measurements along Libby Creek from the top of the main channel where the uppermost channel from the west joins the uppermost channel from the south, about 1 mile upstream of the CMW boundary to LB-200 (Chart 19). MMC also completed synoptic flow measurements in this same area in September and October 2012, and extended the measurements up to the top of the highest, most westerly channel up to an elevation of 5,880 feet (Figure 76). MMC completed synoptic flow measurements from LB-40 to LB-100 in July through October 2013. The 2012 and 2013 synoptic flow measurements are provided in Table 106. LB-300 was not included in the synoptic flow measurements of upper Libby Creek. This entire section of the Libby Creek channel is narrow, with numerous steep side

Chart 19. Flow in Upper Libby Creek, September 2010.



Source: Geomatrix 2010b.

Table 106. 2012 and 2013 Synoptic Streamflow Measurements in Upper Libby Creek.

Measurement Date	LB-40	LB-30	LB-20	LB-50	LB-70	LB-80	LB-100	LB-200
9/13/12	0.18	0.54	0.30	1.67	1.37	1.40	3.87	2.78
9/27/12	0.14	0.29	1.66	1.87	1.08	1.77	2.33	NM
10/10-14/12	0.02	0.37	0.25	0.85	0.15	0.61	1.92	NM
7/10/13	3.34	5.52	1.55	10.88	13.16	10.53	19.70	12.57
8/7/13	1.39	2.05	0.87	4.83	4.31	3.19	7.40	5.27
9/4/13	0.33	0.73	0.57	2.67	2.00	1.24	2.39	NM
10/4-7/13	1.86	3.27	1.21	6.67	12.12	13.46	25.90	24.83

All flows are in cubic feet per second. LB-20 and LB-30 are tributaries to the mainstem of Libby Creek between LB-40 and LB-50.
NM = No measurement.
Source: MMC 2014d.

channels on both sides of the creek. At 5,880 feet, in an area of extensive colluvium and rock talus, the flow in the channel was measured at 0.02 cfs in September 2012. Perennial flow in Libby Creek originates slightly above LB-50 where a fault of the Snowshoe thrust cuts across the valley (Fillipone and Yin 1994). At most locations measured in the mainstem, the creek showed flow gains except at the last location at LB-200.The creek for the most part gains flow from above LB-50 to LB-100, then loses flow between LB-100 and LB-200. Measurements indicate that some water is lost to alluvial deposits between LB-100 and LB-200, and that the alluvium is limited in the volume of water it can carry.

Downstream of LB-200, at least five steep side channels enter the main channel of Libby Creek between LB-200 and LB-300. The Libby Creek channel does not begin to widen and become flatter until the Libby Adit site just above LB-300. Historical flow data (1989-2013) for LB-200 and LB-300 collected on the same date show that during low flows (defined for this purpose as flow of less than 4.63 cfs, the estimated $7Q_2$ flow at LB-300), the stream gained an average 36 percent in flow between LB-200 and LB-300. Based on these data, upper Libby Creek to LB-300 is largely a gaining stream, with inflow from groundwater (either directly to the mainstem or via the numerous side channels), and a temporary loss to alluvium of limited thickness within the narrow channel above LB-200. This water appears to return to the creek between LB-200 and LB-300.

3.11.3.3 Spring Flows

Numerous springs occur in the analysis area and are discussed in section 3.10, *Groundwater Hydrology*.

3.11.3.4 Stream Channel Characteristics of Impoundment Sites

3.11.3.4.1 Little Cherry Creek Tailings Impoundment Site

At the Little Cherry Creek Tailings Impoundment Site, the Little Cherry Creek channel substrate material is predominantly gravel. The average bankfull width of upper Little Cherry Creek is 8 feet and 14 feet in the lower creek. The maximum bankfull depth is 0.7 to 1.2 feet. The floodplain width ranges from 30 to more than 100 feet. The channel gradient ranges from 7 percent near the confluence with Libby Creek to 2 percent in the upper part of the watershed (Kline

Environmental Research 2005a). The channel is stable, and the stream contains pools and riffles. Bedrock outcrops in the channel downstream of the Seepage Collection Dam Site. The range of measured Little Cherry Creek flows is provided in Table 104.

3.11.3.4.2 Poorman Tailings Impoundment Site

Surface water in four drainages in the Poorman Tailings Impoundment Site (Drainages 3, 5, 10 and 14) flows east toward Libby Creek (Figure 87). The four drainages comprise a small, 1,025-acre watershed within the Libby Creek watershed. Libby Creek is a third-order stream. The area upstream of and including the watershed of the four unnamed drainages is 23,245 acres. Major tributaries of Libby Creek upstream of the Poorman Tailings Impoundment Site are Poorman Creek, Ramsey Creek, Howard Creek, and Midas Creek. The four drainages were characterized by Kline Environmental Research (2012). The descriptions below apply to observations made in May and September 2011.

Drainage 3

Drainage 3 originated from two main branches (Figure 87). The flow path from a wetland (WUS 2) and a spring (SP-28) and a spring slightly downgradient in one of the branches had minor flow when measured in May 2011. The flow path transitioned from unchannelized with flow in May 2011 to channelized with flow in September 2011. The second main branch also originated in a wetland (WUS 1). From WUS 1, the flow path was mainly unchannelized, with short reaches where it was channelized, with a transition to a mainly persistent flow near the confluence with the other main branch. The combined flows in the second branch created a channel with persistent flow for most of the distance to Libby Creek. Of the four drainages, Drainage 3 had the highest measured discharge (202 gpm) to Libby Creek when measured in May 2011.

Drainage 5

Drainage 5 originated from two branches (Figure 87). Flow in one of the branches is entirely unchannelized. Flow began upstream of Spring 31, flowed through a wetland (WUS-36), drained through a culvert (NFS road #6212H), and continued through dense alder before merging with a second branch. The second branch began at Spring 32, flowed through channel habitat, then became unchannelized. The second branch was joined by flow from Spring 30 and entered wetland WUS-4. This wetland had standing water in May and September 2011. Flow through the culvert at NFS road #6212H ceased in October. Below the culvert, flow became somewhat dispersed through a dense stand of alder, where it joined with the other branch.

After the two branches combined, the channel became entrenched and crossed a low-gradient, bushy area before cascading down a steep bank in a narrow v-shaped valley. It then flattened out and ended abruptly at a pool near the edge of the proposed Seepage Collection Pond in Alternative 3. Flow to the terminal pond appeared to be perennial. From the terminal pool, there was no evidence of surface flow connecting Drainage 5 to Libby Creek.

Drainage 10

The three branches in Drainage 10 were largely unchannelized. Flow in Drainage 10 originated at springs 33, 34, and 35. the lower portion of the main branch dropped steeply through a narrow, v-shaped valley, forming step pools, step riffles, and cascades, followed by a riffle-dominated final reach. The drainage became unchannelized across a flat area leading to two culverts under NFS road #1408. The flow dispersed and infiltrated in this flat area and did not always reach the culverts. Kline Environmental Research (2012) assumed that Drainage 10 connected to Libby Creek downgradient of the culvert.

Drainage 14

All of the flowing reaches of Drainage 14 were in the upper part of the drainage. Segments of channelized flow were scattered throughout the drainage. Four springs (37, 38, 39, and 40) contributed water to the channel. Several reaches of Drainage 14 below the upper reaches were only identifiable during spring runoff. The lowest reach of Drainage 14 within the disturbance boundary was channelized in a well-defined valley. Surface flow at the downstream disturbance boundary was assumed to reach Libby Creek.

3.11.3.5 Climate Change

The USDA Forest Service issued the KIPZ Climate Change Report in 2010 (USDA Forest Service 2010a). The Department of the Interior, Bureau of Reclamation issued three reports on climate change in 2011 (Reclamation 2011a, 2011b, 2011c), discussed in section 3.3.1, *Climate Change* and in section 3.10.3.4, *Climate Change* in the *Groundwater Hydrology* section. For the Columbia River Basin in general, warming is expected to diminish the accumulation of snow during the cool season (i.e., late autumn through spring) and the availability of snowmelt to sustain runoff during the warm season (i.e., late spring through early autumn). Increased rainfall in December through March is expected to increase runoff during those months. Decreased snowpack volume could result in decreased groundwater infiltration, decreased spring/summer runoff, increased rain-on-snow events, and ultimately decreased contribution to baseflow in streams (USDA Forest Service 2010a; Reclamation 2011c).

3.11.4 Environmental Consequences

3.11.4.1 Alternative 1 – No Mine

Under this alternative, MMC would not develop the Montanore Mine. Any existing exploration-related or baseline collection disturbances by MMC would be reclaimed in accordance with existing laws and permits. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands. Reduction of streamflow in Libby Creek above the Libby Adit from the partial dewatering of the Libby Adit would continue until the Libby Adit was plugged and groundwater levels recovered. Streamflow below the Libby Adit would not be affected.

3.11.4.2 Effects Analysis of the Action Alternatives

Mine facilities and activities in Alternatives 2, 3 and 4 would affect streamflow and the volume and level of Rock Lake. All mine alternatives would reduce groundwater discharge to area streams and Rock Lake due to mine and adit inflows and lowering of the potentiometric surface during all five mine phases (Evaluation, Construction, Operations, Closure and Post-Closure). When the potentiometric surface reached steady state conditions after mining ceased, the effect would vary by drainage and without or with mitigation. Without mitigation, the effect on streamflow in the East Fork Rock Creek and East Fork Bull River and on the volume and level of Rock Lake would be the same in all mine alternatives. The effects on aquatic life and habitat due to streamflow changes are described in Section 3.6, *Aquatic Life and Fisheries.* The indirect effects due to streamflow changes on riparian vegetation are described in Section 3.22, *Vegetation*, and on wetland vegetation are described in Section 3.23, *Wetlands and Other Waters of the U.S.* Various mitigations of effects on surface water may be used and are described in sections 2.5.4.3.2, 3.10.4.3.3 or 3.11.4:

- Mitigation modeled by MMC in the 3D model, which is the grouting of the side of the mine blocks which are adjacent to the Rock Lake Fault This grouting would occur on the three uppermost mine blocks and corresponding access ramps during operations
- Maintaining one or more barrier pillars, if necessary, in the mine during operations and constructing bulkheads at the access openings at Closure
- Increasing the buffer zones near Rock Lake and the Rock Lake Fault
- Additional grouting along the Rock Lake Fault
- Mitigation of effects on senior water rights in the Libby Creek watershed during Construction, Operations, Closure, and Post-closure

3.11.4.3 Alternative 2 – MMC Proposed Mine

In MMC's proposal, the mill and production adits would be located in the upper Ramsey Creek drainage, about 0.5 mile east of the CMW boundary. An additional adit on MMC's private land in the Libby Creek drainage and a ventilation adit on MMC's private land east of Rock Lake would be used for ventilation. A tailings impoundment would be constructed in the Little Cherry Creek drainage, and would require the diversion of Little Cherry Creek. Two LAD Areas between Poorman Creek and Ramsey Creek are proposed to allow for wastewater discharge using sprinklers during the growing season. A portion of the waste rock produced by driving the adits may be stored temporarily at LAD Area 1, and at the Libby Adit Site, before use in construction.

3.11.4.3.1 Evaluation and Construction Phases (Years 1 through 5)

Streamflow—West Side Streams

Low Flow

Stream baseflow is predicted to change during the Evaluation and Construction Phases (Geomatrix 2011a). At the end of the Evaluation and Construction Phases, streamflow reductions would be 3 percent or less in the East Fork Rock Creek and East Fork Bull River. Effects of Alternative 2 would be the same as Alternative 3 without mitigation.

Streamflow—East Side Streams

Low Flow

Libby, Ramsey, and Poorman Creeks. In Alternative 2, MMC proposes to use slow rate land application for primary treatment of wastewater (Geomatrix 2007b; MMC 2008). Land application is the uniform application (usually with sprinklers) of wastewater to a vegetated soil surface, with no runoff. The discharged water can receive significant treatment as it flows through the plant root/soil matrix (Environmental Protection Agency 2006b). Water discharged to the LAD Areas would either evapotranspire or percolate to groundwater. Water that percolated to groundwater would flow downgradient to the nearest stream. Land application would occur only during the 6-month growing season. The application rate would be adjusted to meet MPDES permitted effluent limits set for discharges at the LAD Areas and to prevent the development of springs in or downgradient of the LAD sites. The discharges to streams from the LAD Areas would be small

(32 gpm or 0.07 cfs); the flow of water initially through groundwater would dampen any sudden increases in streamflow due to the additional water. When land application was used in Alternative 2, increases in flow due to treated water discharges would be less than in Alternative 3 because much of the water discharged at the LAD Areas would evaporate or be used by plants.

Effects of mine inflows on the low flows of east side streams would be similar to Alternative 3. Construction Phase effects for Alternative 3 are shown in Table 108. In Alternative 2, the adits would be in two drainages (Libby and Ramsey creeks), and total water inflow into the adits would be greater in Alternative 2 than Alternatives 3 and 4. Compared to Alternatives 3 and 4, effects on streamflow in Libby Creek above LB-300 would be slightly less and would be slightly greater on Ramsey Creek. Discharges during both phases would increase low flow below LB-300. Discharges from the LAD Areas reaching Ramsey, Libby and Poorman creeks would partially offset streamflow effects from mine dewatering.

MMC did not propose in Alternative 2 to discharge water whenever flow at LB-2000 was less than 40 cfs to avoid adversely affecting senior water rights. When water was stored for mill startup during the Construction Phase, low flow at and downstream of LB-300 would be substantially less in Alternative 2 than Alternatives 3 or 4.

Little Cherry Creek. Little Cherry Creek would not be affected during the Evaluation Phase. After the Diversion Dam was constructed during the Construction Phase, water in Little Cherry Creek above the tailings impoundment would be diverted around the tailings impoundment down to Libby Creek via a 10,800-foot-long Diversion Channel. The channel would be sized to divert large flood flows safely around the tailings impoundment. The Diversion Channel would consist of an upper channel, and two existing natural drainages. Two natural drainages would be used to convey water from the upper channel to Libby Creek. The northern drainage (Drainage 10) is currently a 9,000-foot long intermittent drainage that is primarily unchannelized in the upper part and has perennial channelized segments interspersed with unchannelized wet and dry segments in the lower part. The southern drainage (Drainage 5) is about 3,000 feet long with similar characteristics to Drainage 10. Flow in Drainage 5 does not appear to reach Libby Creek (Kline Environmental Research 2012). During the Construction Phase, the flow in Drainages 5 and 10 would increase.

Surface water within the catchment area of the Seepage Collection Dam and within the tailings impoundment area would be captured and returned to the mill for ore processing. Below the Seepage Collection Dam, the source of water to the former Little Cherry Creek channel would be surface water runoff from the catchment area and groundwater discharge below the Seepage Collection Dam.

Bear Creek. Low flow in Bear Creek would not be affected during the Evaluation or Construction Phases.

Peak and Average Annual Flow

The KNF's ECAC model results (KNF 2012a) indicates timber clearing for the mine facilities in Ramsey Creek may measurably increase the peak flow of the creek (Appendix H). The increase in Ramsey Creek peak flow is estimated to be 8 percent. When coupled with the MMC's proposed transmission line alternative (Alternative B), mine-related water yield increase would reach a measurable level in Ramsey and Poorman creeks. According to Grant *et al.* (2008), changes in peak flow that fall in a range of ±10 percent are within the error of peak flow measurement and cannot be ascribed as an effect. Based on an analysis of streamflow data from streams with gaging stations located at the periphery of the analysis area on the KNF, the average variability in low flow values is 20 percent (Wegner 2007). Increased peak flows as a result of timber clearing in other streams in Alternative 2 and in combined Mine-Transmission Line Alternative 2B would be less than 10 percent. Discharges of mine and adit inflows would slightly increase peak flow (less than 1 percent) and average annual flow (about 5 percent) at LB-300. The percent increase in average annual flow below LB-300 would be less as flow increases downstream.

Rock Lake

The effect on Rock Lake volume and levels would be the same as Alternative 3 without mitigation.

Stream and Floodplain Crossings

Alternative 2 would require three new road crossings across perennial streams and one new road crossing across a non-perennial stream (Table 107). The Ramsey Plant Site would affect less than 0.1 acre of FEMA-designated 100-year floodplain on Ramsey Creek. During construction, disturbances within the FEMA-designated 100-year floodplain would be minimized. New bridges are proposed over Ramsey and Poorman creeks and a culvert would be installed in Little Cherry Creek above the Diversion Dam. For all alternatives, no designated 100-year floodplains would be crossed by new roads. After construction is completed, the bridges and culvert would not affect natural streamflow.

Table 107. Comparison of Stream and Floodplain Crossings Required for Mine Alternatives.

Mine Alternative	Number of Stream Crossings by New Roads		Disturbance Area within a FEMA-Designated 100-year Floodplain (acre)
	Perennial Stream	Other Streams	
2	3	1	<1
3	1	1	9
4	2	1	3

< = less than.
Source: GIS analysis by ERO Resources Corp. using KNF data.

An estimated 12,600 feet of the Little Cherry Creek floodplain would be inundated by construction of the tailings impoundment and seepage collection pond. A new floodplain would be created along the diverted Little Cherry Creek channel and the floodplain of Drainage 10 may widen with increased flows. The net floodplain loss would be 9,510 feet in the Little Cherry Creek watershed.

3.11.4.3.2 Operations Phase (Years 6 through 25)

Streamflow—West Side Streams

Low Flow

The effect on west side streams would be greater than during the Construction Phase, and the greatest effect during the Operations Phase would be at the end of mining operations. The effect would be the same as Alternative 3 without mitigation (Table 110). For the two west side aquatic life sites (RC-3 and EFBR-2), the effect would be the same as Alternative 3 without mitigation (Table 109).

Streamflow—East Side Streams

Low Flow

Libby, Ramsey, and Poorman Creeks. The effect of mine inflows on east side streams would be greater than during the Construction Phase, and the greatest effect during the Operations Phase would be at the end of mining operations. MMC did not propose in Alternative 2 to discharge water during operations whenever flow at LB-2000 was less than 40 cfs to avoid adversely affecting senior water rights. The water balance for Alternative 2 indicates that up to 159 gpm of additional water on an annualized basis would be required during the Operations Phase to meet mill needs (Table 14 in Chapter 2). Flow at and downstream of LB-300 would be less in Alternative 2 than Alternatives 3 or 4. The effect on Ramsey Creek would be slightly greater in Alternative 2 because the adits in Ramsey Creek drainage would affect streamflow in Ramsey Creek and less in upper Libby Creek (Table 110). The effect on Poorman Creek would be only from mine inflows (a loss of 0.01 cfs without mitigation and no effect with MMC's modeled mitigation). The pumpback wells and impoundment diversions would not affect Poorman Creek in Alternative 2.

Little Cherry Creek. The agencies completed an analysis of the effect of Alternative 2 to the Little Cherry Creek watershed area and the resulting change in the flow of area streams (ERO Resources Corp. 2010a in Appendix H). Precipitation and runoff captured by the tailings impoundment and the Seepage Collection Dam would no longer flow to either the diverted or former Little Cherry Creek. During operations, 13 percent of the Little Cherry Creek watershed would continue to contribute flow to the former Little Cherry Creek channel downstream of the Seepage Collection Dam; the estimated average annual flow would be 0.77 cfs. The flow in Drainage 10 would be about 60 percent of the flow of the original Little Cherry Creek. The estimated $7Q_{10}$ flow of the water diverted to Drainages 5 and 10 would be 0.16 cfs. Diversions, combined with the pumpback well system would likely eliminate the $7Q_{10}$ flow in the diverted Little Cherry Creek and substantially reduce the $7Q_2$ flow. Flow below the Seepage Collection Dam in the former Little Cherry Creek channel would also be substantially reduced. The flow in Drainages 5 and 10 (the diverted Little Cherry Creek) would increase. Some of the flow would be intercepted by the pumpback well system.

Bear Creek. Low flow in Bear Creek would be reduced during the Operations Phase by diversions and a pumpback well system at the Little Cherry Creek impoundment. The effect was not quantified.

Peak and Average Annual Flow

The effect on peak flow in Ramsey Creek from timber harvesting for mine facilities would continue during the Operations Phase. Other than Ramsey Creek, the effect on peak and average annual flows in the Libby Creek watershed would be negligible. Appropriation of water for mill use would be taken when the flow of Libby Creek was equal to or greater than the average annual low flow of the creek at a rate of up to 159 gpm (0.35 cfs), which would reduce peak flow and average annual flow in Libby Creek at the point of diversion (about LB-2000).

Rock Lake and Rock Creek Meadows

The effect on Rock Lake volume and levels and the effect on Rock Creek Meadows would be the same as Alternative 3 without mitigation.

3.11.4.3.3 Closure Phase (Years 26 to 30)

Streamflow—West Side Streams

The effects during the Closure Phase would be the same as Alternative 3 without mitigation.

Streamflow—East Side Streams

Low Flow

Libby, Ramsey, and Poorman Creeks. After the adits were plugged at the surface as proposed in Alternative 2, reduction in low flow above the Libby Adit Site (LB-300) and above lower Ramsey Creek (RA-600) would be slightly greater than predicted during the Operations Phase, with the greatest reductions occurring immediately after the adits were plugged. The effect was not quantified. Compared to Alternative 3, effects above LB-300 would be slightly less and above RA-600 would be slightly greater. Discharges during both phases would increase streamflow downstream of the LAD Areas and Water Treatment Plant discharge. Discharges would partially offset streamflow effects from mine dewatering during low flows. Overall streamflow increases due to discharges would be less than in Alternative 3 because some water would evaporate at the LAD areas. The effect on flows in Poorman Creek during this phase would be negligible.

Little Cherry Creek and Bear Creek. The effect on Little Cherry Creek and Bear Creek would be the same as during the Operations Phase.

Peak and Average Annual Flow

After site reclamation, the increase in peak flow in Ramsey Creek would be less than during operations as disturbed areas became revegetated. The effect of discharges and vegetation clearing on other streams would be the same as during the Construction Phase. MMC did not propose any diversions from Libby Creek except as needed during the Operations Phase.

Rock Lake and Rock Creek Meadows

The effect on Rock Lake volume and levels and on Rock Creek Meadows would be greater than during the Operations Phase. The effect during the Closure Phase was not quantified and would be the same as Alternative 3 without mitigation.

3.11.4.3.4 Post-Closure Phase (Years 31+)

Streamflow—West Side Streams

Low Flow

The effect on west side streams would increase from the Operations and Closure Phases and would be the greatest during the Post-Closure Phase after the end of mining operations in the East Fork Rock Creek, Rock Lake, and the East Fork Bull River. The effects would be the same as described for Alternative 3 (Table 112 and Table 113).

Streamflow—East Side Streams

Low Flow

Libby, Ramsey, and Poorman Creeks. The effect would be the same as Alternative 3 without mitigation except that the effect on Ramsey Creek would be slightly greater (Table 112 and Table 113).

Little Cherry Creek and Bear Creek. After the impoundment was reclaimed and runoff was no longer subject to ELGs and applicable water quality standards, runoff from the reclaimed tailings impoundment surface and the watershed west of the impoundment would be routed toward Bear Creek. Because the impoundment would be reclaimed, runoff would be stormwater not mixed with any mine drainage or process water. The Bear Creek watershed area where runoff would meet the creek would increase by 560 acres, an 8 percent increase (ERO Resources Corp. 2010a). Watershed area and mean annual precipitation were the location-specific variables in the equations developed by the USGS to estimate both $7Q_2$ and $7Q_{10}$ flow in the region that includes the analysis area (Hortness 2006). Assuming no change in annual precipitation, the Hortness method would predict that an 8 percent increase in watershed area would increase $7Q_2$ and $7Q_{10}$ flow by about 8 percent. At closure, the reclaimed impoundment surface would drain toward Bear Creek and the reclaimed impoundment would be in a watershed adjacent to the original watershed (Little Cherry Creek). Some of the precipitation that would infiltrate into the reclaimed impoundment would be intercepted by the impoundment's underdrain system and routed toward Little Cherry Creek, the original watershed. Consequently, the Hortness method overestimates $7Q_2$ and $7Q_{10}$ flow in watersheds containing the reclaimed impoundment. Both $7Q_2$ and $7Q_{10}$ flow likely occur during late summer or early fall during periods of little or no precipitation. The amount of baseflow that would flow during these period toward Bear Creek would be negligible. The agencies anticipate little or no increase in $7Q_2$ and $7Q_{10}$ flow in Bear Creek. Any increased flow would partially offset the flow reduction caused by the pumpback well system as long as it operated. The effect of the pumpback well system on Bear Creek was not quantified.

Low flows in the diverted Little Cherry Creek and Drainage 10 would likely be substantially reduced as long as the pumpback well system operated. When the impoundment was reclaimed and the pumpback well system no longer operated, the watershed of the former Little Cherry Creek would be 220 acres larger than during the Operations Phase, but would remain 74 percent smaller than the existing creek. The effect of a smaller watershed would be less than the Hortness method would predict based on watershed size because some of the water intercepted by the impoundment's underdrain system would flow to the former Little Cherry Creek. The diverted creek's watershed (Drainage 10) would be 45 percent smaller than the existing Little Cherry Creek's watershed.

Peak and Average Annual Flow

During the Post-Closure Phase, peak flow in Ramsey Creek would gradually return to pre-mine conditions as disturbed areas became revegetated. The agencies estimate the Ramsey Creek watershed would take 25 years after completion of the Closure Phase to recover to existing peak flow conditions. The average annual flow in Bear Creek would be an estimated 8 percent higher over the long term. The watershed of diverted Little Cherry Creek would be 915 acres, or 54 percent smaller than the original Little Cherry Creek. Average annual flows of diverted Little Cherry Creek are estimated to be about half of the original creek flows. The former Little Cherry Creek channel below the impoundment dam would have a watershed of 445 acres (ERO Resources Corp. 2010a in Appendix H), providing some flow to the channel. In addition, Klohn

Crippen (2005) estimated at steady state 50 to 100 gpm from the impoundment's underdrain system would flow toward the former Little Cherry Creek. Following cessation of the pumpback wells and recovery of groundwater levels, springs and seeps outside of the impoundment footprint that were affected by the pumpback wells would likely return to pre-mine conditions and also may contribute to baseflow. The effect of discharges and vegetation clearing on other streams would be the same as during the Construction Phase. After discharges ceased, peak flow and average annual flow would return to pre-mine conditions.

Rock Lake and Rock Creek Meadows

The effect on Rock Lake volume and levels and on Rock Creek Meadows would be the same as Alternative 3 without mitigation and is discussed in section 3.11.4.4.4 *Post-Closure Phase.*

3.11.4.3.5 Climate Change

Due to the range in possible effects of climate change on the water resources and the many factors that could affect that outcome, quantifying the impacts of climate change was not feasible. It is difficult to predict how the hydrologic systems in the Montanore Project analysis area would respond to the forecasted regional effects of climate change. Uncertainty is discussed in section 3.10.4.2.3, *Climate Change*.

The Forest Service (2010a) and the Bureau of Reclamation (2011c) predicted that more precipitation may fall as rain in December through March, resulting in more runoff in the winter, and reduce the accumulation of snow in the winter. Climate change may also reduce summer and fall runoff, and reduce baseflow in streams in the Columbia River Basin. Decreased groundwater infiltration could reduce the project's mine and adit inflows, but because baseflow to streams would also decrease, the percentage change to baseflow may remain the same. If mine and adit inflows decreased, discharges to Libby Creek would be less and makeup water requirements would increase. If climate change did not reduce infiltration enough to change mine and adit inflows from those projected without climate change, any increase in winter streamflows due to climate change may moderate the effect of mine inflows during the winter low flow periods, and any decrease in fall flows may magnify the effect of mine inflows during the fall low flow periods. As described in Appendix C, MMC would monitor streamflows at potential impact area sites and benchmark sites (similar to project area sites, but outside the area of potential mine impacts) to evaluate trends due to mining compared to trends due to non-mining effects such as climate change.

3.11.4.4 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

In Alternative 3, mine facilities would be located in alternate locations. MMC would develop an impoundment site north of Poorman Creek for tailings disposal, use a plant site between Libby and Ramsey creeks, and construct two additional adits in the upper Libby Creek drainage. LAD Areas would not be used. All excess mine and adit water not used for mine operations would be treated at the Libby Adit Water Treatment Plant and discharged to Libby Creek. Treated discharge water would be subject to MPDES permitted effluent limits.

The Libby Plant Site would be built with fill material from a large cut on the west side of the plant site. Based on preliminary analysis, the cut and fill materials would balance, and waste rock would not be used in plant site construction. Avoiding the use of waste rock in plant site construction would minimize the potential for stormwater runoff from the plant site to adversely affect the quality of nearby water resources.

The effects on aquatic life and aquatic habitat due to streamflow changes are described in section 3.6, *Aquatic Life and Fisheries*. The indirect effects due to streamflow changes on riparian vegetation are described in section 3.22, *Vegetation*, and on wetland vegetation are described in section 3.23, *Wetlands and Other Waters of the U.S.* Various mitigations of effects on surface water may be used and are described in sections 2.5.4.3.2, 3.10.4.3.3, or 3.11.4.

3.11.4.4.1 Evaluation and Construction Phases (Years 1 through 5)

The effect on west side streams during the Evaluation and Construction Phases during low flow periods would be small. A decrease of 0.01 cfs (2 percent reduction of the estimated $7Q_{10}$ flow) at EFRC-200 during the Evaluation Phase is predicted. Estimated changes in lake levels and lake surface area would be below what can be accurately calculated. In east side streams, predicted changes during the Evaluation Phase are small decreases (0.02 cfs) between the CMW boundary and the Libby Adit in Libby Creek. The current adit dewatering has likely resulted in a reduction in Libby Creek baseflow, but the effect is not detected because either the reduction is very small and/or there are insufficient baseline data (before the adit was constructed) for comparison to current conditions. Below the Water Treatment Plant at the Libby Adit, predicted discharges of up to 263 gpm would increase flow at LB-300 in Libby Creek by 12 percent of the estimated $7Q_2$ flow and 19 percent of the estimated baseflow. A decrease of 0.01 cfs (2 percent reduction of the estimated $7Q_{10}$ flow) at the CMW boundary at Rock Lake is also predicted. The remainder of this section discusses flow changes during the Construction Phase (Table 108).

Streamflow—West Side Streams

Low Flow

The effect on west side streams during the Construction Phase during low flow periods would be small (up to a loss of 3 percent at EFRC-200), but slightly greater than the Evaluation Phase (Table 108). The effects on aquatic life sites RC-3 and EFBR-2 in the Evaluation and Construction Phases were not estimated, but would be smaller than shown for the Operations Phase (Table 109).

Streamflow—East Side Streams

Low Flow

Low flow in Ramsey, Poorman, and Little Cherry creeks would not be affected during the Evaluation Phase. The effect during the Construction Phase on low flow in Ramsey, Poorman, and Little Cherry creeks would be small (-1 to +3 percent). If baseflow changes in Ramsey Creek adversely affected a senior water right on Ramsey Creek during any mining phase, MMC would develop a plan during final design to convey treated water from the Water Treatment Plant to a location upstream of the right's point of diversion. Discharge to Ramsey Creek would equal MMC's Ramsey Creek baseflow changes whenever the flow at RA-300 was less than 1 cfs. Baseflow in Libby Creek at LB-100 (near the CMW boundary) is predicted not to change during the Evaluation Phase, and is predicted to decrease by up to 9 percent during the Construction Phase. Flow in Libby Creek at and below LB-300 would increase due to discharges from the Water Treatment Plant, which would reach a maximum of 1.11 cfs during the Construction Phase. At LB-300, flow would increase by 0.96 cfs, which would be a 79 percent increase above the estimated baseflow (Table 108). At LB-2000, the increase in $7Q_{10}$ flow is estimated to be 0.67 cfs, a 7 percent increase. The low flow in Bear Creek would not be affected. The effects on aquatic life site LB-2 for the Evaluation and Construction Phases were not estimated, but would be smaller than shown for the Operations Phase (Table 109).

Table 108. Estimated Changes during $7Q_2$ and $7Q_{10}$ Flows, Construction Phase, Alternative 3.

Activity	East Fork Rock Creek EFRC-200†	Rock Creek RC-2000	East Fork Bull River EFBR-500	Ramsey Creek RA-600	Poorman Creek PM-1200	Little Cherry Creek LC-800	Libby Creek LB-300†	Libby Creek LB-2000
	(cfs except % change)							
Modeled baseflow change (without mitigation)	-0.01	-0.02	0.00	-0.02	0.00	0.00	-0.13	-0.17
Potable water	0.00	0.00	0.00	0.00	0.00	0.00	-0.02	-0.02
Pumpback wells	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Subtotal	-0.01	-0.02	0.00	-0.02	0.00	0.00	-0.15	-0.19
Stormwater diversion at $7Q_2$ flow	0.00	0.00	0.00	0.00	0.08	0.01	0.00	0.00
Impoundment precipitation captured at $7Q_2$ flow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.38
Water treatment plant discharge	0.00	0.00	0.00	0.00	0.00	0.00	1.11	1.11
Change at 7Q2 flow	**-0.01**	**-0.02**	**0.00**	**-0.02**	**+0.08**	**+0.01**	**+0.96**	**+0.54**
Estimated $7Q_2$ flow	0.92	13.53	5.77	3.26	2.46	0.32	4.63	13.85
Percent Change in $7Q_2$ Flow	**-1%**	**<-1%**	**0%**	**-1%**	**+3%**	**+3%**	**+21%**	**+4%**
Stormwater diversion at $7Q_{10}$ flow	0.00	0.00	0.00	0.00	0.05	0.01	0.00	0.00
Impoundment precipitation captured at $7Q_{10}$ flow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
Change at $7Q_{10}$ flow	**-0.01**	**-0.02**	**0.00**	**-0.02**	**+0.05**	**+0.01**	**+0.96**	**+0.67**
Estimated $7Q_{10}$ flow	0.29	8.80	3.71	2.07	1.55	0.19	1.22	8.99
Percent Change in $7Q_{10}$ Flow	**-3%**	**<-1%**	**0%**	**-1%**	**+3%**	**+3%**	**+79%**	**+7%**

†Modeled baseflow values used rather than estimated $7Q_{10}$ flow for EFRC-200 and LB-300 (see section 3.8.3).
Effects shown do not include mitigation measures such as grouting during operations or maintaining barriers in the mine void, or using multiple plugs in the adits during closure. Such mitigation would be evaluated after additional data were collected during the Evaluation Phase. Effects shown do include discharges to Libby Creek and (but not Ramsey Creek) during all phases to avoid adversely affecting senior water rights.
cfs = cubic feet per second; < = less than.
Note: Values shown for modeled baseflow change include 2 years of mining.
Groundwater models were used to predict effects from mine dewatering and the pumpback wells. With the data currently available, the model results provide a potential range of dewatering rates and streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. Both 3D groundwater flow models would be refined and rerun after data from the Evaluation Phase were incorporated into the models (see section C.10.4, *Evaluation Phase* in Appendix C). Following additional data collection and modeling, the predicted impacts on surface water resources in the analysis area, including simulation of mitigation measures, may change and the model uncertainty would decrease. See section 3.10.4.3.5, *Groundwater Model Uncertainty* for more discussion of model uncertainty.

The primary long-term source of water in the perennial reaches of the four tributaries in the impoundment site is one or more springs located within the footprint of the tailings impoundment. After the springs were filled during the Construction Phase, flow in the perennial reaches downgradient of the impoundment would likely be reduced, at least during baseflow conditions. Perennial flow would change to intermittent or ephemeral flows in some segments.

Table 109. Predicted Changes in Baseflows and Wetted Perimeters at LB-2, RC-3 and EFBR-2 during Operations and Post-Closure, All Mine Alternatives.

Site and Description	LB-2 (Libby Creek above Little Cherry Creek)	RC-3 (East Fork Rock Creek above Confluence with West Fork Rock Creek)	EFBR-2 (East Fork Bull River at Confluence with Isabella Creek)
Existing Conditions and No Action Alternative			
Estimated $7Q_{10}$ Flow (cfs)	8.62	5.70	2.93
Estimated Wetted Perimeter at $7Q_{10}$ Flow (ft^2)	7.38	26.62	1.31
During Operations (Year 22)			
Effect on $7Q_{10}$ Flow (cfs)	+0.82	-0.06	-0.07
% Change in $7Q_{10}$ Flow (cfs)	+10%	-1%	-2%
Effect on Wetted Perimeter (ft^2)	+2.54	-0.28	-0.09
% Change in Wetted Perimeter	+34%	-1%	-7%
During Post-Closure (Year 38)			
Effect on Flow (cfs)	0.00	-0.51	-0.31
% Change in $7Q_{10}$ Flow (cfs)	0%	-9%	-11
Effect on Wetted Perimeter (ft^2)	0.00	-2.52	-0.35
% Change in Wetted Perimeter	0%	-9%	-26%

Effects shown do not include mitigation measures such as grouting during operations or maintaining barriers in the mine void, or using multiple plugs in the adits during closure. Such mitigation would be evaluated after additional data were collected during the Evaluation Phase. Effects shown do include discharges to Libby Creek during all phases to avoid adversely affecting senior water rights.
Source: ERO 2012a.

The current locations and periods of intermittent and ephemeral flow are expected to be similar after construction of the impoundment, but the magnitude of flow would be reduced due to significant reductions in drainage area from the tailings impoundment. The four tributaries have a low capacity to convey water to Libby Creek, and their combined flow of up to 0.7 cfs is much less than the flow of Libby Creek near the impoundment site. The effects on Libby Creek would minor during high flow conditions and negligible or nonexistent for the majority of the year. Appendix L discusses the effects of changes to the four tributaries and Libby Creek due to the tailings impoundment in greater detail.

Peak and Average Annual Flow

During the Construction Phase, less than a 1 percent increase in peak flow from timber clearing for the mine facilities is estimated in all east side streams. All transmission line alternatives combined with Alternative 3 would have estimated increases in peak flow of less than 10 percent. The Poorman Tailings Impoundment would be located in the watersheds of four small drainage channels. This alternative would not require the diversion of Little Cherry Creek or Poorman Creek. Any flow within the watershed above the impoundment would be routed to Poorman Creek or Little Cherry Creek. Water from above the Poorman Tailings Impoundment and Plant

Access Road would be diverted either toward Poorman Creek or Little Cherry Creek, increasing the watershed of both creeks by about 3 percent (ERO Resources Corp. 2010a). ERO Resources' analysis indicated the watershed above the impoundment and access road was 230 acres; NewFields analysis (NewFields 2014b) indicated the area was 270 acres. The difference in effect would be negligible. Average annual flow in both creeks would increase by about 3 percent. Discharges of mine and adit inflows would slightly increase peak flow (less than 1 percent) and average annual flow (about 5 percent) at LB-300. The percent increase in average annual flow below LB-300 would be less as flow increases downstream.

Rock Lake and Rock Creek Meadows

Groundwater discharge into Rock Lake would decrease beginning in the Evaluation Phase and continuing through the Construction Phase. The 3D model predicted very small decreases during the Evaluation (3 acre-feet per year) and Construction Phases (9 acre-feet per year). The effect on the estimated lake volume of 1,302 acre-feet would be negligible. The effect on lake volume, lake level, and surface area during the 2-month late summer/early fall period would be very small, less than can be calculated accurately (Table 114).

The 3D model predicted a decrease of 0.01 cfs in East Fork Rock Creek where it enters Rock Creek Meadows. Observations made during an agency field review in a very dry period (September 2007) indicated that a high water table supported the wetlands. Baseflow in East Fork Rock Creek where it enters Rock Creek Meadows was estimated at 2 cfs. A reduction of 0.01 cfs from an estimated baseflow of 2 cfs in the East Fork Rock Creek at the Meadows would result in a less than 1 percent flow reduction. As discussed in Section 3.11.4.4.2, *Operations Phase,* other sources of water to the Meadows would not be affected by mining. The watershed area for Rock Creek Meadows is about 1,070 acres for the East Fork Rock Creek and 2,970 acres for the other tributaries to Rock Creek Meadows that would not be affected by mining. Based on watershed size and the fact that watershed characteristics are similar to the East Fork Rock Creek watershed, the surface inflow to Rock Creek Meadows from the other tributaries is likely to be about three times greater than that from the East Fork Rock Creek. The hydrology support for the wetland vegetation in Rock Creek Meadows is not expected to be affected.

Stream and Floodplain Crossings

Alternative 3 would require one new road crossing across a major and minor stream (Table 107). The Seepage Collection Pond and infiltration gallery for Libby Creek appropriations would affect 9 acres of the designated 100-year floodplain of Libby Creek. During final design, MMC would avoid or minimize, to the extent practicable, locating facilities, such as the Seepage Collection Pond, in a floodplain. The agencies' monitoring and mitigation plans include the construction of some minor facilities in the Libby Creek floodplain, such as an infiltration gallery for makeup water in Libby Creek, and streamflow measurement devices. No alternative exists to avoid locating these facilities in the Libby Creek floodplain. If locating mine facilities in a floodplain could not be avoided during final design, MMC would submit a floodplain permit application to the DNRC that provides details on the obstruction or use of a floodway/floodplain before construction. DNRC's permit issuance is based on the danger to life and property downstream, availability of alternate locations, possible mitigation to reduce the danger, and the permanence of the obstruction or use (76-5-405, MCA).

3.11.4.4.2 Operations Phase (Years 6 through 25)

Streamflow—West Side Streams

The effect on west side streams during the Operations Phase during low flow periods without mitigation would be a reduction of 0.06 to 0.07 cfs in all west side streams (Table 110). The reduction in low flow would be most pronounced in the East Fork Rock Creek at the CMW boundary (EFRC-200). The 3D model predicted that with MMC's modeled mitigation, the reduction would be 0.05 cfs at EFRC-200, or 0.01 cfs less than shown in Table 110. The flow reduction at EFRC-200 would be 21 percent of the baseflow without mitigation and 17 percent with MMC's modeled mitigation. The effects on aquatic life sites RC-3 and EFBR-2 during Operations (Year 22) and Post-Closure (Year 38) are provided in Table 109. During Operations, the wetted perimeter at RC-3 would be reduced by 1 percent and at EFBR-2 by 7 percent.

Streamflow—East Side Streams

Low Flow

During the Operations Phase, low flow in Libby Creek above LB-300 and its downstream tributaries would be reduced by mine activities. The predicted reductions of the estimated $7Q_{10}$ flow in lower Poorman Creek (PM-1200), without mitigation, would be 12 percent and 19 percent in Little Cherry Creek (LC-800) (Table 110). The *Groundwater Hydrology* section discusses the geology of the impoundment sites. A low permeability bedrock ridge separates groundwater flow between the watershed of Little Cherry Creek and those of Drainages 5 and 10 in the Poorman Impoundment Site. NewFields (2014a) concluded that the bedrock ridge would limit drawdown in the Little Cherry Creek watershed, but drawdown could still extend between watersheds unless the bedrock ridge provided a complete barrier to cross-boundary groundwater flow. Additional subsurface data from this area would be collected during the final design process of the Poorman Impoundment to assess the separation of groundwater flow between the Little Cherry Creek and Poorman Impoundment Site watersheds and the 3D model would be rerun with the new data to evaluate the site conditions.

The 3D model predicted that with mitigation, reductions at RA-600 and PM-1200 would be 0.01 cfs less than shown in Table 110. Low flow in Bear Creek would not be affected. If MMC's Ramsey Creek water appropriation adversely affected a senior water right on Ramsey Creek during any mining phase, MMC would develop a plan during final design to convey treated water from the Water Treatment Plant to a location upstream of the right's point of diversion. Discharge to Ramsey Creek would equal MMC's Ramsey Creek appropriation whenever the flow at RA-300 was less than 1 cfs.

At LB-100 in upper Libby Creek, baseflow is predicted to decrease by up to 22 percent during the Operations Phase. Because of Water Treatment Plant discharges, flow is estimated to increase by 138 percent of the modeled baseflow at LB-300 and by 39 percent of the estimated $7Q_2$ flow. At LB-2000 and aquatic site LB-2, the estimated $7Q_{10}$ flow would increase by 9 percent and $7Q_2$ flow increase by 6 percent. The wetted perimeter at LB-2 would increase by an estimated 34 percent. Low flow in the four unnamed drainages at the impoundment area would be substantially reduced because the watershed would be 87 percent smaller and the pumpback well system would intercept all groundwater that currently flows into the drainages. The agencies' mitigation plans (section 2.5.7 in Chapter 2) describes mitigation that would replace the functions of the channels directly or indirectly affected by the Poorman Tailings Impoundment.

Table 110. Estimated Changes during $7Q_2$ and $7Q_{10}$ Flows, Operations Phase, Alternative 3.

Activity	East Fork Rock Creek EFRC-200†	Rock Creek RC-2000	East Fork Bull River EFBR-500	Ramsey Creek RA-600	Poorman Creek PM-1200	Little Cherry Creek LC-800	Libby Creek LB-300†	Libby Creek LB-2000
	(cfs except % change)							
Modeled baseflow change (without mitigation)	-0.06	-0.06	-0.07	-0.04	-0.01	0.00	-0.20	-0.27
Potable water	0.00	0.00	0.00	0.00	0.00	0.00	-0.02	-0.02
Pumpback wells	0.00	0.00	0.00	0.00	-0.18	-0.04	0.00	-0.55
Subtotal	-0.06	-0.06	-0.07	-0.04	-0.19	-0.04	-0.22	-0.84
Stormwater diversion at $7Q_2$ flow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Impoundment precipitation captured at $7Q_2$ flow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.38
Water treatment plant discharge	0.00	0.00	0.00	0.00	0.00	0.00	2.04	2.04
Change at $7Q_2$ flow	**-0.06**	**-0.06**	**-0.07**	**-0.04**	**-0.19**	**-0.04**	**+1.82**	**+0.82**
Estimated $7Q_2$ flow	0.92	13.53	5.77	3.26	2.46	0.32	4.63	13.85
Percent Change in $7Q_2$ Flow	**-7%**	**<-1%**	**-1%**	**-1%**	**-8%**	**-11%**	**+39%**	**+6%**
Stormwater diversion at $7Q_{10}$ flow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Impoundment precipitation captured at $7Q_{10}$ flow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.25
Water treatment plant discharge	0.00	0.00	0.00	0.00	0.00	0.00	1.91	1.91
Change at $7Q_{10}$ flow	**-0.06**	**-0.06**	**-0.07**	**-0.04**	**-0.19**	**-0.04**	**+1.69**	**+0.82**
Estimated $7Q_{10}$ flow	0.29	8.80	3.71	2.07	1.55	0.19	1.22	8.99
Percent Change in $7Q_{10}$ Flow	**-21%**	**-1%**	**-2%**	**-2%**	**-12%**	**-19%**	**+138%**	**+9%**

†Modeled baseflow values used rather than estimated $7Q_{10}$ flow for EFRC-200 and LB-300 (see section 3.8.3).
cfs = cubic feet per second; < = less than.
Effects shown do not include mitigation measures such as grouting during operations or maintaining barriers in the mine void, or using multiple plugs in the adits during closure. Such mitigation would be evaluated after additional data were collected during the Evaluation Phase. Effects shown do include discharges to Libby Creek and possibly Ramsey Creek during all phases to avoid adversely affecting senior water rights.
Groundwater models were used to predict effects from mine dewatering and the pumpback wells. With the data currently available, the model results provide a potential range of dewatering rates and streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. Both 3D groundwater flow models would be refined and rerun after data from the Evaluation Phase were incorporated into the models (see Section C.10.4, *Evaluation Phase* in Appendix C). Following additional data collection and modeling, the predicted impacts on surface water resources in the analysis area, including simulation of mitigation measures, may change and the model uncertainty would decrease. See section 3.10.4.3.5, *Groundwater Model Uncertainty* for more discussion of model uncertainty.

Peak and Average Annual Flow

Due to Water Treatment Plant discharges, peak flow would increase slightly (less than 1 percent) and average annual flow by about 5 percent at LB-300, with a smaller percent increase down to LB-2000. Peak flow and average annual flow at and downstream of LB-2000 in Alternative 3 during the Operations Phase would be less than during the Construction Phase due to all of MMC's appropriations, primarily of up to 2.5 cfs during April through July.

Water from above the Poorman Tailings Impoundment and Plant Access Road would continue to be diverted either toward Poorman Creek or Little Cherry Creek, increasing the watershed and average annual flow of both creeks by about 3 percent (ERO Resources Corp. 2010a). The watersheds of the drainages in the Poorman Impoundment Site (Drainages 5 and 10) would be reduced by about 85 percent during Operations. Flow in Drainages 5 and 10, which are currently perennial in upper segments and intermittent in lower segments, would rarely occur during Operations. Flow reduction in the other two channels would be similar.

Rock Lake and Rock Creek Meadows

The 3D model predicted, for an average precipitation year, a decrease of 47 acre-feet per year of groundwater flowing into Rock Lake without mitigation (36 acre-feet with mitigation). The effect on the estimated lake volume of 1,302 acre-feet would be negligible. The effect on lake volume, levels and surface area during the 2-month late summer/early fall period would be very small, less than can be calculated accurately (Table 114). The 3D model predicted a decrease of 0.06 cfs in East Fork Rock Creek where it enters Rock Creek Meadows. It is uncertain whether the effect of mine inflows on Rock Lake during the late summer/early fall period would be greater or less during a multi-year dry or multi-year wet period because these scenarios have not been modeled. The watershed of Rock Lake receives a large amount of precipitation, primarily during the winter and spring, and during a rainy period in late fall. There is enough water even in a very dry year to refill the lake many times during both the snowmelt runoff period and the fall rainy period after drawdown periods when outflows exceed inflows. The water level in Rock Lake would "reset" to full capacity each spring and each fall even during a very dry period (ERO Resources Corp. 2012c).

The groundwater level at the Meadows or other surface flows to Rock Creek Meadows would not be reduced because Rock Creek Meadows and the tributaries that flow into Rock Creek Meadows are outside of the model-predicted drawdown due to mine inflows. MMC completed an annual average water balance for Rock Creek Meadows (MMC 2012f), but did not evaluate the water balance during low flow periods. Observations made during an agency field review in a very dry period (September 2007) indicated that a high water table supported the wetlands. Baseflow in East Fork Rock Creek where it enters Rock Creek Meadows was estimated at 2 cfs. A reduction of 0.06 cfs from an estimated baseflow of 2 cfs in the East Fork Rock Creek at the Meadows would result in a 3 percent flow reduction, and the other sources of water to the Meadows would not be affected by mining. As discussed previously, the surface inflow from the other tributaries that flow directly into the Meadows is likely to be about three times greater than that from the East Fork Rock Creek. The hydrology support for the wetland vegetation in Rock Creek Meadows is not expected to be affected.

3.11.4.4.3 Closure Phase (Years 26 to 30)

Streamflow—West Side Streams

The effect on west side streams would be greater in the Closure Phase than in the Operations Phase. Table 111 provides the unmitigated effects. Low flow would be 0.01 to 0.03 cfs greater than shown in Table 111 with mitigation. The agencies' proposed mitigation and its effectiveness are discussed in section 3.10.4.3.6*, Effectiveness of Agencies' Proposed Monitoring and Mitigation*.

Streamflow—East Side Streams

Low Flow

Libby, Ramsey, Poorman, and Little Cherry Creeks. The following discussion is based the results of the 3D model that did not consider multiple adit plugging for water rights mitigation at Closure. The effects during the Closure Phase without MMC's modeled mitigation or multiple adit plugs would be less than in the Operations Phase (Table 111). Low flow would be 0 to 0.01 cfs greater than shown in Table 111 with MMC's modeled mitigation.

To mitigate effects on senior water rights on Libby Creek and Ramsey creeks, MMC would install plugs at the base of each adit soon after mining operations ceased. Reductions in streamflow due to adit inflows would continue in Libby Creek above LB-300 in Libby Creek, and in Ramsey Creek above RA-300 whenever flow at RA-300 was less than 1 cfs. At LB-100 in upper Libby Creek, baseflow would decrease by up to 19 percent during the Closure Phase. Streamflow reductions would continue and would cease within an estimated one to two decades after all initial adit plugs were in place. The effect would be reduced to a few years if MMC used water diverted from Libby Creek during high flows to fill the adits during the Closure Phase. Below these locations, discharges to mitigate senior water rights would increase flow.

The effect on flow in Little Cherry Creek would be similar to the Operations Phase (Table 111). The role of a bedrock ridge was discussed under the Operations Phase effects.

Peak and Average Annual Flow

The effect during the Closure Phase on peak flow in all east side streams would be small. Due to Water Treatment Plant discharges, peak flow would increase slightly (less than 1 percent) and average annual flow would increase by about 5 percent at LB-300 and by a smaller percent below LB-300 down to LB-2000. MMC's water appropriations, particularly those during April through July if they continued throughout the Closure Phase, would slightly reduce peak and annual flows in Libby Creek at and downstream of LB-2000. Water from above the Poorman Tailings Impoundment and Plant Access Road would continue to be diverted either toward Poorman Creek or Little Cherry Creek, increasing the watershed and average annual flow of both creeks by about 3 percent (ERO Resources Corp. 2010a).

Table 111. Estimated Changes during $7Q_2$ and $7Q_{10}$ Flows, Closure Phase, Alternative 3.

Activity	East Fork Rock Creek EFRC-200†	Rock Creek RC-2000	East Fork Bull River EFBR-500	Ramsey Creek RA-600	Poorman Creek PM-1200	Little Cherry Creek LC-800	Libby Creek LB-300†	Libby Creek LB-2000
	(cfs except % change)							
Modeled baseflow change	-0.18	-0.19	-0.16	-0.03	0.00	0.00	-0.19	-0.25
Potable water	0.00	0.00	0.00	0.00	0.00	0.00	-0.02	-0.02
Pumpback wells	0.00	0.00	0.00	0.00	-0.18	-0.04	0.00	-0.55
Subtotal	-0.18	-0.19	-0.16	-0.03	-0.18	-0.04	-0.21	-0.82
Stormwater diversion at $7Q_2$ flow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Impoundment precipitation captured at $7Q_2$ flow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.38
Water treatment plant discharge	0.00	0.00	0.00	0.00	0.00	0.00	1.20	1.20
Change at $7Q_2$ flow	**-0.18**	**-0.19**	**-0.16**	**-0.03**	**-0.18**	**-0.04**	**0.99**	**0.00**
Estimated $7Q_2$ flow	0.92	13.53	5.77	3.26	2.46	0.32	4.63	13.85
Percent Change in $7Q_2$ Flow	**-20%**	**-1%**	**-3%**	**-1%**	**-7%**	**-13%**	**+21%**	**0%**
Stormwater diversion at $7Q_{10}$ flow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Impoundment precipitation captured at $7Q_{10}$ flow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.25
Water treatment plant discharge	0.00	0.00	0.00	0.00	0.00	0.00	1.07	1.07
Change at $7Q_{10}$ flow	**-0.18**	**-0.19**	**-0.16**	**-0.03**	**-0.18**	**-0.04**	**0.86**	**0.00**
Estimated $7Q_{10}$ flow	0.29	8.8	3.71	2.07	1.55	0.19	1.22	8.99
Percent Change in $7Q_{10}$ Flow	**-62%**	**-2%**	**-4%**	**-1%**	**-12%**	**-21%**	**+70%**	**0%**

†Modeled baseflow values used rather than estimated $7Q_{10}$ flow for EFRC-200 and LB-300 (see section 3.8.3).
Effects shown do not include mitigation measures such as grouting during operations or maintaining barriers in the mine void, or using multiple plugs in the adits during closure. Such mitigation would be evaluated after additional data were collected during the Evaluation Phase. Effects shown include discharges to Libby Creek (but not Ramsey Creek) during all phases to avoid adversely affecting senior water rights.
Groundwater models were used to predict effects from mine dewatering and the pumpback wells. With the data currently available, the model results provide a potential range of dewatering rates and streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. Both 3D groundwater flow models would be refined and rerun after data from the Evaluation Phase were incorporated into the models (see Section C.10.4, *Evaluation Phase* in Appendix C). Following additional data collection and modeling, the predicted impacts on surface water resources in the analysis area, including simulation of mitigation measures, may change and the model uncertainty would decrease. See section 3.10.4.3.5, *Groundwater Model Uncertainty* for more discussion of model uncertainty.

Rock Lake and Rock Creek Meadows

The effect on Rock Lake would be slightly greater than described in the Operations Phase. The decrease in the flow in East Fork Rock Creek where it enters Rock Creek Meadows would be slightly greater than described in the Operations Phase. Baseflow in East Fork Rock Creek where it enters Rock Creek Meadows was estimated at 2 cfs. A reduction of 0.18 cfs from an estimated baseflow of 2 cfs in the East Fork Rock Creek at the Meadows would result in a 9 percent flow reduction, and the other sources of water to the Meadows would not be affected by mining. As discussed previously, the surface inflow from the other tributaries that flow directly into the Meadows is likely to be about three times greater than that from the East Fork Rock Creek. The hydrology support for the wetland vegetation in Rock Creek Meadows is not expected to be affected.

3.11.4.4.4 Post-Closure Phase (Years 31+)

The Post-Closure Phase would begin after all active reclamation activities were completed. The mine void and adits would continue to fill with water and groundwater levels would continue to decline. After reaching a maximum drawdown and maximum reductions in baseflow in the Rock Creek and East Fork Bull River drainages early in the Post-Closure Phase, the 3D model predicted groundwater levels would begin to recover and would reach equilibrium or steady state in 1,172 years without MMC's modeled mitigation to 1,322 years with MMC's modeled mitigation. Multiple adit plugs, which are a component of the agencies' mitigation that were not simulated in the model, would also increase the time to reach steady state conditions over the mine void because adit inflows would not fill the void. The actual time to recover to steady state would be re-evaluated using the 3D model after additional data were collected during the Evaluation Phase. Once the potentiometric surface stabilized, without MMC's modeled mitigation, groundwater flow to Rock Lake and the baseflow component of streamflow at some stream locations would be reduced.

Streamflow—West Side Streams

The effect on west side streams would be greater than during the Operations and Closure Phases. In Rock Creek and the East Fork Rock Creek, without MMC's modeled mitigation, streamflow is predicted to decrease by a maximum 0.29 cfs at the CMW boundary (EFRC-200) and by 0.65 cfs at the mouth of Rock Creek (RC-2000) (Table 112). The reduction would consist of the entire baseflow at EFRC-200 and 7 percent of the estimated $7Q_{10}$ flow at RC-2000. Rock Creek at the mouth is often dry during low flow periods and the reduction may not be measurable in the channel. When the channel was dry, the effect would be to reduce subsurface flow. The reduction in flow in the East Fork Bull River at the CMW boundary (EFBR-500) would be 0.4 cfs, or 11 percent of the estimated $7Q_{10}$ flow and 7 percent of the estimated $7Q_2$ flow. For the Bull River at the mouth, streamflow is predicted to decrease by a maximum of 0.39 cfs without mitigation, or 1 percent of the estimated baseflow of 40 cfs (Geomatrix 2012).

With mitigation, streamflow is predicted by the 3D model to decrease by 0.17 cfs at EFRC-200 (a 59 percent decrease in baseflow), by 0.15 cfs at RC-2000 (a 2 percent decrease in the estimated $7Q_{10}$ flow), and by 0.39 cfs at EFBR-500 (an 11 percent decrease in the estimated $7Q_{10}$ flow and 7 percent of the estimated $7Q_2$ flow).

The unmitigated effects on aquatic life sites RC-3 and EFBR-2 are provided in Table 109. The predicted wetted perimeter decreases are 9 percent for RC-3 and 26 percent for EFBR-2.

As the mine void filled and groundwater levels over the mine and adits reached steady state conditions, the effects on streamflow would decrease (Table 113). Without mitigation, permanent flow reductions of about 10 percent of the baseflow at EFRC-200 and less than 1 percent of the estimated $7Q_{10}$ flow at RC-2000 are predicted to occur. A permanent decrease of 0.01 cfs is predicted at EFBR-500, and a flow increase of 0.05 cfs is predicted at the mouth of the East Fork Bull River. The uncertainty of the location where streamflow would increase in the East Fork Bull

River is discussed in section 3.10.4.3.4, *Post-Closure Phase* in the *Groundwater Hydrology* section.

At EFRC-200, modeled baseflow is estimated to be reduced by 10 percent without MMC's modeled mitigation (Table 113). Without MMC's modeled mitigation, there is the potential for groundwater to permanently flow from the East Fork Rock Creek watershed to the East Fork Bull River watershed via the mine void because of the very high permeability void that would connect the watersheds. With MMC's modeled mitigation, the flow at EFRC-200 is predicted to return to pre-mining conditions and, the loss of water from the mine void to the East Fork Bull River may be minimized. The flow in East Fork Bull River would permanently decrease by 0.02 cfs in the CMW and 0.01 cfs below the CMW boundary (the same as without mitigation), and the flow of the East Fork Bull River at the mouth would decrease by 0.01 cfs. The agencies' proposed mitigation and its effectiveness in minimizing effects on baseflow are discussed in section 3.10.4.3.6, *Effectiveness of Agencies' Proposed Monitoring and Mitigation* in the *Groundwater Hydrology* section.

Streamflow—East Side Streams

Low Flow

The effects on streamflows shown in Table 112 assume the impoundment was reclaimed, the adits were not plugged near the mine void, the pumpback wells at the tailings impoundment were operating at the same rate as during the Closure Phase (0.55 cfs), and the Water Treatment Plant was used to treat discharged water, some of which would be used to avoid adversely affecting senior water rights. When discharge occurred at the Water Treatment Plant, flow would increase by 0.54 cfs at LB-300 (Table 112). Low flow at LB-2000 would not change. As long as the pumpback well system operated, the low flow in Poorman Creek would be reduced by 0.18 cfs. The reduction at PM-1200 would be 12 percent of the estimated $7Q_{10}$ flow and 7 percent of the estimated $7Q_2$ flow. Low flow in Bear Creek would not be affected. The length of time seepage interception and water treatment would be necessary is unknown, and may be decades or more after operations. If seepage interception and water treatment were not necessary at the time when maximum baseflow reductions occurred, streamflow in Poorman Creek would not be affected, and streamflow in Libby Creek above LB-300 would be affected only by baseflow reductions from mine inflows. At LB-100 in upper Libby Creek, baseflow would decrease by up to 12 percent during the Post-Closure Phase. Low flow in Libby, Ramsey and Poorman creeks would return to pre-mining conditions with or without mitigation when groundwater levels reach steady state conditions (Table 113).

Table 112. Estimated Changes during $7Q_2$ and $7Q_{10}$ Flows, Post-Closure Phase, Alternative 3.

Activity	East Fork Rock Creek EFRC-200†	Rock Creek RC-2000	East Fork Bull River EFBR-500	Ramsey Creek RA-600	Poorman Creek PM-1200	Little Cherry Creek LC-800§	Libby Creek LB-300†	Libby Creek LB-2000
	(cfs except % change)							
Without MMC's Modeled Mitigation								
Modeled baseflow change‡	-0.29	-0.65	-0.40	-0.02	0.00	0.00	-0.12	-0.11
Potable water	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01
Pumpback wells§	0.00	0.00	0.00	0.00	-0.18	-0.04	0.00	-0.55
Stormwater diversion at $7Q_2$ flow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Impoundment precipitation captured at $7Q_2$ flow§	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water treatment plant discharge	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.67
Change in $7Q_2$ flow	**-0.29**	**-0.65**	**-0.40**	**-0.02**	**-0.18**	**-0.04**	**0.54**	**0.00**
Estimated $7Q_2$ flow	0.92	13.53	5.77	3.26	2.46	0.32	4.63	13.85
Percent Change in $7Q_2$ Flow	**-32%**	**-5%**	**-7%**	**<-1%**	**-7%**	**-13%**	**+12%**	**0%**
Stormwater diversion at $7Q_{10}$ flow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Change in $7Q_{10}$ flow	**-0.29**	**-0.65**	**-0.40**	**-0.02**	**-0.18**	**-0.04**	**+0.54**	**0.00**
Estimated $7Q_{10}$ flow	0.29	8.80	3.71	2.07	1.55	0.19	1.22	8.99
Percent Change in $7Q_{10}$ Flow	**-100%**	**-7%**	**-11%**	**-1%**	**-12%**	**-21%**	**+44%**	**0%**
With MMC's Modeled Mitigation								
Modeled baseflow change	-0.17	-0.15	-0.39	-0.02	0.00	0.00	-0.12	-0.10
Potable water	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01
Pumpback wells§	0.00	0.00	0.00	0.00	-0.18	-0.04	0.00	-0.55
Stormwater diversion at $7Q_2$ flow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Impoundment precipitation captured at $7Q_2$ flow§	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water treatment plant discharge	0.00	0.00	0.00	0.00	0.00	0.00	0.66	0.66
Change in $7Q_2$ flow	**-0.17**	**-0.15**	**-0.39**	**-0.02**	**-0.18**	**-0.04**	**+0.53**	**0.00**
Estimated $7Q_2$ flow	0.92	13.53	5.77	3.26	2.46	0.32	4.63	13.85
Percent Change in $7Q_2$ Flow	**-18%**	**-1%**	**-7%**	**<-1%**	**-7%**	**-13%**	**+11%**	**0%**
Stormwater diversion at $7Q_{10}$ flow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Change in $7Q_{10}$ flow	**-0.17**	**-0.15**	**-0.39**	**-0.02**	**-0.18**	**-0.04**	**+0.53**	**0.00**
Estimated $7Q_{10}$ flow	0.29	8.80	3.71	2.07	1.55	0.19	1.22	8.99
Percent Change in $7Q_{10}$ Flow	**-59%**	**-2%**	**-11%**	**-1%**	**-12%**	**-21%**	**+43%**	**0%**

†Modeled baseflow values used rather than $7Q_{10}$ flow for EFRC-200 and LB-300 (see section 3.8.3).
§Assumes impoundment was reclaimed and pumpback well system was operating.
Maximum model predicted baseflow reductions occur at Year 38 for the Rock Creek drainage and Year 52 for the East Fork Bull River drainage. Baseflow changes for east slope watersheds in this table are for Year 38.
cfs = cubic feet per second; < = less than.
Effects shown do not include mitigation measures not provided in MMC's 3D model report such as increasing buffer zones or using multiple plugs in the adits during closure. Such mitigation would be evaluated after additional data were collected during the Evaluation Phase. Effects shown do include discharges to Libby Creek (but not Ramsey Creek) during all phases to avoid adversely affecting senior water rights.
Groundwater models were used to predict effects from mine dewatering and the pumpback wells. With the data currently available, the model results provide a potential range of dewatering rates and streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. Both 3D groundwater flow models would be refined and rerun after data from the Evaluation Phase were incorporated into the models (see Section C.10.4, *Evaluation Phase* in Appendix C). Following additional data collection and modeling, the predicted impacts on surface water resources in the analysis area, including simulation of mitigation measures, may change and the model uncertainty would decrease. See section 3.10.4.3.5, *Groundwater Model Uncertainty* for more discussion of model uncertainty.

Table 113. Estimated Changes during $7Q_2$ and $7Q_{10}$ Flows, Steady State Conditions Post-Closure, Alternative 3.

Activity	East Fork Rock Creek EFRC-200[†]	Rock Creek RC-2000	East Fork Bull River EFBR-500	East Fork Bull River at Mouth	Ramsey Creek RA-600	Poorman Creek PM-1200	Little Cherry Creek LC-800	Libby Creek LB-300[†]	Libby Creek LB-2000
Effects at Estimated $7Q_2$ Flow									
Estimated $7Q_2$ flow	0.92	13.53	5.77	12.27	3.26	2.46	0.32	4.63	13.85
Change at $7Q_2$ flow without MMC's modeled mitigation	-0.03	-0.03	-0.01	0.05	0.00	0.00	0.00	0.00	0.00
Percent Change in $7Q_2$ Flow without MMC's modeled mitigation	-3%	<-1%	<-1%	1%	0%	0%	0%	0%	0%
Change at $7Q_2$ flow with MMC's modeled mitigation	0.00	0.01	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00
Percent Change in $7Q_2$ flow with MMC's modeled mitigation	0%	<+1%	<-1%	<-1%	0%	0%	0%	0%	0%
Effects at Estimated $7Q_{10}$ Flow									
Estimated $7Q_{10}$ flow	0.29	8.80	3.71	7.97	2.07	1.55	0.19	1.22	8.99
Change at $7Q_{10}$ flow without MMC's modeled mitigation	-0.03	-0.03	-0.01	0.05	0.00	0.00	0.00	0.00	0.00
Percent Change in $7Q_{10}$ flow without MMC's modeled mitigation	-10%	<-1%	<-1%	<1%	0%	0%	0%	0%	0%
Change at $7Q_{10}$ flow with MMC's modeled mitigation	0.00	0.01	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00
Percent Change in $7Q_{10}$ flow with MMC's modeled mitigation	0%	<+1%	<-1%	<-1%	0%	0%	0%	0%	0%

[†]Modeled baseflow values used rather than estimated $7Q_{10}$ flow for EFRC-200 and LB-300 (see section 3.8.3).
All units are cfs except % change; cfs = cubic feet per second; < = less than.
Groundwater models were used to predict effects from mine dewatering and the pumpback wells. With the data currently available, the model results provide a potential range of dewatering and pumping rates and streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. Both 3D groundwater flow models would be refined and rerun after data from the Evaluation Phase were incorporated into the models (see Section C.10.4, *Evaluation Phase* in Appendix C). Following additional data collection and modeling, the predicted impacts on surface water resources in the analysis area, including simulation of mitigation measures, may change and the model uncertainty would decrease. See section 3.10.4.3.5, *Groundwater Model Uncertainty* for more discussion of model uncertainty.

After the surface of the impoundment was reclaimed and runoff was no longer subject to ELGs and applicable water quality standards were met, a channel would be excavated through the tailings and Saddle Dam abutment to route runoff from the site toward a tributary of Little Cherry Creek. The runoff channel would be routed at no greater than 1 percent slope and along an alignment requiring the shallowest depth of tailings to be excavated down to the channel grade. The side slopes would be designed to be stable and would be covered with coarse rock to prevent erosion. The Little Cherry Creek watershed area where runoff would meet the creek would increase by 633 acres, potentially increasing the flow in Little Creek by an estimated 67 percent (ERO Resources Corp. 2010a). At the mouth of Little Cherry Creek, the watershed would be 644 acres larger, a 44 percent increase. The Hortness method overestimates $7Q_2$ and $7Q_{10}$ flow in watersheds containing the reclaimed impoundment, as discussed previously under Alternative 2. Both $7Q_2$ and $7Q_{10}$ flow likely occur during late summer or early fall during periods of little or no precipitation. The amount of baseflow that would flow during these periods toward Little Cherry Creek would be negligible. The agencies anticipate little or no increase in $7Q_2$ and $7Q_{10}$ flow in Little Cherry Creek. Any increased flow would be partially offset by flow reduction due to the pumpback well system as long as it operated. As discussed in the Operations Phase, the pumpback wells may not affect flow in Little Cherry Creek.

Low flow at LB-2 would not be affected (Table 109) because MMC would discharge water to Libby Creek and possibly Ramsey Creek from water stored in the adits to the extent necessary to avoid adversely affecting senior water rights.

Peak and Average Annual Flow

Reductions in peak and annual flow in east side streams would continue in the Post-Closure Phase. Peak and annual flow in Poorman Creek and Ramsey Creek would return to pre-mine conditions after the tailings impoundment was reclaimed, the adits were completed plugged, and the pumpback well system ceased operations. Peak and annual flow in the four unnamed drainages below the Poorman Impoundment would be substantially less than pre-mine conditions because stormwater from the reclaimed impoundment surface would be diverted to Little Cherry Creek, reducing the watershed of Drainage 10 by 66 percent and the watersheds of the other three drainages by 74 percent (ERO Resources Corp. 2010a in Appendix H).

As long as the pumpback well system operated, flow in the four unnamed drainages at the impoundment area would be substantially reduced. After the impoundment was reclaimed and the pumpback ceased operation, flow in the four unnamed drainages at the impoundment area would be substantially reduced from pre-mine conditions, but slightly greater than in the Operations Phase. Compared to pre-mine size, the watershed of Drainage 10 would be 66 percent smaller and the watersheds of the other three drainages would be 74 percent smaller (ERO Resources Corp. 2010a in Appendix H). Peak flows would be reduced by similar percentages. The Hortness method overestimates $7Q_2$ and $7Q_{10}$ flow in watersheds containing reclaimed impoundments as discussed in Alternative 2. Klohn Crippen (2005) estimated a steady state flow from the underdrain system of 50 to 100 gpm for the Little Cherry Creek impoundment and the agencies anticipate conditions at the Poorman Impoundment Site would be similar. Springs outside of the impoundment footprint that were affected by the pumpback wells would likely return to pre-mine conditions and also may contribute baseflow to channels outside of the impoundment.

After the impoundment was reclaimed, surface water runoff that was diverted to Poorman Creek prior to closure would flow toward the reclaimed impoundment. The watershed and average annual flow in Poorman Creek would return to pre-mine conditions. The watershed area of Little Cherry Creek would increase by 644 acres, an increase of 44 percent (ERO Resources Corp. 2010a). It is expected that average annual flow in Little Cherry Creek would increase by a smaller percentage, as the larger watershed would not increase flow during low-flow periods. The larger watershed would increase runoff during storm events. Due to Water Treatment Plant discharges, peak flow would increase slightly (less than 1 percent) and average annual flow would increase by about 5 percent at LB-300 and by less than 5 percent below LB-300 down to Poorman Creek. The effect on average annual flow in Libby Creek between Poorman Creek and Little Cherry Creek would be offset as result of the diversion of runoff to Little Cherry Creek. Other segments of Libby Creek would return to pre-mine conditions after the tailings impoundment was reclaimed, the adits were completed plugged, and the pumpback well system ceased operations.

As part of the final closure plan, MMC would complete a hydraulic and hydrologic (H&H) analysis of the proposed runoff channel during final design, and submit it to the lead agencies and the Corps for approval. The H&H analysis would include a channel stability analysis and a sediment transport assessment. Based on the analysis, modifications to the final channel design would be made and minor modifications to the upper reaches of the tributary of Little Cherry Creek may be needed to minimize effects on channel stability in the tributary of Little Cherry Creek and to avoid allowing water to pond on the surface of the reclaimed tailings. Other drainage alternatives for the surface of the reclaimed tailings impoundment that protect against erosion but also provide aquatic habitat downstream of the impoundment may be developed with agency approval.

Rock Lake

Effects on Rock Lake during the Post-Closure Phase would be a reduction in groundwater flow to the lake and a reduction in water stored in the lake. The effects would depend on the time of year and whether the potential effects were mitigated. The following discussion is based on the results of the 3D model for an average precipitation year and an analysis of the Rock Lake water balance (ERO Resources Corp. 2012c). It is uncertain whether the effect of mine inflows to Rock Lake during the late summer/early fall period would be greater or less during a multi-year dry or multi-year wet period because these scenarios have not been modeled. The watershed of Rock Lake receives a large amount of precipitation, primarily during the winter and spring, and during a rainy period in late fall. There is enough water even in a very dry year to refill the lake many times during both the snowmelt runoff period and the fall rainy period after drawdown periods when outflows exceed inflows. The water level in Rock Lake would "reset" to full capacity each spring and each fall even during a very dry period (ERO Resources Corp. 2012c).

Without MMC's Modeled Mitigation

Without MMC's modeled mitigation, the potentiometric surface surrounding Rock Lake would continue to decline after mining ceased. When the potentiometric surface decreased below the lake surface, the groundwater flow direction would reverse. As a result, water would flow out of the lake toward the mine void, resulting in a loss of lake volume. The model predicted the loss would occur for about 130 years after mining ceased (Geomatrix 2011c).

The estimated reduction in lake volume, surface area and lake level would be greatest 16 years after mining ceased and the adits were plugged, and would gradually decrease after that time. During the late summer/early fall period, the volume of the lake would be reduced by a maximum of about 4 percent, the surface area would be reduced by a maximum of about 3 percent, and the lake level would decline by 1.2 feet (Table 114). Littoral vegetation, if present in shallow areas of Rock Lake, may experience drier conditions late in the growing season. During the 7-month winter period, the lake volume would be reduced by an estimated 5 percent, the surface area by 4 percent, and the lake level would decline by about 1.5 feet (Table 115).

Table 114. Estimated Effects on Rock Lake during 2-Month Summer/Fall Period.

Phase	Total Mine Depletions During Period (acre-feet)	Initial Lake Volume (acre-feet)	Ending Lake Volume (acre-feet)	Volume Reduction (%)	Change in Lake Level (feet)	Change in Surface Area (acres)	Surface Area Reduction (%)
Construction (without mitigation)	1.5	1,302	1,300.5	<0.1	*	*	*
Operations (without mitigation)	7.8	1,302	1,294.2	0.6	*	*	*
Operations (with mitigation)	6.0	1,302	1,296.0	0.5	*	*	*
Post-Closure (maximum reduction, without mitigation)	53.0	1,302	1,249.0	4	-1.2	1.5	3
Post-Closure (maximum reduction, with mitigation)	20.5	1,302	1,281.5	2	-0.5	0.6	1
Post-Closure (steady state, without mitigation)	4.0	1,302	1,298.0	0.3	*	*	*
Post-Closure (steady state, with mitigation)	0.0	1,302	1,302.0	0.0	0.0	0.0	0

* Estimates of changes in lake levels and lake surface area would be very small and cannot be accurately calculated.
cfs = cubic feet per second; < = less than.
A groundwater model was used to predict effects from mine dewatering. With the data currently available, the model results provide a potential range of dewatering rates and streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. The 3D groundwater flow model would be refined and rerun after data from the Evaluation Phase were incorporated into the models (see Section C.10.4, *Evaluation Phase* in Appendix C). Following additional data collection and modeling, the predicted impacts on surface water resources in the analysis area, including simulation of mitigation measures, may change and the model uncertainty would decrease. See section 3.10.4.3.5, *Groundwater Model Uncertainty* for more discussion of model uncertainty.
Source: ERO Resources Corp. 2012c.

At steady state conditions, the model predicted that the potentiometric surface would not recover completely to pre-mining conditions, resulting in less groundwater flow into the lake. Total groundwater inflow to Rock Lake would be permanently reduced by 24 acre-feet per year, about 2 percent of the estimated full lake volume. During the late summer/early fall period, Rock Lake would have a volume and surface area reduction estimated to be less than 1 percent (Table 114). The volume, surface area, and level of the lake would not be affected during the 7-month winter period (Table 115). The permanent effect on the lake during the 7-month winter period would be a reduction in groundwater inflow to the lake of about 10 percent, which would result in 10 percent less outflow from the lake into the East Fork Rock Creek.

Without mitigation, the change to Rock Lake may be measurable as a long-term trend during periods when deep bedrock groundwater is the only source of supply to Rock Lake, but a trend may be difficult to observe or measure when the lake was ice-covered. The effects on Rock Lake would occur during these two periods, but the lake would refill each year during snowmelt runoff and during late fall precipitation that resulted in runoff to Rock Lake. An analysis of precipitation

Table 115. Estimated Effects on Rock Lake during 7-Month Winter Period during Maximum Reduction in Potentiometric Surface and at Steady State Post-Closure.

Phase	Total Mine Depletions During Period (acre-feet)	Initial Lake Volume (acre-feet)	Ending Lake Volume (acre-feet)	Volume Reduction (%)	Change in Lake Level (feet)	Change in Surface Area (acres)	Surface Area Reduction (%)
Maximum Effect							
Post-Closure without mitigation	63.6	1,302	1,238.4	5	-1.5	1.8	4
Post-Closure with mitigation	0.0	1,302	1,302.0	0	0.0	0.0	0
Steady State Conditions							
Post-Closure without mitigation	0.0	1,302	1,302.0	0	0.0	0.0	0
Post-Closure with mitigation	0.0	1,302	1,302.0	0	0.0	0.0	0

A groundwater model was used to predict effects from mine dewatering. With the data currently available, the model results provide a potential range of dewatering rates and streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. The 3D groundwater flow model would be refined and rerun after data from the Evaluation Phase were incorporated into the models (see Section C.10.4, *Evaluation Phase* in Appendix C). Following additional data collection and modeling, the predicted impacts on surface water resources in the analysis area, including simulation of mitigation measures, may change and the model uncertainty would decrease. See section 3.10.4.3.5, *Groundwater Model Uncertainty* for more discussion of model uncertainty.
Source: ERO Resources Corp. 2012c.

within the watershed above Rock Lake that considered possible losses before runoff reaching the lake showed that there is enough water even in a very dry year to refill Rock Lake many times during both the snowmelt runoff period and the fall rainy period (ERO Resources Corp. 2012c).

With MMC's Modeled Mitigation

With MMC's modeled mitigation, the 3D model predicted less of a reduction in the potentiometric surface at Rock Lake. During operations, the effect on Rock Lake would be slightly less with MMC's modeled mitigation than without. The estimated reduction in lake volume, surface area and lake level would be greatest 16 years after mining ceased and the adits were plugged. At that time during the 2-month summer/fall period, the volume of the lake would be reduced by an estimated 2 percent, the surface area would be reduced by an estimated 1 percent, and the lake level would decline by 0.5 foot (Table 115).

At steady state conditions, there would be slightly less baseflow (-0.01 cfs) at EFRC-50 upstream of Rock Lake. The 3D model predicted that low permeability barriers would increase groundwater flow toward the lake by 0.01 cfs. The net result would be no change in the lake volume, lake level or surface area at steady state (Table 115). The agencies' mitigation, leaving barrier pillars with access openings that would be plugged at closure with bulkheads, would be designed, based on hydrologic data collected during mining, to minimize post-mining changes in East Fork Rock Creek and East Fork Bull River streamflow and water quality. The mitigation of increasing the buffer zones near Rock Lake and the Rock Lake Fault, which was not modeled, may eliminate effects on Rock Lake during and after mining.

Rock Creek Meadows

The 3D model-predicted effect on the East Fork Rock Creek where it enters Rock Creek Meadows would be greatest 16 years after mine closure, and is estimated to be 0.43 cfs (Klepfer Mining Service 2012). Observations made during an agency field review in a very dry period (September 2007) indicated a high water table supported the wetlands. Baseflow in East Fork Rock Creek at the Meadows was estimated to be 2 cfs (discussed in section 3.10.3.1.2 in the *Groundwater Hydrology* section). A reduction of 0.43 cfs would be about 20 percent of the estimated baseflow in East Fork Rock Creek. Groundwater levels at Rock Creek Meadows and other tributaries that flow into the East Fork Rock Creek at the Meadows are predicted not to be affected by mining. The hydrology support for the wetland vegetation in Rock Creek Meadows is not expected to be affected.

3.11.4.4.5 Climate Change

The effects of climate change in combination with Alternative 3 would be the same as in combination with Alternative 2.

3.11.4.4.6 Uncertainties Associated with Detecting Streamflow Changes due to Mine Activities

The ability to measure streamflow accurately and precisely depends on a number of factors, reviewed by Harmel *et al*. (2006). Potential errors in streamflow measurement are introduced in the measurement of stream depth, velocity, and channel dimensions. Accuracy varies over the distribution of flows, ranging from a few percent for low flows measured with an accurately calibrated weir, to 10 to 15 percent or more for high flows measured by standard stage-to-discharge techniques and calibrated against periodic wading discharge measurements (Grant *et al.* 2008). In an analysis of effects of forest harvest activities on peak flows and channel morphology in the Pacific Northwest, Grant *et al.* (2008) identified a detection limit for changes in peak flow measurements of about ±10 percent; changes in peak flow that fall in this range are within the error of peak flow measurement and cannot be ascribed as an effect.

Harmel *et al.* (2006) reported measurement error in overall streamflow measurement for a “typical” scenario, a “best case” scenario, and a “worse case” scenario. The best case scenario represented measurement procedures used with a concentrated effort in quality assurance/quality control (QA/QC) unconstrained by financial and personnel resource limitations and in ideal hydrologic conditions. The typical scenario represented measurement procedures conducted with a moderate effort at QA/QC and under typical hydrologic conditions. For a typical scenario, estimated measurement error averaged 10 percent and ranged from 6 percent to 19 percent for a range of conditions. The estimated measurement error was 3 percent for the best case scenario, which included flow measurement under ideal hydrologic conditions, specifically a pre-calibrated flow control structure (stable bed and channel) and a stilling well for stage measurement. Measurement error reported by Harmel *et al.* (2006) is consistent with an earlier evaluation of measurement error by the USGS (Sauer and Meyer 1992). Sauer and Meyer reported most measurements will have standard errors ranging from about 3 percent to 6 percent, with a low of 2 percent under ideal conditions.

A recent improvement in streamflow measurement for streams that are at least a foot deep is the use of acoustic Doppler current profilers to measure streamflow. Under suitable conditions, the advantages are that this method is much faster and no less accurate than mechanical current meters, it allows measurements where mechanical current meters are inappropriate or unreliable, and it measures continuous profiles of water velocity, providing more accurate streamflow measurements (Hirsch and Costa 2004).

The natural variability in streamflow also influences the ability to detect a mining-induced change in streamflow. Based on an analysis of streamflow data from streams with gaging stations located at the periphery of the analysis area on the KNF, Wegner (2007) reported the average variability in low flow values is 20 percent. In stream reaches when and where the only source of water to streams is deep bedrock groundwater, it is expected that flow variability would be less. A sufficient number of streamflow measurements could be collected to determine whether the streamflow that may be affected by mining is statistically different from the streamflow that occurred pre-mining, regardless of variability. Although mining-induced streamflow changes would initially be small and gradually increase, a trend should be observable given adequate streamflow monitoring before mining began, during all mining phases, and after mining ceased.

3.11.4.4.7 Effectiveness of Agencies' Proposed Monitoring and Mitigation

Monitoring

MMC would monitor lake levels in Rock Lake and Lower Libby Lake as one component of a comprehensive plan to monitor project effects. MMC began measuring lake level continuously in Rock Lake in 2009 and the KNF currently is monitoring the lake level in Lower Libby Lake. Continued monitoring of lake levels would be effective for subsequently detecting changes in lake levels due to possible dewatering effects of the project. During periods when runoff from precipitation or snowmelt is supplying water to the lake, it probably would not be possible to measure the effect of the project if the lake level changes are in the predicted range of 1 foot or less. Wanless Lake, 4 miles south of Rock Lake and outside of the area of influence of the Montanore Project, would be used as a benchmark lake and would monitored in the same manner as Rock Lake (Appendix C). The monitoring would be effective in assisting MMC and the agencies in separating natural variability from the effects of the mine on Rock Lake.

Streamflow would also be measured at numerous locations during the various mine phases (see Appendix C) to monitor the effects of mine activities. Some sites would be monitored continuously, while others would be measured every other week, monthly or at quarterly intervals when streams were not frozen. For stream sites measured continuously, after adequate data were collected, stage/discharge relationships, daily flows, and yearly hydrographs would be developed and used to estimate baseflow, average, and peak flows. As discussed in the previous section, there are potential errors in streamflow measurement, particularly in rock-filled mountain streams, and during very low flows, but streamflow measurements would be effective for monitoring the effects of mine activities when the agencies' monitoring plans in Appendix C were implemented. Swamp Creek, which originates at the Wanless Lake outlet, would be used as a reference stream on the west side of the divide and Bear Creek would be used as a reference stream on the east side of the divide. These streams are located outside of the area of influence of Alternative 3, and monitoring would be effective in assisting MMC and the agencies in separating natural variability from the effects of the mine on analysis area streams.

Mitigation

Mitigation of effects on the baseflow of streams within the CMW and to Rock Lake, the effectiveness of the mitigations and the uncertainty associated with each mitigation are discussed in detail in section 3.10.4.3.5, *Groundwater Model Uncertainty* and section 3.10.4.3.6, *Effectiveness of Agencies' Proposed Monitoring and Mitigation* in the *Groundwater Hydrology* section. Mitigations would include:

- Buffers around the Rock Lake Fault and Rock Lake where mining would not occur to reduce the risk of high mine inflows and excessive impacts on surface flows and the level of Rock Lake. Based on the 3D model results, buffers would be highly effective in minimizing effects on surface water.
- Barrier pillars in the mine with bulkheads at access openings, if necessary, to minimize post-mining changes in streamflow in East Fork Rock Creek and East Fork Bull River and eliminate the loss of water from storage in Rock Lake. The 3D model results indicated that the concept of barriers in the mine void would be effective in reducing post-mining impacts on streams and in eliminating the loss of water from storage in Rock Lake. Barrier design would be based on an analysis of hydrologic data collected during mining to assess the need for barriers and to optimize their effectiveness.
- Grouting in the mine to reduce adit and mine inflows, which would reduce changes in baseflow in nearby watersheds. With the planned proper maintenance during the Construction and Operations Phases, grouting would be effective in reducing mine and adit inflows. The uncertainty of the effectiveness of grouting over the long term was considered in the agencies' analysis.
- Placing adit plugs post-mining would be effective for separating the mine void from the adits, which would allow streamflows in the Libby Creek watershed to recover to pre-mining conditions more quickly.

Other activities that would reduce streamflow in Libby Creek (capture of precipitation and evaporation in the impoundment, and operation of the pumpback wells) would be effectively mitigated in Alternatives 3 and 4 by discharges of treated water from the Water Treatment Plant that would be equal to or greater than the flow reductions in Libby Creek. The use of thickened tailings in Alternative 3 would reduce the amount of water stored in the tailings by up to about 1 cfs, and reduce makeup water requirements from Libby Creek. Thickened tailings would be an effective mitigation because it would reduce MMC's appropriation at the Libby Creek infiltration gallery. The mitigation for effects on senior water rights in Libby and Ramsey creeks is discussed in section 2.5.4.3.2, *Water Rights* in Chapter 2 and section 3.12.4.3 under *Water Rights*.

The disturbance area of Alternatives 3 and 4 would be less than Alternative 2, which would effectively minimize peak flow increases in all area streams.

In Alternatives 3 and 4, runoff from the reclaimed tailings impoundment would be directed toward Little Cherry Creek instead of Bear Creek proposed in Alternative 2. As part of the final closure plan, MMC would complete a H&H analysis of the proposed runoff channel during final design that would include a channel stability analysis and a sediment transport assessment. The runoff channel design would effectively minimize effects on Little Cherry Creek. Other effects on streamflow in streams other than Libby Creek, such as Poorman and Little Cherry creeks, would be unavoidable.

The agencies' analysis indicates that various discharges or diversions in all mine alternatives may result in changes in the estimated $7Q_{10}$ flow of greater than 10 percent. Although not analyzed, various discharges or diversions also may change the mean monthly flow by more the 15 percent.

The DEQ would determine whether the changes would be nonsignificant during the MPDES permitting process.

3.11.4.5 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would be similar to Alternative 3, but modified from MMC's proposed Little Cherry Creek Impoundment Site. All other modifications and mitigations described in Alternative 3, other than those associated with the Poorman Tailings Impoundment Site, would be part of Alternative 4. The amount of seepage collected by the Seepage Collection System, which includes seepage from the tailings impoundment, may be increased by optimizing the location of the Seepage Collection Dam where bedrock outcrops in the Little Cherry Creek drainage. Any tailings seepage not intercepted by the drains beneath the impoundment and dams would likely discharge to the former Little Cherry Creek watershed through the fractured bedrock aquifer. Consequently, siting the Seepage Collection Dam at or below the location where bedrock outcrops in the Little Cherry Creek drainage would increase the likelihood that the seepage would be collected by the dam. In Alternative 4, MMC would conduct additional geotechnical work near the Seepage Collection Dam during final design and site the dam lower in the drainage if technically feasible. Pumpback wells would intercept tailings impoundment seepage not intercepted by the underdrain system before it reached surface water.

Effects on west side streams, Rock Lake, and Ramsey Creek would be the same as those described in Alternative 3 during all phases of the project. Effects on Libby Creek would be slightly greater (3 percent) because the tailings impoundment would be 20 acres larger and would intercept more precipitation. Effects on Poorman, Little Cherry and Bear creeks through the Operations Phase would be the same as Alternative 2 without mitigation; these effects were not quantified. Alternative 4 would require two new road crossings across a perennial stream and one new crossing of a non-perennial stream (Table 107).

During the Construction Phase, less than a 1 percent increase in peak flow from timber clearing for the mine facilities is estimated in all east side streams. All transmission line alternatives combined with Alternative 4 would have estimated increases in peak flow of less than 10 percent.

The agencies' monitoring and mitigation plans include the construction of minor facilities in the Libby Creek floodplain, such as streamflow measurement devices and an infiltration gallery for makeup water in Libby Creek. No alternative exists to avoid locating these facilities in the Libby Creek floodplain and the effect would be the same as Alternative 3.

The effect on the Little Cherry Creek floodplain would be less than that described for Alternative 2. In Alternative 4, a new floodplain would be created along the diverted Little Cherry Creek channel.

After the tailings impoundment surface and dams were reclaimed, the runoff would no longer be subject to ELGs. When it met applicable water quality standards, runoff from the reclaimed tailings impoundment surface would be routed via the permanent Diversion Channel and Drainage 10 to Libby Creek (as compared to Alternative 2, where runoff from the reclaimed tailings impoundment surface would flow toward Bear Creek). After the South Saddle Dam and the south Main Dam abutment were reclaimed, runoff would flow to the Diversion Channel. Consequently, the watershed of Drainage 10 would increase by about 500 acres post-mining, as compared to operational conditions. This additional area may require MMC to complete more channel stabilization work in Drainage 10 due to increased flow, plus follow-up monitoring. Average annual flow in the diverted Little Cherry Creek would be about five times the existing flow in Drainage 10 and about 10 percent less than the current flow of Little Cherry Creek (Appendix H).

Compared with the pre-mining watershed area, the post-mining watershed area contributing water to the former Little Cherry Creek channel would be 85 percent smaller directly below the tailings impoundment and 74 percent smaller at the confluence of former Little Cherry and Libby creeks. The Hortness method overestimates $7Q_2$ and $7Q_{10}$ flow in watersheds containing the reclaimed impoundment, as discussed in Alternative 2. Changes in the watershed areas contributing flow to Bear and Libby Creek would be 5 percent or less. Below Bear Creek, streamflow in Libby Creek would return to pre-mining conditions, less any reduced baseflow which would be less than 1 percent of the estimated $7Q_{10}$ flow at Libby Creek at US 2. Following cessation of the pumpback wells and recovery of groundwater levels, springs and seeps outside of the impoundment footprint that were affected by the pumpback wells would likely return to pre-mine conditions and may contribute to baseflow.

3.11.4.6 Alternative A – No Transmission Line

In Alternative A, the transmission line, substation and loop line for the Montanore Project would not be built. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands. Possible impacts on streams due to construction, operation, and maintenance of a new transmission line, Sedlak Park Substation, and loop line would not occur.

3.11.4.7 Alternative B – MMC Proposed Transmission Line (North Miller Creek Alternative)

3.11.4.7.1 Construction Phase

Alternative B transmission line would have four perennial stream crossings: the Fisher River, Howard Creek, Libby Creek, and Ramsey Creek. The alignment also would have 16 new crossings over other streams. Five new road crossings over other streams would be required. The transmission line would cross 1.1 miles of floodplains and require 1.6 acres of new roads within a floodplain (Table 116). Eight structures would be located in a floodplain. Construction would be curtailed during heavy rains or high winds to prevent erosion to streams. MMC identified four possible methods of stream crossings: fords, culverts, arches, and bridges. Culverts would be the most commonly used crossing method. Because the construction time of the line would be short, MMC anticipates that no drainage would be provided for the temporary roads and would follow the agencies' guidance if installation of culverts were required. Culvert installations on perennial streams would meet BMP requirements. In all transmission line alternatives, the DEQ would require on-site inspections of perennial stream crossings associated with the 230-kV transmission line to determine the most suitable crossing methods and timing of construction that would minimize impacts on floodplains and streamflow (see Environmental Specifications in Appendix D). During construction, streams may be temporarily dammed or routed around construction activities. Damming the stream would reduce or eliminate flow below the dam for a short period of time. After construction was completed, the bridges and culvert would not affect natural streamflow.

Table 116. Comparison of Stream and Floodplain Crossings Required for Transmission Line Alternatives.

Transmission Line Alternative	Number of Stream Crossings by New Roads		Acres of New Roads within FEMA Designated 100-Year Floodplain	Crossings by Transmission Line		
				Miles of Floodplain	Number of Streams	
	Perennial Stream	Other Stream			Perennial Stream	Other Stream
B	0	5	1.6	1.1	4	16
C-R	0	0	0.2	0.4	5	15
D-R	0	0	0.2	0.3	4	18
E-R	0	1	0.2	0.3	4	19

Source: GIS analysis by ERO Resources Corp. using KNF data.

The proposed Sedlak Park Substation would be south of Sedlak Creek and the loop line would cross the creek. Sedlak Creek has a small drainage area and an undefined floodplain. The Sedlak Park Substation and loop line would not affect streamflow in Sedlak Creek.

During the Construction Phase, a 1 percent or less increase in peak flow from timber clearing for the transmission line is estimated in all east side streams. Based on the ECAC model results (Appendix H), the mine-related water yield increase with the combination of Alternative 2 and Alternative B would reach a measurable level in Ramsey and Poorman creeks, with an estimated peak flow increase in Ramsey Creek of 12 percent.

3.11.4.7.2 Operations Phase

The transmission line and associated road crossing culverts would not affect streamflow during operations.

3.11.4.7.3 Decommissioning Phase

As proposed, culverts would remain after the project was completed. The culverts would not affect natural streamflow.

3.11.4.8 Transmission Line Alternatives C-R, D-R and E-R

3.11.4.8.1 Construction Phase

Five perennial streams would be crossed by the transmission line in Alternative C-R: Fisher River, West Fisher Creek, Miller Creek, Howard Creek, and Libby Creek. Preliminary design indicates all transmission line alternatives except Alternative B would span a bend in the creek; it may be possible to avoid spanning the creek during final design. The effect of the Sedlak Park Substation and loop line in all agency alternatives would be the same as Alternative B. The transmission line would cross an estimated 0.4 mile of floodplains and require 0.2 acre of new roads within a floodplain (Table 116). Two structures would be located in a floodplain. Alternative C-R would require no new road crossings over major or minor streams. Culverts would be installed, if needed, on roads used for maintenance access. Other aspects of stream crossings, such as compliance with the Environmental Specifications in Appendix D, would be the same as Alternative B (section 3.11.4.7, *Alternative B – MMC Proposed Transmission Line (North Miller Creek Alternative)*).

Four perennial streams would be crossed by the transmission line in Alternative D-R: Fisher River, West Fisher Creek, Howard Creek, and Libby Creek. The transmission line would cross an estimated 0.3 mile of floodplains and require 0.2 acre of new roads within a floodplain (Table 116). Two structures would be located in a floodplain. Alternative D-R would require no new road crossings over any stream.

Four perennial streams would be crossed by the transmission line in Alternative E-R: Fisher River, West Fisher Creek, Howard Creek and Libby Creek. The transmission line would cross an estimated 0.3 mile of floodplains and require 0.2 acre of new roads within a floodplain (Table 116). Two structures would be located in a floodplain. The alternative would require no new road crossings over perennial streams, and one new crossing over a non-perennial stream. Road and culvert construction, maintenance and removal, and effects on peak flow would be the same as Alternative C-R.

During final design, MMC would avoid or minimize, to the extent practicable, locating structures and roads in a floodplain. If locating transmission line structures and roads in a floodplain could not be avoided during final design, MMC would submit a flood plain permit application to the DNRC that provides details on the obstruction or use of a floodway/floodplain before construction. DNRC's permit issuance is based on the danger to life and property downstream, availability of alternate locations, possible mitigation to reduce the danger, and the permanence of the obstruction or use (76-5-405, MCA).

In Alternatives C-R, D-R, and E-R, installation of culverts, bridges, or other structures at perennial stream crossings would be specified by the agencies following on-site inspections with DEQ, Forest Service, FWP, landowners, and local conservation districts. Installation of culverts or other structures in a water of the United States would be in accordance with the U.S. Army Corps of Engineers 404 and DEQ 318 permit conditions. Work in streams within the transmission line corridor would be in accordance with MFSA certificate requirements. All culverts would be sized according to Revised Hydraulic Guide (KNF 1990) and Parrett and Johnson (2004). Where new culverts were installed, they would be installed so water velocities or positioning of culverts would not impair fish passage. Stream crossing structures would be able to pass the 100-year flow event without impedance.

Based on the KNF ECAC model results (Appendix H), timber clearing for access roads and the transmission line in Alternatives C-R, D-R, and E-R is not predicted to measurably increase the peak flow of any streams. All transmission line alternatives combined with Mine Alternatives 3 and 4 would have estimated increases in peak flow of less than 10 percent.

3.11.4.8.2 Operations Phase

The transmission line and associated road crossing culverts would not affect streamflow during mine operations.

3.11.4.8.3 Decommissioning Phase

After line installation was completed, access roads would be changed to intermittent stored service. Culverts would be removed by the KNF if determined to be high risk for blockage or failure. Stream banks would be laid back to allow streamflow to pass without scouring or ponding. Transmission line roads would be decommissioned after mine closure and removal of the transmission line. Culverts would be removed and fill areas sloped back and stabilized during road decommissioning.

3.11.4.9 Cumulative Effects

3.11.4.9.1 Rock Creek Project

The Montanore and Rock Creek Projects, assuming they occurred concurrently, would cumulatively reduce flow in the Rock Creek, East Fork Bull River, and Bull River watersheds. No other aspects of the two projects would have cumulative effects on surface water resources. MMC's 3D model simulated the concurrent operation of both mines, based on several assumptions regarding the Rock Creek Mine design. The maximum effects on Rock Creek and the East Fork Bull River would occur after both mines ceased operations (assumed to be operating and closing simultaneously). The effects on low flows at RC-2000 and EFBR-500 are provided in Table 117. Compared to direct effects, cumulative flow reductions would be 0.03 cfs greater in Rock Creek at the mouth and the East Fork Bull River at the mouth, and 0.08 cfs greater at EFBR-500 at the CMW boundary. The cumulative effect at EFBR-500 would be a 13 percent reduction in the estimated $7Q_{10}$ flow and an 8 percent reduction in the estimate $7Q_2$ flow. The cumulative reduction in the wetted perimeter of the stream would be 30 percent at EFBR-2, and 18 percent at RC-3. The 3D model predicted that streamflow in the Libby Creek watershed, and Rock Lake levels would not be affected by the Rock Creek mine.

For the Bull River at the mouth, the cumulative effect would be a maximum flow reduction due to mine inflows of 0.48 cfs, which is a 1 percent decrease in the estimated baseflow of 40 cfs at that location (Geomatrix 2011a). During periods of the year when streamflow is dominated by surface water runoff (snowmelt and storm events), the effects on streamflow of the two mine projects would be negligible.

At the mouth of Rock Creek, the predicted reductions in low flows may not be measurable in the stream because the creek is often dry during baseflow periods (the flow reduction would be to subsurface flow). With mitigation, the cumulative effect on the East Fork Rock Creek and Rock Creek would be the same as discussed under the Montanore alternatives.

As the mine void filled and groundwater levels above the mines and adits reached steady state conditions, the effects on streamflow would decrease. Cumulative effects at steady state conditions were not quantified.

RCR prepared a 3D numerical hydrogeological model of the Rock Creek mine area to assist in defining potential impacts on groundwater and surface water resources (Hydrometrics 2014). For the Rock Creek Mine Supplemental EIS, the predicted cumulative effects were estimated by adding the results from the Montanore and Rock Creek 3D models for the respective periods of greatest groundwater drawdown. RCR's model predicted effects were slightly greater than estimated by MMC's 3D model. Because the two models present results for slightly different scenarios, Table 117 includes results for only one bulk hydraulic conductivity (10^{-6} cm/sec) from the Rock Creek model. The Montanore 3D model was used simulate to both unmitigated and mitigated effects, whereas the Rock Creek model only simulated unmitigated effects.

Table 117. Estimated Cumulative Changes during $7Q_2$ and $7Q_{10}$ Flows, Maximum Baseflow Changes during Post-Closure.

Variable	Rock Creek RC-2000		East Fork Bull River EFBR-500		East Fork Bull River @ Mouth	
	Without Mitigation	With MMC's Modeled Mitigation†	Without Mitigation	With MMC's Modeled Mitigation†	Without Mitigation	With MMC's Modeled Mitigation†
MMC's Model Results						
Modeled baseflow change (cfs)	-0.68	-0.19	-0.48	-0.47	-0.36	-0.37
Estimated $7Q_2$ flow (cfs)	13.53	13.53	5.77	5.77	12.27	12.27
Percent Change in $7Q_2$ Flow	-5%	-1%	-8%	-8%	-3%	-3%
Estimated $7Q_{10}$ flow (cfs)	8.80	8.80	3.71	3.71	7.97	7.97
Percent Change in $7Q_{10}$ Flow	-8%	-2%	-13%	-13%	-5%	-5%
RCR's Model Results						
Modeled baseflow change (cfs)	-1.05	—	—	—	-0.80	—
Estimated $7Q_2$ flow (cfs)	13.53	—	—	—	12.27	—
Percent Change in $7Q_2$ Flow	-8%	—	—	—	-7%	—
Estimated $7Q_{10}$ flow (cfs)	8.80	—	—	—	7.97	—
Percent Change in $7Q_{10}$ Flow	-12%	—	—	—	-10%	—

Groundwater models were used to predict effects from mine dewatering and the pumpback wells. With the data currently available, the model results provide a potential range of dewatering and pumping rates and streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. Both 3D groundwater flow models would be refined and rerun after data from the Evaluation Phase were incorporated into the models (see Section C.10.4, *Evaluation Phase* in Appendix C). Following additional data collection and modeling, the predicted impacts on surface water resources in the analysis area, including simulation of mitigation measures, may change and the model uncertainty would decrease. See section 3.10.4.3.5, *Groundwater Model Uncertainty* for more discussion of model uncertainty.

†These are only for unmitigated conditions for the Rock Creek mine because Rock Creek model did not evaluate effects of mitigation.

3.11.4.9.2 Other Reasonably Foreseeable Actions

Cumulative effects in the analysis area on both the east and west slopes of the Cabinet Mountains include past and current actions that are likely to continue in the future and reasonably foreseeable actions that could affect streamflows, spring flows, and lake levels. Other area mining activities, particularly in-stream suction dredging and placer exploration, have in the past created physical substrate habitat alterations in area streams. Other activities that could affect surface water flows include timber harvesting, land clearing, home construction, road construction, septic field installation, water well drilling, livestock grazing, and stream channel and bank stabilization or restoration projects. These activities could either increase or reduce water sources to streams, springs and lakes; other than the Montanore and Rock Creek Projects, cumulative effects would be minor. The cumulative peak flow increase in the Libby Creek and Fisher Creek watersheds would be less than 10 percent. For annual water yield, the cumulative annual flow increases would mostly be less than 1 percent, with the largest impact being a 4 percent increase. These increases would offset flow decreases predicted to occur due to mine inflows and water diversions (Table H-9, Appendix H). For example, in the Ramsey Creek watershed, the analysis predicted a cumulative increase in flow during baseflow periods of 0.2 cfs for Alternative 3. The maximum flow reduction to Ramsey Creek due to mine inflows would be 0.04 cfs. The effects on aquatic life and aquatic habitat due to streamflow changes are described in Section 3.6, *Aquatic Life and Fisheries.* The indirect effects due to streamflow changes on riparian vegetation are described in Section 3.22, *Vegetation*, and on wetland vegetation are described in Section 3.23, *Wetlands and Other Waters of the U.S.*

The proposed Wayup Mine in upper West Fisher Creek and the Libby Creek Ventures drilling plan adjacent to Upper Libby Creek Road would have negligible cumulative effects on streamflows.

3.11.4.10 Regulatory/Forest Plan Consistency

This section discusses compliance with applicable laws and regulations regarding surface water hydrology, specifically changes in streamflow and floodplains. Section 3.13.4.11, *Regulatory/ Forest Plan Consistency* in the subsequent *Water Quality* section (p. 729) discusses compliance with water quality laws and regulations.

3.11.4.10.1 Organic Administration Act and Forest Service Locatable Minerals Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources; comply with applicable state and federal water quality standards including the Clean Water Act; take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations; and reclaim the surface disturbed in operations by taking such measures as preventing or controlling onsite and off-site damage to the environment and forest surface resources.

The reclamation plan in all mine and transmission line alternatives would ensure changes in streamflow would be minimized. Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8. In these alternatives, MMC did not propose to implement feasible measures to minimize changes in streamflow and to protect fisheries habitat from changes in streamflow. The agencies' alternatives (Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R) would incorporate additional feasible and practicable measures to minimize adverse environmental impacts on National Forest surface resources and to maintain and protect fisheries habitat. The measures would include increasing mining buffer zones, installing multiple adit plugs at closure, grouting, and, if necessary, leaving mine void barriers. Using thickened tailings would reduce MMC's appropriation from the Libby Creek and minimize effects on Libby Creek streamflow. The agencies' alternatives expanded MMC's proposed monitoring plans and would include action levels on mine inflows and changes in surface water flow and lake levels that would trigger corrective measures to be implemented by MMC (see Appendix C).

Alternative 2 would have a disturbance area of 2,582 acres. The disturbance area of Alternative 4, which would have a tailings impoundment at the same location as Alternative 2, would be smaller than Alternative 2 by 658 acres by eliminating the LAD disturbance area and minimizing the disturbance area around the tailings impoundment. The disturbance area of Mine Alternative 3 would be the smallest. The smaller disturbance area of Alternatives 3 and 4 minimize peak flow increases in all area streams. Because the clearing width for Transmission Line Alternative B would be narrower than the agencies' transmission line alternatives, the maximum clearing width for Alternative B would be less than the agencies' alternatives. Clearing associated with the agencies' transmission line alternatives would be minimized through the development and implementation of a Vegetation Removal and Disposition Plan.

In Alternatives 3 and 4, runoff from the reclaimed tailings impoundment would be directed toward Little Cherry Creek instead of Bear Creek proposed in Alternative 2. As part of the final closure plan in Alternatives 3 and 4, MMC would complete a H&H analysis of the proposed runoff channel during final design that would include a channel stability analysis and a sediment transport assessment. The runoff channel would be designed to minimize adverse effects of increased streamflow on Little Cherry Creek. MMC's mitigation plans contained limited measures to protect fisheries habitat from changes in streamflow. The agencies' alternatives would create or secure genetic reserves through bull trout transplanting or habitat restoration; rectify factors that are limiting the potential of streams to support increased production of bull trout; and e eradicate non-native fish species, especially brook trout that are a hybridization threat to bull trout. Through these mitigations, the agencies' alternatives would comply with 36 CFR 228.8 to minimize adverse environmental impact.

3.11.4.10.2 Wilderness Act

All mine alternatives have the potential to indirectly affect wilderness qualities. Mitigation measures identified in Chapter 2 for Alternatives 3 and 4 and monitoring required for Alternatives 3 and 4 (Appendix C) would be implemented to minimize changes in wilderness character. Mitigation measures such as increasing the buffer zones near Rock Lake and the Rock Lake Fault, and the agencies' monitoring coupled with final design criteria submitted for the agencies' approval, would reduce the risk of subsidence and measurable hydrological indirect effects to the surface within the wilderness.

Mitigation measures and monitoring requirements in Alternatives 3 and 4 are reasonable stipulations for protection of the wilderness character and are consistent with the use of the land for mineral development. Alternatives 3 and 4 would be conducted to protect the surface resources in accordance with the general purpose of maintaining the wilderness unimpaired for future use and enjoyment as wilderness and to preserve the wilderness character consistent with the use of the land for mineral development and production in compliance with 36 CFR 228.15 and the Wilderness Act. The agencies' mine and transmission line alternatives would comply with the Wilderness Act. Alternatives 3 and 4 would minimize adverse environmental impacts on surface resources within the wilderness, and thereby comply with the regulations (36 CFR 228, Subpart A) for locatable mineral operations on National Forest System lands.

3.11.4.10.3 Clean Water Act and Montana Water Quality Act

The DEQ will discuss compliance with applicable water quality regulations addressing streamflow including nondegradation rules in the ROD and the Statement of Basis for the MPDES permit renewal. 36 CFR 228.8(h) states that "certification or other approval issued by state agencies or other federal agencies of compliance with laws and regulations relating to mining operations will be accepted as compliance with similar or parallel requirements of these regulations." DEQ's permit decision and associated conditions on the MPDES permit renewal or any other state water quality permit would constitute compliance with Montana water quality requirements and Clean Water Act requirements regarding water quality.

3.11.4.10.4 Kootenai Forest Plan

The agencies conducted a floodplain/wetland analysis on all mine and transmission line alternatives, complying with the KFP standard to conduct a floodplain/wetland analysis. The estimated peak flow increase in all mine and transmission line alternatives and all combined mine and transmission line alternatives would be below the peak flow increase guidelines.

3.11.4.10.5 Executive Order 11988 and Montana Floodplain and Floodway Management Act

Transmission line facilities are not subject to the Montana Floodplain and Floodway Management Act. Based on conceptual designs presented in Chapter 2, all mine and transmission line alternatives would have some facilities located in a FEMA designated floodplain. Mine Alternative 2 would have the least amount of disturbance in a FEMA designated floodplain. Construction of the Seepage Collection Pond and an infiltration gallery for makeup water in Mine Alternative 3 would have 9 acres of construction in a floodplain and Mine Alternative 4 would have 3 acres. During final design, MMC would be required to avoid or minimize, to the extent practicable, locating facilities, such as the Seepage Collection Pond in Alternative 3, in a floodplain. If locating mine facilities in a floodplain could not be avoided, an application for a floodplain permit would be submitted to the DNRC that provides details on the obstruction or use of a floodway floodplain and a permit would be required before construction. DNRC's permit issuance is based on the danger to life and property downstream, availability of alternate locations, possible mitigation to reduce the danger, and the permanence of the obstruction or use (76-5-405, MCA). DNRC's permit decision and associated conditions on the floodplain permit for these facilities would constitute compliance with requirements of Executive Order 11988.

In addition to the facilities described above, the agencies' monitoring and mitigation plans associated with Alternatives 3 and 4 would require the construction of some minor facilities in the Libby Creek floodplain, including an infiltration gallery for makeup water and continuous flow measurement devices in the Libby Creek floodplain. In compliance with Executive Order 11988, the KNF finds that no alternative exists to avoid locating these minor facilities in the Libby Creek floodplain. DNRC's permit decision and associated conditions on the floodplain permit would constitute compliance with requirements of Executive Order 11988.

3.11.4.11 Irreversible and Irretrievable Commitments

During operations, use of mine and adit inflows and any water needed for mine operations would be an irretrievable commitment of resources. Any permanent change in stream or spring flow or lake levels due to mining would be an irretrievable and irreversible commitment of resources. Some water would be used consumptively by the project, reducing the total water yield in the region by that amount. Relative to the total yield of the affected watersheds, the consumptively used volume would be small. The reduction in yield would be an irretrievable commitment of resources.

The tailings impoundment in the Little Cherry Creek watershed in Alternatives 2 and 4 would permanently alter the flow in Little Cherry Creek, Bear Creek (Alternative 2 only), Libby Creek, and two unnamed drainages. Alternative 3 would alter the flow in the Little Cherry Creek, Poorman Creek, Libby Creek, and four unnamed drainages. These flow changes would be an irreversible commitment of surface water resources.

3.11.4.12 Short-Term Uses and Long-Term Productivity

The short-term use of surface water resources in the various alternatives would consist of diverting analysis area streams for mining, and using analysis area streams for discharge of treated water. Changes that may occur that would affect the long-term productivity of surface water resources include:

- Changes in flow in streams and springs that receive some of their water supply from bedrock groundwater, as well as changes in the levels of Rock Lake that may occur due to mine inflows
- Changes to watersheds and floodplains (and the streams and springs within them) that would be permanently covered by the tailings impoundment site
- Changes in streamflow that would occur due to permanent stream diversions around or from the tailings impoundment site

3.11.4.13 Unavoidable Adverse Environmental Effects

The consumptive use of groundwater by the project during operations would unavoidably reduce the total water yield from this portion of the Cabinet Mountains. The anticipated consumptive use is expected to be small relative to the total water yield of this area. Water yield would remain reduced until the project no longer consumptively used water, and then slowly return to the pre-mining yield as the mine void filled, which the 3D model predicted would require 490 years. Water levels overlying the mine are predicted by the model to reach steady state conditions 1,150 to 1,300 years after mining ended. The actual time to recover to steady state may be shorter or longer and would be re-evaluated using the 3D model after additional data were collected during the Evaluation Phase). Without mitigation, such as barrier pillars and bulkheads, water levels over the mine void nearest Rock Lake are predicted to remain about 200 feet below pre-mine conditions. Mitigation would reduce this effect. Mining of the ore body would unavoidably reduce streamflow and deep groundwater inflow to Rock Lake. Without mitigation, a change in deep groundwater inflow to Rock Lake would permanently reduce the volume and level of Rock Lake. With mitigation, the volume and level of Rock Lake would be affected until groundwater levels reached steady state conditions. If deep groundwater was a component of the inflow to St. Paul Lake, mine dewatering would unavoidably reduce this source of water to the lake, and the lake level may lower more quickly during dry years when the only source of water to the lake was bedrock groundwater.

3.12 Water Rights

3.12.1 Regulatory Framework

3.12.1.1 Montana Water Use Act

The Montana Water Use Act requires that any person, agency, or governmental entity intending to acquire new or additional water rights or change an existing water right in the state obtain a beneficial water use permit before commencing to construct a new or additional diversion, withdrawal, impoundment, or distribution works for appropriations of groundwater or surface water.

The Montana Water Rights Bureau, within the Water Resources Division of the DNRC, administers the Water Use Act and assists the Water Court with the adjudication of water rights. An Application for Beneficial Water Use Permit requires proof that there is water physically and legally available at the proposed point of diversion in the amount requested (ARM 36.12.1702 and 36.12.1705). Senior water rights have an earlier priority date and claimants who hold them have a higher priority to divert water from a stream or water body than those with more junior rights. If a senior water user would be adversely affected by a new use, the application must include a mitigation plan with specific conditions that the new water user is willing to accept to eliminate or mitigate potential adverse effects on senior water rights. For example, a new water user may need to divert or pump water only at certain times when adequate water is available for all users or may need to find water from another source to replace water appropriated by the new user.

Dewatering the adits or mine void during mining, or filling of the adits and mine void during the Closure and Post-Closure Phases is not a beneficial use of water and a beneficial water use permit would not be required. Although MMC would not be able to obtain a permit to secure an appropriation to dewater the adits or mine void or fill the mine void, the Water Use Act has a requirement that a person cannot waste water, use water unlawfully, or prevent water from moving to another person having a prior right to use the water. If dewatering the Libby Adit or filling of the mine void resulted in one of these, MMC would need a plan to regulate the controlling works of an appropriation as may be necessary to prevent the wasting or unlawful use of water and to ensure that a person having a prior senior right is not deprived of their lawful use of water (85-2-114(1), MCA).

Changes in an existing water right include a change in the point of diversion, place of use, the purpose of use, or the place of storage. A change in a water right can be made as long as there is no adverse impact on other appropriators. Before a change can be initiated, approval from the DNRC must be obtained. Increasing the amount of water consumed from a stream would be considered a new water right requiring an application for beneficial water use.

3.12.1.2 USDA Forest Service/State of Montana Reserved Water Rights Compact

Additional requirements for obtaining a new water rights permit come from the Forest Service/State of Montana Reserved Water Rights Compact (85-20-1401 Article IV B.1., MCA). The compact was entered into by the State of Montana and the United States of America to settle all claims to federal reserved water rights for National Forest System lands administered by the Forest Service. Article IV.B.1.of the compact provides that there will be sequencing of the permitting process for water appropriations under state law and the permitting for access and use of National Forest System lands in relation to water appropriations to avoid conflict between state and federal permitting. Under the compact, an applicant is required to show proof of federal authorization before the application for a new appropriation of water or a change of appropriation will be considered correct and complete when:

- A state permit is required prior to a new appropriation of water, including groundwater, or a change of appropriation, and
- A federal authorization is required to occupy, use, or traverse National Forest System lands for the purpose of diversion, impoundment, storage, transportation, withdrawal, use, or distribution of water for the appropriation or change of appropriation.

A state permit for a new appropriation will be subject to any terms, conditions, and limitations related to the use of water contained in the approved Plan of Operations. For the Montanore Project, the federal authorization for occupancy and use of National Forest System lands in relation to MMC's water appropriations would be the Forest Service's approved Plan of Operations for the project. Any new state permit(s) for water appropriations by MMC would be subject to the terms, conditions, and limitations in the Plan of Operations relating to the use of water.

3.12.2 Analysis Area and Methods

The water rights analysis area is slightly larger than described in section 3.11.2.1, *Analysis Area* and includes the Libby Creek watershed to the Kootenai River and the Bull River below the confluence of the East Fork Bull River to the confluence with the Clark Fork River. Water rights in streams in the transmission line corridors would not be affected. The impact on groundwater rights from pumping the pumpback wells and from mine inflows was evaluated based on the location of the rights with respect to the 3D-modeled drawdown areas. The impact on a spring right located near MMC's proposed infiltration gallery to divert groundwater in the alluvium of Libby Creek was evaluated based on the possible source of water to the spring. Possible impacts on surface water rights due to changes in streamflow were evaluated by comparing requested water appropriations to measured streamflow in all potentially affected streams.

3.12.3 Affected Environment

Surface water in the analysis area is used for a variety of beneficial uses including domestic water supply, irrigation, mining, stock watering, fish habitat, and wildlife. The DNRC has 38 active water rights on record for surface water within the Libby Creek watershed, including diversions from Bear, Ramsey and Libby creeks, as well as unnamed tributaries to Libby Creek. Most of the surface water permits are for domestic, irrigation, fishery and mining use. The total active surface water rights are for an average use of about 55 cfs, and maximum use of about 81 cfs. The 30 spring rights in the Libby Creek watershed are used for primarily for domestic, irrigation and livestock purposes. The livestock rights are for 30 gallons per day per animal unit. The total for the rights (not including stock rights with only animal unit limits) is a maximum flow of 4.93 cfs, and maximum volume of about 1,726 acre-feet. There are 19 groundwater rights listed within the analysis area. Six of these rights are springs, and the rest are wells; the well depth range is 40 to 235 feet, with all but one well less than 100 feet deep. The total for the groundwater rights is a maximum flow of 1.1 cfs, and maximum volume of about 359 acre-feet.

MMC holds two 1902 surface water rights on Libby Creek, one for mining near the Libby Adit site in Section 15, Township 27N, Range 31W (with a maximum diversion of 44.9 gpm between April 1 and December 19, and maximum volume of 50.97 acre-feet), and one for domestic use in the same section (15 gpm year-round, and a maximum volume of 1.5 acre-feet). MMC also holds a 1989 groundwater right near the Libby Adit site in Section 15, Township 27N, Range 31W (with a total diversion of 40 gpm year-round).

The Forest Service has a year-round 40 cfs instream flow right with a 2007 priority date for a segment of Libby Creek that starts at Bear Creek and goes to above Hoodoo Creek. The use of the right is to provide adequate flows for bull trout to migrate from Libby Creek into Bear Creek and spawn. The Forest Service also has a 1949 right to divert 0.5 cfs for mining during May and June from Libby Creek above the confluence with Howard Creek at the Recreation Gold Panning Area, and a 1925 water right on Libby Creek above Ramsey Creek to divert 25 gpm for commercial purposes.

A senior water right holder owns three 1925 surface water rights on Libby Creek for mining, domestic and stock use, and one 1900 water right on Ramsey Creek for mining use. Each of the water rights for mining are for a maximum diversion rate of 1 cfs and maximum volume of 521.6 acre-feet per year.

In Alternatives 3 and 4, MMC would acquire a parcel along US 2 through which Swamp Creek flows for wetland mitigation (see section 2.5.7.1, *Jurisdictional Wetlands and Other Waters of the U.S.*). The current owner of this parcel has a surface water right to flood irrigate 26 acres of hay meadow between May 1 and October 31, with a maximum diversion rate of 291.72 gpm, and maximum volume of 52 acre-feet per year.

No surface water rights exist on the East Fork Bull River and no groundwater rights are in the East Fork Bull River basin. There are three surface water rights on the Bull River downstream of the East Fork Bull River for domestic and irrigation purposes with a total maximum diversion rate of 0.21 cfs and maximum volume of 37 acre-feet per year. One domestic surface water right for 10 gpm and a shallow groundwater right for 20 gpm are held on Rock Creek about 2 miles downstream of the confluence of West Fork Rock Creek and East Fork Rock Creek.

3.12.4 Environmental Consequences

3.12.4.1 Alternative 1 – No Mine

In this alternative, MMC would not develop the Montanore Project. Any existing exploration-related or baseline collection disturbances by MMC would be reclaimed in accordance with existing laws and permits. Surface water and groundwater rights in the area would not be affected. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands.

3.12.4.2 Alternative 2 – MMC Proposed Mine

For all mine alternatives, MMC would have to acquire new surface water and groundwater appropriations from the DNRC to use water for mining and wetland mitigation purposes. MMC did not apply for beneficial water use permits for Alternative 2. MMC estimated that a permit for

200 to 300 gpm would be adequate for mining purposes. The rate and points of diversion for Alternative 2 would vary slightly from those described in Alternative 3. MMC did not propose to discharge treated water to Libby Creek or Ramsey Creek to prevent adverse effects on senior water rights. Baseflow changes and appropriations by MMC from Libby Creek would adversely affect senior water rights. Baseflow changes also may affect senior water rights in Ramsey Creek.

The spring and groundwater well rights located in or near the analysis area are all located outside of the 3D-model predicted drawdown area for mine inflows. There is a water right for a developed spring located near the confluence of Bear Creek and Libby Creek that may be within the drawdown area for the pumpback wells for the Little Cherry Creek tailings impoundment and possibly within the area of influence of the make-up well near Libby Creek. This water right is 76D 28349 00, a 15 gpm water right for mining with a May 1 to September 30 period of use. The source of water for this spring is unknown. If it is alluvial groundwater in the Libby Creek channel, then the flow of the spring may be reduced due to pumping from the pumpback wells or the make-up well, but would be measurable only during low flow periods in Libby Creek. If the source of water for the spring water right is bedrock rather than alluvial water, then appropriation of water by MMC from the make-up well or pumping from the pumpback wells would not affect the flow of the spring.

3.12.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

3.12.4.3.1 Libby Creek

MMC applied for new surface water and groundwater beneficial water use permits using the project components of Alternative 3 (MMC 2012a). Section 2.5.4.3.2, *Water Rights* in Chapter 2 discusses the three water rights for which MMC submitted applications to the DNRC. The applications include a mitigation plan to avoid adversely affecting senior water rights on the mainstem of Libby Creek during the Operations Phase. The DNRC will determine whether requested uses are permittable during the water rights permitting process. The agencies modified MMC's mitigation plan was submitted to the DNRC.

To mitigate effects on senior water rights during all mine phases, MMC would monitor the flow at LB-2000, and whenever flow was less than 40 cfs at LB-2000, would treat and discharge water from the Water Treatment Plant at a rate equal to its Libby Creek watershed appropriations. The agencies anticipate discharges typically would occur in January through March, and August through December. Make-up water during operations would be diverted from Libby Creek during high flows (discussed in the next paragraph). Similar mitigation would occur during the Closure and Post-Closure Phases using water stored in the adits. The effect of filling the mine void with the adits plugged as proposed by the agencies on Libby Creek streamflow has not been quantified. MMC would update the groundwater model in the final closure plan to predict the effect on Libby Creek streamflow of filling the mine void with the adits plugged. Based on this information, MMC would mitigate any effects to senior water rights, if needed, to avoid adversely affecting senior water rights. The agencies' mitigation required in Alternative 3, discussed in Section 2.5.4.3.2, *Water Rights*, would ensure MMC's appropriations or baseflow changes would not injure senior water rights during adit or mine void filling.

In addition to groundwater interception from pumpback wells, and interception of precipitation at the Poorman Impoundment Site, MMC would divert groundwater from an infiltration gallery near Libby Creek during high flows, estimated to be in April through July. The maximum diversion rate would be 1,260 gpm (2.8 cfs). MMC's water rights applications included an analysis on the legal availability of water for such a diversion. The DNRC will determine the legal availability of water for MMC's requested new rights.

If required by the DNRC, MMC would obtain a beneficial use permit for water use at the isolated wetland mitigation sites. If a beneficial use permit was required and obtained, the permit would be conveyed to the Forest Service at the same time the mitigation sites were conveyed.

3.12.4.3.2 Ramsey Creek

On Ramsey Creek, a senior water right holder has a 1 cfs water right for mining between RA-200 and RA-400. The baseflow is estimated to be about 0.38 cfs in Ramsey Creek at the CMW boundary, and may be about 1 cfs at this right's point of diversion on Ramsey Creek. The maximum predicted baseflow decrease due to mine inflows is 0.04 cfs at the CMW boundary and would be similar at the point of diversion. This reduction would adversely affect this water right whenever flow at the point of diversion was less than 1 cfs. MMC would monitor flow in Ramsey Creek at RA-300, above the point of diversion (see Appendix C, Section C.10). When the 3D model was updated after the Evaluation Phase, MMC would re-evaluate potential effects on Ramsey Creek. If the senior water right on Ramsey Creek would be adversely affected during any mining phase, MMC would develop a plan during final design to convey treated water from the Water Treatment Plant to a location upstream of the right's point of diversion (RA-300). Discharge of treated water to Ramsey Creek would require a new outfall in MMC's MPDES permit.

3.12.4.3.3 Swamp Creek

In Alternatives 3 and 4, MMC would acquire a parcel along Swamp Creek for wetland mitigation and the water right associated with this parcel allows for flood irrigation of 26 acres of hay meadow. Rehabilitation of the site to improve its functions as a wetland would not require a water right. MMC would file for a change of use for this water right to an instream flow right.

3.12.4.3.4 Groundwater Rights in the Libby Creek Watershed

The spring and groundwater well rights located in or near the analysis area are all located outside of the 3D-modeled drawdown areas due to mine inflows and the pumpback wells. Developed spring water right 76D 28349 00, a 15 gpm water right for mining with a May 1 to September 30 period of use, is located near and downstream of MMC's proposed infiltration gallery. MMC would divert water at a rate up to 760 gpm from April through July. Assuming that the source of water for the spring water right is alluvial water associated with Libby Creek, it is not expected that pumping from the infiltration gallery during high streamflow (40 cfs or greater) would affect the ability of the spring water rights owner to divert 15 gpm from the spring. If the source of water for the spring water right is bedrock rather than alluvial water, then appropriation of water by MMC from the infiltration gallery would not affect the flow of the spring.

3.12.4.3.5 East Fork Rock Creek, Rock Creek, East Fork Bull River, and Bull River

Water rights in the East Fork Bull River basin would not be affected because there are no existing water rights in that basin. Water rights in the Bull River downstream of the East Fork Bull River would not be affected because the maximum predicted flow reduction would be less than 1 cfs, and the model-estimated baseflow of the Bull River at the confluence with the Clark Fork River is 40 cfs. The surface water right on Rock Creek for 10 gpm is not expected to be affected by the predicted flow decrease due to mine inflows of between 0.5 and 0.65 cfs of the estimated baseflow, which is between 3 and 7 cfs at the point of diversion. The shallow groundwater right for 20 gpm is outside of the area of expected drawdown due to mine inflows.

3.12.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

MMC did not apply for beneficial water use permits for Alternative 4. The rate and points of diversion for Alternative 4 would vary slightly from those described in Alternative 3. The effects on area surface water rights would be the same as described in Alternative 3 and on groundwater rights would be the same as described in Alternative 2.

3.12.4.5 Transmission Line Alternatives

In the transmission line alternatives, the small flow changes expected to occur as a result of water use for dust control or concrete mixing are not expected to adversely affect area water rights. Similarly, the construction and maintenance of the Sedlak Park Substation and the loop line would not affect water rights.

3.12.4.6 Cumulative Effects

Because any new MMC water right could not injure existing water rights, no water rights would be cumulatively affected.

3.12.4.7 Regulatory/Forest Plan Consistency

Alternative 2 would not comply with the Montana Water Use Act or the Montana Reserved Water Rights Compact. MMC did not propose to discharge treated water to Libby Creek or Ramsey Creek to prevent adverse effects on senior water rights. Baseflow changes and appropriations by MMC from Libby Creek would adversely affect senior water rights.

Alternative 3 and 4 would comply with the Montana Water Use Act and the Montana Reserved Water Rights Compact. In Alternative 3 and 4, mine and adit inflows would not be used beneficially during any mine phase and treatment and discharge of all mine and adit inflows would not require a beneficial use permit. MMC would discharge treated water to Libby Creek and Ramsey Creek, as necessary, to prevent adverse effects on senior water rights. At Closure, MMC would install two or more plugs in each of the three Libby Adits. As long as MMC appropriated or diverted water from Libby Creek whenever flow at LB-2000 was less than 40 cfs, MMC would treat, if necessary to meet MPDES permitted effluent limits, stored adit water and discharge it to Libby Creek at a rate equal to all of MMC's Libby Creek appropriations or diversions occurring at that time. Discharges to Ramsey Creek also would be required if the modeling indicated adit inflows during the Closure Phase would adversely affect the senior water right on Ramsey Creek. Any new water right for water use issued pursuant to Montana law for water use in Alternative 3 and 4 would be consistent with the terms of an approved Plan of Operations. An approved Plan of Operations consistent with Alternative 3 or 4 would contain the stipulation that any water right acquired solely for the purposes of mineral development in an approved Plan of Operations would terminate when the Plan of Operations terminated. Any change in beneficial use or place of use of water authorized under an approved Plan of Operations would cause the authorization for that water use to terminate unless prior written approval from the KNF was obtained.

36 CFR 228.8(h) states that "certification or other approval issued by state agencies or other federal agencies of compliance with laws and regulations relating to mining operations will be accepted as compliance with similar or parallel requirements of these regulations." DNRC's permit decision and associated conditions on any beneficial water use permit would constitute compliance with Montana water use requirements.

3.12.4.8 Irreversible and Irretrievable Commitments

Because the 3D predicted streamflow in the Libby Creek watershed eventually would return to pre-mining conditions, no irreversible or irretrievable commitment of resources would occur.

3.12.4.9 Short-Term Uses and Long-Term Productivity

This section is not applicable to water rights.

3.12.4.10 Unavoidable Adverse Environmental Effects

The issuance of new water rights would not adversely affect other water rights.

3.13 Water Quality

3.13.1 Regulatory Framework

3.13.1.1 Permits and Authorizations Held by MMC

3.13.1.1.1 Board of Health and Environmental Sciences Order No 93-001-WQB

NMC submitted a "Petition for Change in Quality of Ambient Waters" in 1989 to the BHES requesting an increase in the allowable concentration of select constituents in surface water and groundwater above ambient water quality, as required by Montana's 1971 nondegradation statute. NMC submitted supplemental information to support the petition in 1992. In response to NMC's petition, the BHES issued an order in 1992, authorizing degradation and establishing limits in surface water and groundwater in the Libby Creek, Poorman Creek and Ramsey Creek watersheds adjacent to the Montanore Project for discharges from the project (BHES 1992; Appendix A). The Order remains in effect for the operational life of the project and for as long as necessary thereafter. The Order established numeric limits for total dissolved solids, chromium, copper, iron, manganese, and zinc in both surface water and groundwater, nitrate+nitrite in groundwater only, and total inorganic nitrogen (nitrate+nitrite+ammonia) in surface water only (Table 118 and Table 119). Although the Order established a limit for copper of 0.003 mg/L, the chronic aquatic life standard of 0.00285 mg/L would be the limiting concentration.

The Order indicates that land treatment, as then proposed and currently proposed in Alternative 2, would satisfy the requirement in ARM 16.20.631(3) (now ARM 17.30.635(3)) to treat industrial wastes using technology that is the best practicable control technology available. In 1992, the DHES (now DEQ) determined that land treatment would provide adequate secondary treatment of nitrate (80 percent removal) and metals. The Order requires the DEQ to review design criteria and final engineering plans to determine that at least 80 percent removal of nitrogen would be achieved and the total inorganic nitrogen concentration in Libby, Ramsey, or Poorman creeks would not exceed 1 mg/L. The Order states "surface water and groundwater monitoring, including biological monitoring, as determined necessary by the Department [DEQ], will be required to ensure that the allowed levels are not exceeded and that beneficial uses are not impaired." The Order also adopted the modifications developed in Alternative 3, Option C, of the Final EIS (USDA Forest Service *et al.* 1992), addressing surface water and groundwater monitoring, fish tissue analysis, and instream biological monitoring.

3.13.1.1.2 MPDES Permit No MT-0030279

The DEQ issued a MPDES permit to NMC in 1997 for Libby Adit discharge to the local groundwater or Libby Creek. Three outfalls were included in the permit: outfall 001 – percolation pond; outfall 002 – infiltration system of buried pipes; and outfall 003 – pipeline outlet to Libby Creek. Only Outfall 001 has been used since permit issuance. The DEQ renewed the permit in 2006. A minor modification of the MPDES permit in 2008 reflected an owner/operator name change from NMC to MMC. In 2011, MMC applied to the DEQ to renew the existing MPDES permit and requested the inclusion of five new stormwater outfalls under the permit. In 2011, the DEQ determined the renewal application was complete and administratively extended the permit (ARM 17.30.1313(1)) until MMC receives the renewed permit.

Table 118. Surface Water Limits Established by BHES Order for the Montanore Project and Montana Surface Water Quality Standards.

Parameter – Category[1]	BHES Order Limit (mg/L)	Human Health Standard (mg/L)	Aquatic Life Standard[2]	
			Acute (mg/L)	Chronic (mg/L)
Temperature (°F) – H	—	—	1ºF max increase for naturally occurring range of 32º to 66ºF, 67ºF max 0.5ºF max increase for naturally occurring 66.5ºF or greater 2ºF per hour max decrease for naturally occurring temperatures above 55ºF; 2ºF max decrease for naturally occurring range of 32º to 55ºF	
pH (s.u.)	—	6.5 – 8.5	6.5 – 8.5	
Dissolved Oxygen[3] – T	—	—	8.0 (early life) 4.0 (other life stages)	9.5 (7-day, early life) 6.5 (30-day, other life stages)
Total dissolved solids (TDS)	100	—	—	—
Total suspended solids (TSS)	—	—	30	20
Turbidity (NTU) – H A-1 waters (within CMW) B-1 waters (outside CMW)	 — —	 — —	 No increase above ambient 5 NTU maximum increase	
Total nitrogen, as N – H July 1 to September 30 October 1 to June 30	 — —	 — —	 0.275 No excessive amounts	
Total Inorganic Nitrogen (TIN), as N – H	1	—	—	
Nitrate + nitrite, as N – T	See TIN value	10	See total nitrogen standard	
Total phosphorus, as P – H July 1 to September 30 October 1 to June 30	 — —	 — —	 0.025 No excessive amounts	
Ammonia, as N – T	See TIN value	—	Calculated based on stream pH	Calculated based on stream pH and temperature
Aluminum[4] – T	—	—	0.75	0.087
Antimony[4] – T	—	0.0056	—	—
Arsenic[4] – C	—	0.01	0.34	0.15
Barium[4] – T	—	1.0	—	—
Beryllium[4] – C	—	0.004	—	—
Cadmium[4] – T	—	0.005	0.00052	0.000097
Chromium[4] – T	0.005	0.1	0.579/0.016[5]	0.0277/0.011[5]
Copper[4] – T	0.003	1.3	0.00379	0.00285
Iron[4] – H	0.1	—	—	1.0
Lead[4] – T	—	0.015	0.014	0.000545
Manganese[4]	0.05	—	—	—
Mercury[4] – T, BCF>300[6]	—	0.00005	0.0017	0.00091
Nickel[4] – T	—	0.1	0.145	0.0161
Selenium[4] – T	—	0.05	0.02	0.005
Silver[4] – T	—	0.1	0.000374	—
Zinc[4] – T	0.025	2	0.037	0.037

[1] T = toxic; C = carcinogen; H = harmful (aquatic life).
[2] Many metals standards are hardness dependent; for this table, values presented are based on a hardness of 25 mg/L.
[3] Dissolved oxygen standards are water column concentrations; see DEQ-7 for other notes.
[4] All metals standards, except aluminum, are based on total recoverable concentrations. Aluminum standards are based on dissolved aluminum concentrations and are valid only in pH range of 6.5 to 9.
[5] Aquatic life chromium standards are for trivalent/hexavalent forms.
[6] Mercury has a bioconcentration factor of greater than 300 (developed by EPA).
mg/L = milligrams/liter; "—" = No applicable standard.
Sources: BHES 1992; Circular DEQ-7, Montana Numeric Water Quality Standards, DEQ 2012b; DEQ 2014b; ARM 17.30.623; ARM 17.30.637 (1)(e).

Table 119. Groundwater Limits Established by BHES Order for the Montanore Project and Montana Groundwater Quality Standards.

Parameter	BHES Order Limit (mg/L)	Montana Groundwater Quality Standard (mg/L)
pH	—	6.5 – 8.5
Total dissolved solids	200	—
Nitrate + nitrite, as N	10	10
Dissolved Metals		
Antimony	—	0.006
Arsenic	—	0.01
Barium	—	1.0
Beryllium	—	0.004
Cadmium	—	0.005
Chromium	0.02	0.1
Copper	0.1	1.3
Iron	0.2	—
Lead	—	0.015
Manganese	0.05	—
Mercury	—	0.002
Nickel	—	0.1
Selenium	—	0.05
Silver	—	0.1
Zinc	0.1	2

"—" = No applicable concentration.
mg/L = milligrams per liter.
Source: BHES 1992; Circular DEQ-7, Montana Numeric Water Quality Standards, DEQ 2012a; ARM 17.30.623.

3.13.1.2 Applicable Regulations and Standards

3.13.1.2.1 Federal Requirements

Organic Administration Act

The Organic Administration Act authorizes the Forest Service to regulate the occupancy and use of National Forest System lands. The Forest Service's locatable minerals regulations are promulgated at 36 CFR 228, Subpart A. The regulations apply to operations conducted under the U.S. mining laws as they affect surface resources on National Forest System lands under the jurisdiction of the Secretary of Agriculture. One of these regulations (36 CFR 228.8) requires that mining activity be conducted, where feasible, to minimize adverse environmental impacts on National Forest surface resources. 36 CFR 228.8 also requires that mining operators comply with applicable state and federal water quality standards including the Clean Water Act; comply with applicable Federal and State standards for the disposal and treatment of solid wastes; take all practicable measures to maintain and protect fisheries and wildlife habitat which may be affected by the operations; construct and maintain all roads so as to assure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water, and other resource values; and reclaim the surface disturbed in operations by taking such measures as preventing or controlling onsite and off-site damage to the environment and forest surface resources. 36 CFR 228.8(h) states that "certification or other approval issued by state agencies or other federal agencies of compliance with laws and regulations relating to mining operations will be accepted as compliance with similar or parallel requirements of these regulations."

Clean Water Act

The Federal Water Pollution Control Act (Clean Water Act) is designed to protect and improve the quality of water resources and maintain their beneficial uses. Proposed mining activities on National Forest System lands are subject to compliance with Clean Water Act Sections 401, 402 and 404 as applicable. The DEQ, EPA, and the Corps all have regulatory, compliance and enforcement responsibilities under the Clean Water Act. Pursuant to the Clean Water Act, MMC must obtain a 401 certification from the DEQ for proposed discharges of fill into navigable waters unless the DEQ waives its issuance (see section 1.6.2.1, *Montana Department of Environmental Quality*).

A 401 certification from the Montana DEQ certifies that the operator's proposed discharges of fill permitted under a Section 404 permit are in compliance with all applicable water quality requirements of the Clean Water Act. Unless the 401 certification is waived, the mining operator must give a copy of the 401 certification to the Forest Service before the KNF can authorize the operator to commence any activity that requires a 404 permit.

Effluent guidelines are national standards for wastewater discharges to surface waters and publicly owned treatment works (sometimes called municipal sewage treatment plants). The EPA issues effluent guidelines for categories of existing sources and new sources under the Clean Water Act. For industrial sources, national effluent limitation guidelines (ELGs) have been developed for specific categories of industrial facilities and represent technology-based effluent limits. The Montanore Mine site is in an industrial category that is specifically identified and included in the ELGs at 40 CFR 440, Ore Mining and Dressing Point Source Category, Subpart J – Copper, Lead, Zinc, Gold, Silver, and Molybdenum Ores Subcategory.

The federal ELGs apply to mine drainage and process wastewater that discharge to surface water. Mine drainage is "any water pumped, drained, or siphoned from a mine" (40 CFR 440.132). Process wastewater is "any water which, during manufacturing or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, by-product, or waste product" (40 CFR 401.11). In terms of the ELG requirements for copper mines that use froth flotation for milling, tailings water is considered process wastewater. Process wastewater from copper mines that use froth flotation for milling may not be discharged to state surface waters except in areas of net precipitation (where precipitation and surface runoff within the impoundment area exceeds evaporation). Because precipitation and surface runoff within the impoundment area would not consistently exceed evaporation, the impoundment in all alternatives would be designed as a zero-discharge facility. The DEQ is responsible for ensuring compliance with the federal ELGs.

Under USDA Nonpoint Source Water Quality Policy Directive 9500-007, the Forest Service agreed to become a Designated Management Agency for National Forest System lands within all states, including Montana. The Forest Service strategy for control of nonpoint source pollution is to require mining operators to apply appropriate BMPs, evaluate BMP performance and initiate corrective action where objectives are not met. The Forest Service's *National Best Management Practices for Water Quality Management on National Forest System Lands* (USDA Forest Service 2012a) are designed to achieve and document water resource protection on National Forest System lands.

A 2008 MOU between the Forest Service and the DEQ entitled "Fostering Collaboration and Efficiencies to Address Water Quality Impairment on National Forest System Lands in Montana" is a component of the national and Montana Nonpoint Source Program and identifies the process of cooperatively ensuring proper design and implementation of water protection management system on National Forest System lands in Montana.

Kootenai Forest Plan

The 1987 KFP established management areas within the forest with different goals and objectives based on the capabilities of lands within the analysis area (USDA Forest Service 1987a). The KFP contains goals, objectives, and standards related to water quality. The KFP established a goal of meeting water quality standards (KFP II-1 #19). To achieve this goal, forest-wide objectives and standards for water quality require application of practicable mitigation measures, such as those identified in the Soil and Water Conservation Handbook (USDA Forest Service 1988b).

3.13.1.2.2 State Requirements

The DEQ is responsible for administering several water quality statutes, including the Public Water Supply Act and the Montana Water Quality Act. The DEQ also administers several sections of the federal Clean Water Act pursuant to an agreement between the State of Montana and the U.S. Environmental Protection Agency. The State of Montana, through the DEQ, has been delegated authority for administering nonpoint source pollution prevention programs, the National Pollutant Discharge Elimination System program, and water quality standards. The Water Quality Act provides a regulatory framework for protecting, maintaining, and improving the quality of water for beneficial uses. Pursuant to the Water Quality Act, the DEQ has developed water quality classifications and standards, as well as a permit system to control discharges into state waters. Mining operations must comply with Montana's regulations and standards for surface water and groundwater.

MPDES permits are required for discharges of wastewater to state surface water. MPDES permits regulate discharges of wastewater by imposing, when applicable, technology-based effluent limits and state surface water quality standards, which include numeric and narrative requirements, nondegradation criteria, and Total Maximum Daily Loads. Montana Ground Water Pollution Control System permits are required for discharges of wastes to state groundwaters. Discharges to groundwater from mining operations subject to operating permits under the Metal Mine Reclamation Act are not subject to groundwater permit requirements (75-5-401(5), MCA).

Water Quality Standards

The DEQ classifies all surface water in the analysis area as either A-1 (within wilderness areas) or B-1. Water quality standards are nearly identical for A-1 and B-1 waterbodies. An A-1 classification has stricter protection requirements associated with allowable levels of impurities for drinking, culinary, and food-processing purposes, and stricter protection requirements associated with allowable levels of turbidity. The water quality of both A-1 and B-1 waterbodies must be suitable for bathing, swimming, and recreation, aquatic life, wildlife, and agricultural and industrial uses. Surface water in the wilderness is classified as A-1, where stricter allowable changes are defined to maintain the water quality classification.

Montana surface water quality standards for inorganic pollutants applicable to the project are provided in Table 118. The DEQ also has required reporting limits for pollutants. Both Montana's surface water and groundwater rules contain narrative standards (ARM 17.30.620 through 17.30.670 and ARM 17.30.1001 through 17.30.1045). The narrative standards cover a number of parameters, such as alkalinity, chloride, hardness, sediment, sulfate, and total dissolved solids (for surface water), for which sufficient information does not yet exist to develop specific numeric standards. These narrative standards are directly translated to protect beneficial uses from adverse effects, supplementing the existing numeric standards. The narrative standard for nutrients is that state surface waters must be free of substances that will create conditions that produce undesirable aquatic life (ARM 17.30.637). For B-1 streams, short-term narrative standards for total suspended sediment and turbidity may be established for stream-related construction activities.

Effective August 8, 2014, the Board of Environmental Review adopted numeric standards for total phosphorus and total nitrogen for wadeable streams in Montana Ecoregions (DEQ 2014a). Wadeable streams are perennial or intermittent streams in which most of the wetted channel is safely wadeable by a person during baseflow conditions; this includes all streams in the analysis area. The analysis area is in the Northern Rockies Ecoregion; all wadeable streams have a seasonal total phosphorus standard is 0.025 mg/L and a seasonal total nitrogen standard is 0.275 mg/L between July 1 to September 30. The narrative nutrient standard applies during October 1 to June 30. Because the numeric nutrient standards are stringent and may be difficult for MPDES permit holders to meet in the short term, Montana's Legislature adopted a law (75-5-313, MCA) allowing for the achievement of the standards over time via variance procedures found in Circular DEQ-12B (DEQ 2014b). A MPDES permit holder may apply for a general variance for either total phosphorus or total nitrogen, or both. The general variance may be established for a period not to exceed 20 years. MMC's water treatment plant in the agencies' alternatives would have a design capacity greater than 1 million gallons per day. Based on this design capacity, a general variance, if granted to MMC, would allow a variance at the end-of-pipe at the Water Treatment Plant of 10 mg/L for total nitrogen and 1 mg/L for total phosphorus. Montana law also allows for the granting of individual nutrient standards variances based on the particular economic and financial situation of a permittee (75-5-313(1), MCA). Individual nutrient standards variances may be granted on a case-by-case basis because the attainment of the base numeric nutrient standards is precluded due to economic impacts, limits of technology, or both (DEQ 2104b).

The DEQ classifies all groundwater in the analysis area as Class I, which are suitable with little or no treatment for public and private drinking water supplies, culinary, and food preparation purposes, irrigation, drinking water for livestock and wildlife, and commercial and industrial purposes. Montana groundwater quality standards for inorganic pollutants applicable to the project are shown in Table 119.

The DEQ may authorize short-term surface water quality standards for total suspended sediments and turbidity for construction of the powerline, access roads, the tailings impoundment, and other stream crossings (75-5-318, MCA). Any exemption would include conditions that minimize, to the extent practicable, the magnitude of any change in water quality and the length of time during which any change may occur. The authorization also would include site-specific conditions that ensure that the activity is not harmful, detrimental, or injurious to public health and the uses of state waters and that ensure that existing and designated beneficial uses of state water are protected and maintained upon completion of the activity. The DEQ may not authorize short-term narrative standards for activities requiring a discharge permit.

Nondegradation Rules

The Montana Water Quality Act requires the DEQ to protect high quality waters from degradation. The current nondegradation rules were adopted in 1994 in response to amendments to Montana's nondegradation statute in 1993 and apply to any activity that is a new or increased source that may degrade high quality water. These rules do not apply to water quality parameters for which an authorization to degrade was obtained prior to the 1993 amendments to the statute. NMC, MMC's predecessor, obtained an authorization to degrade in 1992 for certain water quality parameters. For those parameters, the limits contained in the authorization to degrade apply. For those parameters not covered by the authorization to degrade, the applicable nonsignificance criteria established by the 1994 rules, and any subsequent amendments, apply (ARM 17.30.715), unless MMC obtained an authorization to degrade under the current statute.

The nondegradation rules (ARM 17.30.715(1)) state that changes in existing surface water quality resulting from the activities that meet the criteria listed below are nonsignificant, and are not required to undergo degradation review:

- Discharges containing carcinogenic parameters, such as arsenic or beryllium, or parameters with a bioconcentration factor greater than 300, such as mercury, at concentrations less than or equal to the concentrations of those parameters in the receiving water;
- Discharges containing toxic parameters, including ammonia, nitrate plus nitrite, nitrite, aluminum, antimony, barium, cadmium, chromium, copper, lead, nickel, selenium, silver, and zinc, which will not cause changes that equal or exceed the trigger values in Circular DEQ-7 (trigger values are used to determine if proposed activities will cause degradation). Whenever the change exceeds the trigger value, the change is not significant if the resulting concentration outside of a mixing zone designated by the DEQ does not exceed 15 percent of the lowest applicable standard;
- Discharges containing harmful parameters, such as iron, turbidity, total nitrogen, and total phosphorus, that do not cause changes outside the mixing zone greater than 10 percent of the applicable standard and where the existing concentration is less than 40 percent of the standard; and
- Discharges causing changes in the quality of water for any parameter for which there are only narrative water quality standards if the changes do not have a measurable effect on any existing or anticipated use or cause measurable changes in aquatic life or ecological integrity.

Notwithstanding compliance with the nonsignificance criteria in ARM 17.30.715(1), the DEQ may determine under ARM 17.30.715(2) that a change in water quality is degradation based on the following criteria: a) cumulative impacts or synergistic effects; b) secondary byproducts of decomposition or chemical transformation; c) substantive information derived from public input; d) changes in flow; e) changes in the loading of parameters; f) new information regarding the effects of a parameter; or g) any other information deemed relevant by the DEQ and that relates to the criteria in ARM 17.30.715 (1). Under ARM 17.30.715(3), the DEQ may determine that a change in water quality is nonsignificant based on information submitted by an applicant that demonstrates conformance with the guidance found in 75-5-301(5)(c), MCA which is: i) potential for harm to human health, a beneficial use, or the environment; ii) strength and quantity of any pollutant; iii) length of time the degradation will occur; and iv) the character of the pollutant so that greater significance is associated with carcinogens and toxins that bioaccumulate or biomagnify and lesser significance is associated with substances that are less harmful or less persistent. Such a determination would be submitted for public comment before making a decision. Under the Montana Water Quality Act, no authorization to degrade may be obtained for outstanding resource waters, such as surface waters within a wilderness.

Total Maximum Daily Loads

Section of the federal Clean Water Act requires states to assess the condition of state waters to determine where water quality is impaired (does not fully support uses identified in the stream classification or does not meet all water quality standards) or threatened (is likely to become impaired in the near future). The result of this review is the compilation of impaired surface waters, which states must submit to the EPA biannually. Section also requires states to prioritize and target water bodies on their list for development of water quality improvement strategies (*i.e.*, TMDLs), and to develop such strategies for impaired and threatened waters. A TMDL is the maximum amount of a pollutant a river, stream or lake can receive and still support all designated uses. Three streams in the analysis area are listed on the most current Montana list of impaired streams (DEQ 2012b). These streams are two segments of Libby Creek, the Fisher River, and Rock Creek.

Libby Creek is separated into two segments on the 2012 list of impaired surface waters. The upper segment is from 1 mile above Howard Creek to the US 2 bridge. This segment is listed as not supporting drinking water and partially supporting its fishery and aquatic life. Agricultural and industrial beneficial uses are fully supported. Contact recreation has not been assessed. Probable causes of impairment listed in 2012 were alteration in stream-side or littoral vegetative covers, mercury, and physical substrate habitat alterations. Probable sources of impairment were impacts from abandoned mine lands and historic placer mining. The lower segment begins at the US 2 bridge and is impaired for sediment and siltation. Both segments may be affected by proposed activities in all mine alternatives. In 2014, the DEQ and the EPA issued TMDLs and a water quality improvement plan for the Kootenai River-Fisher River project area, which includes Libby Creek. The DEQ performed updated assessments on Libby Creek for metals impairment and did not identify metals impairment conditions in Libby Creek in the reassessment (DEQ and Environmental Protection Agency 2014). The impairment causes for this 1 mile section of Libby Creek (mercury) will be removed from the 2014 Water Quality Integrated Report. The remaining impairments for this section, alteration in stream-side or littoral vegetative covers and physical substrate habitat alterations, do not require development of a TMDL (DEQ and Environmental Protection Agency 2014). The DEQ and EPA established a sediment TMDL of 4,234 tons/year average annual load for Libby Creek from the US 2 bridge to the confluence with the Kootenai River. MMC would implement BMPs included in the MPDES permit to meet the sediment wasteload allocation of 24 tons/year developed in the TMDL for the project.

The Fisher River from the Silver Butte/Pleasant Valley junction to the Kootenai River is impaired, with aquatic life support and cold-water fishery uses only partially supported. Probable causes for the Fisher River impairment were listed in 2012 as a high flow regime and high lead concentrations (source unknown), with probable sources of these impairments listed as channelization, grazing, road runoff, road construction, silvicultural activities, and stream bank modification and destabilization. In 2014, the DEQ and EPA issued draft and a water quality improvement plan for the Kootenai River-Fisher River project area, which included the Fisher River. The DEQ performed updated assessments on the Fisher River for metals impairment and did not identify metals impairment conditions in the Fisher River in the reassessment (DEQ and Environmental Protection Agency 2014). The impairment causes for the Fisher River (lead) will be removed from the 2014 Water Quality Integrated Report. The remaining impairment, high flow regime, does not require development of a TMDL (DEQ and Environmental Protection Agency 2014).

Rock Creek is impaired from the headwaters (including Rock Lake and East Fork Rock Creek) to the mouth at the Clark Fork River, with aquatic life support and cold-water fishery uses only partially supported. Probable causes for the Rock Creek impairment were listed in 2012 as other anthropogenic substrate alterations, with probable sources of these impairments listed as silvicultural activities. In 2010, the DEQ issued sediment TMDLs and a framework for water quality restoration for the lower Clark Fork River tributaries, which included Rock Creek. The DEQ concluded Rock Creek's impairment is not a pollutant and does not require a TMDL (DEQ 2010a).

3.13.2 Analysis Area and Methods

3.13.2.1 Analysis Area

The groundwater quality analysis area is the same as groundwater hydrology and is described in section 3.10.2.1, *Analysis Area.* The surface water quality analysis area is the same as surface water hydrology and is described in section 3.11.2.1, *Analysis Area.*

3.13.2.2 Methods

3.13.2.2.1 Baseline Data Collection

NMC began surface water quality data collection in the analysis area in 1988 and MMC has continued data collection to the present time. In addition, the Forest Service has collected water quality data on some analysis area streams since 1960. Details of the surface water baseline data collection through 2009 are provided in the Data Collection section of the *Final Baseline Surface Water Quality Technical Report* (ERO Resources Corp. 2011c). The Forest Service is conducting a long-term air quality study that began in 1991 that includes lake chemistry monitoring of Upper and Lower Libby Lakes (Grenon and Story 2009, McMurray 2013). Gurrieri and Furniss (2004) reported results of chemical analyses at Rock Lake of bulk atmospheric deposition, lake water, surface inflow, and springs collected manually in 1999 at two- to four-week intervals during the ice-free period. Snow samples were collected in June 1999 at Rock Lake. Kline Environmental Research and NewFields (2012) reported water quality field parameters for drainages in the Poorman Impoundment Site, and in headwater tributaries in the mine area.

NMC collected groundwater data from monitoring wells in the Little Cherry Creek and Poorman Tailings Impoundment Sites, LAD Areas, and Libby Adit Site between 1988 and 1995 (Geomatrix 2006c). The sampling frequency varied from one to multiple times per year. Water samples were collected from wells in the Poorman Tailings Impoundment Site between 1988 and 1993 and analyzed for most major cations and anions and total dissolved solids. MMC collected quarterly groundwater quality data from two monitoring wells beginning in 2005, one in the Little Cherry Creek Tailings Impoundment Site (LCTM-8V) and one near the proposed LAD Areas (WDS-1V). MMC also collected monthly groundwater quality data from two monitoring wells at the Libby Adit Site (MW07-01 and MW07-02) beginning in 2007.

3.13.2.2.2 Impact Analysis Methods

Mass Balance Analysis

A mass balance approach was used to predict potential surface water quality changes resulting from mine wastewater discharge. For Alternatives 3 and 4, mass balance calculations were completed for Libby Creek at LB-300 where discharges from the Water Treatment Plant would be made. For Alternative 2, the agencies completed mass balance calculations for three streams near where discharges from the Water Treatment Plant or from the LAD areas would occur: Libby, Poorman, and Ramsey creeks. Locations analyzed on Poorman and Ramsey creeks for the Alternative 2 LAD areas were PM-1200, RA-400 and RA-600 downgradient of the two proposed LAD areas (data used for PM-1200 were collected at PM-1000, and data used for RA-600 were collected at RA-500, RA-550, and RA-600). In all alternatives, mass balance calculations were completed at locations on Libby Creek at LB-1000 and LB-2000, downgradient of the discharges. In the calculations, a representative wastewater quality at an estimated flow rate was mixed with a representative surface water quality at an estimated flow rate to estimate a final surface water concentration. The mass balance calculations presented in Appendix G provide predicted concentrations, after mixing, of total dissolved solids, ammonia, nitrate, total inorganic nitrogen (which was treated in the calculations as the sum of ammonia + nitrate), total nitrogen, total phosphorus, aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, and zinc. Data were also collected for thallium, but thallium was not detected in surface water, groundwater, or adit and mine water, and it is not discussed further.

Because the numeric nutrient standards are stringent and may be difficult for MMC to meet in the short term, the agencies' analysis assumed that MMC would receive a general variance from the base nitrogen and phosphorus standards. For total phosphorus, it was assumed for the impact analysis that MMC would obtain a general variance of 1 mg/L. For total nitrogen, it was assumed that MMC would receive a general variance of 10 mg/L. Because nitrate would be the dominant nitrogen form, the analysis assumed that the BHES Order limit of 1 mg/L for TIN would be the applicable limit for nondegradation purposes. The DEQ will complete a nondegradation review and set effluent limits during the MPDES permitting process. The nitrogen and phosphorus limits of 1 mg/L for ambient surface waters could be modified in the MPDES permit issued by DEQ at any time if nuisance algal growth caused by MMC's discharge was observed.

For discharges to groundwater at the LAD Areas and tailings impoundment sites, dissolved metal concentrations were used. For MMC's proposed discharges to LAD Areas, some of which would also reach surface water, dissolved metal concentrations were used for the representative wastewater quality because discharges would flow through unconsolidated materials and reach groundwater before reaching surface water.

Potential changes in groundwater quality were assessed by developing representative wastewater quality that would be discharged to groundwater, such as seepage from the tailings impoundment in all mine alternatives and water applied to the LAD Areas in Alternative 2. The agencies completed mass balance calculations for discharges at the impoundment sites and LAD Areas. Representative wastewater quality at an estimated flow rate was mixed with representative ambient groundwater at an estimated groundwater flux to estimate a final groundwater concentration. The uncertainties associated with the mass balance calculations are discussed in section 3.13.4.5, *Uncertainties Associated with the Water Quality Assessment*. The agencies' approach to developing representative concentrations is discussed in subsequent sections.

Streamflows used for the calculations were estimated $7Q_{10}$ flow less any pre-discharge depletions (see next section), except for LB-300, where the modeled baseflow less any pre-discharge depletion due to mine inflow was used (see section 3.8.3). Discharge rates used in the mass balance calculations are provided in Appendix G.

Stormwater runoff events associated with storms exceeding the 10-year/24-hour storm (the design capacity of the Alternative 2 stormwater retention ponds) were not analyzed. The water quality of both the storm runoff and the storm flows of the receiving streams are unknown. A qualitative analysis of possible changes in stream water quality during storm runoff events was completed. Streamflow would be very high during such an event, with discharges to Poorman and Ramsey creeks likely less than 5 percent of the high flows. Any discharges from stormwater retention ponds would be sampled and regulated.

Surface water quality changes to streams, springs, and lakes due to reduced contributions from deeper bedrock groundwater were evaluated qualitatively. Available data on the relative contribution of direct surface runoff, shallow groundwater, and deeper bedrock groundwater, and the water quality of each source to surface water at specific locations are not adequate for a quantitative analysis.

The following subsections describe the streamflow rates, groundwater flux, receiving and wastewater quality values used in the mass balance calculations.

Streamflow Rates Used in Mass Balance Analyses

The DEQ's standard surface water mixing zone rules (ARM 17.30.516) require the use of the $7Q_{10}$ flow to assess effects of discharges that may affect surface water. The $7Q_{10}$ flow is the lowest 7-day average flow that occurs on average once every 10 years. The USGS (Hortness 2006) developed the method used by the agencies to estimate $7Q_{10}$ flow (Appendix G). The estimated $7Q_{10}$ flow for analysis area monitoring locations is:

- 2.06 cfs (925 gpm) for Ramsey Creek at RA-400
- 2.07 cfs (929 gpm) for Ramsey Creek at RA-600
- 1.55 cfs (696 gpm) for Poorman Creek at PM-1200
- 3.03 cfs (1,361 gpm) for Libby Creek at LB-300
- 8.59 cfs (3,855 gpm) for Libby Creek at LB-1000
- 8.99 cfs (4,035 gpm) for Libby Creek at LB-2000

For LB-300, the flow used in the mass balance analyses was 1.22 cfs, which was the baseflow for LB-300 estimated in the 3D groundwater model. The reason for using the modeled baseflow rather than the estimated $7Q_{10}$ flow at LB-300 is explained in section 3.8.3. This baseflow was the flow estimated by the 3D model for average climate conditions; it is possible that the flow at LB-300 might be lower than 1.22 cfs when climate conditions were drier and/or hotter than average.

For the mass balance analyses, the flow reductions estimated by the 3D model were subtracted from the estimated $7Q_{10}$ flow (or from the modeled baseflow at LB-300), potable water use (9 gpm) was subtracted from the Libby Creek flows, and water diverted from Libby Creek by the impoundment and pumpback wells (up to 247 gpm) was subtracted from the Libby Creek flows in the pumpback well area of influence (at LB-2000 for Alternatives 2 and 4 and LB-1000 and 2000 for Alternative 3). The resulting flows were used in the mass balance calculations.

Groundwater Flux Used in Mass Balance Analyses

Section 3.10.4.2.1, *LAD Areas* provides the agencies' analysis of the maximum possible application rate of wastewater that could occur to the LAD Areas based on guidance documents from the Corps and EPA (Corps 1982; Environmental Protection Agency 2006b) and limitations due to the hydrologic characteristics of subsurface unconsolidated materials. The maximum application rate to the LAD Areas that the agencies estimated would be 130 gpm. The application rate was used in the agencies' analysis of effects for Alternative 2; application rate would vary and would be based on BHES Order limits and MPDES permitted effluent limits. Applied water that was not evapotranspired would percolate to and then mix with groundwater and then flow to adjacent streams. For Alternatives 3 and 4, the agencies assumed that all water treated and released from the Water Treatment Plant to Libby Creek, and, if necessary for water right concerns, to Ramsey Creek, would meet BHES Order limits or applicable nondegradation criteria at the end of a mixing zone in accordance with the MPDES permit.

Tailings seepage was estimated with groundwater modeling conducted of the Little Cherry Creek Impoundment Site for MMC (Klohn Crippen 2005) and independently verified by the lead agencies (USDA Forest Service 2008). Seepage not collected by the underdrain is expected to flow to groundwater at a rate of about 25 gpm and, after the impoundment was reclaimed, slowly decrease to 5 gpm (Klohn Crippen 2005). The agencies used the same estimates for the Poorman Impoundment Site because of the similarity in the geologic conditions and in the proposed underdrain system at both sites. For the mass balance analysis to estimate effects on groundwater quality, the groundwater flux (volume per unit time) beneath the Little Cherry Creek impoundment was estimated to be about 35 gpm (Geomatrix 2007b) and the agencies estimated a groundwater flux of 41 gpm under the Poorman tailings impoundment. Downgradient of the tailings impoundment, such water would be captured by a pumpback well system before reaching surface water and returned to the tailings impoundment.

Receiving Water Quality Used in Mass Balance Analysis

Receiving water quality includes both surface water and groundwater. For the mass balance analyses, estimates of the representative water quality of the streams that would receive wastewater discharges were derived from surface water monitoring data collected from 1988 to 2012 (ERO Resources Corp. 2011c; MMC 2008, 2009b, 2010, 2011b, 2012g, 2013). Representative surface water concentrations are provided in Appendix K-1. For the analyses for the Alternative 2 LAD Areas and the tailings impoundment for all alternatives, estimates of the ambient groundwater quality were derived from groundwater data collected from 2005 to 2009 (MMC 2008, 2009b, 2010). Water quality in a well in the Little Cherry Creek Impoundment Site was used to represent ambient concentrations at both impoundment sites. Representative concentrations for each parameter in groundwater are provided in Appendix K-4.

Representative values were determined after removing data outliers. For water quality parameters with no below detection limit values, the representative value is the median concentration. For parameters with some below detection limit values (less than or equal to 70 percent), the representative value is the Kaplan Meier mean concentration. For parameters with greater than 70 percent below detection limit values, the representative concentration is the median concentration with the detection limit substituted for below detection limit results. The *Final Baseline Surface Water Quality Technical Report* (ERO Resources Corp. 2011c) discusses the methods used in determining representative concentrations in ambient surface waters along with details concerning data reduction methods and outlier identification. The same methods were applied in determining the representative groundwater concentrations. The data outliers removed along with a discussion of the data reduction methods are provided in Appendix K-11. The agencies reviewed and summarized available water quality data collected through 2012. Any data collected after 2012 has not been reviewed as part of this EIS evaluation.

Wastewater Quality

Consistent with the recommendations of the Global Acid Rock Drainage guide (International Network for Acid Prevention 2010) for mine planning, feasibility and design stage projects, potential water quality impacts were predicted for material types based on geological descriptions and mineral deposit models. Changes in the chemistry of water interacting with rock exposed in underground mine workings, backfilled waste rock, surface facilities constructed with waste rock, and tailings were evaluated using available metal mobility and kinetic analyses of rock from the Montanore, Rock Creek, and Troy deposits (see section 3.9.4, *Environmental Geochemistry*). Estimates of wastewater quality (Table 120) relied on monitored water quality from the Libby Adit, the waste rock stockpiled at the Libby Adit, and the Troy Mine underground workings, tailings impoundment, and decant pond (Appendix K). Because no organic nitrogen data were available for the mine and tailings water from the Troy mine, total nitrogen concentrations provided in Table 120 for mine and tailings water are only for the total of nitrate, nitrite and ammonia concentrations. A *Final Baseline Surface Water Quality Technical Report* (ERO Resources Corp. 2011c) provides the methods used in reducing the data, identifying outliers, and determining representative concentrations in wastewater. Representative wastewater concentrations were updated using available water quality data collected through 2012. A discussion of the geochemistry information used in developing wastewater quality is in section 3.13.3.3, *Geochemistry of Exposed Materials*. Section 3.13.4.5, *Uncertainties Associated with the Water Quality Assessment* discusses the uncertainties of the concentrations provided in Appendix K.

Three aspects of water management at Montanore in Alternatives 3 and 4 would likely result in lower concentrations of total dissolved solids, metals, and nutrients in tailings water quality than found at the Troy Mine. 1) Mine and adit water would not be used for ore processing, but would be treated year-round and discharged from the Water Treatment Plant. 2) Pumpback wells at the impoundment would pump groundwater mixed with tailings seepage back into the impoundment. The estimated seepage at full capacity is 25 gpm and the estimated pumping rate of all pumpback wells is 250 gpm. Groundwater at both impoundment sites would have lower concentrations of all parameters than tailings water. 3) MMC would divert water from Libby Creek during high flows for mill use. MMC estimates 125 million gallons of water would be needed during an average precipitation year. The makeup water would be stored in the impoundment, the Seepage Collection Pond, or the mine/yard pond at the Libby Plant Site. Libby Creek surface water would have lower concentrations of all parameters than tailings water.

Table 120. Estimated Adit, Mine, and Tailings Wastewaters and Water Treatment Plant Treated Water Quality for Alternatives 2, 3, and 4.

Parameter	Construc-tion Adit Water	Post-Construc-tion Adit Water	Mine Water Operations	Mine Water Post-Operations	Tailings Water	Water Treatment Plant Discharge
Total dissolved solids	122	114	121	108	266	110
Ammonia, as N	<0.65	<0.050	<1.6	<0.16	4.4	0.70
Nitrate, as N	<37	<0.12	**3.1**	**0.76**	**13**	0.60
Total Nitrogen	<38.1	<0.13	**<4.7**	**<0.92**	**17.4**	1.30
Total Phosphorus	<0.026	<0.0073	0.096	<0.10	0.086	0.01
Aluminum	<0.014	<0.011	0.075	**<0.050**	<0.13	0.090
Antimony	<0.00069	<0.00032	<0.0088	<0.0094	0.023	0.0010
Arsenic	<0.0057	<0.0011	<0.018	<0.0031	<0.0017	0.00010
Barium	0.014	0.012	0.068	**0.043**	<0.11	0.20
Beryllium	<0.00080	<0.00080	**<0.0010**	**<0.0010**	<0.0010	0.00020
Cadmium	<0.000080	<0.000080	0.0015	**0.00040**	0.00097	0.000010
Chromium	<0.00047	<0.00054	<0.0010	**<0.0010**	<0.0010	0.0060
Copper	<0.0012	<0.0010	0.042	0.065	0.026	0.0035
Iron	<0.017	<0.017	<0.15	<0.020	0.050	0.13
Lead	<0.00010	<0.00017	0.0080	**0.0060**	<0.0044	0.00035
Manganese	<0.0050	<0.0050	0.21	0.067	0.51	0.070
Mercury	<0.000022	<0.000017	<0.0000050	**0.00059**	<0.0000050	0.000010
Nickel	<0.00075	<0.00055	<0.010	**<0.010**	<0.010	0.0030
Selenium	<0.0010	<0.0010	0.0020	**<0.0010**	<0.0013	0.0015
Silver	<0.00020	<0.00025	**0.075**	**0.0040**	**0.0017**	0.00040
Zinc	<0.010	<0.012	<0.012	<0.013	<0.010	0.030

All concentrations are in mg/L. All metal concentrations are dissolved metals unless otherwise noted.
Bolded nitrate concentrations indicate analyses were for nitrate plus nitrite.
Bolded total nitrogen concentrations do not include organic nitrogen because organic nitrogen data were not collected at the Troy mine for mine and tailings water.
Bolded metal concentrations are total results due to either lack of dissolved data or dissolved data that were below the laboratory detection limit with the detection limit being greater than the lowest water quality standard.
Concentrations presented with a < symbol had at least one sample with a reported concentration less than the detection limit used in calculating representative values; detection limit used in calculating representative value when reported concentration was below the detection limit.
Source: Appendices G and K.

Underground workings would expose zones of ore and waste rock to groundwater, with relatively low reactive surface area. Most sulfide and metal-bearing minerals are encapsulated within silica in the Revett Formation and water quality impacts would likely be minimal. Waste rock backfilled into underground workings would be variably reactive; the extent of sulfide oxidation and metal release would depend on the surface area of the backfill, as well as the relative conditions of saturation and oxygen availability. For this assessment, water interacting with ore and waste rock exposed in underground workings was estimated using the water chemistry measured in the Troy Mine adit, where comparable zones of in-place ore and waste, and backfill deposits, are exposed to groundwater. Underground workings in ore would be minimal during the Evaluation Phase. Any ore that was stockpiled early in mine life would be stockpiled in the tailings impoundment, placed on a liner at the waste rock stockpile area in the tailings impoundment, or stored at the stockpile area. Any seepage water from the ore would be collected and re-used in the mine or treated. Unsaturated conditions expected to exist underground during the Construction and Operations Phases are represented with operational monitoring data from the Troy Mine (Table 120; Appendix K-8). The conditions expected at closure are represented with water quality data collected at the Troy Mine during a period of interim closure between 1993 and 2004 when dewatering occurred during most of the period and the majority of the underground workings remained unsaturated. The results of laboratory kinetic tests generally agree with the monitoring data, although some differences in metal concentrations (relative magnitude, dissolved vs. total, etc.) were observed that would be addressed during Evaluation Phase testing. Future geochemical analyses of metal release potential for waste rock (see Appendix C) would be used, together with monitoring of underground water quality during operations, to address uncertainty about the contribution from backfilled waste rock and refine long-term predictions of water quality for underground workings.

Waste rock would be used for tailings dam construction in all mine alternatives and for plant site construction in Alternative 2. Any rock with a potential for acid generation or trace metal release would be placed as backfill. As kinetic and metal mobility test data are limited for waste rock weathering in the surface environment, the best available data are from the water sump for Prichard and Burke waste rock deposited on a liner at the Libby Adit Site. Data from water in the sump at the Libby Adit waste rock stockpile (Appendix K-10) were used to represent changes in water quality related to waste rock to be used at the impoundment site.

The tailings would have a low residual sulfide content after ore removal, and low potential for acid generation under either saturated (during operations) or unsaturated conditions (post-closure), but due to its relatively high surface area would release trace quantities of metals into solution. This conclusion is consistent with monitoring data from the Troy tailings impoundment, as well as kinetic and metal mobility tests of Montanore tailings conducted before 1992, and with the results of the tailings analysis from Rock Creek. Due to the scale effects of surface area and water flux on metal concentrations predicted for the tailings impoundment, the best available data for the assessment are the field-scale water quality monitoring results from the Troy impoundment (Appendix K-9). The specific identity and concentrations of metals would be re-evaluated when a bulk composite sample of ore could be collected during the Evaluation Phase and tested metallurgically to produce tailings for further testing (see Appendix C). This would allow consideration of any changes in water quality that could result from dewatering at post-closure.

Nitrate concentrations are less affected by the primary mineralogy of the rock than by the blasting practices used in mining. Increased nitrate concentrations are expected in water intercepted near blasted zones. Nitrate and ammonia concentrations of the wastewater from the mine and adits are not known. Data from the Libby Adit during the construction by NMC and from the nearby Troy Mine show a wide range of nitrate and ammonia concentrations. For water pumped from adits during construction, the nitrate concentration range is 0.0096 to 687 mg/L, with a representative concentration of <37 mg/L, and the ammonia concentration range is 0.010 to 21.9 mg/L, with a representative concentration of <0.65 mg/L (Appendix K-5). Additional data on nitrate and ammonia concentrations would be collected during the Evaluation Phase. The agencies used the Libby Adit water quality data collected by NMC after adit construction ceased and nitrate and ammonia concentrations were not affected by blasting to develop an estimate of nitrate and ammonia concentrations in wastewater from post-construction adits. From the post-construction adits, the representative nitrate concentration is estimated to be <0.12 mg/L and the average ammonia concentration is <0.050 mg/L in wastewater (Appendix K-6).

Stream Temperature

Stream temperature is an important criterion for aquatic life and Montana has surface water aquatic life standards for temperature that restrict temperature changes. For bull trout, water temperatures ranging from 36° to 59°F are needed, with adequate thermal refugia available for temperatures at the upper end of this range. Constant temperatures greater than 60°F have been shown to be intolerable for bull trout (Maret *et al*. 2005). Direct solar radiation is the primary contributor to daily fluctuations in stream temperature, but stream temperature is influenced by many factors: air temperature, topography, weather, shade, streambed substrate (bedrock versus gravel or sandy bottoms), stream morphology, the amount of subsurface streamflow, and groundwater inflows (USDA Pacific Northwest Research Station 2005). The project may affect stream temperatures by vegetation clearing, discharge of treated water from the Water Treatment Plant, decreased streamflow due to direct diversions, and changes in groundwater discharge to area streams. Due to the numerous factors affecting stream temperatures and the constantly changing stream temperature regime that occurs, it is difficult to predict how the project may alter stream temperature, or to what extent stream temperatures may be changed.

The temperature of the discharge of mine and adit water is expected to be between 56° and 65°F based on measured temperatures of the Water Treatment Plant influent (MMC 2008, 2009b, 2010, 2011b, 2012g, 2013). The temperature of the tailings water discharge during the Closure and Post-Closure Phases is expected to be close to ambient temperature at the time of discharge from the Water Treatment Plant, except during the winter months, when it may be warmer. Discharges during operations would be a mixture of mine and adit water, and water stored in the tailings impoundment. Water discharged from the Water Treatment Plant, if discharged to the percolation pond next to Libby Creek, would cool as it flowed from the percolation pond via the subsurface to the creek. Discharges to either the percolation pond or directly to Libby Creek would cool further when mixed with receiving creek water.

In Alternative 2, discharges would be to groundwater at the LAD Areas and to either groundwater or surface water from the Water Treatment Plant at the Libby Adit Site. In Alternatives 3 and 4, discharges would be to either groundwater or surface water from the Water Treatment Plant at the Libby Adit Site. Temperature was not included in the mass balance calculations because the temperature of the discharge water and the receiving water would vary during the year. For all Water Treatment Plant discharges, the DEQ during the MPDES permitting would determine effluent limits for each necessary parameter at each outfall that were protective of aquatic life. Temperatures downstream of the Water Treatment Plant outfalls would be monitored during water resources and aquatic biology monitoring.

Vegetation clearing would occur at stream crossings of new or widened roads and the transmission line. The removal of all riparian vegetation for road construction and reconstruction and riparian vegetation taller than 10 feet for the transmission line along streams would increase direct solar radiation to streams. The transmission line alternatives would cross between four and five perennial streams and numerous smaller streams (Table 77). Vegetation clearing would be up to 150 feet wide in Alternative B and up to 200 feet wide in the other alternatives. Clearing may increase stream temperature at and for a short distance below the stream crossings, but it is difficult to predict the magnitude of the effect due to other factors affecting stream temperature and the constantly changing stream temperature regime.

The pumpback wells and any other diversions (such as make-up wells) would reduce streamflow. For example, at PM-1200 in Poorman Creek, the estimated $7Q_{10}$ flow is predicted to be reduced by up to 12 percent. It is possible that this might increase the stream temperature during low flows, but forest shading and flow in the gravel streambed substrate, as well as groundwater supply to the stream, may prevent or minimize such a temperature change.

The reduction in bedrock groundwater inflows to analysis area streams due to mine inflows may increase stream temperatures where bedrock groundwater is the major component of baseflow. Bedrock groundwater flow to streams is fracture controlled and does not occur uniformly along any stream reach. It is difficult to predict how, when and where reduced bedrock inflows may affect stream temperatures, or if such changes would be measureable.

Given all of the factors that affect stream temperature, as well as the constantly changing stream temperature regime, it may not be possible to separate any effect of the mine alternatives on stream temperature from other effects. The proposed water resources and aquatic biology monitoring for Alternative 3 is presented in Appendix C. Stream temperature is not discussed further.

Erosion and Sedimentation

The agencies analyzed the potential effects of facility construction and diversions on erosion and sedimentation both qualitatively and quantitatively. The effects of facility construction were qualitatively analyzed. In all mine alternatives, the proposed Rock Lake Ventilation Adit would be on a steep, rocky slope about 800 feet east of and 600 feet higher than Rock Lake. Because the total disturbance area for this adit would be small (about 1 acre), any effects would be minor and are not discussed further.

All mine and transmission line alternatives would require the construction of new roads, and the use of closed roads. Road construction and reconstruction is often considered the largest source of sediment in mining and timber harvest areas due to the removal of vegetation and construction of cut and fill slopes that expose large areas subject to erosion (Belt *et al.* 1992). To mitigate for project access effects on grizzly bears, some roads that are currently open would be closed, most before the Evaluation Phase and all before the Construction Phase. Other roads would be closed at the end of operations.

The agencies used Forest Service interfaces for the Water Erosion Prediction Project Computer Model (FS WEPP) (USDA Forest Service 1999a) to quantitatively evaluate erosion and sediment delivery from forest roads that would be used for each mine alternative and each transmission line alternative, and for roads that would be closed for grizzly bear mitigation. It was assumed that roads would be graveled and use would be high. Short new access roads would be constructed for the transmission line alternatives. To complete the FS WEPP analysis (KNF 2013), the agencies assumed that the access roads would be located within 100 feet of surface water, would be surfaced with native material, would be 30 feet wide and would have a 2 percent gradient. Most roads used in the transmission line analysis would be greater than 100 feet from surface water. Based on prior road decommissioning activities on the Libby Ranger District, closed roads are expected to deliver sediment for up to 2 years after treatment. Revegetation and stabilization is complete by the end of the second year after the work was completed. The KNF used a 30-year analysis period to assess effects (KNF 2013). The accuracy of the predicted values from the model is, at best, within ±50 percent. Actual sediment delivery rates to streams would be highly variable due to large variations in local topography, climate, soil properties, and vegetation properties; predicted rates are only an estimate of a highly variable process (USDA Forest Service 1999a). Data were collected in the summer of 2010 for use in the WEPP model to generate results at a drainage-area level.

The FS WEPP:Road Batch is designed to predict sediment delivery from roads to streams without BMPs or mitigations such as surface drainage, ditch relief, or paving. BMPs would be used during road construction and closure activities to reduce the amount of sediment reaching streams. BMPs would be the most effective way to minimize sediment delivery from affected forest roads and are estimated to be between 88 and 99 percent effective (KNF 2002b, DNRC 2010). The agencies used the lower end of BMP effectiveness (88 percent) in the WEPP analysis (KNF 2013).

3.13.3 Affected Environment

3.13.3.1 Surface Water

3.13.3.1.1 Streams

The representative quality of the mine area streams is summarized in Appendix K-1. The surface waters in the analysis area are a calcium-bicarbonate water. Total suspended solids, total dissolved solids, turbidity, major ions, and nutrient concentrations are all low, frequently at or below analytical detection limits. Metal concentrations are generally low with a high percentage of below detection limit values (exceptions include aluminum and barium). Analysis area streams are poorly buffered due to low alkalinities. Consequently, surface waters tend to be slightly acidic, with most pH values slightly below 7. The acidity has two likely natural sources: organic acids originating from surrounding coniferous forests and dissolved carbon dioxide in surface water and groundwater draining into the area streams. Median water hardness in area streams are typically less than 35 mg/L, with upper stream reaches having median hardness values typically less than 10 mg/L. Surface water in the Poorman Impoundment Site, some of which originates from bedrock springs, had pH values ranging from 7.2 to 8.2 and higher ion concentrations than other surface water in the project area (Kline Environmental Research 2012).

3.13.3.1.2 Springs

The representative quality of the mine area springs is summarized in Appendix K-2. Springs from all areas are mostly calcium bicarbonate water, but some are sodium bicarbonate water. Springs with higher total dissolved solids and metal concentrations (*e.g.*, SP-14 and SP-30 shown on Figure 70) are a result of longer subsurface flow paths than other springs. For example, a spring located directly above Rock Lake (SP-1R) appears to receive mostly shallow groundwater, whereas a spring below Rock Lake (SP-3R) appears to receive a combination of shallow and deeper groundwater; both springs are shown on Figure 68.

3.13.3.1.3 Lakes

The representative quality of the mine area lakes is summarized in Appendix K-3. Lakes located in or near the CMW are quite dilute; the primary source of dissolved solids and nutrients is bedrock groundwater (Gurrieri and Furniss 2004). Groundwater entering the lakes can be the major source of nutrients for phytoplankton in the lakes. An investigation of Rock Lake completed in 1999 (Gurrieri and Furniss 2004) found that during the ice-free season, groundwater contributed 71 percent of the minerals to the lake, surface water contributed 25 percent, and rainfall contributed 4 percent. Seasonal variations in the water quality of Rock Lake indicate that the volume of inflow from various sources (snowmelt, rainfall, shallow and deep groundwater) varies proportionally during the year. Because the watershed above Rock Lake consists of highly resistant bedrock with little vegetation and soil cover, snowmelt and surface water entering the lake are very dilute (very low dissolved solids). Because the Libby Lakes are extremely dilute and very vulnerable to atmospheric acid deposition, and possible indicators of climate change, they were monitored beginning in 1991 (Grenon and Story 2009; McMurray 2013).

In July through September 2013, MMC measured specific conductance, pH, temperature, dissolved oxygen and turbidity in the outlets from Rock Creek and Wanless Lake, the latter a benchmark monitoring location outside of the range of influence of expected mine or adit inflows. The water quality results were similar. Specific conductance was slightly higher in water at the Wanless Lake outlet (ranging from 3 to 4.5 µS/cm higher in the Wanless Lake outlet). MMC also measured specific conductance, pH, temperature, and dissolved oxygen in Wanless Lake. All of the specific conductance measurements for Rock and Wanless lakes were less than 25 µS/cm, indicating quite dilute lakes.

3.13.3.2 Groundwater

Several monitoring wells installed adjacent to the Libby Adit Site, near the LAD Areas or at the proposed location of the Alternative 2 and 4 tailings impoundment are screened in the unconsolidated glacial or fluvial sands and gravels (Figure 68 and Figure 70). Water samples from the Libby Adit represent the quality of water in fractured deep bedrock. The sources of the adit water were generally more than 1,000 feet below the ground surface and seasonal trends in water quality were not observed in the data, as might be expected in shallow groundwater influenced by surface water infiltration. Appendix K-4 summarizes the quality of shallow groundwater at the Libby Adit Site, LAD Areas, Little Cherry Creek Impoundment Site, and deep bedrock groundwater from the Libby Adit Site. For purposes of analysis, it is assumed that the groundwater quality under the Poorman Tailings Impoundment Site is the same as under the Little Cherry Creek Tailings Impoundment Site because the two locations are adjacent to each other and are geologically similar.

Groundwater samples from monitoring wells in the Libby Adit, Little Cherry Creek tailings impoundment, and LAD Area sites show that existing groundwater in the unconsolidated sediments is a calcium-bicarbonate or calcium-magnesium bicarbonate type with low total dissolved solids concentrations, low nutrient concentrations, and dissolved metal concentrations that are typically below detection limits. Barium and manganese were the only metals consistently detected in groundwater samples. The Libby Adit wells appear to be influenced by seasonal infiltration of surface water because they have seasonal fluctuations in ion concentrations (generally low in May through July, and higher in the fall through winter months). The Little Cherry Creek tailings impoundment and LAD Area wells have consistently low ion concentrations that do not appear to fluctuate seasonally. The pH of groundwater is slightly acidic in the various facility areas (Appendix K-4). Bedrock groundwater has higher ion concentrations, especially sodium and bicarbonate. The pH is somewhat alkaline, and the water is harder.

3.13.3.3 Geochemistry of Exposed Materials

3.13.3.3.1 Ore

Because there has been no historical development of ore within the Montanore deposit, the proposed action would modify the existing underground environment. Low concentrations of dissolved copper, manganese, and zinc are predicted for release when ore and waste rock in the adit walls are exposed to air and water. The sulfides contained in the ore are predominantly non-acid generating, although some potentially reactive sulfides may be present in altered waste zones (Enviromin 2013b). The massive nature of the quartzite that hosts Revett-style ore would limit the surface area exposure of potentially reactive sulfides and substantially reduce the potential for acid generation by exposed ore. The small percentage of sulfides that would be exposed is expected to oxidize to form secondary copper oxide and sulfate minerals with variable solubilities. These secondary minerals would have potential to release metals into groundwater at a near-neutral pH. Results reported for dissolved metal concentrations in Troy Adit mine water, which are believed to result from this process, are consistent with the metal release concentrations reported in metal mobility and kinetic tests of rock from Montanore. Higher total recoverable metal concentrations are expected in groundwater samples that contain sediment, which reflects the importance of metal transport by sediment. For these reasons, any water from underground workings would be treated before discharge in Alternatives 3 and 4 to meet MPDES-permitted effluent limits.

3.13.3.3.2 Tailings

During operations, ore would be shipped to the mill for processing, where 90 percent of the sulfides would be removed. Following grinding, pH adjustment, and removal of sulfide during processing, the homogenous tailings would have an elevated pH of 9 or greater, with a low sulfide content of less than 0.1 percent. Due to the elevated pH and low sulfide content, acid generation from tailings would be unlikely. Tests of metal mobility in tailings, and operational monitoring at the analogous Troy Mine, suggest that some metals would be mobile in tailings effluent at a near-neutral pH, particularly during operations when suspended sediments may transport adsorbed metals. These metals include aluminum, cadmium, copper, iron, lead, manganese, and silver. Nitrate and ammonia concentrations also would be elevated. Only dissolved constituents would have the potential to move beyond the impoundment and potentially affect groundwater and surface water quality, and it is likely that mobile concentrations would decrease when suspended solids were diminished at closure. Tailings would be placed in the impoundment during operations, under saturated conditions, and remain exposed to weathering processes in the tailings impoundment under unsaturated conditions at closure. The specific concentrations of metals would be re-evaluated in tests conducted during the Evaluation Phase (see Appendix C) when a bulk composite sample of ore would be collected from the evaluation adit and metallurgically processed to produce tailings for further kinetic leach testing (see Appendix C). This testing would allow consideration of any changes in water quality that could result from dewatering of tailings post-closure.

3.13.3.3.3 Waste Rock

Waste rock to be mined at Montanore has a low risk of acid generation, but may release low concentrations of metals. A relatively low tonnage of reactive waste rock would be produced, which would be placed as backfill in underground workings and stored under saturated, anaerobic conditions. The same volume of each lithology would be produced under each alternative, and waste rock would be used for tailings dam construction in all mine alternatives and for Plant Site construction in Alternative 2.

The environmental geochemistry data indicate that a portion of the lower Revett Formation has the potential to generate acid, while other portions of the formation do not. Kinetic data support the potential for weak acid generation from the lower Revett altered waste zones, particularly the barren lead zone that separates the two ore zones (Zones 1 and 2) (Figure 11 in Chapter 2). This zone has the potential to reduce the pH in water to 6 and release low concentrations of barium, copper, lead, manganese, and zinc. The risk to water quality would be mitigated by limiting the mining of rock within the barren lead zone. Additional characterization as development advanced through the lower Revett altered waste zones would be important for selection of waste rock for use in tailings dam construction, and would also be of value in understanding potential changes in mine water chemistry resulting from backfilling of reactive waste rock. Rock in the lower Revett would be exposed in workings during the Evaluation, Construction, and Operations Phases of the project.

Comparison of the static results with kinetic test data indicates that static test data overestimate the potential for acid formation from the Prichard Formation waste rock, a conclusion that is supported by the neutral mine drainage observed in the exposed section of Prichard Formation in the Libby Adit and from the rock stockpiled at the Libby Adit Site. In spite of a neutral pH, Prichard Formation rock has the potential to release low quantities of arsenic, iron, manganese, and zinc. Metal release information would also be important for final Water Treatment Plant design. The majority of the exposure of rock from the Prichard and Burke formations would occur during adit construction, through operations, and into closure. Waste mined from the Burke Formation appears unlikely to generate acid, although additional data would be collected to confirm this.

3.13.3.4 Climate Change

Section 3.10.3.4, *Climate Change* in the *Groundwater Hydrology* section discusses projected climate trends for the Columbia River Basin in general. Several variables potentially affected by climate change, such as water temperature, flow, runoff rate and timing, and the physical characteristics of the watershed, affect water quality (Lettenmaier *et al*. 2008). While it is likely that climate change will affect the capacity of surface water ecosystems to remove pollutants and improve water quality, the timing, magnitude, and consequences of these impacts are not well understood (Lettenmaier *et al*. 2008).

3.13.4 Environmental Consequences

This section describes the anticipated changes in surface water and groundwater quality for each alternative. This includes analysis area streams, lakes, springs, and aquifers underlying the mine facilities. Potential direct and indirect effects of the project are described, as are potential cumulative effects that may occur as a result of the mine and transmission line alternatives and identified reasonably foreseeable actions.

3.13.4.1 Alternative 1 – No Mine

In this alternative, MMC would not develop the Montanore Project. Any existing exploration-related or baseline data collection disturbances by MMC would be reclaimed in accordance with existing laws and permits. The DEQ’s approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit Evaluation program that did not affect National Forest System lands. Discharges from the Water Treatment Plant would continue until the adit was plugged.

3.13.4.2 Alternative 2 – MMC Proposed Mine

Development of the Montanore Project would require construction of project facilities, such as a mill, tailings impoundment, adits, and access roads. In MMC’s proposal, the mill and mine production adits would be located in the upper Ramsey Creek drainage, about 0.5 miles from the CMW boundary. An additional adit on MMC’s private land in the Libby Creek drainage and a ventilation adit on MMC’s private land east of Rock Lake would be used for exploration and ventilation. A tailings impoundment proposed in the Little Cherry Creek drainage would require the diversion of Little Cherry Creek. MMC anticipates and the agencies concur that proper management of explosives and use of emulsions would reduce nitrate concentrations from those detected during the initial Libby Adit construction. Adit and mine water would be treated, if needed, before discharging to LAD Areas for secondary treatment. Two LAD Areas between Poorman Creek and Ramsey Creek are proposed to allow for discharge of excess mine water using sprinkler irrigation of water on the land surface. A portion of the waste rock resulting from adit development may be stored temporarily on an unlined surface at LAD Area 1, and at the Libby Adit Site. The total area of disturbance for Alternative 2 would be 2,582 acres.

Sanitary waste would be collected and shipped off-site for treatment and disposal. Handling sanitary waste in this manner would not be feasible because the City of Libby would not accept sanitary waste produced at the operation and no other feasible off-site option was available.

3.13.4.2.1 Evaluation and Construction Phases (Years 1-5)

Groundwater

Mine Area

During the Evaluation and Construction Phases, groundwater would flow toward the adit and mine openings, and the quality of groundwater surrounding the adits and mine would not be adversely affected by the mine. In the streams whose baseflow would be reduced as a result of mining, water quality changes may occur. Deeper bedrock groundwater is likely to have higher total dissolved solids concentrations than shallow groundwater or direct runoff to streams, so a decrease in the deeper bedrock groundwater contribution to streamflow may result in lower total dissolved solids concentrations in streams.

The Libby Lakes are located at an elevation of about 7,000 feet, and are perched above the potentiometric surface. The lakes lie on a series of faults and vertically oriented bedding planes, but there are no observations, data, or numerical model results to indicate that the lakes are hydraulically connected to the deep bedrock potentiometric surface. It is unlikely that the Libby Lakes would be affected by mining activities during these phases. Because deep bedrock groundwater is a contributor to Rock Lake throughout the year (Gurrieri 2001), mining may affect the water quality of Rock Lake. There are subtle differences in the quality of shallow and deeper groundwater, both of which are source waters for Rock Lake, as is surface water runoff (Gurrieri 2001). Baseline water quality data for Rock Lake are provided in Appendix K-3. It may be difficult to differentiate changes in water quality from pre-mining water quality variability. If less groundwater were contributed to Rock Lake, total dissolved solids, silica (needed by diatoms), and nutrient concentrations may decrease in the lake.

Depending on the ratio between shallow and deep groundwater contribution to area springs, water quality changes may be slight and not detectable. In the case of springs that receive a large portion of their flow from deep groundwater, total dissolved solids concentrations may decrease as the shallow groundwater accounts for a larger proportion of the total flow. The only springs whose water quality may be adversely affected by the mine would be those in the analysis area located below an elevation of about 5,000 to 5,600 feet (see section 3.10.4.3.1, *Seeps and Springs* of the *Groundwater Hydrology* section).

Libby Adit Area

Mine and adit water treated at the Water Treatment Plant at the Libby Adit Site (up to 500 gpm in Alternative 2) may be discharged to groundwater via a percolation pond located in the alluvium adjacent to Libby Creek or, when the percolation pond reached capacity, to Libby Creek. The pH of the discharge of mine and adit water is expected to be about 8, slightly greater than instream pH values of between 6.5 and 7.5 in Libby Creek. Water discharged from the Water Treatment Plant, if discharged to the percolation pond next to Libby Creek, would mix with groundwater with a pH of about 6.5. Mixing would also occur within an authorized mixing zone in Libby Creek. After mixing, the expected quality of the treated water would be below BHES Order limits and applicable nondegradation criteria in surface water and groundwater. During the MPDES permitting process, the DEQ would determine if the groundwater mixing zone in the current permit would be renewed.

Tailings Impoundment Area

No water would be stored at the tailings impoundment site during the Evaluation Phase. Groundwater quality in the area would not be affected. The Starter Dam would be constructed partially with waste rock. Limited testing of waste rock excavated from the Libby Adit indicated waste rock leachate contained elevated nutrient concentrations (Table 94). Nitrate concentrations may increase beneath the Starter Dam. MMC committed to implementing seepage control measures, such as pumpback recovery wells, if required to comply with applicable standards. Seepage pumpback wells could be installed along the downstream toe of the tailings dam. Given the heterogeneity of the foundation soils, additional wells could be required to ensure that all flow paths were intercepted. The wells may require active pumping, depending on the artesian pressures within the wells (Klohn Crippen 2005).

After the Starter and Seepage Collection Pond dams were constructed, precipitation and runoff would be captured behind the dams. Some of the area behind the Starter Dam would be lined. Some seepage not collected by the Seepage Collection System would reach groundwater. Water stored behind the Starter Dam would be of generally good quality because it would be mostly precipitation and surface water runoff. Water stored in the impoundment would not affected groundwater quality.

LAD Areas

When mine and adit water was discharged to the LAD Areas, it would mix with precipitation, and much of it would evapotranspire. The quality of the water before chemical and biological treatment within the plant root/soil matrix would change as a result of dilution by rain water, then concentration of about 90 percent (on average, depending on the season of discharge, weather conditions, soil moisture levels, etc.) of this water could be lost to the atmosphere via evapotranspiration. Resultant nutrient and metal concentrations were calculated and used for the mass balance analysis (Appendix G). The water would then be treated within the plant root/soil matrix.

Land application can substantially reduce suspended sediment, nitrogen, phosphorus and metal concentrations in the applied water. Nitrogen removal occurs through vegetation uptake, biological reduction through nitrification/denitrification in the soil, and ammonia volatilization. The main concern associated with land application is the potential for nitrate to be transported to groundwater (Environmental Protection Agency 2006b). Nitrate removal is site- and effluent-specific; removal depends on application rate, soil physiochemical properties, soil hydraulics, soil moisture, soil organic content vegetation types, slope, and temperature. Ammonia removal is by volatilization, uptake by vegetation, and adsorption by clay minerals in the soil; its removal depends on temperature, pH, soil characteristics and soil water content. Phosphorus removal is accomplished through plant uptake and by fixation in the soil matrix. Metals are removed by adsorption, precipitation, ion exchange, biogeochemical reactions, uptake by plants and microorganisms, and complexation (Environmental Protection Agency 2006b). Metal removal is site- and effluent-specific and depends on vegetation type, soil characteristics, pH, and temperature.

Due to the many variables that have not been specifically defined for the LAD Areas, the agencies could not determine specific treatment rates for nitrate, nitrite, ammonia, total nitrogen, total phosphorus and metals. The BHES Order requires the DEQ to review design criteria and final engineering plans to determine that at least 80 percent removal of nitrogen would be achieved by LAD treatment. Removal rates for ammonia, nitrate, and nitrite cannot be determined until LAD Area final engineering plans, design criteria, and soil studies were submitted and monitoring commenced. Treatment rates for nitrogen compounds appear to vary widely, ranging from 50 to 90 percent for total nitrogen (Environmental Protection Agency 2002). Maximum nitrogen removal occurs when nitrogen is applied in the ammonia or organic form rather than the nitrate form (Georgia Department of Natural Resources 2006; Environmental Protection Agency 2006b). Ammonia represents the reduced (less oxidized) form of nitrogen, while nitrate represents the oxidized form. Ammonia is expected to be present in wastewater used on the LAD Areas. Nitrates are more readily taken up by plants, while ammonia is more readily adsorbed by soils. Phosphorus removal by land application has shown a wide range of removal rates ranging from 20 to 100 percent (EPA 1974), and is a function of residence time and travel distance involving complex physical, biochemical, and chemical interactions, soil type and vegetation type.

In the agencies' analysis, land application treatment rates were assumed to be 50 percent for nitrate, ammonia, total nitrogen, total phosphorus, and some metals. If needed, primary treatment of nitrate would occur before land application disposal. For zinc, aluminum, barium and manganese, a 10 percent removal was assumed, and for copper and nickel a 90 percent removal was assumed. A report prepared for NMC (Camp Dresser and McKee, Inc. 1991) on soil attenuation in the analysis area showed high copper attenuation in the analysis area soils. Zinc may be taken up by vegetation, but does not, in general, sorb readily on soils. Manganese also does not sorb readily on all soil types. In the agencies' analysis, it was assumed that 90 percent of the zinc and manganese percolated to groundwater.

The predicted concentrations in groundwater after mixing beneath the LAD Areas for each mine phase, when an estimated rate of 130 gpm of water was sent to the LAD Areas for treatment (see section 3.10.4.2.1, *LAD Areas* of the *Groundwater Hydrology* section), are provided in Table 121. Predicted concentrations in groundwater would be slightly better during the Post-Closure Phase than those shown for the Closure Phase. If land application of excess water resulted in BHES Order limit or nondegradation criteria exceedances, MMC would treat the additional water at the Water Treatment Plant instead of discharging it to the LAD Areas. No natural attenuation or removal mechanisms for total dissolved solids in groundwater is expected; dissolved solids concentrations in groundwater may increase based on residence time. No natural attenuation or removal is expected for nitrate in groundwater. Analyses of the Troy Mine decant pond disposal system by Hydrometrics (2010), Land and Water Consulting (2004), and Camp, Dresser and McKee (2010), indicated natural attenuation or removal of metals from tailings impoundment seepage would occur, including antimony, arsenic, copper, and mercury. These investigations are described under the Operations Phase. Based on these findings, the predicted antimony, arsenic, copper, and mercury concentrations in groundwater (Table 121) may be higher than would actually occur during the Evaluation, Construction, Closure and Post-Closure Phases. Oxygen-ation of the mine and adit water from the use of sprinklers at the LAD Areas may result in the precipitation of iron oxide and manganese oxide on the land surface. As a result, the predicted iron and manganese groundwater concentrations shown in Table 121 may be higher than would actually occur. The ambient manganese concentration in groundwater at the LAD Areas exceeds the BHES Order limit. Iron and manganese oxides are relatively insoluble, and if precipitated on the ground surface at the LAD Areas, would not dissolve. Although large runoff events may loosen the material and erode it downhill, the material would not reach surface water as most runoff would be captured by sediment ponds designed for a 10-year/24-hour storm. A larger storm event may result in iron and manganese precipitates eroding downhill to surface water.

Table 121. Predicted Concentrations in Groundwater after Mixing beneath the LAD Areas, Alternative 2.

Parameter	Ambient Concentration	Construction Phase	Closure Phase	BHES Order Limit[1]	Applicable Nondegradation Criteria Outside of a Mixing Zone		
					Ambient Concentration[2]	Trigger Value[3]	15% of Lowest Standard[4]
Total dissolved solids	63	**283**	**580**	200			
Nitrate	0.060	**<38**	**13**	10			
Antimony-T	<0.0030	<0.0022	**<0.025**			0.0004	0.0009
Arsenic-C	<0.0030	**<0.0076**	**<0.0033**		<0.0030		
Barium-T	<0.0067	<0.029	**<0.21**			0.002	0.15
Beryllium-C	<0.0010	<0.0007	<0.0007		<0.0010		
Cadmium-T	<0.00010	<0.00013	**<0.0011**			0.0001	0.000075
Chromium-T	<0.0010	<0.0010	<0.0015	0.02			
Copper-T	<0.0010	<0.00074	<0.0061	0.1			
Iron-H	<0.052	<0.043	<0.076	0.2			
Lead-T	<0.00034	<0.00019	<0.0011			0.0001	0.0023
Manganese	<0.081	<0.049	**<1.0**	0.05			
Mercury-T	<0.000020	**<0.000033**	<0.000015		<0.000020		
Nickel-T	<0.010	<0.0051	<0.0070			0.0005	0.015
Selenium-T	<0.0010	<0.00151	<0.0018			0.0006	0.0075
Silver-T	<0.00050	<0.00045	<0.0020			0.0002	0.015
Zinc-T	<0.010	<0.024	<0.024	0.1			

All concentrations are mg/L. All metal concentrations are for dissolved metals.
Method used to derive representative ambient water quality concentrations described in ERO 2011c. Concentrations presented with a < symbol had at least one sample with a reported concentration less than the detection limit used in calculating representative values; detection limit used in calculating representative value when reported concentration was below the detection limit.
No discharges to LAD Areas are projected to occur during the Operations Phase.
Predicted concentrations greater than BHES Order limits or applicable nondegradation criteria without additional primary treatment before land application are shown in **bold**.
[1] BHES Order limits apply to only to those parameters for which limits were set in 1992: total dissolved solids, nitrate, chromium, copper, iron, manganese, and zinc.
[2] No increase in ambient concentrations outside of a mixing zone designated by the DEQ applies to degradation determination in nondegradation review for arsenic, beryllium, and mercury.
[3] Trigger values apply to degradation determination in nondegradation review for antimony, barium, cadmium, lead, nickel, selenium, and silver.
[4] 15% of lowest standard only applies to degradation determination for concentrations of toxins (antimony, barium, cadmium, lead, nickel, selenium, and silver) outside of a mixing zone designated by the DEQ if the change in water quality exceeds the trigger value. The DEQ typically does not grant mixing zones for LAD Areas.
Source: Appendix G.

MMC requested a source-specific groundwater mixing zone for the LAD Areas in Alternative 2 (Geomatrix 2007b). A mixing zone is a limited area of a surface water body or a portion of an aquifer, where initial dilution of a discharge takes place and water quality changes may occur, and where certain water quality standards may be exceeded (ARM 17.30.502(6)). During the MPDES permitting process, the DEQ would determine if a mixing zone beneath and downgradient of the LAD Areas would be granted in accordance with ARM 17.30.518 and, if so, would determine its size, configuration, and location. If DEQ granted a mixing zone, water quality changes might occur, but BHES Order limits could not be exceeded outside the mixing zone, and for other water quality parameters, nondegradation criteria could not occur outside the mixing zone unless authorized by DEQ. The DEQ typically does not grant mixing zones for LAD Areas. The DEQ also would determine where compliance with applicable standards would be measured.

Surface Water

West Side Streams, Lakes, and Springs

During the Evaluation and Construction Phases, water quality in streams, lakes, and springs on the west side of the divide may be affected by reductions due to mine inflows in groundwater discharge to streams and Rock Lake. Because bedrock groundwater has higher dissolved solids concentrations, a reduction in groundwater discharge may result in surface water having lower dissolved solids concentrations. The change in groundwater discharge would be very small during these phases and it is unlikely that changes in water quality would be detectable.

East Side Streams, Lakes, and Springs

Effects of Mine Inflows and Discharges. Reductions in groundwater discharge to springs and streams east of the divide due to mine inflows would be small during the Evaluation and Construction Phases; changes in water quality would not likely be detectable. No lakes in the Libby Creek watershed would be affected by mine dewatering. Effects on the spring located close to the LAD Areas (such as SP-21 shown on Figure 70), assuming that shallow groundwater was a source of supply to such springs, would be similar to the effects on groundwater beneath the LAD Areas (Table 121).

Predicted concentrations after mixing at RA-600 (Ramsey Creek), PM-1200 (Poorman Creek), and LB-1000 (Libby Creek) following discharge at the Water Treatment Plant and the LAD Areas during Construction and Closure Phases are provided in Table 122, Table 123, and Table 124, respectively. The predicted concentrations for sites in Libby, Poorman, and Ramsey creeks were compared to the BHES Order limits, where applicable, or were evaluated based on the criteria for determining nonsignificant changes in water quality for parameters not listed in the BHES Order. Instream water quality concentrations during the Evaluation Phase would be similar to the Construction Phase. Predicted concentrations would be slightly better during the Post-Closure Phase than those shown in the tables for the Closure Phase. Predicted concentrations for all mine phases at numerous monitoring locations are presented in Appendix G.

Table 122. Predicted Concentrations with Land Application Treatment after Mixing at RA-600, Alternative 2.

Parameter	Ambient Concen-tration	Construction Phase	Closure Phase	BHES Order Limit[1]	Applicable Nondegradation Criteria Outside of a Mixing Zone			
					Ambient Concen-tration[2]	Trigger Value[3]	15% of Lowest Standard[4]	10%/40% of Lowest Standard[5]
Total dissolved solids	<13	<22	<33	100				
Ammonia, as N	<0.052	<0.079	<0.22	TIN=1				
Nitrate, as N	<0.081	<1.4	<0.58	TIN=1				
Total inorganic nitrogen	<0.13	**<1.5**	<0.80	1				
Total nitrogen	<0.25	**<1.63**	<0.92					0.1/0.4
Total phosphorus	<0.0096	<0.011	**<0.013**					0.1/0.4
Aluminum - T	0.013	<0.014	<0.022			0.03	0.013	
Antimony-T	<0.0030	<0.0030	**<0.0038**			0.0004	0.00084	
Arsenic-C	<0.0020	**<0.0022**	<0.0020		<0.0020			
Barium-T	<0.0040	<0.0052	<0.012			0.002	0.15	
Beryllium-C	<0.0010	<0.00099	<0.00099		<0.0010			
Cadmium-T	<0.000017	<0.000024	<0.000055			0.0001	0.000015	
Chromium-T	<0.0010	<0.0010	<0.0010	0.005				
Copper-T	<0.0010	<0.0010	<0.0012	0.003				
Iron-H	<0.050	<0.050	<0.051	0.1				0.1/0.4
Lead-T	<0.00010	<0.00010	<0.00013			0.0001	0.000082	
Manganese	<0.0023	<0.0036	<0.039	0.05				
Mercury-T	<0.000020	<0.000020	<0.000020		<0.000020			
Nickel-T	<0.0051	<0.0050	<0.0051			0.0005	0.0024	
Selenium-T	<0.0010	<0.0010	<0.0010			0.0006	0.00075	
Silver-T	<0.00020	**<0.00041**	<0.00026			0.0002	0.000056	
Zinc-T	<0.0038	<0.0044	<0.0044	0.025				

All concentrations are mg/L. All metal concentrations are for total recoverable metals except aluminum, which is dissolved.
Method used to derive representative ambient water quality concentrations described in ERO 2011c.
Concentrations presented with a < symbol had at least one sample with a reported concentration less than the detection limit used in calculating representative values; detection limit used in calculating representative value when reported concentration was below the detection limit.
No discharges to LAD Areas are projected to occur during the Operations Phase.
Predicted concentrations greater than BHES Order limits or applicable nondegradation criteria without additional primary treatment before land application are shown in **bold**.
[1] BHES Order limits apply to only to those parameters for which limits were set in 1992: total dissolved solids, nitrate, chromium, copper, iron, manganese, and zinc.
[2] No increase in ambient concentrations outside of a mixing zone designated by the DEQ applies to degradation determination in nondegradation review for arsenic beryllium, and mercury.
[3] Trigger values apply to degradation determination in nondegradation review for aluminum, antimony, barium, cadmium, lead, nickel, selenium, and silver.
[4] 15% of lowest standard only applies to degradation determination for concentrations of toxins (aluminum, antimony, barium, cadmium, copper, lead, nickel, selenium, and silver) outside of a mixing zone designated by the DEQ if the change in water quality exceeds the trigger value.
[5] 10% and 40% of lowest standard applies to degradation determination review for iron, total nitrogen and total phosphorus. For total nitrogen, it was assumed that the BHES Order limit of 1 mg/L for TIN would be the applicable limit for total nitrogen. For total phosphorus, it was assumed the circular DEQ-12B variance concentration of 1 mg/L would apply.
Source: Appendix G.

Table 123. Predicted Concentrations with Land Application Treatment after Mixing at PM-1200, Alternative 2.

Parameter	Ambient Concentration	Construction Phase	Closure Phase	BHES Order Limit[1]	Applicable Nondegradation Criteria Outside of a Mixing Zone			
					Ambient Concen-tration[2]	Trigger Value[3]	15% of Lowest Standard[4]	10%/40% of Lowest Standard[5]
Total dissolved solids	<23	<29	<36	100				
Ammonia, as N	<0.050	<0.068	<0.16	TIN=1				
Nitrate, as N	<0.053	<0.95	<0.38	TIN=1				
Total inorganic nitrogen	<0.10	<1.0	<0.54	1				
Total nitrogen	<0.22	**<1.1**	<0.66					0.1/0.4
Total phosphorus	<0.0099	<0.011	<0.012					0.1/0.4
Aluminum - T	<0.010	<0.011	<0.016			0.03	0.013	
Antimony-T	<0.00050	<0.00053	**<0.0011**			0.0004	0.00084	
Arsenic-C	<0.00050	**<0.00067**	<0.00050		<0.00050			
Barium-T	<0.0064	<0.0071	<0.011			0.002	0.15	
Beryllium-C	<0.00020	<0.00020	<0.00020		<0.00020			
Cadmium-T	<0.000040	<0.000044	<0.000065			0.0001	0.0000145	
Chromium-T	<0.0010	<0.0010	<0.0010	0.005				
Copper-T	<0.0010	<0.0010	<0.0011	0.003				
Iron-H	<0.050	<0.050	<0.051	0.1				0.1/0.4
Lead-T	<0.000045	<0.000048	<0.000068			0.0001	0.000082	
Manganese	<0.00089	<0.0018	<0.025	0.05				
Mercury-T	<0.000020	<0.000020	<0.0000020		<0.000020			
Nickel-T	<0.00050	<0.00050	<0.00055			0.0005	0.0024	
Selenium-T	<0.0010	<0.0010	<0.0010			0.0006	0.00075	
Silver-T	<0.00020	<0.00034	<0.00024			0.0002	0.000056	
Zinc-T	<0.0031	<0.0035	<0.0035	0.025				

All concentrations are mg/L. All metal concentrations are for total recoverable metals except aluminum, which is dissolved.
Method used to derive representative ambient water quality concentrations described in ERO 2011c.
Concentrations presented with a < symbol had at least one sample with a reported concentration less than the detection limit used in calculating representative values; detection limit used in calculating representative value when reported concentration was below the detection limit.
No discharges to LAD Areas are projected to occur during the Operations Phase.
Predicted concentrations greater than BHES Order limits or applicable nondegradation criteria without additional primary treatment before land application are shown in **bold**.
[1] BHES Order limits apply to only to those parameters for which limits were set in 1992: total dissolved solids, nitrate, chromium, copper, iron, manganese, and zinc.
[2] No increase in ambient concentrations outside of a mixing zone designated by the DEQ applies to degradation determination in nondegradation review for arsenic beryllium, and mercury.
[3] Trigger values apply to degradation determination in nondegradation review for aluminum, antimony, barium, cadmium, lead, nickel, selenium, and silver.
[4] 15% of lowest standard only applies to degradation determination for concentrations of toxins (aluminum, antimony, barium, cadmium, copper, lead, nickel, selenium and silver) outside of a mixing zone designated by the DEQ if the change in water quality exceeds the trigger value.
[5] 10% and 40% of lowest standard applies to degradation determination review for iron, total nitrogen and total phosphorus. For total nitrogen, it was assumed that the BHES Order limit of 1 mg/L for TIN would be the applicable limit for total nitrogen. For total phosphorus, it was assumed the circular DEQ-12B variance concentration of 1 mg/L would apply.
Source: Appendix G.

Table 124. Predicted Concentrations with Land Application Treatment after Mixing at LB-1000, Alternative 2.

Parameter	Ambient Concen-tration	Construction Phase	Closure Phase	BHES Order Limit[1]	Applicable Nondegradation Criteria Outside of a Mixing Zone			
					Ambient Concen-tration[2]	Trigger Value[3]	15% of Lowest Standard[4]	10%/40% of Lowest Standard[5]
Total dissolved solids	<33	<43	<50	100				
Ammonia, as N	<0.030	<0.10	<0.17	TIN=1				
Nitrate, as N	<0.034	0.62	0.29	TIN=1				
Total inorganic nitrogen	<0.064	<0.72	<0.46	1				
Total nitrogen	<0.11	<0.77	<0.51					0.1/0.4
Total phosphorus	<0.0070	<0.0077	<0.0086					0.1/0.4
Aluminum - T	<0.017	<0.024	<0.029			0.03	0.013	
Antimony-T	<0.00050	<0.00056	<0.00090			0.0004	0.00084	
Arsenic-C	<0.00020	**<0.00030**	**<0.00022**		<0.00020			
Barium-T	0.0066	<0.024	<0.032			0.002	0.15	
Beryllium-C	<0.00020	<0.00020	<0.00020		<0.00020			
Cadmium-T	<0.000060	<0.000058	<0.000069			0.0001	0.000015	
Chromium-T	<0.0010	<0.0014	<0.0016	0.005				
Copper-T	<0.00046	<0.00074	<0.00089	0.003				
Iron-H	<0.017	<0.027	<0.031	0.1				0.1/0.4
Lead-T	<0.000054	<0.000082	<0.00010			0.0001	0.000082	
Manganese	<0.00099	<0.0076	<0.023	0.05				
Mercury-T	<0.000020	<0.000019	<0.000019		<0.0000020			
Nickel-T	<0.00050	<0.00072	<0.00082			0.0005	0.0024	
Selenium-T	<0.0010	<0.0011	<0.0011			0.0006	0.00075	
Silver-T	<0.00020	<0.00030	<0.00025			0.0002	0.000056	
Zinc-T	<0.0044	<0.0069	<0.0076	0.025				

All concentrations are mg/L. All metal concentrations are for total recoverable metals except aluminum, which is dissolved.
Method used to derive representative ambient water quality concentrations described in ERO 2011c.
Concentrations presented with a < symbol had at least one sample with a reported concentration less than the detection limit used in calculating representative values; detection limit used in calculating representative value when reported concentration was below the detection limit.
No discharges to LAD Areas are projected to occur during the Operations Phase.
Predicted concentrations greater than BHES Order limits or applicable nondegradation criteria without additional primary treatment before land application are shown in **bold**.
[1] BHES Order limits apply to only to those parameters for which limits were set in 1992: total dissolved solids, nitrate, chromium, copper, iron, manganese, and zinc.
[2] No increase in ambient concentrations outside of a mixing zone designated by the DEQ applies to degradation determination in nondegradation review for arsenic and mercury.
[3] Trigger values apply to degradation determination in nondegradation review for aluminum, antimony, barium, cadmium, lead, nickel, selenium, and silver.
[4] 15% of lowest standard only applies to degradation determination for concentrations of toxins (aluminum, antimony, barium, cadmium, copper, lead, nickel, selenium, and silver) outside of a mixing zone designated by the DEQ if the change in water quality exceeds the trigger value.
[5] 10% and 40% of lowest standard applies to degradation determination review for iron, total nitrogen and total phosphorus. For total nitrogen, it was assumed that the BHES Order limit of 1 mg/L for TIN would be the applicable limit for total nitrogen. For total phosphorus, it was assumed the circular DEQ-12B variance concentration of 1 mg/L would apply.
Source: Appendix G.

Nitrate and ammonia concentrations were added together to evaluate compliance with the BHES Order limit for total inorganic nitrogen (TIN). The BHES Order TIN limit (1 mg/L) during the Evaluation and Construction Phases at RA-400 and RA-600 are predicted to be exceeded without nitrogen pre-treatment. The TIN and total nitrogen limit during the Evaluation and Construction Phases at PM-1200 is predicted to be exceeded without nitrogen pre-treatment. The mass balance analysis also predicted exceedances of BHES Order limits or applicable nondegradation criteria for antimony, arsenic, and silver at RA-400. The mass balance analysis predicted exceedances of BHES Order limits or applicable nondegradation criteria for antimony, arsenic, and silver at RA-600, antimony, arsenic and silver at PM-1200, and arsenic at LB-1000. If land application of excess water resulted in BHES Order limit or nondegradation criteria exceedances, MMC would treat the additional water at the Water Treatment Plant instead of discharging it to the LAD Areas. Libby Creek is listed by DEQ as impaired for drinking water use due to exceedance of the human health standard for mercury; the predicted mercury concentration in receiving waters after mixing would be below the human health mercury standard for surface water (0.00005 mg/L). In 2014, the DEQ and the EPA issued TMDLs and a water quality improvement plan for the Kootenai River-Fisher River project area, which includes Libby Creek. The DEQ performed updated assessments on Libby Creek for metals impairment and did not identify metals impairment conditions in Libby Creek in the reassessment (DEQ and Environmental Protection Agency 2014). The impairment causes for this 1 mile section of Libby Creek (mercury) will be removed from the 2014 Water Quality Integrated Report.

During the MPDES permitting process, the DEQ would determine if a mixing zone in any stream receiving a discharge would be allowed and, if so, would determine its size, configuration, and location. MMC requested a source-specific mixing zone for lower Ramsey Creek, lower Poorman Creek, and Libby Creek (Geomatrix 2007b). The DEQ would make the same determinations regarding a mixing zone as it would for discharges at the LAD Areas.

Effects of Stormwater Runoff, Erosion, and Sedimentation. Until vegetation ground cover reached pre-disturbance levels, erosion rates would be higher than before disturbance and may increase stream sedimentation in and downstream of the analysis area. MMC would implement a SWPPP to minimize erosion and sedimentation from disturbed areas during construction and operations. The plan would address stormwater runoff from mine-related facilities for soil stockpiles, access/haul roads, adit pads not constructed of waste rock, and parking lots. The plan would describe the potential sources of stormwater pollution, pollution prevention practices, sediment and erosion control measures, runoff management, inspections, and reporting. BMPs would include ditches, sediment traps, and sediment retention ponds.

At the Ramsey Creek Plant Site, runoff from the top of the plant site pad area would be directed to a lined holding pond; runoff from the portal area and face of the plant site pad (including seepage) would be collected in ditches and directed to one or more sediment ponds. These ponds would be designed to contain runoff from a 10-year/24-hour storm of 2.4 inches. Runoff from storms greater than a 10-year/24-hour storm may overflow the sediment pond and enter Ramsey Creek. The effect on stream water quality may not be detectable during a storm event when the flow of Ramsey Creek would be high. Overflows could cause erosion and short-term increases in sediment in Ramsey and Libby creeks. The high streamflow present during such an event would likely distribute much of any released sediment well downstream to be deposited in floodplains, low gradient stream reaches, or transported to the Kootenai River. Once all plant site facilities were constructed, most of the surface area of the pad would be covered with impermeable materials, with any surface runoff directed to the lined holding pond.

The Ramsey Plant Site would be built within a Riparian Habitat Conservation Area (RHCA, discussed in the *Aquatic Life and Fisheries* section), as defined by the Inland Native Fish Strategy (INFS). A literature review associated with the development of the INFS (USDA Forest Service 1995) concluded that non-channelized sediment flow rarely travels more than 300 feet and 200- to 300-foot riparian buffers are generally effective at protecting streams from sediment from non-channelized overland flow (Belt *et al.* 1992). The Ramsey Plant Site would increase the potential for non-channelized sediment flow to reach Ramsey Creek.

Stormwater flow would be managed at the LAD Areas and the Little Cherry Creek Impoundment Site in the same manner as the Ramsey Plant Site. Stormwater runoff would be collected in ditches and directed to one or more sediment ponds. The ponds would be designed to contain runoff from a 10-year/24-hour storm. In the case of storms larger than a 10-year/24-hour storm, effects on nearby streams may be the same as discussed for the sediment ponds for the Ramsey Plant Site.

All clearing before construction at the LAD Areas would be located 300 feet or more from Libby, Poorman and Ramsey creeks. MMC would shut off sprinklers during periods of stormwater runoff, snowmelt, or saturated ground conditions, and MMC would not operate the LAD Areas in a manner that produced runoff or increased spring flow. With these measures in place, increases in sediment directly to Libby, Poorman or Ramsey creeks from tree thinning or use of the LAD Areas are not expected.

A Diversion Dam in Little Cherry Creek would be constructed to divert flow above the dam around the tailings impoundment. After the Diversion Dam was constructed during the Construction Phase, water in Little Cherry Creek above the tailings impoundment would be diverted to Libby Creek via a 10,800-foot long Diversion Channel to ensure that it would not contact any mine wastewater, waste rock or tailings. The channel would be sized to divert large flood flows safely around the tailings impoundment. The Diversion Channel would consist of an upper channel, and two existing natural drainage channels that flow toward Libby Creek. Two natural drainages would be used to convey water from the upper channel to Libby Creek. The northern drainage (Drainage 10) is currently a 9,000-foot long intermittent drainage that is primarily unchannelized in the upper part and has perennial channelized segments interspersed with unchannelized wet and dry segments in the lower part. The southern drainage (Drainage 5) is about 3,000 feet long with similar characteristics to Drainage 10. Flow in Drainage 5 does not reach Libby Creek (Kline Environmental Research 2012).

During the Construction Phase, the flow in Drainages 5 and 10 would increase and would change to perennial flow. Because the tributaries are not large enough to handle the expected flow volumes, downcutting and increased sediment delivery to Libby Creek is expected to occur as the channel stabilized. In the event of heavy precipitation during construction of the channel, substantial erosion and short-term increases in sedimentation to the lower drainage and Libby Creek would occur. Where possible, MMC would construct some bioengineered and structural features in the two drainages to reduce flow velocities, stabilize the channels, and create fish habitat. An energy dissipater would be constructed at the outlet section of both drainages to reduce flow velocity of water entering Libby Creek. Short sections of these two drainages are steep, and it may be difficult to access such sections to complete any channel stabilization work. In addition, some sections of these two drainages have thick vegetation that may require clearing before starting channel stabilization, which may temporarily create erosion and increase sediment delivery to the drainages.

The KNF's analysis of sediment erosion from roads to streams compared existing conditions (road use without the mine) to the action alternatives (Table 125). Existing sediment delivery varied by alternative because roads proposed for use in each alternative would be different. The KNF implements BMPs on roads when they are upgraded for various purposes; the analysis assumes the KNF would not upgrade any of the roads used for Alternative 2 before the Montanore Project is implemented. The KNF also assumed that BMPs would not be implemented to forest roads without the project. During the Evaluation and Construction Phases, 9.8 tons of sediment would be delivered from roads to area streams compared to a sediment delivery of 32.7 tons during 5 years without BMPs under existing conditions without the project. A reduction in sediment is anticipated in the following streams: Bear, Big Cherry, Getner, Hoodoo, Libby, Little Cherry, and Ramsey creeks (KNF 2013). A less than 1-ton increase is predicted for Poorman

Table 125. Estimated Sediment Delivery from Roads to Analysis Area Streams by Mine Phase for Mine Alternatives.

Phase	Existing Sediment Delivery from Roads to Streams (tons)†	Predicted Sediment Delivery from Roads to Streams With Project (tons)	Reduction from Existing Conditions (tons)
Alternative 2 Roads			
	Without BMPs	***With BMPs***	
Evaluation	13.08	7.31	5.77
Construction	19.62	2.47	17.15
Operations	130.80	69.24	61.56
Closure	13.08	7.01	6.07
Post-closure	19.62	18.54	1.08
Total	**196.20**	**104.57**	**91.63**
Alternative 3 Roads			
	Without BMPs	***With BMPs***	
Evaluation	26.44	20.57	5.87
Construction	39.66	10.97	28.69
Operations	264.40	104.98	159.42
Closure	26.44	10.50	15.94
Post-closure	39.66	23.21	16.45
Total	**396.60**	**170.22**	**226.38**
Alternative 4 Roads			
	Without BMPs	***With BMPs***	
Evaluation	26.82	20.95	5.87
Construction	40.23	11.46	28.77
Operations	268.20	108.26	159.94
Closure	26.82	10.91	15.91
Post-closure	40.23	23.02	17.21
Total	**402.30**	**174.60**	**227.70**

†Existing sediment delivery to streams is for roads that would be used in Alternatives 2, 3, or 4.
Source: KNF 2013.

Creek. The two road closures proposed in Alternative 2 for grizzly bear mitigation would not reduce sediment reaching streams because they are not available for closure. One road proposed for closure, NFS road #4784 (upper Bear Creek Road) would be closed for mitigation of the Rock Creek Project. The other road proposed for closure, NFS road #4724 (South Fork Miller Creek), would be used in constructing transmission line Alternatives D-R and E-R.

Although MMC would implement BMPs to reduce sedimentation, MMC may request and the DEQ may authorize a short-term exemption from surface water quality standards for total suspended sediments and turbidity for construction of the powerline, access roads, the tailings impoundment, and other stream crossings. If authorized, the exemption would include conditions that minimize, to the extent practicable, the magnitude of any change in water quality and the length of time during which any change may occur. Any exemption would ensure that existing and designated beneficial uses of state water were protected and maintained upon completion of the activity.

Surface water monitoring would include regular sampling for total suspended sediments and turbidity. In all alternatives, MMC would inspect the BMPs at least once every 14 calendar days, and within 24 hours after any precipitation event of 0.5 inches or greater or within 24 hours after a snowmelt event that produced visible runoff at the construction site. MMC would maintain the BMPs so that they remained effective. Post-construction, BMPs would be inspected at least monthly (during the snow-free period) until revegetation was successful and, as during construction, within 24 hours after any precipitation event of 0.5 inches or greater or a snowmelt event that produces visible runoff. Inspection and monitoring of stormwater BMPs would continue until the areas disturbed during construction were finally stabilized. If the agencies were to observe increased suspended sediment concentrations that could not be explained by natural events such as snowmelt or large precipitation events, the agencies would investigate the source of the increased sediment load to the stream. If the agencies determined that sediment discharge was occurring to a stream from a construction or post-construction mine or transmission line site, MMC would be required, after notification from the agencies, to implement measures to eliminate the sediment source to the stream within 24 hours. These measures would eliminate or minimize erosion and sedimentation of area streams.

As part of its proposed Fisheries Mitigation Plan, MMC would conduct a sediment-source inventory in the watershed, and stabilize, recontour, and revegetate priority sediment-source areas, which are typically roadcuts in the watersheds of Libby, Hoodoo, Poorman, Midas, and Crazyman creeks. MMC's proposed mitigation is not reflected in the sediment rates shown in Table 125. Implementation of this measure would reduce the sediment delivery to area streams. MMC also would rehabilitate habitat upstream from the mouth of Howard Creek through creation of pool and hiding cover habitat, stabilization of old mining spoils, and channel narrowing. The installation of grade control structures in streams to improve aquatic habitat may increase sediment concentrations in streams temporarily. After the activities were completed, and the improvements stabilized, sediment delivery to area streams would decrease below existing levels.

3.13.4.2.2 Operations Phase (Years 6 through 25)

Groundwater

Mine Area

Groundwater in the vicinity of the adit and mine would flow toward the mine and adit voids, so groundwater quality surrounding the adits and mine would not be affected by the mine. Adit, mine, and tailings impoundment water would be collected and used for milling purposes.

Libby Adit Area

No mine or adit water would be treated at the Water Treatment Plant and discharged Creek during operations because all water would be used in the mill.

Tailings Impoundment Area

During the Operations Phase, it is estimated that a maximum of 25 gpm of water would seep to groundwater under the tailings impoundment (Klohn Crippen 2005). The existing groundwater quality would be altered because tailings seepage would have higher concentrations of nutrients, some metals, and total dissolved solids than existing groundwater.

Using the DEQ's approach for determining a standard mixing zone (ARM 17.30.517), MMC estimated a groundwater flux of 10 gpm. An additional 25 gpm was added to the estimated flux to account for flow in the buried alluvial channel (Geomatrix 2007b). The hydrologic and geologic conditions of the Little Cherry Creek Tailings Impoundment Site are complex. The agencies used a groundwater flux of 35 gpm in the agencies' mass balance calculations for Alternative 2 as a reasonable estimate of flux beneath the impoundment site. Results of the mass balance analysis are provided in Table 126. The predicted groundwater concentrations were compared to the BHES Order limits, where applicable, or applicable nondegradation criteria.

During operations, elevated antimony and manganese concentrations are predicted to occur in groundwater beneath and downgradient of the tailings impoundment. The manganese exceedance of the BHES Order limit is due in part to the ambient groundwater manganese concentration exceeding the BHES Order limit. Based on analyses of the Troy Mine decant pond disposal system by Land and Water Consulting (2004), Hydrometrics (2010) and Camp, Dresser and McKee (2010), the agencies anticipate natural attenuation and removal of metals in the tailings water infiltrated at the tailings impoundment. Assuming that geochemical conditions would be similar at Montanore as at the Troy Mine, groundwater metal concentrations beneath the impoundment area are expected to be less than those predicted by the mass balance calculations (Table 126). Nitrate would not be attenuated or removed as mine water infiltrated to groundwater.

In a 2004 study, Land and Water Consulting (2004) evaluated the fate and movement of copper beneath the Troy Mine decant ponds. Geologic material beneath the decant ponds was analyzed for total copper to identify the composition of copper minerals and to identify which mineral phases contain the most copper. Study results indicated that copper was attenuated within the upper foot of soil primarily through the precipitation of secondary copper minerals (carbonates, silicates, and oxides) and through the secondary adsorption of copper onto organic matter. Precipitation is the formation of a solid (mineral) from dissolved constituents in groundwater, and adsorption is a process where dissolved metal adheres to the surface of organic particles (USDA Forest Service and DEQ 2012).

Table 126. Predicted Concentrations in Groundwater after Mixing beneath the Tailings Impoundment without Attenuation, Alternatives 2 and 4.

Parameter	Ambient Concen-tration	Opera-tions Phase	Post-Closure at Stabilized Flow Conditions	Applicable Nondegradation Criteria Outside of a Mixing Zone			
				BHES Order Limit[1]	Ambient Concen-tration[2]	Trigger Value[3]	15% of Lowest Standard[4]
Total dissolved solids	60	146	86	100			
Nitrate, as N	<0.10	5.5	1.7	TIN=1			
Antimony-T	<0.0030	**<0.011**	**<0.0055**			0.0004	0.0009
Arsenic-C	<0.0030	<0.0025	<0.0028		<0.0030		
Barium-T	<0.040	<0.069	<0.049			0.002	0.15
Beryllium-C	<0.0010	<0.0010	<0.0010		<0.0010		
Cadmium-T	<0.00010	<0.00046	<0.00021			0.0001	0.000075
Chromium-T	<0.00074	<0.00085	<0.00077	0.005			
Copper-T	<0.0012	<0.012	<0.0043	0.003			
Iron-H	<0.010	<0.027	<0.015	0.1			
Lead-T	<0.00028	<0.0020	<0.00080			0.0001	0.0023
Manganese	<0.077	**<0.26**	**<0.13**	0.05			
Mercury-T	<0.000030	<0.000020	<0.000027		<0.000030		
Nickel-T	<0.010	<0.010	<0.010			0.0005	0.015
Selenium-T	<0.0010	<0.0011	<0.001			0.0006	0.0075
Silver-T	<0.00050	<0.0010	<0.00064			0.0002	0.015
Zinc-T	<0.0064	<0.0079	<0.0069	0.025			

All concentrations are mg/L. All metal concentrations are for dissolved metals.
Method used to derive representative ambient water quality concentrations described in ERO 2011c.
Concentrations presented with a < symbol had at least one sample with a reported concentration less than the detection limit used in calculating representative values; detection limit used in calculating representative value when reported concentration was below the detection limit.
Predicted concentrations greater than BHES Order limits or applicable nondegradation criteria without additional primary treatment before land application are shown in **bold**.
[1] BHES Order limits apply to only to those parameters for which limits were set in 1992: total dissolved solids, nitrate, chromium, copper, iron, manganese, and zinc.
[2] No increase in ambient concentrations outside of a mixing zone designated by the DEQ applies to degradation determination in nondegradation review for arsenic beryllium, and mercury.
[3] Trigger values apply to degradation determination in nondegradation review for antimony, barium, cadmium, lead, nickel, selenium, and silver.
[4] 15% of lowest standard only applies to degradation determination for concentrations of toxins (antimony, barium, cadmium, copper, lead, nickel, selenium, and silver) outside of a mixing zone designated by the DEQ if the change in water quality exceeds the trigger value.
Source: Appendix G.

The geochemical conditions at the Troy Mine tailings impoundment conducive to metals attenuation and removal included neutral to alkaline pH, oxidizing conditions, the presence of moderate amounts of dissolved silica, bicarbonate, and low to moderate amounts of organic material (Hydrometrics 2010). The metals that were attenuated or reduced at the Troy Mine tailings impoundment area included antimony, arsenic, copper, and lead. Comparing decant pond water concentrations to those collected in the adjacent downgradient groundwater at the Troy Mine, Hydrometrics (2010) reported a 50 percent reduction in antimony concentrations, an order of magnitude (10 times) reduction in copper concentrations, and reduction to undetectable concentrations for arsenic. Cadmium, mercury, and silver were not detected in either the Troy

Mine decant pond water or the underlying shallow groundwater. Based on scientific literature, Hydrometrics (2010) concluded that if higher concentrations of cadmium, mercury, or silver occurred in the decant pond water, the necessary geochemical conditions existed to attenuate and remove these metals.

Camp Dresser and McKee (2010) completed a study of the Troy Mine decant ponds for the DEQ designed to evaluate whether other attenuation or removal mechanisms of metals that would occur in the event that the initial mechanisms, such as precipitation, became less effective. These secondary attenuation processes would occur when oxygen-rich mine water from the decant ponds mixed with groundwater. When oxygen-poor groundwater contains iron, dissolved iron precipitates from solution as iron hydroxide (a solid mineral). When the iron hydroxide precipitates, it facilitates removal of other metals from water by co-precipitation. Specifically, the 2010 Camp, Dresser and McKee study evaluated the following: whether dissolved iron in groundwater would precipitate as iron hydroxide; whether dissolved iron that precipitates would help remove copper and other metals (co-precipitation) from mine waters; and the quantity of other metals that would be removed with the iron. The evaluation consisted of computer geochemical modeling based on the quality of mine water and the groundwater under the tailings impoundment; and bench-scale jar testing using varying proportions of mine water and groundwater. The computer modeling showed that between 98 and 100 percent of the iron would precipitate in response to mixing of the waters, while the laboratory tests showed that precipitation of the iron resulted in the removal of 73 to 98 percent of the copper and 11 to 59 percent of the antimony (Camp Dresser and McKee 2010).

Based on the mass balance calculations, seepage of impoundment water is predicted to increase the manganese concentration in groundwater under the tailings impoundment. Oxygenation of the water stored as surface water in the impoundment would cause the precipitation of manganese oxide and a decrease in the dissolved manganese concentration in the impounded water. Therefore, the predicted manganese groundwater concentration based on the mass balance calculation may be higher than would actually occur. The predicted manganese concentration exceeds the BHES Order limit. Although the manganese concentration may exceed the BHES Order limit beneath the impoundment, all groundwater containing elevated concentrations would be intercepted by the pumpback wells and returned to the mill or treated and discharged. The pumpback well system would minimize the effect to groundwater quality and prevent the movement of the tailings seepage water to any surface water.

In all mine alternatives, a MPDES-permitted outfall would not be required for the tailings impoundment seepage because seepage reaching groundwater would be collected by the pumpback system and not discharged to surface water. The discharge to groundwater beneath the impoundment would be authorized by a DEQ Operating Permit and a seepage recovery zone would encompass the impoundment footprint and extend to the pumpback wells, if installed. MMC requested a source-specific groundwater mixing zone for the tailings impoundment in Alternative 2 (Geomatrix 2007b). The DEQ would make the same determinations regarding a mixing zone as it would for discharges at the LAD Areas.

LAD Areas

Groundwater quality beneath the LAD Areas would not be affected because discharge to the LAD Areas would not occur during operations.

Surface Water

West Side Streams, Lakes, and Springs

Mine dewatering and the resulting drawdown of bedrock groundwater may subtly change the water quality of various water bodies, such as the East Fork Rock Creek, Rock Lake, East Fork Bull River, and springs and seeps. Reducing the source of deeper groundwater may reduce the concentration of some anions and cations in surface water, such as sodium, calcium, potassium, bicarbonate, magnesium, chloride, and sulfate. If such a water quality change occurred, it would be detectable only during low flow periods when bedrock groundwater is the major source of supply to surface water. Even at low flows, the changes in water quality may be difficult to measure.

Maximum modeled nitrogen emissions from the exhaust adit at the Libby Adit Site during operations in Alternative 2 are predicted to exceed deposition analysis thresholds at Upper Libby Lake, Lower Libby Lake and Rock Lake. Maximum sulfur deposition impacts were less than the deposition analysis thresholds at Lower Libby Lake and Rock Lake and greater than the deposition thresholds at Upper Libby Lake (see Table 56, p. 297). Upper Libby Lake with very low ANC values would be at risk of becoming more acidic in Alternative 2.

East Side Streams, Lakes, and Springs

Mine Dewatering and Discharges. The effects on streams, springs, and seeps due to mine dewatering would be the same as described for west side surface water. No lakes in the Libby Creek watershed would be affected by mine dewatering. Discharges of mine, adit and tailings impoundment water from the LAD Areas and the Water Treatment Plant during operations were not proposed because the water would be used for milling purposes. If sustained inflows higher than those predicted by the 3D model occurred during the Operations Phase, MMC would implement excess water contingency actions, such as increased grouting, increased sprinkler evaporation at the impoundment, increased storage in the impoundment, or, if necessary, treatment and discharge at the Water Treatment Plant. Discharges would likely be less than the rates during the Construction, Closure and Post-Closure Phases, and water quality effects would be less than predicted for those phases.

The pumpback wells downslope of the Little Cherry Creek tailings impoundment would reduce streamflow in Libby, Little Cherry and likely Bear creeks. The pumpback well system would likely eliminate the $7Q_{10}$ flow in the diverted Little Cherry Creek and substantially reduce the $7Q_2$ flow. Flow below the Seepage Collection Dam in the former Little Cherry Creek channel would also be substantially reduced. Shallow groundwater at the impoundment site has higher total dissolved solids, nitrate, and metal concentrations than Libby Creek. The flow reduction in Libby Creek and Bear Creek would be less than 10 percent of the estimated $7Q_{10}$ flow. It is likely that changes in the water quality of Libby Creek and Bear Creek during operation of the pumpback wells would not be detectable.

Effects of Runoff from Roads. The KNF's WEPP analysis found that roads proposed for use by Alternative 2, with BMPs, would deliver and estimated 69 tons of sediment that would reach area streams during the Operations Phase, a reduction of 61.6 tons from existing conditions (Table 125) (KNF 2013). BMPs and monitoring would be implemented to minimize sediment reaching streams. Road closures proposed in Alternative 2 would not reduce sediment reaching streams.

As part of MMC's Fisheries Mitigation Plan (see section 2.4.6.2, *Fisheries*), MMC may conduct a sediment-source inventory in the watershed, and stabilize, recontour, and revegetate priority source areas, which are typically roadcuts in Libby, Hoodoo, Poorman, Midas, and Crazyman creeks. If selected as part of the Fisheries Mitigation Plan, these measures would reduce sediment to area streams.

Risks of Impoundment Failure during Construction, Operations, and Closure. The agencies evaluated the risks associated with impoundment failure during construction, operations, and closure using a failure modes effects analysis (Klohn Crippen Berger 2009). The analysis identified potential failure modes of all project components. For each failure mode, the agencies estimated the likelihood of occurrence and likely consequences to determine an overall risk level. The risk level integrated likelihood and consequences. The analysis included a discussion of risk management plans.

The assessment evaluated the main dam, the impoundment and associated facilities, tailings and water transport, and closure. Most of the risks associated with impoundment construction, operations, and closure were low or inconsequential. The assessment identified three failure modes for the Little Cherry Creek impoundment with moderately low risks that had the potential to cause water quality effects. The effect of these failure modes would adversely affect groundwater quality beneath the impoundment or surface water in former Little Cherry Creek or Libby Creek.

The failure mode with the highest consequence was failure of the tailings dam due to the liquefaction of the loose glacial outwash layer beneath the tailings impoundment under seismic loading (result of an earthquake). The likelihood of liquefaction of the glacial outwash layer is discussed in section 3.14.3 of the *Geotechnical* section. Should such a failure occur, sediment, tailings, and impoundment water would be uncontrollably released to the environment. The volume of material released and the effect of the release on the environment cannot be predicted, and would depend on many factors, including the type of failure, size of the tailings impoundment at the time of failure, volume of water associated with the failure, and the initial volume and character of the sediments, and the character of concurrent releases from other sources. Under the worst-case scenario, tailings impoundment water containing dissolved metals and reagent residues, and large masses of tailings and sediment would flow into the Libby Creek stream channel. Some of the material would probably remain in the channel for an undefined period of time following failure, while the liquid and remaining solids would be carried downstream. Water quality would be substantially affected. Subsequent to any such failure, seasonal high flows would continue to wash most of the remaining material downstream. Most of the fine sediment from any such catastrophic failure would probably persist in the Libby Creek watershed for many years.

Another potential risk is the release of tailings from a tailings pipeline leak. For example, at the Troy Mine, a recent failure released about 45 tons of tailings into a nearby creek. Suspended sediments were briefly observed for more than 14 miles downstream to the Kootenai River. The failure was caused by a 2-centimeter hole in tailings pipeline. This section of pipe now is equipped with a secondary containment structure. The Troy mine pipeline is polymer lined single-walled pipe buried over much of its length, with a pressure-sensitive leak detection system. The line has some secondary containment at its midpoint, and some secondary containment at stream crossings. In Montanore, the greatest risk would be at the crossings of Ramsey Creek and Poorman Creek. The pipelines would not be buried at the Ramsey Creek or Poorman Creek crossings, but would be in a lined, covered trestle adjacent to the bridge. The creek crossings would have secondary containment built into the crossings besides the double-walled pipe. The containment would be covered and drain toward a designed sump or tank system. Valves would be installed on either side of the crossings to minimize the quantity of tailings that would reach the creek. Should the tailings reach a creek, water quality would be substantially affected. Subsequent to any such failure, seasonal high flows would wash most of the remaining material downstream. Most of the fine sediment from any such failure would probably persist in the Libby Creek watershed for many years.

Risk of Accidental Spills and Ruptures. In all alternatives, MMC would use non-hazardous and small amounts of hazardous materials in its operations, including reagents during milling (potassium amyl xanthate, methyl isobutyl carbinol and polyacrylamide), lubricants, fuel, and blasting agents. Material safety data sheets for the proposed reagents are presented in MMC's Plan of Operations (MMI 2005a, MMC 2008).

The agencies evaluated the risk associated with several possible accidental spill failure modes, such as loss of fuel at the plant site from equipment failure or operator error, spills of materials along access roads from accidents or operator error, and spills of concentrate between the plant site and Libby Loadout (Klohn Crippen Berger 2009). A spill or release may result in short-term water quality degradation of area streams. The effect would depend on the response time for cleanup, the toxicity of the material spilled, the size of the spill, how much entered the creek, and how much dilution occurred within the stream. The risk level for the evaluated accidental spill failure modes was low or inconsequential (Klohn Crippen Berger 2009). MMC would implement an Emergency Spill Response Plan in the event of any spill or release.

A rupture or break in either the proposed tailings slurry or return water pipelines may result in short-term water quality degradation. All pipelines would be encased in larger pipes at stream crossings, and emergency storage areas would be provided in critical reaches along the utility corridor. Slurry lines would be continuously operated and monitored at the ore concentrator at the mill. In the event that pipeline leakage occurred, the system would be shut down and immediately repaired. Impacts for major ruptures would depend on the location of the rupture and the response time for cleanup. The agencies evaluated the risk associated with tailings slurry or return water pipelines. Based on the proposed pipeline design, the risk level associated with failure of tailings slurry or return water pipelines leading to the Little Cherry Creek impoundment was low (Klohn Crippen Berger 2009).

3.13.4.2.3 Closure and Post-Closure Phases (Years 25+)

Groundwater

Mine Area

During the Closure Phase in Alternative 2, the adits would be plugged at the surface, and groundwater would begin to fill the mine and adit void. The 3D model predicted that the mine void and adits would require about 490 years to fill. Groundwater in the vicinity of the mine would continue to flow toward the mine void until the regional potentiometric surface recovered to near pre-mining conditions after a predicted 1,150 to 1,300 years after mining ended. The actual time to recover to steady state may be shorter or longer based on actual adit and mine inflow rates and adit plug locations, and would be re-evaluated using the 3D model after additional data were collected during the Evaluation Phase. Groundwater quality would not be affected during the Closure Phase.

For adits from which water may discharge after mine closure, a water-retaining plug would be installed in competent bedrock. Design of the water-retaining plug would be determined by hydrologic and geotechnical data. Because water-retaining plugs can be located deeper into the adit than a dry plug, the adits from the portal to the plug would be backfilled. Final plugging design for “wet” openings would be prepared for the agencies’ approval before cessation of operations.

The agencies anticipate the quality of the post-closure mine water would be similar to the Troy Mine water quality when it was not operating (Appendix K-8). The potentiometric surface would begin to recover, but water would continue to flow toward the mine void for hundreds of years. Eventually, water may begin to flow out of the mine void, mix with groundwater in saturated fractures, react with iron oxide and clay minerals along an estimated 0.5-mile or greater flow path, undergo changes in chemistry due to sorption of trace elements and mineral precipitation, and, without mitigation, and flow at a predicted rate of 0.07 cfs (32 gpm) as baseflow to the East Fork Bull River. Using all available hydrologic data collected during mining, mitigation (low permeability barriers in the mine) would be designed to minimize post-mining streamflow changes in the East Fork Rock Creek and East Fork Bull River.

Tailings Impoundment Area

During the Closure Phase, the tailings would continue to consolidate and MMC would begin reclamation of the impoundment. MMC estimates it would take up to 20 years for settling and consolidation at the tailings impoundment to stop and to completely reclaim the tailings impoundment surface. MMC would continue to operate the seepage collection system and pumpback wells until BHES Order limits or applicable nondegradation criteria were met without treatment. As adjacent compliance wells met applicable standards, individual pumpback wells may be shut down and adjacent compliance wells would continue to be monitored. As a result, long-term water treatment and surface water and groundwater quality monitoring may be required. The Water Treatment Plant and LAD Areas would continue to be used for treatment of water collected by the seepage collection and pumpback well systems. Effects on groundwater quality would be similar to the Operations Phase.

Seepage from the tailings impoundment reaching groundwater is estimated to decrease from 25 gpm to 17 gpm about 10 years after closure, stabilizing at 5 gpm at steady state conditions (Klohn Crippen 2005). The effect on groundwater quality under the tailings impoundment at a seepage rate of 25 gpm during operations and 5 gpm when the seepage rate is estimated to stabilize is provided in Table 126. Water quality effects during the Closure and Post-Closure Phases when the seepage rate would be decreasing, before stabilizing at 5 gpm, would be less than shown for operations and greater than shown for steady state conditions. The analysis predicted that the water quality standard for antimony and the BHES Order limit for manganese would be exceeded at both the 25 gpm and 5 gpm seepage rates. The manganese exceedance of the BHES Order limit is due in part to the ambient groundwater manganese concentration exceeding the BHES limit. As discussed under the Operations Phase, the predicted antimony and manganese groundwater concentrations based on the mass balance calculation may be higher than would actually occur because of attenuation. Water quality beneath the impoundment would improve slowly over time as infiltrated precipitation mixed with water retained in the impoundment, and water quality concentrations in groundwater after mixing beneath the tailings impoundment would be less than shown in Table 126. MMC would maintain and operate the necessary seepage collection facilities (underdrain system and pumpback wells) until BHES Order limits or applicable nondegradation criteria were met, without treatment, in all receiving waters. MMC also would continue water monitoring as long as the MPDES permit was in effect. As long as post-closure water treatment was required, the agencies would require a bond for the operation and maintenance of the water treatment facilities. The length of time these closure activities would occur is not known and may be decades or more.

LAD Areas

The projected effects on groundwater under the LAD Areas after mill operations ceased are provided in Table 121. Total dissolved solids, nitrate, and dissolved antimony, arsenic, barium, beryllium, cadmium, and manganese concentrations are predicted to exceed one of the applicable criteria. The manganese exceedance of the BHES Order limit is due in part to the ambient groundwater manganese concentration exceeding the BHES Order limit. The predicted dissolved metal concentrations may be higher than would actually occur because they may be attenuated or removed. As infiltrated precipitation mixed with water in the tailings impoundment, the quality of collected tailings seepage water sent to the LAD areas would improve, and the concentrations beneath the LAD Areas would be less than those shown in Table 122, Table 123, and Table 124. The length of time tailings water may be discharged at the LAD Areas is not known and may be decades or more. Water quality beneath the LAD Areas would return to pre-mine conditions soon after discharges to the areas ceased.

Libby Adit Area

Water treated at the Water Treatment Plant (up to 500 gpm in Alternative 2) may be discharged to groundwater via a percolation pond located in the alluvial adjacent to Libby Creek. The expected quality of the treated water would be below groundwater BHES Order limits and nondegradation criteria. The length of time water may be discharged from the Water Treatment Plant is not known and may be decades or more. Groundwater quality would return to pre-mine conditions soon after discharges to the percolation pond ceased.

Surface Water

West Side Streams, Lakes, and Springs

Effects on west side streams, lakes, and springs would persist through the Closure and Post-Closure Phases as mine dewatering would continue to reduce the potentiometric surface. Without mitigation, the largest reductions in deep bedrock groundwater discharge to springs, the East Fork Rock Creek, Rock Lake, and East Fork Bull River would occur about 16 years after mine closure. After that time, groundwater discharges to surface would begin to increase as the potentiometric surface was recovering. Reduced bedrock groundwater entering surface water may reduce the concentration of some anions and cations in surface water, such as sodium, calcium, potassium, bicarbonate, magnesium, chloride, and sulfate. Whether water quality changes would be detectable or could be separated from natural variability is unknown. Based on previous studies of Rock Lake (Gurrieri 2001, Gurrieri and Furniss 2004), the water quality in Rock Lake may change due to the reduction in deep bedrock groundwater, and may be detectable if mitigation to reduce effects on Rock Lake were not implemented. The lake could become somewhat more acidic, could lose some of its buffering capacity, and the loads of nutrients (especially nitrate), sulfate, calcium, magnesium, sodium, and silicon dioxide could be reduced. These changes could reduce nutrient availability to phytoplankton in Rock Lake.

If mine void water flowed to the East Fork Bull River after mine closure, it is not likely that changes in water quality in the river would be detectable. The effect cannot be accurately quantified without additional information from the underground mine. To develop a quantitative estimate of the actual effect, MMC would monitor the chemistry within the underground workings, evaluate downgradient groundwater flow and chemistry within bedrock fracture systems, and monitor baseflow in the East Fork Bull River (see Appendix C, *Water Resources Monitoring*).

Nitrogen and sulfur emissions from the mine's exhaust adit at the Libby Adit Site would substantially decrease when underground mining ceased and would end when all underground mobile equipment ceased operating.

East Side Streams, Lakes, and Springs

Water Quality. Without mitigation, the largest reductions in deep bedrock groundwater discharge to springs and streams in the Libby Creek watershed would occur about 3 years after mine closure. Reduced bedrock groundwater entering surface water may reduce the concentration of some anions and cations in surface water, such as sodium, calcium, potassium, bicarbonate, magnesium, chloride, and sulfate. Whether water quality changes in Libby Creek above the Water Treatment Plant discharge point or in Ramsey Creek would be detectable or could be separated from natural variability is unknown. After mine closure and plugging of the adits near the surface, groundwater contributions to surface water would begin to increase as the potentiometric surface was recovering. After the adit filled, baseflow conditions would return to pre-mining conditions, and stream water quality is not expected to be affected. No lakes in the Libby Creek watershed would be affected by mine dewatering or changes in the potentiometric surface after mining.

Discharges from the LAD Areas are predicted to exceed BHES Order limits or applicable nondegradation criteria for six metals in Ramsey Creek, five metals in Poorman Creek, and three metals in Libby Creek (Table 122, Table 123, and Table 124). Libby Creek is listed by DEQ as impaired for drinking water use due to exceedances by mercury of the human health standard; the mercury concentration in discharges would be below the human health water standard. In 2014, the DEQ and EPA issued TMDLs and a water quality improvement plan for the Kootenai River-Fisher River project area, which includes Libby Creek. The DEQ performed updated assessments on Libby Creek for metals impairment and did not identify metals impairment conditions in Libby Creek in the reassessment (DEQ and Environmental Protection Agency 2014). The impairment causes for this 1 mile section of Libby Creek (mercury) will be removed from the 2014 Water Quality Integrated Report.

After the impoundment was reclaimed and runoff met BHES Order limits or applicable nondegradation criteria, runoff from the reclaimed tailings impoundment surface and the watershed west of the impoundment would be routed toward Bear Creek. The water quality of Bear Creek would not be degraded by the runoff. MMC would design a riprapped channel to Bear Creek. The design would incorporate features that provide for stability of a transition zone so that sediment delivery to streams was not increased. A small, rock-filled check dam would be located just beyond the northwest end of the reclaimed impoundment. The check dam would be designed for the 100-year storm event. Sediment would be removed from behind the dam, if necessary. These measures would minimize the amount of sediment reaching Bear Creek. Increased sedimentation to Libby Creek within the upper and lower impaired segments would likely not occur.

The KNF's WEPP analysis found that roads proposed for use by Alternative 2, with BMPs, 25.6 ton of sediment would reach area streams during the Closure and Post-Closure Phases, a reduction of 7.2 tons compared to existing conditions for the same roads without BMPs (Table 125) (KNF 2013). BMPs and monitoring would be implemented to minimize sediment reaching streams. Road closure mitigation would not affect sediment generation during the Closure Phase. In the event that a large runoff-producing storm occurred during the initial reclamation period, soil losses along roads and road cuts may be locally moderate to severe.

3.13.4.2.4 Climate Change

It is difficult to predict how the hydrologic systems in the analysis area would respond to the forecasted regional effects of climate change. Decreased groundwater contribution to baseflow in streams and groundwater flow to wilderness lakes could change the chemistry of the streams and lakes, as could a seasonally altered runoff pattern. If climate change reduced groundwater infiltration enough to reduce mine and adit inflows, less water would contact exposed mineralized rock, which could reduce metal mobility and the potential for metal leaching in the mine. Discharges of treated water to Libby Creek would be less if mine and adit inflows decreased. Any effect on water quality from the project, combined with the effects of climate change, may be different than those estimated to occur with the Montanore Project alone. As described in Appendix C, MMC would monitor streamflows and water temperatures at potential impact area sites and benchmark sites (similar to project area sites, but outside the area of potential mine impacts) to evaluate trends due to mining compared to trends due to non-mining effects such as climate change. For all discharges, the DEQ would determine effluent limits for each outfall that were protective of aquatic life during the MPDES permitting.

3.13.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Alternative 3 would incorporate modifications and mitigating measures proposed by the agencies that would reduce water quality impacts on area streams and springs. The LAD Areas would not be used in Alternative 3. Any excess water would be treated at the Water Treatment Plant at the Libby Adit Site and discharged at existing permitted outfalls. The tailings impoundment would be at the Poorman Impoundment Site, which would not require diversion of Little Cherry Creek. Seepage from the Poorman Tailings Impoundment Site would be intercepted by pumpback well system during the Operations, Closure and Post-Closure Phases. Power backup would ensure that the pumpback wells would be continuously operated to protect surface water and groundwater quality. During system maintenance, individual pumps would be shut off for only short periods of time to maintain complete capture around the tailings impoundment. Tailings and reclaimed water pipelines would be buried, which, along with a leak detection system, would reduce the risk of affecting surface water resources. Sanitary waste would be treated on-site and pumped to the tailings impoundment during operations. MMC would comply with Forest Service policies when disposing of demolition debris during Closure. The total disturbance area for Alternative 3 would be 1,565 acres. The following sections discuss only those effects that would be different from Alternative 2.

3.13.4.3.1 Effects of Mine Inflows and Pumpback Wells

The effects from mine inflows on surface water and groundwater quality during the Evaluation through Operations Phases would be the same as described for Alternative 2. The effect on water quality in streams, springs, and lakes during the Closure and Post-Closure Phases would be less than Alternative 2 due to implementing mitigation measures to reduce effects on water quality. Depending on the relative contribution of surface water, shallow groundwater and deep groundwater to each surface water and groundwater body, water quality changes may be slight and not detectable, or may be greater and detectable. Because the Ramsey Adits would not be constructed, Ramsey Creek would be affected less than in Alternative 2 because there would be less drawdown in the Ramsey Creek watershed due to mine inflows. Three adits in the Libby Creek drainage would reduce streamflow in Libby Creek slightly more than Alternative 2, so water quality effects on upper Libby Creek (above the Water Treatment Plant point of discharge) may be slightly greater than in Alternative 2.

The pumpback wells, located downgradient of the tailings impoundment (Figure 26), would reduce streamflow in Poorman and Libby creeks. The modeled flow reduction in Poorman Creek would be up to 9 percent of the estimated $7Q_{10}$ flow. Shallow groundwater at the impoundment site has higher total dissolved solids, nitrate, and metal concentrations than Poorman and Libby creeks. During low flows, reducing shallow groundwater contribution to the creek may result in slight detectable changes in the water quality of Poorman Creek. It may not be possible to separate such changes from natural variability. In Libby Creek, the flow reduction due to pumping from the pumpback wells would be less than 10 percent of the estimated $7Q_{10}$ flow; it is likely that changes in the water quality of Libby Creek during operation of the pumpback wells would not be detectable.

Rock Creek is listed by the DEQ as impaired due to anthropogenic substrate alterations, with the probable source of impairment listed as silvicultural activities. The DEQ issued a sediment TMDL for Rock Creek (DEQ 2010a). It is unlikely that the predicted flow decreases in the East Fork Rock Creek (up to 0.29 cfs at EFRC-200) and Rock Creek (up to 0.65 cfs at RC-2000), which are small compared to channel-forming flows, would affect sediment transport, aggradation and degradation in East Fork Rock Creek or Rock Creek.

3.13.4.3.2 Effects of Discharges

During all mine phases in Alternative 3, excess water would be treated at the Water Treatment Plant and discharged to an outfall at the Libby Adit Site. The existing treatment plant would be modified to treat nitrogen compounds (primarily nitrates and ammonia), phosphorus, and possibly dissolved metals, and its capacity increased. An additional outfall may be needed in Ramsey Creek to avoid adversely affecting senior water rights. The pH of the discharge of mine and adit water is expected to be about 8, slightly greater than in-stream pH values of between 6.5 and 7.5 in Libby Creek. Water discharged from the Water Treatment Plant, if discharged to the percolation pond next to Libby Creek, would mix with groundwater with a pH of about 6.5. Mixing would also occur within an authorized mixing zone in Libby Creek. After mixing, water treated and discharged from the Water Treatment Plant would be below BHES Order limits and applicable nondegradation criteria in surface water and groundwater. Groundwater and surface water quality would not be adversely affected.

Libby Creek is listed by the DEQ as impaired for drinking water use due to exceedances by mercury of the human health standard; the mercury concentration in receiving waters after mixing would be below the human health standard. In 2014, the DEQ and EPA issued TMDLs and a water quality improvement plan for the Kootenai River-Fisher River project area, which includes Libby Creek. The DEQ performed updated assessments on Libby Creek for metals impairment and did not identify metals impairment conditions in Libby Creek in the reassessment (DEQ and Environmental Protection Agency 2014). The impairment cause for this 1 mile section of Libby Creek (mercury) will be removed from the 2014 Water Quality Integrated Report.

Libby Creek is also listed as impaired for aquatic life use due to alterations in physical substrate habitat, sediment and siltation. The increase in flow from the Water Treatment Plant would be negligible during high flows, and is predicted to increase low flow by more than 100 percent of the modeled baseflow at LB-300 during operations (from 1.2 to 3.1 cfs). The increase during bankfull or channel-forming flows would be less than 1 percent. The flow increase would not move substantially more material in the channel, would not alter the physical substrate habitat, and would not affect sediment transport, aggradation and degradation. To address the sediment TMDL on Libby Creek, MMC would implement BMPs included in the MPDES permit to meet the sediment wasteload allocation of 24 tons/year developed by DEQ for the project.

The mass balance analysis, using $7Q_{10}$ flow less any predicted mine inflow or pumpback well streamflow reductions, was completed for all alternatives assuming certain treated total dissolved solids, nitrogen and metal concentrations at the Water Treatment Plant outfall needed to meet applicable BHES Order limits or prevent significant changes in water quality for nutrients and toxic, carcinogenic or bioconcentrating parameters not listed in the BHES Order at all locations downstream of the Water Treatment Plant discharge mixing zone (currently LB-300). The expected water quality of the mine wastewater, adit wastewater during construction and post-construction, tailings wastewater post-operations, and Water Treatment Plant treated water quality are provided in Table 120. The discharges to Libby Creek may increase concentrations of total dissolved solids, nitrogen, phosphorus, and some metal concentrations in Libby Creek below LB-300 above ambient concentrations. Table 127 provides the results after mixing at LB-300 and Table 128 provides the results after mixing at LB-1000; results for LB-2000 are provided in Appendix G. Predicted concentrations during the Post-Closure Phase would be slightly better than those shown in the Closure Phase at LB-300 and LB-1000. Although concentrations of some parameters are predicted to increase, BHES Order limits or applicable nondegradation criteria would not be exceeded during all mine phases at either location. Poorman Creek would not be affected by discharges. Discharges would not occur to Ramsey Creek unless required for water rights mitigation; if needed, the discharged water would meet BHES Order limits and applicable nondegradation criteria. During the permitting process, the DEQ would make the same determinations regarding a mixing zone at the tailings impoundment for seepage reaching groundwater in Alternative 3 that were discussed in Alternative 2.

Total nitrogen concentrations are predicted to increase to as much as 0.96 mg/L at LB-300, 0.35 mg/L at LB-1000, and 0.38 mg/L at LB-2000, which are above the total nitrogen standard of 0.275 mg/L. Predicted increased total phosphorus concentrations would remain below the total phosphorus standard. The predicted total nitrogen increases to above the standard may result in increased levels of filamentous algae in Libby Creek below the water treatment plant discharge point. This may result in decreases in dissolved oxygen concentrations to below the standard during low flow periods in early fall, and may also result in higher pH levels in the creek. It is uncertain whether the pH standard would be exceeded due other factors that affect pH, such as chemical buffering or re-aeration rates in Libby Creek (Suplee, pers. comm. 2014).

Table 127. Predicted Concentrations after Mixing at LB-300, Alternative 3.

Parameter	Ambient Concentration	Construction Phase	Operations Phase	Closure Phase	BHES Order Limit[1]	Applicable Nondegradation Criteria Outside of a Mixing Zone			
						Ambient Concen-tration[2]	Trigger Value[3]	15% of Lowest Standard[4]	10%/40% of Lowest Standard[5]
Total dissolved solids	<25	<68	<82	<71	100				
Ammonia, as N	<0.050	<0.38	<0.49	<0.40	TIN=1				
Nitrate, as N	<0.13	<0.37	<0.45	<0.38	TIN=1				
Total inorganic nitrogen	<0.18	<0.75	<0.94	<0.78	1				
Total nitrogen	<0.26	<0.79	<0.96	<0.82					0.1/0.4
Total phosphorus	<0.0064	<0.0082	<0.0088	<0.0083					0.1/0.4
Aluminum - T	<0.012	<0.052	<0.064	<0.054			0.03	0.013	
Antimony-T	<0.00050	<0.00075	<0.00084	<0.00077			0.0004	0.00084	
Arsenic-C	<0.00035	<0.00022	<0.00018	<0.00022		<0.00035			
Barium-T	<0.0026	<0.10	<0.14	<0.11			0.002	0.15	
Beryllium-C	<0.00020	<0.00020	<0.00020	<0.00020		<0.00020			
Cadmium-T	<0.0000088	<0.0000094	<0.000010	<0.0000094			0.0001	0.000078	
Chromium-T	<0.0010	<0.0035	<0.0044	<0.0037	0.005				
Copper-T	<0.0010	<0.0023	<0.0027	<0.0024	0.003				
Iron-H	<0.024	<0.078	<0.10	<0.081	0.1				0.1/0.4
Lead-T	<0.00025	<0.00030	<0.00032	<0.00030			0.0001	0.000082	
Manganese	<0.0019	<0.037	<0.048	<0.039	0.05				
Mercury-T	<0.000010	<0.000010	<0.000010	<0.000010		<0.000010			
Nickel-T	<0.00050	<0.0018	<0.0022	<0.0019			0.0005	0.0024	
Selenium-T	<0.0010	<0.0013	<0.0013	<0.0013			0.0006	0.00075	
Silver-T	<0.00020	<0.00030	<0.00033	<0.00031			0.0002	0.000056	
Zinc-T	<0.0080	<0.019	<0.023	<0.020	0.025				

Assumed quality of Water Treatment Plant effluent discharge is provided in Table 120.
All concentrations are mg/L. All metal concentrations are for total recoverable metals except aluminum, which is dissolved.
Method used to derive representative ambient water quality concentrations described in ERO 2011c.
Concentrations presented with a < symbol had at least one sample with a reported concentration less than the detection limit used in calculating representative values; detection limits used in calculating representative values when reported concentrations were below the detection limit.
Predicted concentrations greater than BHES Order limits or applicable nondegradation criteria are shown in **bold**; no exceedances of BHES Order limits or nondegradation criteria during any mine phase were predicted.
[1] BHES Order limits apply to only to those parameters for which limits were set in 1992: total dissolved solids, nitrate, chromium, copper, iron, manganese, and zinc.
[2] No increase in ambient concentrations outside of a mixing zone designated by the DEQ applies to degradation determination in nondegradation review for arsenic, beryllium, and mercury.
[3] Trigger values apply to degradation determination in nondegradation review for aluminum, antimony, barium, cadmium, copper, lead, nickel, selenium and silver.
[4] 15% of lowest standard only applies to degradation determination for concentrations of toxins (aluminum, antimony, barium, cadmium, copper, lead, nickel, selenium, and silver) outside of a mixing zone designated by the DEQ if the change in water quality exceeds the trigger value.
[5] 10% and 40% of lowest standard applies to degradation determination review for iron, total nitrogen and total phosphorus. For total nitrogen, it was assumed that the BHES Order limit of 1 mg/L for TIN would be the applicable limit for total nitrogen. For total phosphorus, it was assumed the circular DEQ-12B variance concentration of 1 mg/L would apply.
Source: Appendix G.

Table 128. Predicted Concentrations after Mixing at LB-1000, Alternative 3.

Parameter	Ambient Concen-tration	Construction Phase	Operations Phase	Closure Phase	BHES Order Limit[1]	Applicable Nondegradation Criteria Outside of a Mixing Zone			
						Ambient Concen-tration[2]	Trigger Value[3]	15% of Lowest Standard[4]	10%/40% of Lowest Standard[5]
Total dissolved solids	<33	<42	<49	<43	100				
Ammonia, as N	<0.030	<0.11	<0.17	<0.12	TIN=1				
Nitrate, as N	<0.034	0.10	<0.15	<0.11	TIN=1				
Total inorganic nitrogen	<0.064	<0.21	<0.32	<0.23	1				
Total nitrogen	<0.11	<0.25	<0.35	<0.26					0.1/0.4
Total phosphorus	<0.007	<0.0074	<0.0076	<0.0074					0.1/0.4
Aluminum - T	<0.017	<0.025	<0.032	<0.026			0.03	0.013	
Antimony-T	<0.00050	<0.00056	<0.00060	<0.00056			0.0004	0.00084	
Arsenic-C	<0.00020	<0.00019	<0.00018	<0.00019		<0.00020			
Barium-T	0.0066	<0.029	<0.046	<0.032			0.002	0.15	
Beryllium-C	<0.00020	<0.00020	<0.00020	<0.00020		<0.00020			
Cadmium-T	<0.000060	<0.000054	<0.000050	<0.000054			0.0001	0.000078	
Chromium-T	<0.0010	<0.0016	<0.0020	<0.0016	0.005				
Copper-T	<0.00046	<0.00082	<0.0011	<0.00085	0.003				
Iron-H	<0.017	<0.030	<0.040	<0.032	0.1				0.1/0.4
Lead-T	<0.000054	<0.000089	<0.00011	<0.000092			0.0001	0.000082	
Manganese	<0.00099	<0.0091	<0.015	<0.010	0.05				
Mercury-T	<0.000020	<0.000019	<0.000018	<0.000019		<0.000020			
Nickel-T	<0.00050	<0.00079	<0.0010	<0.00082			0.0005	0.0024	
Selenium-T	<0.0010	<0.0011	<0.0011	<0.0011			0.0006	0.00075	
Silver-T	<0.00020	<0.00022	<0.00024	<0.00023			0.0002	0.000056	
Zinc-T	<0.0044	<0.0074	<0.010	<0.0077	0.025				

Assumed quality of Water Treatment Plant effluent discharge is provided in Table 120.
All concentrations are mg/L. All metal concentrations are for total recoverable metals except for aluminum, which is dissolved.
Method used to derive representative ambient water quality concentrations described in ERO 2011c.
Concentrations presented with a < symbol had at least one sample with a reported concentration less than the detection limit used in calculating representative values; detection limits used in calculating representative values when reported concentration were below the detection limit.
Predicted concentrations greater than BHES Order limits or applicable nondegradation criteria are shown in **bold**; no exceedances of BHES Order limits or nondegradation criteria during any mine phase were predicted.
[1] BHES Order limits apply to only to those parameters for which limits were set in 1992: total dissolved solids, nitrate, chromium, copper, iron, manganese, and zinc.
[2] No increase in ambient concentrations outside of a mixing zone designated by the DEQ applies to degradation determination in nondegradation review for arsenic, beryllium, and mercury.
[3] Trigger values apply to degradation determination in nondegradation review for aluminum, antimony, barium, cadmium, copper, lead, nickel, selenium, and silver.
[4] 15% of lowest standard only applies to degradation determination for concentrations of toxins (aluminum, antimony, barium, cadmium, copper, lead, nickel, selenium, and silver) outside of a mixing zone designated by the DEQ if the change in water quality exceeds the trigger value.
[5] 10% and 40% of lowest standard applies to degradation determination review for iron, total nitrogen and total phosphorus. For total nitrogen, it was assumed that the BHES Order limit of 1 mg/L for TIN would be the applicable limit for total nitrogen. For total phosphorus, it was assumed the circular DEQ-12B variance concentration of 1 mg/L would apply.
Source: Appendix G.

Metals, nitrogen and total dissolved solids concentrations in groundwater after mixing beneath the Poorman Tailings Impoundment Site would be similar to Alternative 2 (Table 126), but the estimated groundwater flux under the Alternative 3 impoundment is slightly greater (41 gpm), resulting in slightly lower projected final mixing concentrations in groundwater under the tailings impoundment (Table 129). As discussed in Alternative 2, groundwater metal concentrations beneath the impoundment area during the Operations Phase may be less than those predicted by the mass balance calculations. Because water quality beneath the impoundment would improve slowly over time as infiltrated precipitation mixed with water retained in the impoundment, water quality concentrations post-closure when the seepage rate stabilized would be less than shown in Table 129.

The risk associated with ore in underground workings and waste rock and ore stockpiles in Alternative 3 would be the same as in Alternative 2. Alternative 3 might have some difference in the potential for acid rock drainage or trace element release from the construction of adits in Libby Creek instead of Ramsey Creek, as compared to Alternative 2. Minor differences in the relative volumes of waste rock lithologies intercepted in the alternative adit locations that would be developed under Alternative 3 may alter the overall potential for changes in water quality, depending upon the relative volume of Prichard and Revett formation altered waste zones to be mined. Any change would likely be minor. Characteristics and suitability of waste rock would be identified through sampling and analysis during the Evaluation Phase. The chemistry of tailings and waste rock used for impoundment construction would not change as a result of constructing impoundments in alternative locations.

The volume of waste rock to be mined from each altered waste zone, and the area of the underground workings that would expose the altered waste zone, are not yet fully defined because final mine plans would depend upon results of the proposed Evaluation Phase work. As noted above, the potential for trace metal release from waste rock used in construction or placed in stockpiles would primarily be a function of how much waste rock was mined from the reactive portions of the lower Revett Formation altered waste zones and the Prichard Formation, and how much metal those rock types would release. The zonation patterns do not indicate a higher potential for acid generation and metal leaching at the Montanore Project than that observed at the Troy Mine, but suggest the need for sampling at a level sufficient to represent the observed variability. These relationships would be further defined during the Evaluation Phase, when waste rock in these zones would be sampled more comprehensively, and would be used to support the need for further testing. Ore collected during the Evaluation Phase would be used to conduct further metallurgical testing with a goal of obtaining tailings reject for kinetic and metal mobility test work using a comprehensive suite of elements. Additional testing would be needed to support the results of a single kinetic test of tailings reported to date, and to provide a more comprehensive suite of metal mobility data for evaluating tailings impoundment performance.

The plant would be constructed at the Libby Plant Site between Libby and Ramsey creeks. Based on preliminary design, the Libby Plant Site would not be built with waste rock. If waste rock was not used to build the plant site, ELGs would not apply to the runoff, and runoff would be considered stormwater and subject to stormwater discharge requirements.

Table 129. Predicted Concentrations in Groundwater after Mixing beneath the Tailings Impoundment without Attenuation, Alternative 3.

Parameter	Ambient Concen-tration	Opera-tions Phase	Post-Closure at Stabilized Seepage Rate	Applicable Nondegradation Criteria Outside of a Mixing Zone			
				BHES Order Limit[1]	Ambient Concen-tration[2]	Trigger Value[3]	15% of Lowest Standard[4]
Total dissolved solids	60	138	82	100			
Nitrate, as N	<0.10	5.0	1.5	TIN=1			
Antimony-T	<0.0030	**<0.011**	**<0.0052**			0.0004	0.0009
Arsenic-C	<0.0030	<0.0025	<0.0029		<0.0030		
Barium-T	<0.040	<0.066	<0.048			0.002	0.15
Beryllium-C	<0.0010	<0.001	<0.001		<0.0010		
Cadmium-T	<0.00010	<0.00043	<0.00019			0.0001	0.000075
Chromium-T	<0.00074	<0.00084	<0.00077	0.005			
Copper-T	<0.0012	<0.011	<0.0039	0.003			
Iron-H	<0.010	<0.025	<0.014	0.1			
Lead-T	<0.00028	<0.0018	<0.00073			0.0001	0.0023
Manganese	<0.077	**<0.24**	**<0.12**	0.05			
Mercury-T	<0.000030	<0.000021	<0.000027		<0.000030		
Nickel-T	<0.010	<0.010	<0.010			0.0005	0.015
Selenium-T	<0.0010	<0.0011	<0.0010			0.0006	0.0075
Silver-T	<0.00050	<0.00095	<0.00063			0.0002	0.015
Zinc-T	<0.0064	<0.0078	<0.0068	0.025			

All concentrations are mg/L. All metal concentrations are for dissolved metals.
Method used to derive representative ambient water quality concentrations described in ERO 2011c.
Concentrations presented with a < symbol had at least one sample with a reported concentration less than the detection limit used in calculating representative values; detection limit used in calculating representative value when reported concentration was below the detection limit.
Predicted concentrations greater than BHES Order limits or applicable nondegradation criteria without additional primary treatment before land application are shown in **bold**.
[1] BHES Order limits apply to only to those parameters for which limits were set in 1992: total dissolved solids, nitrate, chromium, copper, iron, manganese, and zinc.
[2] No increase in ambient concentrations outside of a mixing zone designated by the DEQ applies to degradation determination in nondegradation review for arsenic beryllium, and mercury.
[3] Trigger values apply to degradation determination in nondegradation review for antimony, barium, cadmium, lead, nickel, selenium, and silver.
[4] 15% of lowest standard only applies to degradation determination for concentrations of toxins (antimony, barium, cadmium, copper, lead, nickel, selenium, and silver) outside of a mixing zone designated by the DEQ if the change in water quality exceeds the trigger value.
Source: Appendix G.

MMC's proposal in Alternative 2 to collect and ship sanitary waste off-site for treatment and disposal was not feasible. In Alternatives 3 and 4 during the Evaluation, Construction, Closure and Post-Closure Phases, MMC would use a septic system consisting of septic tanks for primary treatment, followed by discharge to a leach field at the Libby Adit. Expected discharge is 585 gallons per day (Geomatrix 2010a). Using Montana DEQ guidelines for performing a nitrate sensitivity analysis for the septic system (DEQ 2010b), the resultant nitrate concentration calculated at the end of a groundwater mixing zone is 0.75 mg/L. The DEQ guidelines were also used for assessing compliance with nondegradation using a surface water dilution analysis (trigger value calculation) for nitrate and phosphorus. Using the proposed treatment system, the calculated increase in the concentration of nitrate (0.0099 mg/L) and phosphorus (0.0007 mg/L) did not exceed the trigger values of 0.01 mg/L for nitrate and 0.001 mg/L for phosphorus (Geomatrix 2010a). The nondegradation criteria do not apply for nitrate in groundwater or for TIN in surface water for the Montanore Project because the BHES Order set limits of 10 mg/L for nitrate in groundwater and 1 mg/L for TIN in surface water. The assessment results showed that the BHES Order limits would not be exceeded for nitrate in groundwater or TIN in nearby Libby Creek.

During Operations, MMC would use a similar system consisting of septic tanks for primary treatment, followed by discharge to the tailings impoundment for final disposal. Disinfection of effluent from the septic tanks would occur before pumping to the impoundment, and would be accomplished by chlorination, ozonation, or ultraviolet light. Disinfection would reduce the number of microorganisms and eliminate potential hazards due to human exposure to the water in the impoundment. About 6,100 gallons per day or a rate of 5 gpm of sanitary wastewater is estimated to be produced through employee use; a rate of 7,000 gallons per day was used for design purposes (Geomatrix 2010a). The estimate is based on 30 office workers (12 gallons per day) and 230 miners/mill workers (25 gallons per day). Sending treated sanitary wastes to the tailings impoundment would not have a detectable effect on surface water or groundwater quality.

3.13.4.3.3 Stormwater Runoff, Erosion, and Sediment Control

The small amount of water diverted around the Poorman Tailings Impoundment Site from the small watershed above the impoundment would not measurably affect the water quality of Little Cherry or Poorman creeks. The quality of the water is expected to be similar to the receiving water quality. In Alternative 3, no diversion channel for Little Cherry Creek would be constructed, and disturbance associated with such a structure would not occur. The disturbance area surrounding the tailings impoundment would be about 300 acres less than Alternative 2 and the potential for erosion and sedimentation to streams would be less than Alternatives 2 and 4.

When the impoundment was no longer needed to store water from the seepage collection and pumpback well systems during the Closure or Post-Closure Phase, a channel would be excavated through the tailings and Saddle Dam abutment at the Poorman Impoundment to route runoff from the site toward a tributary of Little Cherry Creek. The runoff channel would be routed at no greater than 1 percent slope and along an alignment requiring the shallowest depth of tailings to be excavated down to the channel grade. The side slopes would be designed to a stable slope and covered with coarse rock to prevent erosion. As part of the final closure plan, MMC would complete a hydraulic and hydrologic (H&H) analysis of the proposed runoff channel during final design, and submit it to the lead agencies and the Army Corps of Engineers for approval. The H&H analysis would include a channel stability analysis and a sediment transport assessment. Based on the analysis, modifications to the final channel design would be made and minor modifications to the upper reaches of the tributary of Little Cherry Creek may be needed to minimize effects on channel stability in the tributary of Little Cherry Creek. These measures would minimize erosion and sedimentation of Little Cherry Creek.

Stormwater flow at all facilities would be managed to minimize erosion and sedimentation movement from project facilities and disturbed areas. Ditches and sediment ponds containing process water or mine drainage would be designed for the 100-year/24-hour storm to minimize potential overflow to nearby streams. The Libby Plant Site would be more than 500 feet from Libby Creek, minimizing the potential for non-channelized overland flow to reach Libby Creek (Belt *et al.* 1992). LAD Areas would not be used in Alternative 3, eliminating the LAD Areas as a potential source of erosion. A diversion dam and channel for the Poorman Impoundment Site would not be needed, and disturbance associated with such structures would not occur in Alternative 3. The disturbance area surrounding tailings impoundment would be about 300 acres less than Alternative 2 and the potential for erosion and sedimentation to streams would be less than Alternatives 2 and 4.

In Alternatives 3 and 4, MMC would implement BMPs and road closure mitigation, some which would be completed before the Evaluation Phase and some before the Construction Phase. Other roads would be closed at the end of operations. With BMPs, the KNF's WEPP analysis estimated sediment delivery from roads to streams to be 170 tons, a reduction of 226 tons from existing conditions during the 30-year analysis period (Table 125) (KNF 2013). KNF implements BMPs on roads when they are upgraded for various purposes; the comparison to existing conditions assumes none of the roads used for Alternative 3 would be upgraded in the foreseeable future without the project. A reduction in sediment is anticipated in the following streams: Bear, Big Cherry, Cable, Crazyman, East Fork Rock, Getner, Hoodoo, Libby, Little Cherry, Midas, Poorman, Ramsey, and Standard creeks (KNF 2013).

Sediment and runoff from all disturbed areas would be minimized through the use of BMPs developed in accordance with the Forest Service's *National Best Management Practices for Water Quality Management on National Forest System Lands* (USDA Forest Service 2012a). To reduce sediment delivery to analysis streams, MMC would complete reclamation work at five sites in Libby Creek, Little Cherry Creek, and Poorman Creek, as discussed in the agencies' mitigation plan in Chapter 2 (section 2.5.7.1.2, *Jurisdictional Waters*). After the activities were completed, and the roads became stabilized, sediment delivery to area streams would decrease below existing levels. In the event that a large runoff-producing storm occurred during the initial reclamation period, soil losses along roads and road cuts may be locally moderate to severe. As discussed under Alternative 2, MMC may request and the DEQ may authorize a short-term exemption from surface water quality standards for total suspended sediments and turbidity for construction of the powerline, access roads, the tailings impoundment, and other stream crossings.

To control dust on mine access roads, MMC would use either a chemical stabilization, groundwater, or segregated mine or adit water with nitrate concentrations of 1 mg/L or less and with concentrations of all other parameters below the mine drainage ELG. This mitigation would reduce the potential for adversely affecting water quality.

3.13.4.3.4 Effect of Nitrogen and Sulfur Emissions on Area Lakes

Maximum modeled nitrogen and sulfur emissions from the exhaust adit at the Libby Adit Site during operations in Alternative 3 are predicted to be less than deposition analysis thresholds at Upper Libby Lake, Lower Libby Lake and Rock Lake (see Table 61, p. 300). Modeled rates were highest at Rock Lake, at 0.00459 kilograms/hectare/year, slightly below the deposition analysis threshold of 0.005 kilograms/hectare/year. The agencies' mitigation, such as limiting generator use at the mill after power was available from a transmission line to 16 hours during any rolling 12-month time period and using Tier 4 engines and ultra-low diesel fuel in underground mobile equipment, would substantially reduce emissions compared to Alternative 2. Nitrogen and sulfur emissions from the mine would substantially decrease when underground mining ceased and would end after the adits were plugged.

In Alternatives 3 and 4, MMC would monitor nitrogen and sulfur emissions at the Libby Adit for a minimum of 2 years. Using the monitoring data, MMC would update the nitrogen and sulfur deposition analysis and compare it the updated model results to the current FLM deposition analysis thresholds. If modeled results using the Libby Adit monitoring data were greater than current FLM deposition analysis thresholds, MMC would develop and implement available control technologies to reduce pollutant emissions.

3.13.4.3.5 Risk of Impoundment Failure

The agencies evaluated the risks associated with impoundment construction, operations, and closure using the same failure modes effects analysis used in Alternative 2 (Klohn Crippen Berger 2009). The Poorman impoundment had a similar risk profile as the Little Cherry Creek impoundment. Three failure modes that potentially could affect water quality had risk levels slightly higher than the Little Cherry Creek impoundment. These three failure modes had a moderately low risk level. The increased risk was associated with use of more complex technology, and the closer proximity to Libby Creek and private land (Klohn Crippen Berger 2009). The likelihood of failure is discussed in section 3.14.3 of the *Geotechnical* section.

3.13.4.3.6 Climate Change

The effects of climate change in combination with Alternative 3 would be the same as in combination with Alternative 2.

3.13.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would be similar to Alternative 3, including the same mitigations to protect surface water, but would have modifications to MMC's proposed Little Cherry Creek Tailings Impoundment as part of the alternative. The total disturbance area for Alternative 4 would be 1,924 acres. The following sections discuss only those effects that would be different than Alternatives 2 or 3. The effects of discharges and nitrogen and sulfur emissions from the exhaust adit at the Libby Adit Site would be the same as Alternative 3.

3.13.4.4.1 Effects of Mine Inflows and Discharges

The effects on surface water and groundwater quality would be the same as Alternative 3, except for effects at the tailings impoundment site. Groundwater quality after mixing with seepage beneath the Little Cherry Creek Impoundment Site would be the same as Alternative 2 (Table 126). As discussed in Alternative 2, groundwater metal concentrations beneath the impoundment area may be less than those predicted by the mass balance calculations. The discussion in Alternative 2 of mixing zones in surface water (at LB-300 in Alternative 4) and groundwater at the tailings impoundment site would apply to Alternative 4. During the MPDES permitting process, the DEQ would make the same determinations regarding a mixing zone for discharges in Alternative 4 that were discussed in Alternative 2.

3.13.4.4.2 Stormwater Runoff, Erosion, and Sediment Control

Stormwater flow at all facilities would be managed in the same manner as Alternative 3. The effects from the Libby Plant Site and the elimination of LAD Areas as a potential source of erosion would be the same as Alternative 3. Ditches and sediment ponds containing process water or mine drainage would be designed for the 100-year/24-hour storm to minimize potential overflow to nearby streams. The use and inspection of BMPs would be the same as Alternatives 2 and 3.

At the tailings impoundment, the Diversion Channel would consist of two main sections: an upper engineered channel and a constructed lower channel to Libby Creek using Drainage 10 as proposed in Alternative 2. The engineered channel would be the same as the engineered channel in Alternative 2 and would be designed for the 6-hour probable maximum flood. To reduce the contribution of sediment to the diverted Little Cherry Creek, water would flow into a constructed channel that would be designed to be geomorphically stable and adequate to handle the 2-year flow event estimated for the increased watershed size. A floodplain would be constructed along the channel to allow passage of the 100-year flow.

MMC also would evaluate potential locations for ponds to capture and retain sediment from the two channels and for creating wetlands in the floodplain of Libby Creek. The majority of sediment generated would occur during the initial channel flush after construction and subsequent high flow and runoff events. In the event of heavy precipitation during construction of the channel, substantial erosion and short-term increases in sedimentation to the lower channel and Libby Creek would occur. Natural and biodegradable materials and vegetation would be used along stream banks and on the floodplain to minimize erosion, stabilize the stream channel and floodplain, and minimize sedimentation to the lower channel and Libby Creek. MMC would construct bioengineered and structural features in the two channels to reduce flow velocities, and minimize erosion and sedimentation, where access was possible to complete such work. Long-term monitoring and maintenance would be required until the agencies determine that the channel was stabilized. With these mitigation measures, the naturally designed constructed channel may be subject to erosion and sedimentation during construction and until vegetation stabilized the stream banks and floodplain.

Following reclamation of the impoundment, the constructed channel would undergo an additional period of channel adjustment when runoff from the impoundment surface would be directed to the Diversion Channel. No runoff would be diverted to Bear Creek as in Alternative 2. The increase in flow to the constructed channel would be about 50 percent higher at closure than during operations. The increased flow would likely cause short-term increases in sedimentation in the lower channel and possibly in Libby Creek. In the long term, runoff from the impoundment would decrease and eventually cease. Sedimentation in the lower channel and Libby Creek would not be expected to occur except during storm events larger than the channel was designed to handle.

The KNF's WEPP analysis found that road closure mitigation and implementation of BMPs would result in a total sediment delivery to streams from roads of 175 tons, a reduction of 228 tons compared to existing conditions during the 30-year analysis period (Table 125) (KNF 2013). The BMPs and monitoring discussed under Alternative 2 would be implemented to minimize sediment reaching streams. A reduction in sediment is anticipated in the following streams: Bear, Big Cherry, Cable, Crazyman, East Fork Rock, Getner, Hoodoo, Libby, Little Cherry, Midas, Poorman, Ramsey, and Standard creeks (KNF 2013).

3.13.4.4.3 Risk of Impoundment Failure

The agencies did not specifically evaluate the risks associated with the agencies' modifications to the Little Cherry Creek impoundment. The Little Cherry Creek impoundment in Alternative 4 would have a similar risk profile as Alternative 2.

3.13.4.5 Uncertainties Associated with the Water Quality Assessment

Changes in surface water and groundwater quality were projected using an analytical technique known as a chemical mass balance analysis. The mass balance analysis estimates the changes in concentrations of metals and other constituents in a receiving stream when discharges from the proposed operation are added. Projected changes in groundwater concentrations are calculated in a similar manner. The projections assume complete mixing of the discharged wastewater and ambient receiving waters. Variables used in the mass balance analysis include flow rate and ambient water quality in the receiving stream, and the rate and water quality of the proposed discharges.

The mass balance analysis uses the estimated wastewater quality shown in Appendix K and the discharged quantities provided in the water balances for each alternative to predict the resulting water quality after mixing with ambient water quality at low flows. At the LAD Areas, average precipitation and evapotranspiration rates for the 6-month growing season were used.

Projections of surface water quality involve a number of uncertainties. These include the ambient and discharge water qualities, ambient water quantities, the effectiveness of treatment of the various water quality parameters by the Water Treatment Plant or land application, discharge water quantities, the effectiveness of mixing in the stream, the exact location where surface water would be affected, and the environmental effect from increased metal concentrations on aquatic life. Because of the complexity of the water quality assessment, each of these uncertainties is discussed briefly in the following sections.

3.13.4.5.1 Ambient Water and Wastewater Quality

Mean or median water quality concentrations of ambient water and wastewater frequently could not be easily estimated because reported water quality concentrations for many parameters, particularly metals, were below the analytical detection limits. The detection limit is the lowest concentration of a parameter detectable by a laboratory using a particular analytical procedure. Parameters with concentrations reported with a "less than" symbol (<) are those parameters with concentrations below the detection limit. For concentrations reported with a less than symbol, the value shown is the "detection limit" reported by the analytical laboratory. If a concentration of a parameter is below the detection limit, the actual concentration is not absolutely known.

In developing estimates of ambient water and wastewater quality, the agencies used the detection limit in determining a representative concentration when the reported concentration was below the detection limit. For all assessment locations, representative concentrations of all samples collected at a particular location were used to represent concentrations during low flow conditions. The method for deriving representative concentrations is described in the *Final Baseline Surface Water Quality Technical Report* (ERO Resources Corp. 2011c). Representative concentrations may be higher or lower than actual concentrations during low flow periods. The projected final concentrations after mixing would be greater if the ambient low flow concentration was higher than the representative concentration or lower if the ambient low flow concentration was lower. A comparison of chemical concentration data with corresponding streamflow measurements was generally inconclusive due to a lack of water quality data collection at high flows.

3.13.4.5.2 Geochemical Characterization

Geochemical sampling was limited to ore and waste rock available from archived rock core that was drilled before the withdrawal of the CMW from mineral entry, and to waste rock obtained from exposures within the Libby Adit. Additional geochemical characterization is needed to expand and refine the available data and requires additional sample collection during the Evaluation and Construction Phases of the project. Early (pre-1992) efforts to characterize the geochemistry of the Rock Creek-Montanore and Troy deposits were limited in scope based on the consistent mineralogy observed in the deposits, and vary in the extent to which they meet current expectations of sampling intensity. Available datasets for each of the similar Revett-style deposits focus on geochemical characterization of particular materials. For example, considerably more waste rock data are available for the Prichard and Burke formations at Montanore than for Rock Creek or Troy, but a greater number of ore samples have been characterized at a more comprehensive level for Rock Creek. Many more water quality monitoring data have been collected over 30 years of operation under facility specific conditions (*e.g.,* underground workings or tailings impoundment) at Troy than at Rock Creek or Montanore.

The elements of uncertainty related to the extent of sampling, such as collection of waste rock from unexposed portions of the Revett, Prichard and Burke formations or analysis of bulk tailings samples for Montanore-specific ore zones, are addressed in the sampling and analysis plans described in Appendix C and by Geomatrix (2007a). The elements of uncertainty related to the use of monitoring data from the geochemical analog at the Troy Mine would also be addressed through Evaluation and Operations Phase monitoring as defined in Appendix C.

Environmental geochemistry data were collected for Montanore, as well as Rock Creek and Troy, for more than 20 years. Changes in analytical methods and quantitation limits have resulted in analysis of different analytes and reporting of multiple detection limits, particularly for trace metals. The absence of some regulated parameters in particular analyses, or the reporting of below detection limit values for some elements at levels above current standards, both introduce uncertainty into predictions of metal mobility for proposed facilities. The need for more comprehensive analyses of metals, at appropriate detection limits, when representative samples of ore, waste, and tailings are accessible in the evaluation adit is addressed in the agencies' Geochemical Sampling and Analysis Plan provided in Appendix C.

Laboratory and field data offer different strengths and limitations that complement one another in predictions of future water quality. Laboratory analyses test the potential for sulfide oxidation and metal release under controlled, pre-defined, short term experimental conditions (*e.g.,* surface area, dilution, oxygen exposure, acidity, etc.), while *in situ* monitoring provides a measurement of these geochemical processes under longer term, field-scale conditions. Laboratory tests can evaluate specific subsamples representative of the range of natural variation, while field-scale studies integrate that variation into a single measurement. It is typically easier to test discrete representative samples under laboratory conditions than to obtain equally representative *in situ* data, particularly for a facility that has not yet been built. The ability to compare results from multiple samples tested using accepted laboratory methods, within and across several Revett-style deposits, with long-term monitoring data from the Libby Adit and Troy Mine reduces uncertainty in predictions made for the Montanore Project. Collection of additional data as specified in the geochemistry sampling and analysis plan provided in Appendix C would reduce the identified uncertainty and allow MMC to appropriately modify waste rock and water management plans before beginning mining operations. Operational monitoring of mined materials and water quality, as recommended by Geomatrix (2007a), and refinement of baseline predictions would allow further reduction of uncertainty before closure.

3.13.4.5.3 Ambient Water Quantity

Surface water low-flow conditions are conservative flows for assessing impacts from pollutant discharges. For the mass balance analysis, estimated $7Q_{10}$ flow were used for assessing potential impacts on surface water quality, or, for LB-300, the modeled baseflow was used (see section 3.13.2.2.2, *Impact Analysis*). Use of a $7Q_{10}$ flow is consistent with the DEQ's standard surface water mixing zone rules (ARM 17.30.516). Measured low flows during the baseline monitoring period were lower at some assessment locations than the estimated $7Q_{10}$ flow. Flows lower than the $7Q_{10}$ flow would result in less dilution and higher instream concentrations than projected, if other assumptions in the mass balance analysis remained constant. Flows higher than the baseflow used in the LB-300 analysis would result in more dilution and lower instream concentrations than projected, if other assumptions in the mass balance analysis remained constant.

A groundwater flux was estimated for assessing impacts on groundwater beneath the two tailings impoundment sites and LAD Areas. MMC's and the agencies' estimates of groundwater flux are based on available data from the two tailings impoundment sites and LAD Areas. To derive groundwater flux, estimates of groundwater gradient and hydraulic conductivity are required. If actual conductivities or gradients were higher than estimated, more water would be available for mixing, and lower groundwater concentrations than those projected would occur. Groundwater flux less than the estimated flux would result in less water available for mixing and higher groundwater concentrations than projected, if other assumptions in the mass balance analysis remained constant.

3.13.4.5.4 Wastewater Quantity

Projected wastewater quantity is based on the estimated water balance for each alternative. Water balances are point estimates of water production and use, developed using standard methods and reasonable assumptions. Actual flow rates for a number of water sources described by the water balance, such as precipitation, evaporation, and dust suppression, would vary seasonally and annually from the rates shown in the estimated water balances. Actual mine and adit inflows would vary as the mine would be developed, partly in response to short-term higher flows from fractures and faults intersected by the mine void, and partly in response to increasing the volume of the mine void as mining progresses. Grouting would reduce mine and adit inflows. The groundwater model provides estimates of mine and adit inflow as mining progresses, but does not consider short-term higher inflow from dewatering fractures and faults.

The agencies used mine and adit inflows predicted by the 3D model by phase to assess impacts on surface water and groundwater quality. Mine and adit inflows actually encountered during all mine phases may be higher or lower than those predicted by the 3D model. Although the 3D model predicted a maximum short-term peak of 800 gpm, the short-term peak of 800 gpm assumed instantaneous development of two new adits and therefore over-estimated peak inflows. The amount of wastewater discharged during each mine phase to the Water Treatment Plant (all alternatives) or to the LAD Areas (Alternative 2 only) would depend on mine and adit inflow rates. Discharge rates at the Libby Adit Site outfalls are limited in the existing MPDES permit by an annual average load limit. MMC would expand the capacity of the Water Treatment Plant to accommodate discharges during the estimated wettest year in a 20-year period. During the MPDES permitting process, the DEQ would determine if load limits in the permit would be changed. The DEQ may also issue an MPDES permit that allowed for seasonal variations in the allowed maximum discharge rate, which would be greater during months when streamflow was higher, and lower during low flows rather than the constant discharge rates used for each mine phase in the EIS analysis. The agencies' estimate of the discharge rate to the LAD Areas for Alternative 2 is presented in Appendix G and discussed in section 3.10.4.2.1, *LAD Areas* of the *Groundwater Hydrology* section. Because of uncertainties in the operational water balance and the discharge rates, the agencies would require monitoring of flows and discharges during all mine phases (Appendix C).

3.13.4.5.5 Water Quality Assessment Locations

In all alternatives, water from the Water Treatment Plant would discharge to a percolation pond adjacent to Libby Creek or, when the percolation pond reached capacity, to Libby Creek immediately upstream of LB-300. In Alternatives 3 and 4, discharges may be needed in Ramsey Creek to protect senior water users or to Libby Creek at a location lower than LB-300 if DEQ determines flow changes are significant. Any Water Treatment Plant discharge location would be monitored as required by the MPDES permit. For Alternative 2, some uncertainty is associated with how and where streams would be affected by discharges from the LAD Areas. In projecting impacts on surface water quality, the agencies chose monitoring stations on Ramsey Creek, Poorman Creek, and Libby Creek, some of which are long-term water quality monitoring sites. For example, the agencies estimated the percentage of the wastewater from LAD Areas 1 and 2 for Alternative 2 that would flow to Ramsey Creek, Poorman Creek, or Libby Creek based on site topography; the actual rate of discharge to each stream may be different. In addition, the locations in each stream at which water from the LAD Areas would discharge may be above or below the monitoring locations used for the impact analysis. A station on Libby Creek (LB-1000) was used to assess the effects of all discharges in Alternative 2.

3.13.4.5.6 Land Application Treatment

Land application of mine wastewater is proposed only for Alternative 2. Land application treatment is site- and effluent-specific. The amount of precipitation that occurs on a land treatment site, the quality of the precipitation, and the rate of evapotranspiration from the land treatment site, are variable and uncertain. Many factors affect treatment effectiveness. The treatment rates for total dissolved solids, nitrogen, and metals are uncertain (see LAD Area discussion under section 3.13.4.2.1, *Evaluation and Construction Phases*). It is not possible to estimate actual removal rates for total dissolved solids, nutrients, and metals until mine wastewater application to the LAD Areas occurred and monitoring data were collected. For the analysis of the effects of land application of wastewater, it was assumed that there would be no operational issues at the LAD Areas, such as uneven application of wastewater or runoff from the site directly to streams before treatment. It was also assumed that the treatment rates would not change over time, which may be realistic if the LAD Areas were properly monitored, inspected, and maintained.

For the water quality impact analysis, it was assumed that the percolation of treated groundwater from the LAD Areas would be essentially a direct discharge into the receiving stream. Depending on the effective porosity of the aquifer under the LAD Areas (which is unknown, but estimated) and the actual flow path, the water treated at the LAD Areas may take from less than a year up to 10 years to reach receiving streams.

3.13.4.5.7 Environmental Effects on Aquatic Life

The concentration at which metals and nutrients affect aquatic life in the analysis area is uncertain. Montana surface water quality standards shown in Table 118 are based on a hardness of 25 mg/L as calcium carbonate ($CaCO_3$); actual hardness in area streams ranges between about 5 and 25 mg/L. Environmental effects on aquatic life from those metals that are hardness-related (cadmium, chromium, copper, lead, nickel, silver, and zinc) may occur at concentrations less than those shown in Table 118. The BHES Order established a limit of 1 mg/L for total inorganic nitrogen, and the DEQ nutrient regulations have a standard of 0.275 mg/L for total nitrogen and 0.025 mg/L for total phosphorus. A general variance to the total nitrogen and total phosphorus concentrations, if granted by DEQ to MMC, would allow a variance at the end-of-pipe at the Water Treatment Plant of 10 mg/L for total nitrogen and 1 mg/L for total phosphorus. The BHES Order limit of 1 mg/L for TIN may be the applicable limit for total nitrogen because nitrate would be the dominant nitrogen form in the Water Treatment Plant effluent. The uncertainty of effects to fish and other aquatic life of nitrogen and phosphorus concentrations being within these limits in Libby Creek downstream of the Water Treatment Plant discharge point is discussed in section 3.6, *Aquatic Life and Fisheries*.

3.13.4.6 Effectiveness of Agencies' Proposed Monitoring and Mitigation Plans

3.13.4.6.1 Monitoring

Geochemical Monitoring

Additional sampling would be conducted during the Evaluation, Construction, and Operations Phases, when a more representative section of waste rock would be available for sampling. Characterization of metal release potential for tailings and waste rock is limited and would be expanded in Alternatives 3 and 4. Descriptions of mineralogy in rocks exposed by the evaluation adit ore zone (for the Revett Formation) and development adits (for the Burke and Prichard formations) would be used to identify subpopulations with sulfide altered waste zone overprints. Their relative importance, in terms of tonnage to be mined, would guide sampling density. If the Wallace Formation was intercepted, samples of the lithology would be collected and characterized. The information would be used to redefine geochemical units for characterization and evaluate potential selective handling and encapsulation requirements.

Waste rock would be stockpiled and runoff from the pile would be contained and treated, if necessary. Waste rock would be used at the impoundment site for dam construction, using selective handling criteria that would be defined during the Evaluation Phase (see section C.9.7, *Data Analysis*). It is not clear which fraction of the Revett Formation waste rock would be brought to the surface. Once more detailed information about the Revett and Prichard formations waste rock was available during the Evaluation Phase, along with updated predictions of metal concentrations for tailings, these sources would be incorporated into updated mass balance calculations found in Appendix G.

Surface Water and Groundwater Monitoring

The agencies' plan (Appendix C) includes monitoring of all surface water bodies and groundwater potentially affected by the project, including collection of additional water quality, flow and lake level data before the Evaluation and Construction Phases. The plan also includes action levels based on monitoring data that would trigger corrective measures to be implemented by MMC. The agencies anticipate that the monitoring plan would successfully identify, measure, and separate water quality effects due to mining from natural variability. To accomplish this, MMC would be required to collect water quality samples from benchmark reference sites located near the analysis area, but outside of the area that might be affected by the project (Appendix C). The benchmark sites would be subject to similar ranges in parameters that cause natural variability of data within the analysis area, such as precipitation and temperature. These benchmark sites would include Wanless Lake, a lake similar to Rock Lake, Swamp Creek, a stream west of the divide similar to upper East Fork Rock Creek and East Fork Bull River, and Bear Creek, a stream east of the divide similar to upper Libby Creek. The monitoring plan would be evaluated during each mine phase and modified if needed. The action levels and associated corrective measures, as well as adaptive management, would be effective in minimizing the potential for adverse changes in surface water or groundwater quality.

3.13.4.6.2 Mitigation for Changes in Sediment Delivery to Streams

1. The disturbance area of Alternatives 3 and 4 would be less than Alternative 2, which would effectively minimize sediment delivery in all analysis area streams.

2. In Alternatives 3 and 4, runoff from the reclaimed tailings impoundment would be directed toward Little Cherry Creek instead of Bear Creek proposed in Alternative 2. As part of the final closure plan, MMC would complete a H&H analysis of the proposed runoff channel during final design that would include a channel stability analysis and a sediment transport assessment. The runoff channel would be effective in minimizing adverse effects of increased streamflow on Little Cherry Creek.

3. In Alternatives 3 and 4, MMC would develop and implement a Road Management Plan addressing all roads used, closed, and stabilized in the alternative. MMC would complete reclamation work at five sites in Libby Creek, Little Cherry Creek, and Poorman Creek to reduce sediment delivery to analysis streams. Twenty-five roads would be closed, some before the Evaluation Phase, some before the Construction Phase, and some during the Closure Phase to mitigate for project access effects on grizzly bears. After roads were stabilized and revegetated, sediment delivery to area streams would cease and overall sediment delivery to analysis area streams would be about 90 tons less to analysis area streams after all of the roads were closed. Road closures would have direct and long-lasting beneficial effects on sediment delivery in all analysis area streams. The agencies expect BMPs implemented to minimize sediment delivery from affected forest roads to be between 88 and 99 percent effective (KNF 2013). MMC would implement and maintain all appropriate BMPs for roads during their use by the project. Appropriate BMPs would be those that: 1) disconnect road surfaces and drainage ditches from streams; 2) shorten road surface lengths draining to surface waters; 3) seed and revegetate disturbed soils; and 4) harden road surfaces. BMPs that accomplish these would be the most effective way to minimize sediment delivery from affected forest roads.

4. In the agencies' preferred alternative (Alternative 3), the tailings impoundment would be at the Poorman Impoundment Site, which would not require the diversion of Little Cherry Creek. The elimination of potential erosion and sediment delivery to the diverted Little Cherry Creek and Libby Creek associated with the diversion would reduce water quality effects on the diverted Little Cherry Creek. In Alternative 4, the tailings impoundment

would be in the Little Cherry Creek channel. The diversion channel would be designed to minimize erosion and sedimentation in the diverted Little Cherry Creek and Libby Creek

3.13.4.6.3 Mitigation for Other Water Quality Changes

5. The LAD Areas would not be used in Alternatives 3 and 4 and all excess water would be treated at the Water Treatment Plant before discharge. Effluent discharged from the Water Treatment Plant to Libby Adit Site outfalls would be required to meet the MPDES permitted effluent limits. The Water Treatment Plant would be designed to treat up to the rate estimated for the wettest year in a 20-year period. The use of a high-capacity Water Treatment Plant would be effective in ensuring effluent limits were met and beneficial uses protected. Effluent limits would need to be very low to avoid significant degradation during low flow conditions; therefore, DEQ might issue an MPDES permit that allowed for seasonal variations in the allowed maximum discharge rate, which would be greater during months when streamflow is higher, and lower during low flows. Alternatives 3 and 4 would have only one point of discharge, which could be much more effectively monitored and controlled.

6. Pumpback wells would be used to capture all seepage from the tailings impoundment that reached groundwater, which would minimize effects to groundwater quality and prevent any seepage from reaching nearby streams and affecting surface water quality. Whether the pumpback wells would effectively capture all of the seepage would be determined by installing numerous monitoring wells downgradient of the pumpback wells (Appendix C). MMC would monitor downgradient wells to detect any groundwater quality changes. If water quality changed at compliance wells due to inadequate capture by the pumpback wells, MMC would be required to increase pumping rates or install additional pumpback wells. Maintaining capture of tailings seepage would be effective in minimizing effects on surface water quality.

7. Runoff and seepage from waste rock stockpiles would be collected and treated at the Water Treatment Plant during the Construction Phase, or used in milling operations during the Operations Phase. Establishment of selective handling criteria and waste rock management in Alternatives 3 and 4 would effectively eliminate waste rock in impoundment dam construction as a potential source for affecting the quality of streams and groundwater within the analysis area.

8. Based on preliminary design, the Libby Plant Site would not be built with waste rock. If waste rock was not used to build the plant site, waste rock would be eliminated as a potential source of metals and nutrients in infiltration and surface water runoff.

9. As needed to minimize water quality effects on the west side streams, springs and lakes, buffer zones would be maintained near Rock Lake and the Rock Lake Fault. The buffer zone thickness would be reassessed through the use of an updated hydrologic model.

10. After the mine area groundwater model was updated at the end of the Evaluation Phase, MMC would submit an updated mine plan to the agencies for approval. The mine plan would identify two barrier pillars 20 feet wide across the width of the ore body that would be left in place (except for openings needed for access) during the first 5 years of mining until additional refinement of the hydrologic model was completed and the need for barrier pillars was evaluated. By the fifth year of operations, MMC would assess the

need for barrier pillars and/or bulkheads to minimize post-mining changes in East Fork Rock Creek and East Fork Bull River streamflow and water quality. If needed, MMC would submit a revised mine plan to the agencies for approval. Grouting would also be implemented in the mine during construction and operations. These mitigations would be effective in reducing wastewater discharges and the potential risk of post-mining water quality effects on west side streams and Rock Lake.

11. Tailings and reclaimed water pipelines would be buried, which, along with a leak detection system, would be effective in reducing the risk of any tailings or reclaimed water reaching surface water resources.

12. Treating sanitary waste on-site (as described in section 2.5.4.4) and pumping to the tailings impoundment during operations rather than storing and shipping off-site for disposal would effectively reduce the risk of untreated sanitary wastewater reaching surface water or groundwater.

13. MMC would comply with Forest Service policies when disposing of demolition debris during closure. It is Forest Service policy to discourage the disposal of solid waste on National Forest System lands unless such use is the highest and best use of the land. No solid wastes other than waste rock would be buried underground in mined-out areas. Limiting solid waste disposal on National Forest System lands would be effective in minimizing effects on groundwater quality from waste disposal.

14. To further reduce the potential for metals and sediment to reach analysis area streams, ditches and sediment ponds that would contain process water or mine drainage would be designed for a 100-year/24-hour storm (rather than the 10-year/24-hour storm proposed in Alternative 2). This mitigation would be more likely to capture all stormwater containing process water or mine drainage during the life of the project and would be effective in reducing water quality effects on east side streams.

15. In Alternatives 3 and 4, to control dust on mine access roads, MMC would use either a chemical stabilization, groundwater, or segregated mine or adit water with nitrate concentrations of 1 mg/L or less and with concentrations of all other parameters below the mine drainage ELG. This mitigation would be effective in eliminating effects on water quality from dust suppression watering.

16. After the electric transmission line (either the 34.5-kV underground line or the 230-kV overhead line) was operational at the mine site, the operation of the diesel generator at the mill would not exceed 16 hours during any rolling 12-month time period (DEQ 2011a). Tier 4 engines and ultra-low sulfur diesel fuel also would be used in underground mobile equipment. These measures would be effective in reducing nitrogen and sulfur deposition into wilderness lakes.

3.13.4.7 Alternative A – No Transmission Line

In Alternative A, the transmission line, substation, and loop line for the Montanore Project would not be built. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands. Possible impacts on streams due to construction, operations, and maintenance of a new transmission line would not occur.

3.13.4.8 Alternative B – MMC Proposed Transmission Line (North Miller Creek Alternative)

The Ramsey Plant Site's electrical service would be provided via a new, overhead transmission line. MMC's proposed alignment would be in the Fisher River, Miller Creek, Midas Creek, Libby Creek, and Ramsey Creek watersheds. This alternative would create the greatest amount of disturbance close to streams because it would have the highest new road mileage and disturbed acreage in areas with severe erosion risk, high sediment delivery to nearby streams, and greatest slope failure potential (see Table 166, p. 855). Possible sediment sources would include new road construction, existing road upgrades, timber and vegetation clearing, soil salvage, and structure installation. The highest risk of increased sedimentation would occur during the Construction Phase of the transmission line, when vegetation was removed from the transmission line corridor, substation site, and access roads.

Occasional short-term increases in the amount of sediment in analysis area streams would be likely within all watersheds. Alternative B would have the greatest effect within the watersheds of impaired streams (Table 130) and Class 1 streams (Table 131). Alternative B would parallel about 4.7 miles of line in the Fisher River, where soils with severe erosion risk and high sediment delivery are found. Two structures and a new road would be required immediately adjacent to the river near the Fisher River crossing. Clearing for the transmission line would disturb about 82 acres in the watershed, and new or upgraded roads would disturb 2 acres (Table 130). As discussed under Alternative 2, MMC may request and the DEQ may authorize a short-term exemption from surface water quality standards for total suspended sediments and turbidity for construction of the powerline, access roads, and other stream crossings.

Construction of the Sedlak Park Substation and loop line would not affect water quality. The BPA would obtain a general permit from the DEQ for any stormwater discharges. The BPA would prepare and implement a SWPPP during substation and loop line construction to minimize water erosion. The substation site would have a stormwater containment system.

Alternative B line clearing also would disturb 15 acres and 2 acres by new or upgraded roads in the Libby Creek drainage. Tree clearing across Libby Creek would be 150 feet wide. The soils at the Libby Creek crossing have severe erosion risk and high sediment delivery. Libby Creek starting at 1 mile above Howard Creek is listed for alteration in streamside vegetative cover, which could result in additional sediment delivery to the creek, and Libby Creek below the US 2 bridge is listed as impaired for sediment and siltation. To address the sediment TMDL on Libby Creek, MMC would implement BMPs included in the MPDES permit to meet the sediment wasteload allocation of 24 tons/year developed by DEQ for the project.

Table 130. Transmission Line Disturbances in the Watersheds of Impaired Streams.

Criteria	Alternative B North Miller Creek (ac.)	Alternative C-R Modified North Miller Creek (ac.)	Alternative D-R Miller Creek (ac.)	Alternative E-R West Fisher Creek (ac.)
Fisher River Watershed				
Clearing area†	82	21	21	21
New roads + closed roads with high upgrade requirements	2	<1	<1	<1
Libby Creek Watershed				
Clearing area†	15	13	13	13
New roads + closed roads with high upgrade requirements	2	<1	<1	<1

†Acreage is based on a 150-foot clearing width for monopoles (Alternative B) and 200-foot width for H-frame structures (other alternatives except for a short segment of the West Fisher Creek Alternative E-R that has monopoles). Actual acreage cleared would be less than listed and would depend on tree height, slope, and line clearance above the ground.
Source: GIS analysis by ERO Resources Corp. using DEQ data (DEQ 2012b).

Table 131. Transmission Line Disturbances in the Watersheds of Class 1 Streams.

Feature	Alternative B – North Miller Creek (acres)	Alternative C-R – Modified North Miller Creek (acres)	Alternative D-R – Miller Creek (acres)	Alternative E-R – West Fisher Creek (acres)
New/High Upgrade Roads	7	<1	<1	<1
Vegetation Clearing (other than for roads)	107	72	47	47

No Class 2 streams are in the transmission line analysis area.
Source: GIS analysis by ERO Resources Corp. using FWP data.

Table 132. Estimated Sediment Delivery from Roads to Analysis Area Streams for Transmission Line Alternatives.

Phase	Existing Sediment Delivery from Roads to Streams[†] (tons)	Predicted Sediment Delivery from Roads to Streams With Project (tons)	Reduction from Existing Conditions (tons)
Alternative B Roads			
	Without BMPs	***With BMPs***	
Evaluation	7.58	7.58	0.00
Construction	11.37	1.43	9.94
Operations	75.80	75.80	0.00
Closure	7.58	0.95	6.63
Post-closure	11.37	11.37	0.00
Total	**113.70**	**97.13**	**16.57**
Alternative C-R Roads			
	Without BMPs	***With BMPs***	
Evaluation	12.56	12.56	0.00
Construction	18.84	2.26	16.58
Operations	125.60	116.60	9.00
Closure	12.56	1.42	11.14
Post-closure	18.84	17.49	1.35
Total	**188.40**	**150.33**	**38.07**
Alternative D-R Roads			
	Without BMPs	***With BMPs***	
Evaluation	8.92	8.92	0.00
Construction	13.38	1.60	11.78
Operations	89.20	80.20	9.00
Closure	8.92	0.99	7.93
Post-closure	13.38	12.03	1.35
Total	**133.80**	**103.74**	**30.06**
Alternative E-R Roads			
	Without BMPs	***With BMPs***	
Evaluation	14.60	14.60	0.00
Construction	21.90	2.67	19.23
Operations	146.00	134.80	11.20
Closure	14.60	1.69	12.91
Post-closure	21.90	20.55	1.35
Total	**219.00**	**174.31**	**44.69**

[†]Existing sediment delivery to streams is for roads that would be used for transmission line access in Alternatives B, C-R, D-R, or E-R.
Source: KNF 2013.

The KNF's WEPP analysis found that roads proposed for use by Alternative B would deliver, with BMPs, an estimated 97 tons of sediment to streams during the 30-year analysis period, a reduction of 17 tons compared to existing conditions for the same roads without BMPs (Table 132). Mitigation to stabilize existing and new roads would include BMPs, revegetation, and access restrictions. After the 2-year closure period, sediment delivery to streams would return to pre-transmission line conditions. A reduction in sediment is anticipated in the following streams: Fisher River, Howard, Libby, Midas, and Miller creeks (KNF 2013).

Implementation of a SWPPP and use of BMPs, Environmental Specifications, and other design criteria would minimize sediment and dust reaching area streams during construction and decommissioning under most conditions, including large runoff-producing weather events. After construction was completed, disturbed areas would be stabilized and revegetated. Erosion and sediment delivery would decrease after vegetation cover was re-established. The DEQ would require on-site inspections of perennial stream crossings to determine the method that would result in minimizing impacts on stream banks and water quality considering the nature and cost of the available crossing methods.

3.13.4.9 Transmission Line Alternatives C-R, D-R, and E-R

The installation of culverts, bridges, or other structures at perennial stream crossings would be specified by the agencies following on-site inspections with the DEQ, Forest Service, FWP, landowners, and local conservation districts. Installation of culverts or other structures in a water of the United States would be in accordance with the U.S. Army Corps of Engineers 404 and DEQ 318 permit conditions. As discussed under Alternative 2, MMC may request and the DEQ may authorize a short-term exemption from surface water quality standards for total suspended sediments and turbidity for construction of the powerline, access roads, and other stream crossings.

3.13.4.9.1 Alternative C-R

The agencies developed two primary alignment modifications to MMC's proposed North Miller Creek alignment in Alternative B. One modification would be routing the line on an east-facing ridge immediately north of the Sedlak Park Substation instead of following the Fisher River. This modification would reduce potential erosion and sedimentation by crossing less area with soils that are highly erosive soils and those with potential for high sediment delivery and slope failure (see Table 166, p. 855) and locating the line farther from streams and wetlands. The other alignment modification would use an alignment up and over a ridge between West Fisher Creek and Miller Creek, reducing clearing in the West Fisher Creek watershed. Other modifications to the alignment are relatively small shifts along an unnamed tributary to Miller Creek that would locate the line farther from these streams and reduce the likelihood of sediment entering the streams. H-frame structures, which generally allow for longer spans and fewer structures and access roads, would be used on this alternative. In some locations, a helicopter would be used to place the structures. These two modifications would reduce potential impacts on water quality by reducing clearing and disturbance associated with new access roads. For analysis purposes, Alternative C-R would end at the Libby Plant Site proposed in Alternatives 3 and 4. Effects would be slightly greater than discussed below if this alternative were selected with Alternative 2 because the plant site would be in the Ramsey Creek watershed.

New road mileage and disturbed acreage would be less in Alternative C-R than Alternative B (see Table 39, p. 222 in Chapter 2; and Table 166, p. 855). Occasional sediment increases would likely still occur within the streams, but the frequency and magnitude of these increases would be less than in Alternative B. The KNF's WEPP analysis found that roads proposed for use by Alternative C-R, with BMPs, would deliver an estimated 150 tons of sediment to streams during the 30-year analysis period, a reduction of 38 tons from existing conditions for the same roads without BMPs (Table 132). Mitigation to stabilize existing and new roads would include BMPs, revegetation, and access restrictions. A reduction in sediment is anticipated in the following streams: Fisher River, Hunter, Libby, Midas, and Miller creeks (KNF 2013).

Alternative C-R would have fewer disturbances in the watersheds of impaired streams than Alternative B (Table 130). Clearing for the transmission line would disturb 21 acres in the Fisher River watershed and 13 acres in the Libby Creek watershed. Tree clearing across Libby Creek would be about 200 feet wide. New or upgraded roads would disturb less than an acre in both watersheds.

3.13.4.9.2 Alternative D-R

Like the Modified North Miller Creek Alternative, this alternative modifies MMC's proposed North Miller Creek Alignment by routing the line on an east-facing ridge immediately north of the Sedlak Park Substation. The crossing of the Fisher River and West Fisher Creek also would be the same as Alternative C-R. Compared to the other alternatives, this alignment would cross less area with soils that are highly erosive soils and those with potential for high sediment delivery and slope failure, reducing the potential for increased sediments in nearby streams (Table 166, p. 855). H-frame structures, which generally allow for longer spans and fewer structures and access roads, also would be used on this alternative, reducing clearing associated with new access roads and potential erosion. For analysis purposes, Alternative D-R would end at the Libby Plant Site proposed in Alternatives 3 and 4. Effects would be slightly greater than discussed below if this alternative were selected with Alternative 2 because the plant site would be in the Ramsey Creek watershed.

New road mileage and disturbed acreage would be less in Alternative D-R than Alternative B (Table 166, p. 855). Occasional sediment increases would likely still occur within the streams, but the frequency and magnitude of these increases would be less than in Alternative B. The KNF's WEPP analysis found that roads proposed for use by Alternative D-R, with BMPs, would deliver an estimated 104 tons of sediment to streams during the 30-year analysis period, a reduction of 30 tons compared to existing conditions for the same roads without BMPs (Table 132). Mitigation to stabilize existing and new roads would include BMPs, revegetation, and access restrictions. A reduction in sediment is anticipated in the following streams: Fisher River, Howard, Hunter, and Miller creeks (KNF 2013).

Effects of Alternative D-R on Class I watersheds and watersheds of impaired streams would be the same as Alternative C-R (Table 130; Table 131). The agencies' mitigation of road closures would reduce the contribution of additional sediment to below existing levels in the Libby Creek watershed. Other effects of Alternative D-R would be the same as Alternative B.

3.13.4.9.3 Alternative E-R

Like the Modified North Miller Creek Alternative, this alternative modifies the North Miller Creek Alternative by routing the line on an east-facing ridge immediately north of the Sedlak Park Substation. The crossing of the Fisher River and West Fisher Creek also would be the same as Alternative C-R. Effects of Alternative E-R on Class I watersheds and watersheds of impaired streams would be the same as Alternative D-R (Table 130; Table 131).

H-frame structures, which generally allow for longer spans and fewer structures and access roads, would be used on this alternative in most locations. In some locations, a helicopter would be used to place the structures. These two modifications would reduce potential impacts on water quality by reducing clearing associated with new access roads. For analysis purposes, Alternative E-R would end at the Libby Plant Site proposed in Alternatives C-R and D-R. Effects would be slightly greater than discussed below if this alternative were selected with Alternative B.

New road mileage and disturbed acreage would be less in Alternative E-R than Alternative B (Table 166, p. 855). Occasional sediment increases would likely still occur within the streams, but the frequency and magnitude of these increases would be less than in Alternative B. The KNF's WEPP analysis found that roads proposed for use by Alternative E-R would deliver an estimated 174 tons of sediment to streams during 30-year analysis period, a reduction of 45 tons compared to existing conditions for the same roads without BMPs (Table 132). Mitigation to stabilize existing and new roads would include BMPs, revegetation, and access restrictions. A reduction in sediment is anticipated in the following streams: Fisher River, Howard, Hunter, Miller, Standard and West Fisher creeks (KNF 2013).

3.13.4.10 Cumulative Effects

Past and current actions, particularly timber harvest, road construction, and mining, have altered surface water quality in the area by increasing sedimentation, destabilizing stream channels and removing streamside vegetation. The DEQ's listing of impaired streams indicates Libby Creek between Howard Creek and the US 2 bridge is impaired due to alteration in stream-side or littoral vegetative covers, and physical substrate habitat alterations. Probable sources of impairment were impacts from abandoned mine lands and historic placer mining. The lower segment begins at the US 2 bridge and is impaired for sediment and siltation. Past activities have also impaired water quality in segments of the Fisher River, Rock Creek, and East Fork Rock Creek.

Suction dredging activities are currently permitted in the Libby Creek drainage. Monitoring by the KNF indicates limited sediment increases in the stream below dredging operations. At low flows, pools tend to accumulate sediment that is transported as bedload. Deposition of bedload would be more pronounced near the dredging sites. Unless substantial bank erosion occurs, increased sediment transport is limited because the overall sediment load delivered to the channel remains the same, and the effects downstream are probably minor (KNF 2007c). Other human activities that may impair surface water quality include septic field installation, livestock grazing, new roads, and other construction. Stream channel and bank stabilization or restoration projects may improve stream water quality.

The Miller-West Fisher Vegetation Management Project consists of commercial timber harvest, pre-commercial thinning and prescribed fire, access management changes, trail construction and improvement, treatment of fuels in campgrounds, and watershed rehabilitation activities in the Miller, Silver Butte, and West Fisher Creek watersheds. If timber harvest activities occurred during the transmission line construction, the two projects may cumulatively increase sediment in Miller Creek or West Fisher Creek over the short term, depending on the transmission line alignment. Road and access management, and watershed condition improvements proposed in the Miller-West Fisher Vegetation Management Project would minimize adverse cumulative effects on surface water quality. Stabilization of streambanks in West Fisher Creek and Montanore road closures in Alternatives C-R, D-R and E-R would cumulatively reduce sediment delivery in West Fisher Creek over the long term.

The proposed Wayup Mine in upper West Fisher Creek and the Libby Creek Ventures drilling plan adjacent to Upper Libby Creek Road would have negligible cumulative effect on water quality. The Montanore and Rock Creek Projects would cumulatively reduce streamflow in Rock Creek and East Fork Bull River. Mine dewatering and the resulting drawdown of bedrock groundwater may subtly change the water quality of the East Fork Rock Creek and East Fork Bull River.

3.13.4.11 Regulatory/Forest Plan Consistency

This section discusses compliance with applicable laws and regulations regarding changes in water quality. Section 3.11.4.10, *Regulatory/Forest Plan Consistency* in the previous *Surface Water Hydrology* section discusses compliance with laws and regulations regarding changes in streamflow and floodplains.

3.13.4.11.1 Organic Administration Act and Forest Service Locatable Minerals Regulations

The Forest Service is responsible for ensuring that mine operations on National Forest System lands comply with Forest Service locatable mineral regulations (36 CFR 228 Subpart A) for environmental protection. One of these regulations (36 CFR 228.8) requires that mining activity be conducted, where feasible, to minimize adverse environmental impacts on National Forest surface resources. 36 CFR 228.8 also requires that mining operators comply with applicable state and federal water quality standards including the Clean Water Act; comply with applicable Federal and State standards for the disposal and treatment of solid wastes; take all practicable measures to maintain and protect fisheries and wildlife habitat which may be affected by the operations; construct and maintain all roads so as to assure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water, and other resource values; and reclaim the surface disturbed in operations by taking such measures as preventing or controlling onsite and off-site damage to the environment and forest surface resources.

The BPA's Sedlak Park Substation and loop line would be on private land and would not be subject to compliance under the Organic Administration Act and Forest Service locatable minerals regulations.

Minimize Adverse Environmental Impact (36 CFR 228.8)

Alternative 2 would have a disturbance area of 2,582 acres. The disturbance area of Alternative 4, which would have a tailings impoundment at the same location as Alternative 2, would be smaller than Alternative 2 by 658 acres by eliminating the LAD disturbance area and minimizing the disturbance area around the tailings impoundment. The disturbance area of Mine Alternative 3 would be the smallest. Because the clearing width for Transmission Line Alternative B would be narrower than the agencies' transmission line alternatives, the maximum clearing width for Alternative B would be less than the agencies' alternatives. Clearing associated with the agencies' transmission line alternatives would be minimized through the development and implementation of a Vegetation Removal and Disposition Plan. The agencies' transmission line alternatives would have less clearing and new road development in the watersheds of impaired streams, in watersheds of Class 1 streams, and on soils with severe erosion risk, high sediment delivery, and slope failure. The predicted delivery of sediment to project area streams from roads in the agencies' mine and transmission line alternatives would be less than in MMC's alternatives. All mine and transmission line alternatives would include the use of BMPs to minimize erosion and effects on surface water quality. The agencies' alternatives would include more frequent BMP monitoring than MMC's alternatives. In summary, Mine Alternative 2 and Transmission Line

Alternative B would not fully comply with 36 CFR 228.8 because MMC did not propose to implement feasible measures to minimize the disturbance area and adverse environmental impacts on surface water quality. Mine Alternatives 3 and 4 Transmission Line Alternatives C-R, D-R, and E-R would comply with 36 CFR 228.8 because the modifications to the disturbance area are feasible and would minimize adverse environmental impacts on surface water quality.

In Alternative 2, MMC proposed to use land application for its primary water treatment method. If land application of excess water resulted in BHES Order limit or nondegradation criteria exceedances, MMC would treat the additional water at the Water Treatment Plant instead of discharging it to the LAD Areas. The agencies' analysis of MMC's proposed plans for land application of excess water predicted, without additional primary treatment before land application, concentrations would be greater than BHES Order limits or applicable nondegradation criteria in groundwater beneath the LAD areas and in surface water in Ramsey, Poorman, and Libby creeks. The agencies' analysis also indicated that tailings water in Alternative 2 would reach surface water without pumpback wells. Any exceedances of BHES Order limits or applicable nondegradation criteria would not comply with state and federal water quality standards. MMC committed to implementing seepage control measures, such as pumpback recovery wells, if required to comply with applicable standards.

The agencies' mitigation in Alternatives 3 and 4 (using a water treatment plant for all discharges, modifying the existing treatment plant to treat nitrogen compounds (primarily nitrates and ammonia), phosphorus, and possibly dissolved metals, increasing the capacity of the existing treatment plant, and requiring a pumpback well system around the impoundment) would minimize changes in water quality in Libby Creek and eliminate changes in water quality of Ramsey and Poorman Creek. In Alternatives 3 and 4, the operation of the diesel generator at the mill site would not exceed 16 hours during any rolling 12-month time period after the electric transmission line was operational. Tier 4 engines and ultra-low sulfur diesel fuel also would be used in underground mobile equipment. These measures would minimize nitrogen and sulfur deposition into wilderness lakes. Alternative 2 would not fully comply with 36 CFR 228.8 because MMC did not propose to implement feasible measures to minimize adverse environmental impacts on surface water quality and fisheries habitat. Alternatives 3 and 4 would comply with 36 CFR 228.8 because the proposed water treatment modifications are feasible and would minimize adverse environmental impacts on surface water quality and fisheries habitat.

Ditches and sediment ponds that would contain process water or mine drainage would be designed in Alternative 2 for a 10-year/24-hour storm. In Alternatives 3 and 4, the ditches and sediment ponds would be designed for a 100-year/24-hour storm. The larger conveyance capacity would more likely capture all stormwater containing process water or mine drainage during the life of the project and would minimize water quality effects on east side streams and fisheries habitat.

In Alternatives 3 and 4, runoff from the reclaimed tailings impoundment would be directed toward Little Cherry Creek instead of Bear Creek proposed in Alternative 2. As part of the final closure plan, MMC would complete a H&H analysis of the proposed runoff channel during final design that would include a channel stability analysis and a sediment transport assessment. The runoff channel would be designed to minimize adverse effects of increased streamflow on Little Cherry Creek water quality and fisheries habitat.

Waste rock management would not comply with 36 CFR 228.8 in Alternative 2. Waste rock would be temporarily stored at an unlined area in the LAD Area 1, Libby Adit Site, and/or Ramsey Adit portal, or hauled to the tailings impoundment area and then used in the impoundment dam. In Alternative 2, the Ramsey Plant site would be constructed of waste rock and be sited in a RHCA. In Alternatives 3 and 4, waste rock would be stored temporarily in lined stockpiles, hauled to a lined location within impoundment footprint, and then used in impoundment dam. The Libby Plant Site in Alternatives 3 and 4 would not be built with waste rock and waste rock would be eliminated as a potential source of metals and nutrients in infiltration and surface water runoff. Alternatives 3 and 4 would comply with 36 CFR 228.8 because the proposed waste rock modifications are feasible and would minimize adverse environmental impacts on surface water quality and fisheries habitat.

State and Federal Water Quality Standards (36 CFR 228.8(b))

In Alternative 2, MMC proposed to use land application for its primary water treatment method. If land application of excess water resulted in BHES Order limit or nondegradation criteria exceedances, MMC would treat the additional water at the Water Treatment Plant instead of discharging it to the LAD Areas. MMC committed to implementing seepage control measures, such as pumpback recovery wells, in Alternative 2 if required to comply with applicable standards. The agencies' analysis of MMC's proposed plans for land application of excess water predicted, without additional primary treatment before land application, concentrations would be greater than BHES Order limits or applicable nondegradation criteria in groundwater beneath the LAD areas and in surface water in Ramsey, Poorman, and Libby creeks. The agencies' analysis also indicated that tailings water in Alternative 2 would reach surface water without pumpback wells. Any exceedances of BHES Order limits or applicable nondegradation criteria would not comply with state and federal water quality standards. Alternative 2 would have a greater risk of not complying with state and federal water quality standards than Alternatives 3 or 4.

The agencies' mitigation in Alternatives 3 and 4 (using a water treatment plant for all discharges, modifying the existing treatment plant to treat nitrogen compounds (primarily nitrates and ammonia) and possibly dissolved metals, increasing the capacity of the existing treatment plant, and requiring a pumpback well system around the impoundment) are designed to minimize changes in surface water quality in the Libby Creek watershed, eliminate changes to groundwater quality by avoiding land application, and ensure compliance with State and Federal water quality standards. The agencies' alternatives expanded MMC's proposed monitoring plans and would include action levels for specific parameters (see Appendix C). Compliance with state and federal water quality standards is discussed below under the Clean Water Act and the Montana Water Quality Act.

Solid Waste Disposal (36 CFR 228.8(c))

All mine and transmission line alternatives would comply with applicable Federal and State standards for the disposal and treatment of solid wastes. All mine alternatives would dispose of tailings and reclaim the tailings impoundment in a manner to minimize adverse impact on the environment and forest surface resources. All mine and transmission line alternatives would comply with the applicable portions of 36 CFR 228.8(c) regarding compliance with federal and state standards for solid waste and tailings disposal. In Alternative 2, MMC would occasionally bury certain wastes underground in mined-out areas. In the agencies' mine and transmission line alternatives, MMC would comply with Forest Service policies when disposing of demolition debris during closure. The agencies' transmission line alternatives would comply with the

Environmental Specifications (Appendix E) regarding solid waste disposal. It is Forest Service policy (FSM 2130) to discourage the disposal of solid waste on National Forest System lands unless such use is the highest and best use of the land. No solid wastes other than waste rock would be buried underground in mined-out areas. Reinforced concrete foundation materials may be buried on National Forest System lands only under certain conditions. These measures would minimize the impact on the environment and forest surface resources. The plans for waste disposal in the agencies' alternatives would comply with 36 CFR 228.8(c).

Fisheries and Wildlife Habitat (36 CFR 228.8(e))

The differences in water treatment methods between Alternative 2 and Alternatives 3 and 4 were discussed in the above section. The agencies' analysis of MMC's proposed plans for land application of excess water predicted, without additional primary treatment before land application, water quality concentrations would be greater than BHES Order limits or applicable nondegradation criteria in surface water in Ramsey, Poorman, and Libby creeks, which would adversely affect fisheries habitat. Alternative 2 would have a greater risk of not complying with 36 CFR 228.8(e) as it applies to water quality than Alternatives 3 or 4.

The above section discussed the differences in the disturbance area, clearing, road construction, and post-closure runoff from the impoundment between the MMC's alternatives and the agencies' alternatives. These modifications in the agencies' alternatives are practicable measures to maintain and protect fisheries. MMC's mitigation plans contained limited measures to protect fisheries habitat from changes in streamflow. The agencies' alternatives would create or secure genetic reserves through bull trout transplanting or habitat restoration; rectify factors that are limiting the potential of streams to support increased production of bull trout; and eradicate non-native fish species, especially brook trout that are a hybridization threat to bull trout.

Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8(e) because MMC did not propose to implement practicable measures to minimize adverse environmental impacts on surface water quality and fisheries habitat. Mine Alternatives 3 and 4 Transmission Line Alternatives C-R, D-R, and E-R would comply with 36 CFR 228.8(e) because the changes in disturbance area, clearing, road construction, and post-closure runoff from the impoundment are practicable and would minimize adverse environmental impacts on surface water quality and fisheries habitat.

Roads (36 CFR 228.8(f))

The following discussion applies to the requirements of 36 CFR 228.8(f) as they apply to surface water quality. Compliance with 36 CFR 228.8(f) regarding roads management is discussed in section 3.6.4.11.4, *National Forest Management Act/Kootenai Forest Plan* (RF-2 through RF-5), beginning on page 453.

In all mine and transmission line alternatives, roads would be constructed and maintained to ensure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water, and other resource values. The Environmental Specifications describe how transmission line roads would be constructed and maintained to ensure adequate drainage and to minimize or eliminate damage to resource values. The agencies' transmission line alternatives would have less new road development in the watersheds of impaired streams, in watersheds of Class 1 streams, and on soils with severe erosion risk, high sediment delivery, and slope failure. The predicted delivery of sediment from roads to streams in the agencies' mine and transmission line alternatives would be less than in MMC's alternatives. At the end of operations, all mine and transmission line alternatives would have roads no longer needed for operations. The agencies' mitigation provides more specificity regarding management of roads no longer needed for operations. Such roads would be placed either in intermittent stored service or decommissioned. Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8(f) as it relates to water quality because MMC did not propose to implement practicable measures to minimize adverse environmental impacts on surface water quality and fisheries habitat. Mine Alternatives 3 and 4 Transmission Line Alternatives C-R, D-R, and E-R would comply with 36 CFR 228.8(f) as it relates to water quality.

Reclamation (36 CFR 228.8(g))

The following discussion applies to the reclamation requirements of 36 CFR 228.8(g) as they apply to surface water quality. Compliance with 36 CFR 228.8(g) regarding reclamation requirements is discussed in section 3.19.4.6 under *Soils and Reclamation*, p. 872. All mine and transmission lines alternative would comply with the requirements of 36 CFR 228.8(g) regarding controlling erosion, controlling surface water runoff, and isolating toxic materials. Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8(g) to implement practicable measures to prevent or control onsite and off-site damage to the environment and forest surface resources. MMC did not propose to implement practicable measures to minimize erosion and maximize reclamation success. The agencies' alternatives would include developing and implementing a final Road Management Plan and a Vegetation Removal and Disposition Plan; increasing the salvage and replacement of suitable soil materials for reclamation; removing a majority of coniferous forest debris removed before soil removal; consolidating soil stockpiles and reclaiming them incrementally; and salvaging disturbed wetland soils for use in constructing new wetlands. These measures would minimize erosion and ensure reclamation success. The agencies' alternatives would comply with 36 CFR 228.(g) as it relates to water quality.

3.13.4.11.2 Clean Water Act and Montana Water Quality Act

The Forest Service is responsible for ensuring that mine operations on National Forest System lands comply with Forest Service locatable mineral regulations (36 CFR 228 Subpart A) for environmental protection. Operators must comply with applicable federal and state water quality standards, including regulations issued pursuant to the Clean Water Act. The DEQ is responsible for ensuring all mine operations comply with the Montana Water Quality Act and its implementing rules.

The BPA is responsible for ensuring construction and operation of the Sedlak Park Substation and loop line comply with the Clean Water Act and the Montana Water Quality Act. Construction and operation of the Sedlak Park Substation and loop line would comply with the Clean Water Act and the Montana Water Quality Act. The BPA would prepare and implement a SWPPP during substation and loop line construction to minimize water erosion.

The above section discussed the differences in disturbance area, clearing, road construction, and post-closure runoff from the impoundment between the MMC's alternatives and the agencies' alternatives. The modifications in the agencies' alternatives are practicable measures to reduce nonpoint source pollution. All mine and transmission line alternatives would include the use of BMPs to minimize erosion and effects on surface water quality. The agencies' alternatives would include more frequent BMP monitoring than MMC's alternatives. All mine and transmission line alternatives would comply with the USDA Nonpoint Source Water Quality Policy Directive 9500-007.

In Alternative 2, MMC proposed to use land application for its primary water treatment method. If land application of excess water resulted in BHES Order limit or nondegradation criteria exceedances, MMC would treat the additional water at the Water Treatment Plant instead of discharging it to the LAD Areas. MMC committed to implementing seepage control measures, such as pumpback recovery wells, in Alternative 2 if required to comply with applicable standards. The agencies' analysis of MMC's proposed plans for land application of excess water predicted, without additional primary treatment before land application, concentrations would be greater than BHES Order limits or applicable nondegradation criteria in groundwater beneath the LAD areas and in surface water in Ramsey, Poorman, and Libby creeks. The agencies' analysis also indicated that tailings water in Alternative 2 would reach surface water without pumpback wells. Any exceedances of BHES Order limits or applicable nondegradation criteria would not comply with the Clean Water Act or the Montana Water Quality Act. Any tailings water reaching surface water would not comply with the ELGs promulgated under Clean Water Act. Alternative 2 would have a greater risk of not complying with the Clean Water Act or the Montana Water Quality Act than Alternatives 3 or 4.

The agencies' mitigation in Alternatives 3 and 4 (using a water treatment plant for all discharges, modifying the existing treatment plant to treat nitrogen compounds (primarily nitrates and ammonia), phosphorus, and possibly dissolved metals, increasing the capacity of the existing treatment plant, and requiring a pumpback well system around the impoundment) are designed to minimize changes in water quality in Libby Creek, eliminate changes in water quality of Ramsey and Poorman Creek, eliminate changes to groundwater quality at the LAD areas, and ensure compliance with the Clean Water Act and the Montana Water Quality Act. The agencies' alternatives expanded MMC's proposed monitoring plans and included action levels for specific parameters (see Appendix C).

The DEQ will discuss compliance with applicable water quality regulations including the ELGs and nondegradation rules in the ROD and the Statement of Basis for the MPDES permit renewal. Unless the DEQ waives its issuance, a 401 certification from the Montana DEQ would certify that MMC's proposed discharges of fill permitted under a Section 404 permit are in compliance with all applicable water quality requirements of the Clean Water Act. Unless the 401 certification is waived, the mining operator must give a copy of the 401 certification to the Forest Service before the KNF would authorize MMC to commence any activity that requires a 404 permit.

36 CFR 228.8(h) states that "certification or other approval issued by state agencies or other federal agencies of compliance with laws and regulations relating to mining operations will be accepted as compliance with similar or parallel requirements of these regulations." DEQ's permit decision and associated conditions on the MPDES permit renewal, DEQ's decision and associated conditions on the 401 certification, and any other state water quality permit would constitute compliance with Montana water quality requirements and Clean Water Act requirements regarding water quality.

3.13.4.11.3 Kootenai Forest Plan

Alternative 2 would have a greater risk of not comply with the KFP than Alternatives 3 or 4. The agencies' analysis of MMC's proposed plans for land application of excess water indicated they would result in water quality standard exceedances without additional pretreatment. The agencies' analysis also indicated that tailings water in Alternative 2 would reach surface water without pumpback wells. Alternative 2 would have a greater risk of exceeding water quality standards than Alternatives 3 or 4. In Alternatives 3 and 4, all water would be treated at a water treatment plant before discharge and would be required to meet water quality standards. All mine and transmission line alternatives would comply with the KFP standard to use soil and water conservation practices and BMPs to minimize nonpoint source pollution. The agencies' alternatives would include more frequent BMP monitoring than MMC's alternatives.

3.13.4.12 Irreversible and Irretrievable Commitments

Water quality impacts resulting from mine inflows post-mining would be an irreversible commitment of surface water resources.

3.13.4.13 Short-Term Uses and Long-Term Productivity

Any change in stream water quality due to discharging mine water to area streams would be a short-term use of the resource. Changes that may occur that would affect the long-term productivity of surface water resources in terms of water quality are water quality changes that may occur due to loss of deep groundwater supply to streams, springs, and lakes.

3.13.4.14 Unavoidable Adverse Environmental Effects

If less groundwater were contributed to Rock Lake, the lake total dissolved solids, silica (needed by diatoms), and nutrient concentrations may decrease in the lake.

3.14 Geotechnical Engineering

This section discusses the lead agencies' analysis of the risk of subsidence in the underground mine, and the stability of the tailings impoundment for Alternatives 2 and 4 (Little Cherry Creek) and Alternative 3 (Poorman). Also included in this section is a comparison of the two alternative tailings sites.

3.14.1 Analysis Area and Methods

Subsidence as related to mining is the downward displacement of the ground surface resulting from the collapse of underground mine workings. The vertical displacement and areal extent of the surface subsidence is related to the size of the underground mine void, its depth below the ground surface, and the area over which the underground collapse has occurred. For this analysis, the area for the subsidence evaluation is the area overlying the Montanore ore body.

Current subsidence prediction and evaluation methods depend on past experience and observed behavior from historical subsidence events. One approach examines the ability of the in place rock to remain stable over a mined-out void, or conversely stated, determining under what conditions rock will fail and collapse into the mined void. This analysis method is suitable for chimney-type failures where the failure process is confined to a relatively narrow chute and the resulting surface subsidence is manifested by sinkholes. MMC used this approach in their subsidence evaluation (Call & Nicholas, Inc. 2005a) by examining the ability and likelihood for there to be sustained caving of rock between the underground workings and the ground surface, which if occurs, would result in subsidence. This analysis method is often used in the design of mines dependent on caving as the ore extraction technique. The lead agencies evaluated the results of MMC's analysis for chimney subsidence, but used a different approach by determining whether the underground pillars were adequately sized to prevent collapse of the underground workings (Agapito Associates, Inc. 2007b). If enough of the pillars fail, the excess weight transferred to adjacent pillars can cause a chain-reaction of pillar failure known as cascading pillar failure. Cascading pillar failure frequently results in surface subsidence over a far greater area (trough subsidence) than what is generated by a chimney-type failure. Evaluating whether mine pillars are adequately sized is also a commonly used technique in underground mine design.

In addition, the agencies performed a Failure Mode and Effects Analysis (FMEA) following methods used by Klohn Crippen (1998, 2005) for the Rock Creek Project to assess the risk of subsidence. The FMEA took into account Troy Mine subsidence experience. Because of similarities between the Montanore and Rock Creek projects, the Rock Creek Project underground mine FMEA is pertinent to the Montanore Project as well.

The analysis area for the impoundment stability analysis is Little Cherry Creek in Alternatives 2 and 4, and between Poorman and Little Cherry creeks in Alternative 3. Klohn Crippen (2005) updated the original design of the proposed Little Cherry Creek tailings impoundment and all associated facilities, incorporating new data on seismicity, ground conditions and seepage parameters since the NMC design from the 1990s, and making design changes required by the lead agencies in their 1992 project approvals. The lead agencies developed a design for an alternative Poorman Tailings Impoundment Site between Poorman and Little Cherry creeks in Alternative 3 in sufficient detail to analyze its effects in the EIS.

3.14.2 Affected Environment

3.14.2.1 Seismicity and Seismic Hazard

The analysis area is located at the northern end of the Intermountain Seismic Belt, which extends from southern Nevada northward through Utah and eastern Idaho and western Montana. In western Montana, the Intermountain Seismic Belt is up to 62 miles wide. The Intermountain Seismic Belt is characterized by moderate to large earthquakes with shallow focal depths. The vast majority of historical seismic activity within western Montana has been concentrated along the Intermountain Seismic Belt (Klohn Crippen 2005)

The seismic analysis for the tailings impoundment employed a deterministic approach by using a known active fault as the source of the seismic event, assigning an earthquake magnitude, and calculating a resulting ground motion at the tailings impoundment site. Five faults identified as being potentially active in the last 1.6 million years are located within 50 miles of the impoundment sites. The closest known potentially active fault to the analysis area is the Bull Lake Fault, located about 12 miles west of the project site. The Bull Lake Fault was used to estimate the site seismicity and is summarized in Table 133 (Klohn Crippen 2005). The site is located in a moderately active seismic area. The design maximum credible earthquake (MCE) is a potential Magnitude 7.0 earthquake on the Bull Lake Fault, which results in a peak ground acceleration of 0.22 g. The fault is part of a series of northwest-southeast trending faults, although the activity along the fault is uncertain. Larger faults, which typically are associated with larger seismic events, are located farther away and do not control the design seismicity. The Bull Lake Fault is unlikely to affect any of the transmission line alignments or the Sedlak Park Substation and loop line.

Table 133. Maximum Credible Earthquake and Site Seismicity.

Parameter	Value
Magnitude (M)	M7.0
MCE Assumed Epicentral Distance	12 miles (19 km)
Source	Bull Lake Fault, classified as later Quaternary, <700,000 years old and potentially active
Peak Bedrock Acceleration (average from attenuation relations)	0.22 g(*) (average from attenuation relations)
Duration of Significant Shaking	27 seconds

*g = gravitational acceleration (32.2 ft/sec^2).
Source: Klohn Crippen 2005.

3.14.2.2 Avalanches and Landslides

Numerous avalanche chutes occur in both upper Libby Creek and Ramsey Creek valleys. The only facility within an avalanche chute path is the Libby Adit Site (Figure 48). Three avalanche chutes are near the Libby Adit Site. The Upper Libby Adit Site, proposed in Alternative 3, is between two avalanche chutes. Because of the high elevation of the chute tops and the narrow widths of the valleys below, avalanches can cross valleys and move up the opposite side.

No landslides or unstable slopes were identified near mine facilities, along the transmission line alignments, or near the Sedlak Park Substation and loop line. Fine-grained soils derived from glaciolacustrine silts and clays are susceptible to slope failures if undercut. Section 3.19.3.1.2, *Glaciolacustrine Soils* discusses these soils in more detail.

3.14.3 Environmental Consequences

3.14.3.1 Subsidence

3.14.3.1.1 Alternative 1 – No Mine

No mining would occur; therefore, the potential for mining-related subsidence would not be present. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Potential subsidence from the Libby Adit would be mitigated by backfilling the entire adit length that occurs in unconsolidated bedrock.

3.14.3.1.2 Alternative 2 – MMC's Proposed Mine

Summary

The lead agencies' evaluation (Agapito Associates, Inc. 2007b) concluded that chimney subsidence breaching the surface to form sinkholes is unlikely given the geotechnical setting (thickness of the overlying rock above the mine workings, and the strength of the overlying rock) and the mine plan proposed by MMC. Isolated roof failure and chimney subsidence to some height above the workings is likely, and could lead to increased rock fracturing and higher groundwater hydraulic conductivity within the overlying strata. The evaluation also estimated that chimney subsidence impacts on groundwater may occur up to about 400 feet above the mine workings. The agencies' evaluation concluded that trough subsidence, while not likely, cannot be entirely dismissed at the current level of design.

Introduction

Underground mining causes a redistribution of stress, which in turn causes displacements in the affected strata. Subsidence is the result of downward displacement of the rock mass from closure or collapse of underground openings. The terms "subsidence" and "surface subsidence" are generally used interchangeably; subsidence has the potential to affect groundwater where it is encountered, even where subsidence has not progressed to the surface.

The magnitude and extent of mining-induced subsidence are directly related to the type and extent of the mining activity. In partial-extraction mining (such as the room-and-pillar method proposed for the Montanore Project), rock strength is estimated and pillars are sized and left permanently to support the overburden, so that subsidence is not planned to occur during active mining. The complex interaction of rock strength, zones of structural weakness, local and regional tectonic forces, and gravity make accurate projections on the likelihood of subsidence very difficult. A stable underground environment during the mining process, could over time become unstable due to some triggering event or changed ground condition. Subsidence after mine abandonment due to time-dependent pillar, roof, or floor failure may still occur and may be the dominant form of subsidence in room-and-pillar mining even in the absence of secondary pillar recovery (Singh 1992). Further, residual subsidence may occur tens or even hundreds of years after active mining (Thorburn and Reed 1977; Mahar and Marino 1981). It is difficult to know if and when conditions will change sufficiently to initiate collapse of underground workings which could lead to surface subsidence.

The two major modes of subsidence associated with mining are chimney subsidence and trough subsidence. Chimney subsidence is associated with roof collapse over small areas, such as individual drifts (Figure 77). Mining through structural weaknesses zones such as a faults can trigger and increase the height of chimney subsidence. Two chimney subsidence events that resulted in sinkholes at the Troy Mine have been reported (Tetra Tech and R Squared 2006). The collapsing rock strata cave progressively upward toward the surface in a chimney-like fashion until either the increased volume of the caved material arrests cave progression, or caving breaches the surface. If chimney subsidence breaches the surface, a sinkhole is formed. Trough subsidence, in which a subsidence basin is formed above caved and sagging strata, occurs over larger areas (*e.g.*, many acres) and is associated with wide-scale pillar, roof, or floor failure.

Geologic Setting

The ore deposit at Montanore occurs in two nearly parallel zones within the lower Revett Formation, part of the Belt Supergroup. The average thickness of the Zone 1 is 30 feet and Zone 2 averages 34 feet. A barren lead zone, ranging in thickness from 0 to 200 feet and averaging about 30 feet, separates the two ore zones. The ore body lies on the lower limb of an overturned syncline (Figure 63) that plunges to the northwest. The syncline is bounded to the west by the Rock Lake Fault, a steeply dipping normal fault, and to the east by the Libby Lake Fault. Ore body dip follows the northwest plunge of the syncline, and ranges from about 5° to 50°. Dimensions of the ore body are about 2,000 feet wide by 11,000 feet long. The thickness of the unmineralized zone overlying the ore body ranges from zero (0) feet at the outcrop at Rock Lake to about 3,800 feet near Libby Lakes (Agapito Associates, Inc. 2007b). Most of the ore body is overlain by between 2,000 and 3,500 feet of cover.

The lower Revett Formation consists primarily of quartzite with some siltite and silty quartzite beds. In addition to the Revett Formation, overlying rocks belong to the St. Regis and Wallace formations. The St. Regis Formation consists of siltites and argillites with some quartzite. The Wallace Formation consists of argillite, siltite, limestone, and dolomitic quartzite. Additional information about the geology of the mine area is found in section 3.9, *Geology and Geochemistry.*

Several lakes exist over or adjacent to the ore body, including Rock Lake on the extreme southern end of the deposit (the ore body outcrops beneath and near Rock Lake), St. Paul Lake on the northern end, and the Libby Lakes near the eastern boundary. Additional information about the surface water resources in the mine area is found in section 3.11.3, *Affected Environment.*

Two other economic copper/silver deposits exist in the general vicinity of the Montanore Project. The Troy Mine (Spar Lake deposit) was permitted in 1979 and was in production until 1993. In late 2004, the Troy Mine was brought back into production. In December 2012, Revett suspended all underground mining activities following back and pillar failures in both the north and south ore bodies in the Middle Quartzite of the Revett Formation that manifested as surface cracking and shallow subsidence (Call & Nicholas 2014). The Rock Creek Project is west of the Montanore Project; the KNF currently is conducting additional environmental analysis of the project (see section 3.3.2.1, *Rock Creek Project*). Although the lithology and mineralogy of the ore zones of the Spar Lake, Rock Lake and Rock Creek deposits are similar, there are significant differences in the character of the sediments overlying the deposits (Tetra Tech, Inc. and R

Squared Incorporated 2006). Continental glaciation in the vicinity of the Troy Mine has resulted in unconsolidated sediments up to 70 feet thick, whereas the Rock Lake and Rock Creek deposits typically has little unconsolidated sediment overlying the bedrock.

MMC's Plan to Minimize Subsidence

MMC has indicated that pillar and opening dimensions would be designed with the goal of preventing surface subsidence. Spans of about 40 feet to 45 feet are planned. A pillar design study (Call & Nicholas 2005a) recommended 62-foot-long pillars, 40-foot-wide openings, and pillar widths varying from 19.5 feet to 49 feet, including 2 additional feet of both width and length to compensate for blast damage. These pillar widths were based on the Wilson pillar design approach (Wilson 1972) and a 1.3 safety factor. Required pillar widths would increase with cover depth (the amount of rock overlying the mine) and pillar height. The Call & Nicholas pillar design study provided for a cover range of 1,000 feet to 3,800 feet. As part of the Libby Adit Evaluation Phase, MMC would conduct additional underground core drilling before developing final mine plans. The drilling would be used to collect detailed information on underground geologic structures, ore thicknesses, ore grades, and hydrology. MMC did not explicitly eliminate the possibility of secondary recovery, or "pillar robbing," at the end of mining, which, if conducted, would increase subsidence risk. Any change to the final mine plan would require the agencies' approval. Additional information about MMC's mine plan is discussed in section 2.4.2.1*, Mining*.

To reduce possible subsidence risk and the interception of groundwater in the potential subsidence area, MMC plans to observe a 500-foot vertical and horizontal buffer zone where the mineralized ore horizon outcrops near Rock Lake. In addition, a 100-foot barrier pillar is planned as a buffer to the Rock Lake Fault. It is anticipated that additional developmental drilling would better define the fault zone and, thus, the limit of mining near the fault and lake. MMC may use a narrower barrier, but only with the agencies' prior approval, should additional testing determine that a smaller buffer zone would be adequate to protect against subsidence and/or hydrologic disturbance. Alternately, the additional testing may indicate that a larger buffer zone would be necessary and MMC would be required to stay farther from the fault or lake.

Potential for Chimney Subsidence, and Likely Effects Were it to Occur

Due to the depth of cover over the mine workings and the high strength of the rock overlying the mining horizon, it is unlikely that chimney subsidence would breach the surface to form sinkholes (Agapito Associates, Inc. 2007b). Some roof failure at mine level would be likely over time, especially after mine abandonment. Caving propagation (incremental upward movement) to some height above the workings would likely occur, but the strength of the overlying rock and the magnitude of the *in situ* tectonic forces likely would lead to the formation of a stable arch of rock over the collapsed area. Should such caving occur, MMC's estimates of final cave height are between 150 feet and 380 feet, or 2.1 to 5.4 times the assumed maximum 70 feet mining height (Call & Nicholas 2006). Due to the thickness of rock overlying the Montanore ore body, and the buffers proposed by MMC, these cave heights would not breach the surface. Any groundwater intercepted by the caved strata would be rapidly transmitted to the mine workings. A fractured zone with increased hydraulic conductivity may exist for some distance above the caved zone, but given the likely diameter of the caved zone (a few feet to tens of feet), the thickness of the fractured zone would be limited and not likely to reach the surface based on the amount of rock overlying the ore. No other direct impacts are anticipated should chimney subsidence occur.

Two chimney subsidence events that resulted in sinkholes at the Troy Mine have been reported (Tetra Tech and R Squared 2006). As discussed in 3.9, *Geology and Geochemistry*, the mineralogy of the ore zone at the Troy Mine is similar to that of Montanore. Sinkhole #1 was initially observed in October 1997 (Call & Nicholas 2005b), about 4 years after the mine had been shut down. At that time, the sinkhole was about 8 feet deep and 15 feet in diameter. By spring 2005, the sinkhole had increased to about 50 to 55 feet deep and 50 feet in diameter. At the mine level, material from the East Fault, a north-northwest trending normal fault that dips at about 65° to the northeast, had accumulated in two separate drifts sometime between the mine closing in 1993 and spring of 2005. Based on measurements of the accumulation of fault material in the mine, estimation of the sinkhole volume, estimates of fault gouge bulking factors, spatial relationships between the East Fault and the mine workings, and other factors, Call & Nicholas (2005b) concluded that the sinkhole was probably not related to underground excavation.

A second sinkhole formed in February 2006, and both sinkholes #1 and #2 were analyzed by Tetra Tech and R Squared (2006). Sinkhole #2 was about 135 feet long and 100 feet wide, with a depth between 20 and 30 feet. It was first noticed 4 days after a ground failure and cave in the underground workings of the Troy Mine. Based on projections of the East Fault to the surface, the location of the sinkholes relative to these projections, and on calculations regarding swell factor and chimney size, Tetra Tech and R Squared concluded that the sinkholes were mining related. The structurally weak East Fault acted as a conduit for progressive rock failure. The overlying rock in and next to the fault was so highly broken, fractured and degraded that it lacked sufficient inherent strength to form a stable arch.

While relevant to the analysis of subsidence potential at Montanore, the formation of sinkholes above the Troy Mine does not imply a similar risk of sinkhole formation at Montanore. The mining depths associated with the two Troy sinkholes were 270 feet and 320 feet, respectively (Tetra Tech and R Squared 2006). Minimum mining depth at Montanore would be 500 feet. Assuming similar mining heights, the increased depth at Montanore would reduce the likelihood of sinkhole subsidence, as would MMC's plan to leave a 100-foot horizontal buffer between mining activity and the Rock Lake Fault. No such plan was required at the Troy Mine, where the East Fault was routinely approached and/or penetrated as part of the mining operation. Had a mitigation plan similar to the Montanore plan been in place at the Troy Mine, it is unlikely that sinkhole subsidence would have occurred (Agapito Associates, Inc. 2007b).

Potential for Trough Subsidence, and Likely Effects Were it to Occur

MMC's design calls for stable pillars to be left in place. If the design assumptions were met, trough subsidence and associated impacts would not occur. Any change to the final mine plan would require the agencies' approval. In order to quantify worst-case impacts, the remaining discussion in this section assumes that design assumptions were not met, and that trough subsidence occurred.

Based on published data from historical incidences of subsidence, trough subsidence over the workings due to unforeseen roof, pillar, or floor failure may result in maximum surface subsidence of 0.1 to 0.2 times the 70 feet mining height, or 7 feet to 14 feet. Surface subsidence would be much less than this if the width of failure at mine level were less than about 1.4 times the cover depth (Agapito Associates, Inc. 2007b). In this case, subsidence at the surface may be minimal or visually undetectable. If substantial surface subsidence were experienced, it would be measured over a surface area that somewhat approximates the area affected at mine level. The area affected at mine level is defined by the draw angle, the angle, in section, measured from the vertical, between the edge of the mine workings and the point on the surface at which subsidence is not detectable. A negative draw angle results in an affected surface area smaller than the area of failure, whereas the opposite is true for a positive draw angle. Based on case studies of initial draw angles in caving operations, it is estimated that the draw angle could vary from -12° to 28°. Using the latter as a worst-case scenario at maximum cover, subsidence could be measured for horizontal distances up to 2,000 feet beyond the footprint of failure. Surface damage is not likely to occur over the full angle of draw, but over the angle of critical deformation, which is typically about 10° less. Therefore, surface subsidence effects may occur up to 1,200 feet beyond the footprint of failure, based on an angle of critical deformation of 18°.

Following back and pillar failures in both the north and south ore bodies in the Middle Quartzite of the Revett Formation that manifested as surface cracking and shallow subsidence, the KNF required Revett to evaluate the pillar design and mining methods used at the Troy Mine to aid in the determination of the causes and contributing factors leading to ground subsidence. Call & Nicholas, Inc. prepared an analysis of subsidence and ground fall at the Troy Mine (Call & Nicholas 2014). The KNF contracted an independent third party review of the Call & Nicholas report and related documents, and an independent evaluation of the Troy Mine subsidence through back-analysis of pillar safety factors (Agapito Associates, Inc. 2014b). In addition, the KNF and the DEQ contracted review of information related to recent surface subsidence observed above the Troy Mine in the context of implications to the Montanore Project (Agapito Associates, Inc. 2014a).

The Call & Nicholas (2014) describes the history of instability associated with middle and lower quartzite mining at the Troy Mine. Before the 2012 failures, no surface subsidence was observed. In 2012, an undetermined number of pillars failed west of the main drive in the north ore body, and a progressive pillar and back collapse was initiated. Access to the area was completely cut off and a full assessment of the damage was not possible. Call & Nicholas investigated surface subsidence and reported that “the surface subsidence observed indicates that the back and pillar failures in both the [north ore body] and [south ore body] of the Middle Quartzite were insufficiently bulked shut by caved material before the down-dropped block,…was undercut and allowed to move along several surface expressed faults. While some portion of the closure was accommodated by separation of bedding, the remainder was expressed as surface subsidence.”

If design assumptions were not met and trough subsidence occurred, surface resources that may be affected include wildlife and vegetation, wetlands, and visual quality. Assuming this worst-case scenario, the lead agencies evaluation concluded the potential for impacts on these resources would be low (Agapito Associates, Inc. 2007b). The referenced report explains the conclusion in more detail.

Possible Effects on Groundwater

Subsidence has the potential to affect groundwater where it is encountered, even where subsidence has not progressed to the surface. Chimney or trough subsidence would have the potential to affect surface water and groundwater in several ways and the effects of subsidence on the hydrologic regime can be highly variable and complex. Numerous case studies have been presented in the literature, and conflicting conclusions between studies are common (Peng 1992). The major factors controlling subsidence effects on hydrology include the horizontal and vertical distance between the caved zone and the water resource and the hydrologic properties of the intervening strata. The severity of hydrologic damage decreases with distance from the subsidence and the presence of low permeability stratum. Peng (1992) suggest an angle of influence of 16° to 26° is appropriate for estimating the distance beyond which hydrologic resources should be unaffected.

Within the angle of influence, hydrologic effects are expected to vary according to where water resources were intercepted vertically. If unplanned trough subsidence occurred, rapid transmission of any groundwater to the workings is expected in the caved zone, for a distance of 2 to 8 times the mining height, or 140 feet to 560 feet, assuming a total mining height of 70 feet (Agapito Associates, Inc. 2007b). A fractured zone would exist over the caved zone, extending perhaps 1,400 feet to 2,100 feet above the mine workings. Increased permeability would be associated with the fractured zone, and permeability would increase from the top of the fractured zone downward. Above the fractured zone, surface fissures may develop, but they probably would not to extend to the fractured zone, as tensile stresses would likely die out and become compressive at some distance beneath the surface. Groundwater flows may be affected from the surface to the fractured zone; any such interruption would continue until post-mining hydraulic heads stabilize.

As previously discussed, the caving height associated with chimney subsidence is estimated between 150 feet and 380 feet, or 2.1 to 5.4 times the assumed maximum 70 feet mining height (Call & Nicholas 2006). Groundwater within this zone would be transmitted to the workings. Increased permeability above this zone would exist, although the zone of increased permeability would likely be of limited extent. The effect on groundwater hydrology is discussed in section 3.10.4.2.1*, Evaluation through Operations Phases*.

The potential for chimney or trough subsidence would be largely a function of mine design and the condition of the rock surrounding the underground workings. MMC has proposed collecting additional underground geotechnical data as part of its Libby Adit evaluation program. The evaluation program would provide additional data to assess local ground conditions, subsidence potential, pillar sizing requirements to minimize the risk of trough subsidence, and the potential of fractures above the mine workings to affect groundwater.

3.14.3.1.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative and Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 3 and Alternative 4 would have the same risk of subsidence and are discussed together. MMC would undertake additional measures regarding pillar design, structural setting, interaction of mine voids and pillars in the two ore zones, and roof support analyses to finalize room and pillar dimensions and the ground support plan. MMC would use a minimum 0.8 pillar width to height ratio as a preliminary numeric criterion, to be finalized during later design efforts, and subject to KNF and DEQ approval. These measures are described under Alternative 3, section 2.5.2.5.4 *Final Underground Mine Design Process*. In addition, the agencies' mitigation of increasing the buffer zones near Rock Lake and the Rock Lake Fault, and the agencies' monitoring, described in Appendix C, coupled with final design criteria submitted for the agencies' approval, would minimize the risk of subsidence and associated effects on surface resources in the CMW.

Agapito Associates' back-analysis of pillar safety factors (Agapito Associates, Inc. 2014b) led to the development of three key mitigation measures designed to minimize subsidence risk:

- Use a variety of pillar strength estimation approaches such as Obert and Duvall (1967), Wilson (1972), Hedley and Grant (1972), Hardy and Agapito (1975), Bieniawski (1981), Stacey and Page (1986), Abel (1988) and Esterhuizen *et al.* (2008) to calculate pillar strength and corresponding factor of safety. This would allow the agencies to better evaluate the MMC design in relation to other standard approaches.
- Use a minimum 0.8 pillar width to height ratio as a preliminary numeric criterion (Agapito Associates, Inc. 2014b). Pillars with less than a 0.8 width to height ratio would require justification by MMC as to their stability.
- Explicitly assess sill pillar stability during all mine planning phases.

MMC would submit a final subsidence monitoring plan to the agencies for approval following the completion of the Libby Adit evaluation program. The most valuable geotechnical data are obtained during mining itself. A rock mechanics program that includes the agencies' mitigations on pillar design, structural geology, interaction between workings, and entry stability and support would reduce the potential for trough subsidence. A comprehensive underground drilling and mapping program would identify zones of structural weakness, such as faults, which could be avoided thereby reducing the potential for triggering a chimney type failure.

The KNF completed a FMEA of the Rock Creek Project underground mine, taking into account the Troy Mine experience, and developed mitigations as part of agency-modified alternatives (Agapito Associates, Inc. 2014a, 2014b). The KNF concluded for the Rock Creek Project that the risks of all failure modes identified during the FMEA for the underground mine, after applying compensating factors, were low or inconsequential. No high or moderate risk failure modes were identified. Because similar compensating factors considered in the FMEA of the Rock Creek Project underground mine would be incorporated into the Montanore mine plan, the agencies concluded the risks of subsidence at Montanore also would be low or inconsequential. The plans and mitigations for Montanore are discussed in section 2.5.2.5.4 *Final Underground Mine Design Process*.

Effectiveness of Agencies' Proposed Mitigation Measures in Alternatives 3 and 4

The agencies' mitigation for subsidence, described in section 2.5.2.5.4, *Final Underground Mine Design Process*, the agencies' mitigation of increasing the buffer zones near Rock Lake and the Rock Lake Fault, and the agencies' monitoring, described in Appendix C, coupled with final design criteria submitted for the agencies' approval, would effectively minimize the risk of subsidence and associated effects on surface resources in the CMW. In addition to the agencies' mitigation measures and monitoring, MMC would fund and facilitate biannual surveys of the underground workings that would be completed by an independent qualified mine surveyor. MMC also would fund an independent technical advisor to assist the agencies in review of MMC's subsidence monitoring plan, underground rock mechanics data collection, and mine plan. Based on the agencies' mitigation and monitoring measures and funding of independent technical assistance during all phases of the project, the agencies conclude the risk of subsidence would be less than in Alternative 2.

3.14.3.2 Impoundment Stability

3.14.3.2.1 Alternative 1 – No Mine

The risk of an impoundment failure and associated impacts would not exist. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands.

3.14.3.2.2 Alternative 2 – MMC's Proposed Mine and Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

The impoundment design in Alternative 2 would be the same as Alternative 4, and both alternatives are discussed together. Through the rest of this section, the impoundment design and analysis is referred to only as the Alternative 2 design or impoundment. In Alternatives 3 and 4, MMC would implement the final design process described in section 2.5.2.5, *Final Design Process.* Technical review of the final tailings facility design would be made by a technical advisory group established by the KNF described in the same section.

The tailings impoundment dam in all alternatives would be considered by the DNRC as a high-hazard dam. The DNRC classifies a dam as high-hazard if it impounds more 50 acre-feet and the DNRC determines that a loss of human life is likely to occur within the flooded area as a result of failure of the dam. The hazard classification is based on the potential loss of life downstream and is not an assessment of the safety of the structure. Dams under a DEQ Operating Permit are exempt from Montana's Dam Safety Act.

MMC used commonly accepted industry criteria and standards for dam design and construction for this point in the design process. The origin and basis of the criteria are founded in years of geotechnical engineering research, design, construction, and performance monitoring. These criteria are set and followed by the U.S. Corps of Engineers (2003) and U.S. Bureau of Reclamation (1977) and serve as the design standards for State dam safety rules and regulations. The same standards also apply to soil and rock structures such as waste rock stockpiles, and cut and fill slopes.

Site Seismicity

The estimated Peak Ground Acceleration (PGA) of 0.22 g (Table 133) is sufficient to demonstrate the feasibility of providing dynamic stability in the layout and design of the tailings impoundment. The site seismicity would be re-evaluated during final design to ensure the estimated PGA is the most appropriate value for the Montanore site and for construction of a high-hazard dam. The PGA is the maximum rate of ground motion that will occur at a site. In MMC's analysis, PGA was based on occurrence of the maximum credible earthquake (Table 133).

Morrison-Knudsen Engineers completed the original seismicity assessment for the project in 1990 (Morrison-Knudsen Engineers 1990). Morrison-Knudsen Engineers' estimated PGA value was the median (middle) probabilistic value obtained from several procedures used to estimate ground motion attenuation. In its update, Klohn Crippen confirmed the appropriateness of Morrison-Knudsen Engineers' PGA value. The estimated PGA value is based on a given probability that a seismic event of a certain magnitude would occur at the site. If the probability of occurrence is changed, a new PGA is determined at the site. Generally, a higher probability of occurrence of an earthquake along a given fault results in a lower magnitude of earthquake and a lower PGA at the site. A deterministic PGA value (a selected PGA value based on the upper range of estimated ground accelerations regardless of the probability (percent chance) of the event occurring and impacting the site) may be more appropriate for the Montanore tailings impoundment. This approach is consistent with seismic design guidelines for tailings dams (International Commission on Large Dams (1989) and the United States Committee on Large Dams (1999) (recommended design criteria by Klohn Crippen (2005)).

The design guidelines proposed by MMC (Klohn Crippen 2005) set the basis for a safe design and construction of the tailings impoundment. The references and agency guidelines cited by MMC, including the DNRC's dam safety regulations, do not provide specific standards with respect to seismic stability of large, high-hazard dams. The agencies' mitigation in Alternatives 3 and 4 would include incorporation of guidelines from other states, as appropriate, during final design.

Stability

MMC addressed the stability of the tailings impoundment dams through a series of minimum allowable safety factors against failure for static and dynamic loading conditions of the facilities (Klohn Crippen 2005). The factors of safety (FOS) for stability are summarized in Table 134. In addition, MMC completed a qualitative risk assessment of potential causes of failure of the tailings facility (Klohn Crippen 2005).

Included in the stability evaluation was a liquefaction analysis (the potential for a soil to act as a heavy fluid with little or no shear strength) to determine the locations of liquefiable or potentially liquefiable ground during the MCE of M7.0. The analysis was based on the number of hammer blows required to drive the soil sampler one foot (blow counts or 'n' values) obtained from Standard Penetration Tests (SPT) recorded during the different geotechnical work conducted in the Little Cherry Creek drainage basin. Under the Little Cherry Creek Tailings Impoundment Main Dam foundation area, the soils with SPTs that were found to indicate potentially liquefiable foundation materials are generally near the ground surface. The liquefaction assessment found that most of the foundation materials under the Alternative 2 tailings Main Dam are medium dense to dense. Only isolated pockets of material have the potential to liquefy during seismic loading with little or no impact on dam stability if left undisturbed during dam construction. Foundation materials under a portion of the Diversion Dam are loose to medium dense and could control the stability of the dam. The influence of the potential liquefaction zones was considered in the stability analyses for the Diversion Dam in Alternative 2 (Klohn Crippen 2005).

Liquefaction of the glaciolacustrine clay beneath the Main Dam foundation would be very unlikely due to the high fines content (*i.e.*, >30%), but could occur under the right conditions. Large seismic events can be expected to generate elevated pore pressures in the clay and could produce a short-term loss of strength following the seismic event (Klohn Crippen 2005). The location of a clay layer within the foundation beneath the right (south) abutment of the Starter Dam and its potentially low shear strength characteristics make the presence of the clay in the foundation a concern with respect to the design and stability of the tailings impoundment Main Dam. As a precaution, MMC proposes to remove a portion of the clayey material and backfill with compacted fill to act as a "shear key" for stability (Figure 9). A shear key is an area of backfilled and compacted material beneath a dam to enhance resistance against the dam sliding horizontally along a preferred plane and to increase the shear resistance of the material under the embankment thereby inhibiting the formation of a circle failure plane. Based on preliminary design, up to three shear keys may be required under the final dam footprint. The extent of the glaciolacustrine clay and its strength would be assessed during final design to determine how much of the material would be removed and to optimize the location and dimensions of shear keys. Similar materials have not been identified in the foundation of the Poorman tailings dam

Table 134. MMC Design Criteria and Calculated Values for Factor of Safety for Alternatives 2 and 4 Impoundment.

Loading Condition	Standard	Minimum Allowable Design Value	Calculated Value
Static Loading Condition	Limit-Equilibrium Factor of Safety (FOS)	FOS = 1.5 For operations and closure. FOS = 1.3 For end-of-construction conditions†.	2.06 1.8
Maximum Credible Earthquake (MCE)	Limit-Equilibrium FOS (Pseudo-static)	FOS = 1.15 For operating and end-of-construction conditions†.	1.34 1.17
	Displacements Estimated by Pseudo-Static Stability Analyses	Horizontal displacement of dam toe = 10 feet. Vertical settlement at the ultimate dam crest limited to less than 3 feet to prevent release of tailings.	2.5 to 10 feet Not Available
Post-Earthquake	Limit Equilibrium Factor of Safety	FOS = 1.1 Using residual strength in liquefied tailings and glaciolacustrine clay.	1.18
	Dynamic Deformation Analysis	Assessment using Makdisi-Seed, and Hynes-Griffith and Franklin empirical methods, as cited in Klohn Crippen 2005.	2 to 10 feet (horizontal)

†End-of-construction stability generally refers to completion of a compacted earthfill dam, not a cycloned sand dam as construction would be ongoing. Values reported are for cyclone dam at end of 5 years of operation. End-of-construction FOS for the compacted starter dam and saddle dams are not available.
Source: Klohn Crippen 2005.

site, but geotechnical data are limited and would need to be expanded to confirm suitability of the dam foundation materials and stability of the dam.

The MCE earthquake estimated for the project site probably would not cause the tailings to liquefy and result in a catastrophic failure. As discussed in section 3.9, *Geology and Geochemistry*, the tailings at the proposed Montanore Mine are likely to be similar to the tailings at the Troy Mine. The tailings at Troy were found to be dilatant (Knight-Piesold and Co. 2007). A dilatant material (also termed shear thickening) is one in which viscosity (commonly perceived as "thickness," or resistance to flow) increases with the rate of shear.

MMC's design criteria (Table 134) outlined the stability evaluation techniques and set the target FOS values to be used. Operational performance and dam safety depend upon on the quality of the geotechnical data and the correct application and use of industry accepted design procedures to complete the design and estimate the FOS. For this reason, thorough geotechnical field studies and complete laboratory test programs are essential in achieving a safe dam structure. The more reliable the available data, the fewer and less conservative are the assumptions for unavailable or unknown design information. Data that is less reliable or available increase the assumptions and the conservatism required to achieve a safe design. Critical conditions have been evaluated and conservative assumptions have been made regarding foundation conditions and strength parameters. Based on the data presented by Klohn Crippen (2005), it has been demonstrated that a safe tailings dam structure could be constructed for Alternatives 2 and 4 with respect to meeting the minimum allowable FOS design criteria based on currently available data. Based on the stability analyses and estimated FOS values for the tailings impoundment dam, the Main Dam would be stable and not exhibit signs of distress or failure. The analyses presented by Klohn Crippen (2005) adequately demonstrate the feasibility of constructing, operating and reclaiming a stable tailings dam under Alternative 2. Additional geotechnical field and laboratory tests would be needed to address assumptions made in the preliminary design and confirm the stability of the dam. In Alternative 4, the seismic design parameters would be re-evaluated using more current data and evaluation procedures, and the dynamic stability confirmed based on any revised parameters. In addition, circular failure plane assessments through the near-dam tailings and dam section and through the dam crest and slope would be completed during final design of the dam.

Tailings slurry deposition patterns used in operations of the impoundment can influence tailings facility stability: the impoundment capacity, and tailings particle size segregation, which can influence the tailings consolidation characteristics. These two issues are not high risk items and normally not an influence in demonstrating the feasibility of a project. For the Little Cherry Creek site, the issues become important due to limited space for dam expansion beyond that proposed. In addition, changes in dam height and dam configuration to increase the impoundment capacity would be critical as it affects other design issues, such as the material mass balance for the cyclone sand dam. Dam stability could be affected should additional dam height be required to store the tailings. Tailings deposition patterns and settled density would be re-evaluated during final design.

Perimeter discharge of tailings slurry, as planned by MMC, typically results in tailings surfaces sloped downward toward the interior of the impoundment area. This downward slope of the tailings away from the embankment crest reduces the available capacity at a given height compared to capacity calculated assuming level tailings deposition. The current height-volume relationship for the Alternative 2 tailings impoundment site is based on level tailings deposition in the impoundment, with some freeboard allowance for the slope of the tailings surface (Klohn Crippen 2007). The agencies' analysis indicates that the height of the dam necessary to achieve the required tailings capacity would need to be slightly higher than the crest elevation estimated by Klohn Crippen. This in turn would require a modification to the dam design and a re-evaluation of the dam stability. Final determination of the dam height versus impoundment capacity would be based on tailings deposition plans and the proposed final end-of-operation surface grading plan. The final dam height and dam configuration would be detailed during final design to confirm the appropriate dam height for use in the final stability analyses.

Tailings deposition patterns into the impoundment also influence the dam height and ultimate stability should the average settled density be less than estimated. Larger particles settle nearest the discharge point and finer particles settle farther out as the tailings slurry flows away from the discharge point. Long travel distances from the point of discharge often result in particle segregation within the tailings impoundment, which typically results in a tailings mass that exhibits lower average settled densities and consolidation characteristics from what was achieved during laboratory testing. Densities lower than estimated may require additional dam height to provide the same storage capacity. Lower tailings densities may also impact the dam stability analyses when considering stability of the upstream section of the dam crest.

In the 1992 Montanore Project Final EIS, artesian groundwater conditions beneath the Little Cherry Creek impoundment site were discussed. Artesian pressures at both impoundment sites (Little Cherry Creek and Poorman) were identified in some boreholes during the site investigations conducted by NMC (Morrison-Knudsen Engineers, Inc. 1990). NMC proposed to use a system of pressure relief wells to relieve artesian water pressures. In 1992, the agencies concluded an adequately designed pressure relief well system would relieve artesian pressure and ensure dam stability during all project phases. MMC reviewed the hydrogeology and assessed the potential effects of the artesian pressures on the dam stability (Klohn Crippen Berger Ltd. 2008), and concluded:

- The stability of the downstream slope of the dam is controlled primarily by the soft glaciolacustrine clay, and the strength of the clay is controlled by the undrained shear strength
- The proposed downstream slope of the dam is flatter than the original design by Morrison-Knudsen
- The impoundment design includes an extensive underdrain system, which would limit the transfer of hydraulic head from the impoundment into the foundation soils
- Existing artesian pressures are not expected to become significantly higher due to impoundment construction and the artesian pressures would not affect the failure mode, including a failure plane through the glaciolacustrine clay
- The dam would be raised in stages over the life of the mine and piezometric pressures in the foundation would be monitored

The agencies concurred with MMC’s conclusions regarding artesian pressures based on available data. In addition, MMC would install pumpback recovery wells in Alternatives 3 and 4 to collect tailings seepage not intercepted by the Seepage Collection System. The pumpback recovery wells would be located beyond the dam toe, and would be designed to collect seepage not collected by the drain system. The pumpback well system would reduce artesian pressures beneath both impoundment sites in Alternatives 3 and 4. The foundation design would be confirmed as part of the final design studies.

Failure Modes Effects Analysis

In addition to completing stability analyses to verify that the design criteria FOS would be met for the tailings dam, MMC completed a qualitative risk assessment of the Little Cherry Creek impoundment using a modified Failure Mode and Effects Analysis (FMEA) process (Klohn Crippen 2005). The agencies updated the analysis in 2008 to include all project infrastructure in Alternatives 2 and 3 (Klohn Crippen Berger 2009). The FMEA is an engineering reliability technique used to systematically identify, characterize, and screen risks that derive from the failure of an engineered system to operate or perform as intended. The term “risk” encompasses the concepts of both the likelihood of failure (the expected frequency of failure), and the severity of the expected consequences if such events occurred. FMEA seeks to characterize risks in a systematic way and is intended to identify the main risks or failure modes (McLeod and Plewes 1999). Because predictive risk assessment involves foreseeing the future, it is an imprecise art (Robertson and Shaw 2003).

An assessment of likelihood and consequences of failure for construction, operations, and closure was made for each of the design and operational components. Five issues were included in the 2008 FMEA related to the tailings dam stability: 1) higher than predicted pore pressure in glaciolacustrine clays; 2) higher than predicted uplift groundwater pressure; 3) loose glacial outwash layer liquefying under seismic loading; 4) plugging of dam underdrains increasing pore pressures; and 5) plugging of impoundment underdrains increasing pore pressures(Klohn Crippen Berger 2009).

The FMEA was completed in a sequential manner by identifying the following:

1. Likelihood of failure quantified on a five-level scale based on an annual probability of failure/percent chance of occurrence (>50%, 10-50%, 1-10%, 0.1-1%, and <0.1%)
2. Consequences of failure ranked on a five-level scale (insignificant to catastrophic) for four areas (water quality, biophysical, community-social, and costs)
3. Level of confidence in the likelihood of failure and/or the consequences based on a three-level scale of high, moderate, and low
4. Compensating factors to reduce the risk for each failure mode and effect

The factors were compared and a Level of Risk was determined for each failure mode. The Level of Risk ranged from Level 5 (completely unacceptable) to Level <1 (lowest level of risk). Each Level of Risk was identified by a pairing of likelihood of an occurrence with consequences of the occurrence. As the Level of Risk decreased, the possibility of occurrence/outcome pairings that resulted in that Level of Risk increased, as summarized below.

- Risk Level 5 – A likelihood of "always certain" and "catastrophic" consequences
- Risk Level 4 – Likely occurrence and catastrophic consequences to always certain occurrence and major consequences
- Risk Level 3 – Possible occurrence and catastrophic consequences to always certain likelihood and moderate consequences
- Risk Level 2 – Unlikely occurrence and catastrophic consequences to always certain likelihood and minor consequences
- Risk Level 1 – Conceivable but improbable occurrence and catastrophic consequences always certain occurrence and insignificant consequences
- Risk Level <1 – Inconsequential risks

Of the failure modes evaluated in 2008 for the Little Cherry Creek impoundment, three were judged to have a risk level of 2, and the other modes had a risk level of 1 or less. The identified Level 2 risks and associated management strategies are shown in Table 135.

Table 135. Level 2 Risks of Little Cherry Creek Tailings Impoundment Site.

Risk	Management Strategy
Loose glacial outwash layer liquefies under seismic loading, leading to dam failure.	Dam design to assume that some material could liquefy. Additional site investigations would better define the spatial extent of any loose layers (see section 2.5.2.5, *Final Design Process*).
"Pervious" soil connection between tailings and bedrock aquifer. "Unknown" aquifer connection to former Little Cherry Creek.	Install pumpback wells to intercept seepage. Install wells downstream of tailings facility for monitoring seepage collection and groundwater quality. Analyze tailings water balance and track seepage return flow to estimate seepage discharging into groundwater (see section C.10.5.5, *Water Balance* in Appendix C).
Erosion due to extreme precipitation on closure.	Closure design to reduce risk of erosion with riprap in potential high flow areas. Long-term care and maintenance would provide for potential repairs after extreme events (see discussion of long-term site monitoring and maintenance in section 1.6.3.2.3, *Other Reclamation Costs*).

Source: Modified from Klohn Crippen Berger 2009.

3.14.3.2.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Stability

The lead agencies completed a stability evaluation of Alternative 3. The purpose was to confirm the feasibility to locate and design a stable Poorman Tailings Impoundment facility at a 120 million-ton capacity between Little Cherry and Poorman creeks.

Design criteria for minimum FOS values for static and dynamic loading conditions were the same as set for the Alternative 2 impoundment site. The PGA value used in the pseudo-static analysis was assumed to be the same as Alternative 2. The two sites (Alternatives 2 and 3) are adjacent to one another and based on limited drilling information from the Poorman site (Alternative 3) appear to have similar foundation conditions. In addition, Alternative 3 borrow soils and cyclone sand foundation materials were assumed to be similar to the Alternative 2 materials; therefore, the Alternative 2 strength parameters were used in the stability analysis. In some cases, lower values were used in the analysis as a degree of conservatism because site-specific data for Alternative 3 are limited and Alternative 3 would be a critical facility to the project. The strength parameters for the tailings were slightly increased to a friction (phi) value equal to 20° because Alternative 3 tailings would be deposited as a high-density slurry resulting in a denser (*i.e.*, higher strength) in-place product. Tailings placed as a high-density slurry generally show an increase in shear strength parameters over tailings placed at a lower slurry density (Klohn Crippen 2005).

The stability of the Alternative 3 tailings dam was evaluated using the slope stability computer program STABL developed at Purdue University. The use of the STABL program is widely accepted in the dam design/geotechnical industry as a suitable design tool, as is the Slope/W program used by Klohn Crippen for the Alternative 2 stability analysis. Both programs incorporate the same methods of analyses in estimating the FOS of a slope. Several commercial software programs that incorporate the STABL program are available. The commercially available software XSTABL 5.0 was used to facilitate data input and view plots of the most critical surfaces (lowest FOS) determined in the analyses. Potential failure surfaces were searched for within the downstream sections of the dam and tailings impoundment, and through the embankment crest and tailings on the upstream side of the dam. In addition, the stability of the tailings slope deposited from the back of the impoundment and above the dam crest elevation was checked to assess the feasibility of placing the tailings in such a configuration. Based on the results of the analyses, the Alternative 3 tailings facility can be designed as a safe and stable structure under both static and pseudo-static loading conditions. Table 136 presents a summary of the results.

Table 136. Calculated Values for Factor of Safety for Alternative 3 Impoundment.

Case	Static FOS	Pseudo-Static FOS	Post-Earthquake FOS
Average Strength Parameters			
Cyclone Sand Dam Minimum allowable FOS	1.9 (1.5)	1.4 (1.15)	1.4 (1.1)
Upper Tailings Slope Minimum allowable FOS	- (1.5)	1.8 (1.15)	2.7 (1.1)
Reduced Strength Parameters			
Cyclone Sand Dam Minimum allowable FOS	1.5 (1.5)	1.1 (1.15)	1.3 (1.1)
Upper Tailings Slope Minimum allowable FOS	5.4 (1.5)	1.5 (1.15)	1.8 (1.1)

Source: Glasgow Engineering 2008.

The tailings deposited from the back slope of the impoundment area and at an elevation above the constructed embankment crest elevation would create the most critical situation for instability in Alternative 3. This situation was evaluated in the stability analyses completed for Alternative 3 (Glasgow Engineering 2008). Based on the results of the analyses presented in Table 136, the proposed cyclone dam and tailings slope would be stable under static and pseudo-static loading conditions and post-earthquake strength reductions. In all but one case, the minimum FOS was met or exceeded in the analyses. The one case that did not meet the minimum was the pseudo-static analysis of the cyclone sand dam assuming reduced shear strength values. The estimated FOS was greater than 1.0 (*i.e.*, not indicating a likely slope failure), but was lower than the minimum allowable FOS. Impacts of failure of the tailings slope would be similar to liquefaction of the tailings slope as discussed in the following paragraph.

Liquefaction potential of the tailings slope deposited at the rear of the impoundment was not considered in the stability review, although recently deposited tailings are subject to liquefaction. The volume of the liquefied mass located at the rear of the impoundment is critical to impoundment stability only if the available storage volume within the impoundment at the dam crest elevation were less than the volume of the liquefied tailings *and* if all of these liquefied tailings were to move *en* masse as a uniform debris flow from the back of the impoundment, down into the impoundment area, and towards the dam. This would not be a critical issue until near the end of the Year 16 of operations. At the end of Year 16, mud wave action from the liquefied tailings and displacement of water stored in the impoundment could result in the overtopping of the embankment crest and possible breach of the dam. This potential for release of tailings from the impoundment may be the most critical situation related to Alternative 3. Such a failure mode has not been quantified but should be included in the final design of the facility. The primary mitigation measure would be increased dam freeboard above the storage level of the tailings. This situation would be most critical in the later years of operations, as it is possible that tailings would not be stored very far above the dam crest until after Year 10 of operations.

The issues of discharge patterns and tailings consolidation patterns related to the dam stability are less influential than as described under Alternative 2. The anticipated slope of the thickened tailings was considered in the conceptual layout of Alternative 3. Also, thickened tailings would not "flow" out into the impoundment in the same manner as slurried tailings. In-place particle segregation and changes in consolidation characteristics are typically not as critical with thickened tailings as with slurry.

Failure Modes Effects Analysis

The Poorman site has a very similar risk profile as the Little Cherry Creek site. Some of the risks differed because of use of more complex technology (thickened tailings), uncertainty of foundation conditions, and proximity to private land. Of the failure modes evaluated for the Poorman Impoundment, six were judged to have a risk level of 2, and the other modes had a risk level of 1 or less. The Level 2 risks identified for the Little Cherry Creek impoundment site would apply to the Poorman site. The additional Level 2 risks and associated management strategies identified for the Poorman Impoundment Site are shown in Table 137.

Table 137. Additional Level 2 Risks of Poorman Tailings Impoundment Site.

Risk	Management Strategy
Pore pressure in clay requires flatter slopes and less storage capacity.	Site investigation would be carried out (see 2.5.2.5, *Final Design Process*)
Foundation more permeable than predicted affects local landowner and require more seepage control.	Site investigations would be carried out and the design modified to reduce seepage. Groundwater monitoring wells and pumpback wells would be installed and monitored during the Construction, Operations, and Closure Phases.
Deposited densities less than predicted requiring more storage capacity.	Test tailings during final design process (see agencies' testing requirements in section 2.5.2.5, *Final Design Process*). Plant operations may require additional backup systems (see prior discussion in the *Operation Flexibility and Impoundment Expansion Potential* section.

Source: Modified from Klohn Crippen Berger 2009.
These risks are in addition to those presented for Little Cherry Creek in Table 135.

Effectiveness of Agencies' Proposed Mitigation Measures in Alternatives 3 and 4

Section 2.5.2.5, *Final Design Process,* describes the process that MMC would use to complete final design of the tailings impoundment in Alternative 3. The design process would likely include a preliminary design phase and a final design phase. Site information would be collected during field studies during final design. The impoundment site in Alternative 4 likely has been sufficiently characterized and geotechnical field studies in Alternative 4 would be limit.

During final impoundment design in Alternatives 3 and 4, MMC would update the seismic stability analysis using the most recent attenuation relationships, update the pumpback well design and analysis, and avoid or minimize to the extent practicable filling waters of the U.S. or locating facilities in a floodplain. MMC would fund an independent technical review of the final design as determined by the lead agencies. Technical review of the final tailings facility design would be made by a technical advisory group established by the lead agencies. The tailings technical advisory group (TAG) would be comprised of agency experts in geotechnical, geochemical, and water quality issues related to current practices in the construction, operations, and closure of tailings facilities. The TAG would advise on the development of the quality assurance/quality control protocols for the tailings facility. The tailings TAG would also advise the lead agencies as to whether the environmental impacts associated with final design remained within the scope of those impacts identified in the Final EIS. The agencies' mitigation would be effective in ensuring the safe design and construction of a tailings impoundment that minimizes environmental impact.

3.14.3.3 Little Cherry Creek (Alternatives 2 and 4) and Poorman (Alternative 3) Tailings Site Comparison

This section presents a comparison of Little Cherry Creek (Alternatives 2 and 4) and Poorman (Alternative 3) tailings impoundment sites. The intent is to provide a summary of available data in each alternative in a comparative format. In general, the Poorman site was developed to avoid or minimize several environmental impacts of Alternative 2.

The primary technical difference in tailings disposal in Alternatives 2 and 3 is the method of tailings deposition used in each alternative. Alternative 2 is based on cyclone separation of the coarse fraction of the tailings for use in dam construction followed by slurry deposition of the finer fraction of the tailings into the impoundment area. Alternative 3 is based on cyclone separation of the coarse fraction of the tailings for use in dam construction as in Alternative 2, and then thickening of the retained finer grained portion of the tailings before deposition in the impoundment. The tailings would be thickened to increase the average in-place density of the tailings thereby reducing the required impoundment capacity.

The following sections present a comparison of the two alternatives based on data and information presented in Chapters 2 and 3, and MMC's Plan of Operations (MMI 2005a, MMC 2008). The comparison is divided in technical issues identified during the analysis process of the two alternatives. The data for each issue are presented in a summary format with brief discussions provided only as needed to clarify the comparison.

3.14.3.3.1 Site Capacity and Expansion Potential Tailings Deposition

Tailings Production

- Alternative 2 – Primary and secondary cyclone for sand generation and use in dam construction; 55 percent slurry density deposited into impoundment from primary cyclone overflow. Direct deposition of secondary cyclone overflow into the impoundment. Tailings surface slope at 1 to 1.5 percent average.
- Alternative 3 – Primary and secondary cyclone for sand generation and use in dam construction; thicken slurry density of primary and secondary cyclone overflow to a 70 percent slurry density at deposition into impoundment. Tailings surface slope at 3 to 5 percent.

120 million ton Capacity Requirement

- Alternative 2 impoundment capacity is reported by MMC as 115 to 120 million tons for a level tailings surface. Tailings discharge patterns into the impoundment have not been configured for a sloped tailings surface and is subject to reduction of total capacity at the proposed dam crest elevation. The net capacity has not been confirmed at 120 million tons.
- Alternative 2 Tailings Deposition – Slurry tailings at 55 percent solids by weight with an average density at the end of operation of 75 pcf (pounds per cubic foot). Deposition of thickened tailings was not considered necessary unless final design studies showed higher density tailings were required to maintain the proposed dam and impoundment footprint.
- Alternative 3 capacity is 120 million tons with thickened tailings deposition from a higher elevation along the back of the impoundment and a sloped tailings surface.
- Alternative 3 Tailings Deposition – Thickened tailings at 70 percent solids by weight with an average settled density of 85 pcf. Deposition of slurry tailings at 55 percent solids by weight was not considered practical as the tailings volume corresponding to this density would require an additional 15 feet of dam height. The ability to achieve these densities is discussed in the following *Operation Flexibility and Impoundment Expansion Potential* section.

Dam Construction

- Alternative 2 – Requires a Starter Dam, a North Saddle Dam, a ridge line South Saddle Dam later raised with cyclone sand, and a Main Dam constructed with cyclone sand (Figure 8).
- Alternative 3 – Requires a Starter Dam, a Rock Toe Berm to anchor toe area of main sand dam, an earthfill Saddle Dam, and a Main Dam constructed with cyclone sand (Figure 26).

Foundation Conditions and Borrow Material

- Alternative 2 – Foundation conditions generally good except that glaciolacustrine clay in Main Dam foundation potentially affects dam design. A portion of the clay would be excavated and backfilled with compacted fill to act as a shear key for stability. High groundwater level in Main Dam area. Sufficient borrow materials available within facility footprint and adjacent areas. Granular materials available through commercial sources. The volume of cyclone sand available for dam construction per year based on yearly production rates versus required volume of sand to raise the dam annually to maintain adequate storage capacity in the impoundment area has not been generated to date by MMC.
- Alternative 3 – Foundation conditions generally good and similar to Alternative 2. Glaciolacustrine clay may not be present in foundation; additional geotechnical investigations would be required. High groundwater level in Main Dam area. Sufficient borrow materials available within facility footprint and adjacent areas. Granular materials available through commercial sources. The volume of cyclone sand available for dam construction per year based on yearly production rates would meet required volume of sand to raise the dam annually to maintain adequate storage capacity in the impoundment area based on the proposed dam layout and impoundments operations. The annual dam volumes were interpolated from dam sections generated from raises at 40-foot height increments.

Seepage Control

- Alternative 2 – Seepage control in Alternative 2 would be provided primarily by collection drains in the impoundment and the dam foundation. The estimated seepage loss to groundwater is 25 gpm into the foundation footprint. Additional design components to reduce seepage losses would include an increased density of the impoundment drainage system, a pumpback well system between the dam and Seepage Collection Pond, or a deeper cutoff trench below the starter dam and under the saddle dams. Seepage interception would be facilitated by the cross-valley dam design. Seepage interception would be more difficult south of the South Saddle Dam, which would be immediately adjacent to the Diversion Channel. A coarse-textured paleochannel under the impoundment may capture and transmit more tailings water seepage than modeled in the seepage analysis.
- Alternative 3 – Seepage control in Alternative 3 would be similar to the Alternative 2 design for seepage control. It is assumed that the average seepage loss would be about 25 gpm as in Alternative 2. The potential for additional seepage control is similar to Alternative 2 and would employ the same alternatives. Due to the wide footprint of the dam face the Poorman Impoundment Site would require a more extensive seepage collection system. In addition, there would be less room downstream of the dam footprint to install a pumpback well system or other seepage interception systems between the dam toe and private property not owned by MMC.

Operation Flexibility and Impoundment Expansion Potential

- Alternative 2 – Upsets in daily operations such as pump failures and surges in the tailings system could likely be handled or accommodated without problems or threat of breach because of excess storage capacity in the tailings impoundment, and options for redirecting water and/or tailings to other storage facilities. An operating plan would address occurrences such as excess water build up or reduction in available cyclone sand. Generation of tailings slurry at 55 percent by weight is a commonly achieved density for tailings using the milling process proposed for Montanore. Less dense slurry deposition could occur due to improper design of the thickener or pumping system, temporary upsets in operations or improper operation practices. Such upsets are expected to be infrequent and short-term and should not affect the operation (water balance and storage capacity) of the impoundment. If extra impoundment capacity were needed, expansion of impoundment capacity beyond the proposed layout would require modifications in the design and construction of the dam crest. The perimeter area for extending the toe of the dam and continuing raises per design to increase capacity is very limited beyond the proposed footprint. Potential alternatives for dam crest raises would include over-steepening the downstream slope in subsequent raises or designing a modified upstream raise of the crest.

- Alternative 3 – Upsets in the tailings thickeners and in daily operations would require an operating plan to accommodate short periods of conventional (less dense) slurried tailings deposition within the impoundment. Such occurrences could be handled and include short-term increases in the amount of water sent to the impoundment with the tailings. The system required to thicken fine tailings to a slurry density of 75 percent has not been determined, but currently available thickening systems have achieved this density. The Montanore ore body consists of hard, unaltered rock that would be crushed to a fine-grained non-plastic material, which is generally amendable to thickening without the use of filters. The thickening system best suited for Montanore tailings would be determined before final design of the site was initiated. Once a system was determined feasible, the potential for upsets would be minimized and limited to infrequent and short-lived upsets as in Alternative 2. In the event it is demonstrated that the tailings could not be thickened in a reasonable manner, the suitability of Alternative 3 tailings facility would have to be re-evaluated and compared to Alternative 2. Expansion of impoundment capacity beyond the proposed layout would require modifications in the original design or in the design and construction of the dam crest sometime after operations began. The perimeter area for extending the toe of the dam and continuing raises per design to increase capacity is limited beyond the proposed footprint. Potential alternatives for dam crest raises would include over-steepening the downstream slope in subsequent raises or designing a modified upstream raise of the crest. Depending upon the characteristics of the thickened tailings, upstream deposition patterns and discharge elevations could also be modified to increase storage capacity.

Based on these comparisons, both alternatives have equally positive as well as limiting attributes and characteristics. The single significant difference between the two alternatives appears to be the ability to deposit the finer fraction of the tailings as a slurry at 55 percent solids by weight in Alternative 2 versus the likely necessity to deposit the tailings as a thickened tailings at 75 percent solids by weight in Alternative 3. This due to limits on the available impoundment footprint area at the Poorman Creek site. A secondary difference is that the storage capacity in Alternative 2 has not been confirmed relative to deposition patterns and the preferred tailings surface configuration at closure. The impoundment capacity in Alternative 3 was based on specific deposition patterns and a defined final tailings surface configuration. Another secondary difference between the alternatives is the potential for additional seepage control once in operation. Alternative 2 site conditions are likely better suited for the installation of remedial mechanisms or facilities for seepage control and collection than in Alternative 3 because of there being more room available for the installation of collections systems downgradient of the embankment toe. Additional design studies are required for both alternatives before identifying a preferred alternative based on technical comparisons such as those presented above. The difference in expansion potential for the two sites is negligible, based on the available data and site layouts.

3.14.3.4 Cumulative Effects

None of the reasonably foreseeable future actions would result in cumulative effects of subsidence risk or impoundment stability with the Montanore Project.

3.14.3.5 Regulatory/Forest Plan Consistency

The KFP does not have specific goals, objectives, and standards for subsidence and impoundment stability. It does contain goals, objectives, and standards for the CMW. All mine alternatives have the potential to indirectly affect wilderness qualities. Mitigation measures identified in Chapter 2 for Alternatives 3 and 4 and monitoring required for Alternatives 3 and 4 (Appendix C) would be implemented to minimize changes in wilderness character. In Alternatives 3 and 4, potential subsidence affecting wilderness lakes and wilderness character would be minimized by the agencies' mitigation described in section 2.5.2.5.4, *Final Underground Mine Design Process*. Key mitigation measures include:

- Completing pre-mine surficial topographic survey and geologic mapping of lands overlying the mine area to identify structures that could affect subsidence potential;
- Using a variety of pillar strength estimation approaches to calculate pillar strength and corresponding factor of safety; using a minimum 0.8 pillar width to height ratio as a preliminary numeric criterion and providing a justification for pillars with less than a 0.8 width to height ratio as to their stability;
- Explicitly assessing pillar stability during all mine planning phases; identifying two barrier pillars 20 feet wide across the width of the ore body that would be left in place (except for openings needed for access) during the first 5 years of mining until additional refinement of the hydrologic model was completed and the need for barrier pillars was evaluated;
- Maintaining at least a 1,000-foot buffer from Rock Lake and a 300-foot buffer from the Rock Lake Fault;
- Maintaining during mining a 100-foot buffer from identified faults unless the agencies approved a narrower buffer;
- Keeping the size and number of drives through the identified faults to the minimum necessary to achieve safe and efficient access across the fault unless the agencies approved a narrower buffer; and
- Explicitly stating that no secondary mining (reduction in pillar width or length, or increase in pillar height from designed final dimensions) would be allowed.

Mitigation measures and monitoring requirements in Alternatives 3 and 4 are reasonable stipulations for protection of the wilderness character and are consistent with the use of the land for mineral development. Alternatives 3 and 4 would be conducted to protect the surface resources in accordance with the general purpose of maintaining the wilderness unimpaired for future use and enjoyment as wilderness, and to preserve the wilderness character consistent with the use of the land for mineral development and production in compliance with 36 CFR 228.15 and the Wilderness Act. The agencies' mine and transmission line alternatives would comply with the Wilderness Act. Alternatives 3 and 4 would minimize adverse environmental impacts on surface resources within the wilderness, and thereby comply with the regulations (36 CFR 228, Subpart A) for locatable mineral operations on National Forest System lands.

3.14.3.6 Irreversible and Irretrievable Commitments

This section is not applicable to geotechnical engineering.

3.14.3.7 Short-term Uses and Long-term Productivity

This section is not applicable to geotechnical engineering.

3.14.3.8 Unavoidable Adverse Environmental Effects

Some roof failure would occur in all action alternatives.

3.15 Land Use

3.15.1 Regulatory Framework

3.15.1.1 Kootenai Forest Plan

The KFP guides all natural resource management activities and establishes management standards for the KNF (USDA Forest Service 1987a). The KFP establishes management direction in the form of prescriptions consisting of goals, objectives, standards, and guidelines. This direction may be established to apply throughout the forest plan area (forest-wide direction), or it may be established for only a part of the forest plan area, a Management Area (MA). The Montanore Project is being evaluated under the 1987 KFP. The KNF is undergoing a forest plan revision in cooperation with the Idaho Panhandle National Forest. The revision is not completed and the direction provided by the 1987 KFP is applicable to the Montanore Project. Management direction for the land use analysis area is described in section 3.15.3.2*, Kootenai National Forest Land Management Plan* below.

3.15.1.2 Montana Fish, Wildlife, and Parks/Plum Creek Conservation Easement

The FWP holds a conservation easement on some lands owned by Plum Creek where the transmission line may be located. Under the terms of the conservation easement, the FWP has reserved the right to prevent any inconsistent activity on or use of the land by Plum Creek or other owners and to require the restoration of any areas or features of the land damaged by such activity or use. Activities and uses prohibited or restricted include installing any natural gas or other pipelines or power transmission lines greater than 25-kV unless the prior written approval is given by the FWP.

3.15.1.3 Local Plans

Unincorporated Lincoln County has no comprehensive or general plan, zoning regulations, or growth policies.

3.15.2 Analysis Area and Methods

3.15.2.1 Analysis Area

The analysis area for land use encompasses an area with a 2,000-foot buffer surrounding project facilities: along the Bear Creek Road south from US 2, the proposed permit boundary areas for the mine facilities, the area crossed by the four transmission line alternatives and associated access roads, and the Sedlak Park Substation site and loop line area (Figure 78).

3.15.2.2 Methods

MMC's mine permit application (MMI 2005a, MMC 2008) contained information about land use in the mine area. In 2005, MMC completed a land use inventory for the transmission line corridors that MMC analyzed by reviewing, refining, and updating existing data (Power Engineers 2005c). The KNF provided digital data on the distribution of MAs on National Forest System lands. The KFP provided management prescriptions for each MA by resource, including recreation, wildlife and fish, timber, soils, water, and air resources, minerals and geology, lands, and facilities (USDA Forest Service 1987a).

The effects analysis assessed how the transmission line and mine facilities may alter existing land uses on both private and public lands within the land use analysis area. The changes in land use in the mine area were calculated based on the acreage of each permit area, and a 100-foot wide road corridor along the Bear Creek Road (NFS road #278), which is outside of a permit area.

In the 1993 ROD approving the lead agencies' preferred alternative for NMC's proposed Montanore Project, the KNF amended the KFP and reallocated an area surrounding the Little Cherry Creek Impoundment Site and the Ramsey Plant Site to MA 31. MA 31 is designed to accommodate the activities associated with mineral development on the KNF (USDA Forest Service 1993). All areas currently proposed for disturbance at the Ramsey Plant Site and the Little Cherry Creek Impoundment Site were not previously reallocated to MA 31, due to mapping technology and a slight change in the Little Cherry Creek Tailings Impoundment design from that approved in 1993. In Alternatives 2, 3 and 4, the KNF would amend the KFP by reallocating to MA 31 all areas within the permit areas of the plant site, the tailings impoundment, and LAD Areas 1 and 2 that currently are not MA 31. In addition, a proposed road and facility corridor that would cross MA 13 would be reallocated to MA 31. This amendment would apply only to National Forest System lands disturbed by any mine alternative, and would not apply to private lands affected by the mine alternatives. Maps showing areas of proposed reallocation are available at the KNF. Changes to existing MA designations were calculated for project facilities in each alternative.

The changes in land use in the transmission line corridors were calculated based on the acreage within a 150-foot tree clearing width for monopoles (Alternative B) and a 200-foot width for H-frame structures (for other alternatives except for a short segment of the West Fisher Creek Alternative that has monopoles). Actual acreage cleared would be less and would depend on tree height, slope, and line clearance above the ground. Acreage of new roads and roads with extensive upgrading requirements was based on an assumed total disturbance width of 25 feet.

Similar to the mine area, the KNF amended the KFP in the 1993 ROD and reallocated areas crossed by the selected North Miller Creek transmission line classified as "corridor avoidance" areas (224 acres) to MA 23. MA 23 is designed to accommodate the activities associated with electrical transmission corridors on the KNF (USDA Forest Service 1987a). All areas currently proposed for disturbance by MMC's proposed transmission line alignment classified as corridor avoidance areas were not reallocated to MA 23 due to mapping technology and slight changes in the North Miller Creek transmission line alignment from that approved in 1993.

In transmission line Alternatives B, C-R, D-R, and E-R, the KNF would amend the KFP by reallocating certain areas within a 500-foot corridor of the selected 230-kV transmission line on National Forest System lands as MA 23. A corridor wider than that used in 1993 was used because the final transmission line alignment may be within 250 feet of the centerline analyzed in the EIS and within 250 feet of the approved facility location (centerline) (ARM 17.20.301 (21)). Specifically, the amendment would apply to the following MAs if crossed by the transmission line: MA 10 and 11 if the proposed corridor were within grizzly bear management situation 1 or 2; and MAs 2, 6, 12, 13, and 14. This amendment would apply only to National Forest System lands that currently are not MA 23 disturbed by any transmission line alternative, and would not apply to private or State lands crossed by the transmission line alternatives. Maps showing areas of proposed reallocation are available at the KNF.

3.15.3 Affected Environment

The KNF manages most lands in the land use analysis area (Figure 78), encompassing a total of 13,235 acres in the mine analysis area, and 14,010 acres in the transmission line analysis area. Private land occurs along Libby Creek, Little Cherry Creek, Miller Creek, West Fisher Creek, and Fisher River. Mine facilities associated with the Montanore Project would be developed on patented mining claims and on unpatented mining claims on National Forest System lands under KNF's management. The KNF manages public land for multiple use benefits, including wood products, recreation, range, wildlife, mineral development, and wilderness. Forest industry land is primarily managed for wood products, and private lands are managed to satisfy individual landowner objectives. Plum Creek, Libby Placer Mining Company, or MMC own most of private lands in the land use analysis area. Plum Creek and other property owners own land along the transmission line corridors; Plum Creek also owns the land proposed for the Sedlak Park Substation and loop line; Libby Placer Mining Company and MMC own land near the proposed mine facilities (Figure 78). Private land within the analysis area includes 446 acres owned by MMC, 5,399 acres owned by Plum Creek, and 4,151 acres owned by other private entities.

The National Forest System lands of the Libby Ranger District provide about 6 to 8 million board feet (mmbf) of timber annually. As discussed in section 3.3, *Reasonably Foreseeable Future Actions or Conditions*, the KNF completed an EIS on the Miller-West Fisher Vegetation Management Project in the land use analysis area. Timber harvest activity also occurs on private, forest-industry lands. The amount of timber harvested has declined in the past 10 years. Small-scale timber harvests occur in the range of 2 to 6 mmbf annually on the private lands in the land use analysis area. Plum Creek has harvested several tracts of private, forest-industry lands on lower Miller Creek and along the Fisher River.

One parcel of State land would be crossed by the West Fisher Creek transmission line alignment. The DNRC manages the surface and mineral resources for the benefit of the common schools and six administrative land offices, under the direction of the State Board of Land Commissioners. The DNRC's obligation for management and administration of Trust Land is to obtain the greatest benefit for the beneficiaries. The greatest monetary return must be weighed against the long-term productivity of the land to ensure continued future returns to the trusts. The Northwestern Land Office of the DNRC facilitates local management of the State lands within the land use analysis area. Hunting also occurs on State land (Power Engineers 2005c).

Some mineral activity currently occurs in the land use analysis area, including small placer operations on Libby and Big Cherry creeks, and small lode mining operations along Libby Creek. A number of mineral operators do some form of mine development work along the east face of the Cabinet Mountains each year. The DEQ permitted three small sand and gravel operations within the land use analysis area. One electrical transmission line is located in the land use analysis area. The BPA currently operates the Noxon-Libby 230-kV transmission line near the proposed Sedlak Park Substation. No pipelines 8 inches or greater in diameter occur within 1 mile of the transmission line alternatives. Four Montana Department of Agriculture registered general (commercial) apiaries are located in the land use analysis area. Commercial apiaries are used for honey production and/or pollination. General (commercial) apiary registrations are apiaries placed by permission on someone's property and contain more than five hives.

3.15.3.1 Private Lands

Southern Lincoln County is a rural area with no major population centers. Large-lot residential properties, ranches, and cabins are found along US 2 near Libby Creek Road (NFS road # 231), Bear Creek Road (NFS road # 278), the Fisher River, and Pleasant Valley. The City of Libby is along the Kootenai River about 15 miles north of the land use analysis area. Twenty residences are within 1 mile of the four transmission line alternatives. Most of these properties are within 0.5 mile of US 2 (Figure 79). No platted subdivisions are within 1 mile of the transmission line alternatives. The Libby Adit Site and portions of the Little Cherry Creek Impoundment Site are private lands owned by MMC.

In 2003, Plum Creek sold a conservation easement to the FWP on 142,000 acres in northwest Montana, some of it (3,658 acres) within the land use analysis area (Figure 78). The land covered by the Thompson-Fisher conservation easement offers opportunities for the continuation of forest and resource management, commercial timber harvesting and other commodity use, recreational characteristics, and open space, all of which provide fish and wildlife habitat. The conservation easement was partially funded by the Forest Legacy Program for the purpose of preventing the land from being converted to non-forest uses. One of the stated purposes of the conservation easement is to "preserve and protect in perpetuity the right to practice commercial forest and resource management." The conservation easement was mapped and reviewed during the transmission line screening analysis process (ERO Resources Corp. 2006b).

Plum Creek lands not covered by the conservation easement are currently managed the same as easement lands (*i.e.*, timber harvest and other commodity use, recreation, and wildlife habitat). Because these lands are not subject to the conservation easement, future land uses by Plum Creek or subsequent owners could change to include activities prohibited by the easement (Parker, pers. comm. 2008).

3.15.3.2 Kootenai National Forest Land Management Plan

Land management direction for the KNF is described in the following sections. Management prescriptions are specified for each MA by resource, including recreation, wildlife and fish, timber, soils, water, and air resources, minerals and geology, lands, and facilities. Only National Forest System lands are managed under the KFP.

3.15.3.2.1 Forest-wide Goals, Objectives, and Standards

Goals

Goals provide information on the long-range management intent. The objectives and standards of both the forest as a whole and individual MAs must support the goals. All activities conducted on the KNF must contribute to the realization of the goals (KFP Vol. 1 II-1). The goal for mineral development, discussed under Goal #11 is to "encourage responsible development of mineral resources in a manner that recognizes national and local needs and provides for economically and environmentally sound exploration, extraction, and reclamation." (KFP Vol. 1 II-2). The KFP also establishes a goal of providing a sustained yield of timber volume responsive to market demands and supportive of a stable base of economic growth in the dependent geographic area (KFP Vol. 1 II-1 #1). Goals for wildlife resources include: (1) maintaining and enhancing sufficient habitat to facilitate recovery of threatened and endangered species (KFP Vol. 1 II-1 #6); (2) maintaining diverse age classes of vegetation to support viable populations of existing vertebrate species, including old growth dependent species (KFP Vol. 1 II-1 #7); (3) managing for sufficient snags (dead standing trees) to maintain viable populations of snag-dependent species (KFP Vol. 1 II-1 #8); and (4) maintaining big game and fisheries habitat (KFP Vol. 1 II-2 #12, #13). For water quality, the KFP establishes a goal of meeting or exceeding state water quality standards (KFP Vol. 1 II-1 #19). To achieve this goal, forest-wide objectives for water quality require application of practicable mitigation measures, including those identified in the Soil and Water Conservation Handbook (USDA Forest Service 1988b).

Objectives

Mineral exploration and development may occur on nearly all areas of the KNF; areas withdrawn from future mineral entry include the CMW and developed recreation sites. MMC currently holds mineral rights inside the CMW established before the legislatively mandated withdrawal date. The objective concerning minerals requires consideration of other resources during mineral exploration and development (KFP Vol. 1 II-8).

Objectives for facility corridors, such as a transmission line, are discussed under Corridors in the KFP. The objectives establish corridor exclusion, avoidance, and window areas to assist in corridor siting (KFP Vol. 1 II-11). Criteria for these areas are outlined in Appendix 15, Corridor Criteria, of the KFP. Goals and objectives for cultural resources, recreation, visual resources, air quality, road management, and riparian areas have also been established and are described in the KFP (KFP Vol. 1 II-5, II-6, II-10, II-11). These are described in other sections of this chapter.

Standards

The minerals standard requires the KNF to “recognize the value and importance of the mineral resource in management activities” (KFP Vol. 1 II-27). Road access for mineral development “will be allowed if it is the next logical step in the development of the mineral resource,” subject to the restriction of various laws, such as the Wilderness Act and the ESA. Plans of Operations for mineral development must include “reasonable and justified” requirements designed to minimize environmental impacts (KFP Vol. 1 II-27). Under the minerals standard, the KNF will provide guidance to the mineral industry, where possible, to assist in developing mining plans that minimize environmental damage (KFP Vol. 1 II-27).

3.15.3.2.2 Management Area Goals and Standards

The KFP describes the goals and standards for 24 MAs located on the forest. The MAs within or adjacent to the land use analysis area are described in the following sections (maps of these management areas are available from KNF). The standards are summarized in Table 138. MAs classified as corridor exclusion or corridor avoidance areas are shown on Figure 79. For all MAs discussed in the following sections, the standard for minerals refers to the forest-wide standards described in the above section. In all MAs, soil and water conservation practices are to be implemented for all developmental activities.

Semi-primitive Non-motorized Recreation (MA 2). The goal of MA 2 is to provide the protection and enhancement areas for roadless recreation use and to provide for wildlife management where specific wildlife values are high. In some areas, this MA provides habitat that will contribute to grizzly bear recovery. Some roads are currently open to some form of motorized recreational use, including snowmobiles. Forest-wide standards for mineral development apply. Roads may be justified for mineral activities. This MA is classified as a corridor avoidance area (KFP Vol. 1 III-5).

Table 138. Summary of Relevant Standards in Selected Management Areas on the KNF.

Management Area	Locatable Mineral Development	Powerline Corridors	Lands and Facility Occupancy	Motorized Access	Wildlife	Logging	Visual Quality Objective	Road Development
Semi-primitive non-motorized recreation (MA 2)	Forest-wide standards apply	Avoidance area	Frequently used facilities normally prohibited	Closed, except for limited exceptions	Grizzly habitat	Unsuitable	Retention	Generally prohibited; existing roads may be used for mineral development on a case-by-case basis; new roads permitted when justified by mineral information
Developed recreation sites (MA 6)	Restricted	Avoidance area	Permitted	Restricted	Provide habitat	Unsuitable	Partial retention	Restricted
Existing wilderness (MA 7)	Valid mineral rights will be managed per existing laws and regulations	Avoidance area	Prohibited	Restricted	Provide habitat	Unsuitable	Preservation	Restricted
Big game winter range (MA 10)	Forest-wide standards apply	Avoidance area	Permitted with winter restrictions	Closed during winter	Maintain openings for big game	Unsuitable	See footnotes†‡	Restricted
Big game winter range/timber (MA 11)	Forest-wide standards apply	Avoidance area	Permitted with winter restrictions	Closed during winter	Maintain openings for big game	Suitable	See footnotes†‡	Restricted
Big game summer range (MA 12)	Forest-wide standards apply	Avoidance area	Frequently used facilities normally prohibited	Roads generally closed	Big game and grizzly habitat	Suitable	See footnote†	Restricted
Designated old growth timber (MA 13)	Forest-wide standards apply	Avoidance area	Restricted	Prohibited during summer/fall	Grizzly bear and old growth species habitat	Unsuitable	See footnotes†‡	Restricted

Table 138. Summary of Relevant Standards in Selected Management Areas on the KNF. (cont'd).

Management Area	Locatable Mineral Development	Powerline Corridors	Lands and Facility Occupancy	Motorized Access	Wildlife	Timber Production	Visual Quality Objective	Road Development
Grizzly habitat (MA 14)	Forest-wide standards apply	Avoidance area	Generally prohibited	Allowed, with restrictions	Grizzly habitat	Suitable	See footnote†	Restricted during active grizzly use
Timber production (MA 15)	Forest-wide standards apply	Permitted	Permitted	Allowed	Provide habitat	Suitable	Maximum modification	Allowed
Timber with viewing (MA 16)	Forest-wide standards apply	Permitted	Permitted	Allowed	Provide habitat	Suitable	Modification	Allowed
Viewing with timber (MA 17)	Forest-wide standards apply	Permitted	Permitted	Allowed	Provide habitat	Suitable	Partial retention	Allowed
Revegetation problem areas (MA 18)	Forest-wide standards apply	Permitted	Permitted	Allowed	Provide habitat	Unsuitable	See footnote†	Restricted
Steep lands (MA 19)	Forest-wide standards apply	Permitted	Permitted	Allowed	Provide habitat	Unsuitable	See footnote†	Allowed
Electric Transmission Corridor (MA 23)	Forest-wide standards apply	Permitted	Permitted	Allowed, with possible public access restriction	Grizzly habitat	Unsuitable	Maximum modification	Allowed
Low Productivity Areas (MA 24)	Forest-wide standards apply	Case-by-case basis	Case-by-case basis	Allowed, with restrictions	Grizzly habitat	Unsuitable	See footnote†	Restricted
Mineral Development (MA 31)	Forest-wide standards apply	Case-by-case basis consistent with mineral production facility	Case-by-case basis consistent with mineral production facility	Allowed	Locate facilities, if possible, away from important winter range, calving areas, riparian areas, and meadows	Unsuitable	Maximum modification	Allowed

†Maximum modification in areas of low visual significance, modification in areas of moderate visual significance, and partial retention in areas of high visual significance.
‡Unless infeasible when attempting to meet the goals of the Management Area.
Source: USDA Forest Service 1987.

Developed Recreation Sites (MA 6). MA 6 includes developed campgrounds, picnic areas, boat ramps, and other developed recreation sites. Areas are usually associated with water features such as lakes, reservoirs, and streams. The goal of MA 6 is to provide safe and sanitary developed recreation in a setting that is pleasant and visually attractive. This MA is usually withdrawn from mineral development, and is classified as a corridor avoidance area (KFP Vol. 1 III-18).

Existing Wilderness (MA 7). The goal of MA 7 is to manage in accordance with the Wilderness Act of 1964, to allow natural processes to continue, maintain the opportunity for solitude and primitive recreation, provide habitat contributing to the recovery of the grizzly bear, and provide natural habitat for viable populations of other species of wildlife which have historically occupied the area. This MA is classified as a corridor avoidance area (KFP Vol. 1 III-23).

Big Game Winter Range (MA 10). The goal of MA 10 is to maintain or enhance the habitat effectiveness for winter use by big-game species including elk, moose, sheep, goats, whitetail deer, and mule deer. The goal also is to maintain or enhance visual resources in areas visible from major travel corridors. This MA is classified as a corridor avoidance area (KFP Vol. 1 III-40).

Big Game Winter Range/Timber (MA 11). The goal for MA 11 is to maintain and enhance winter range habitat effectiveness for big game species while also producing a programmed yield of timber and maintaining the scenic resource in areas of high visual significance. The standards concentrate on protection of important wintering areas and providing optimum habitat for elk, mule deer, whitetail deer, moose, sheep, and goats for winter survival. These areas are corridor avoidance areas in grizzly bear habitat. Programmed timber harvest is authorized (KFP Vol. 1 III-45).

Big Game Summer Range/Timber (MA 12). The goal for MA 12 emphasizes maintenance or enhancement of summer and fall big game habitat while producing a programmed yield of timber. The goals and standards focus on providing big game habitat diversity for black bear, grizzly bear, elk, moose, mule deer, and whitetail deer. Timber production will be maintained through cultural treatments and regeneration harvest designed to reduce the frequency of entries. Facilities that require frequent maintenance or occupancy are normally not allowed. This MA is a corridor avoidance area in areas important to grizzly bear use (KFP Vol. 1 III-51).

Designated Old Growth Timber (MA 13). MA 13 provides the special habitat necessary for old growth-dependent wildlife on at least 10 percent of the land area within each major drainage, and in units that represent the major habitat types and tree species of each drainage. The standards emphasize providing diverse, high quality, year-round habitat for old growth-dependent wildlife (usually other than big game) by relying on natural processes of stand aging, decadence and eventual deterioration. This MA is classified as a corridor avoidance area (KFP Vol. 1 III-56).

Grizzly Bear Habitat/Timber (MA 14). MA 14 is designed to maintain or enhance grizzly bear habitat, reduce grizzly/human conflicts, assist in the recovery of the grizzly bear, realize a programmed level of timber production, and provide for the maintenance or enhancement of other wildlife, especially big game. Identified grizzly habitat components will be maintained or enhanced, and key components such as wet meadows and bogs will be mapped and managed as riparian areas. This MA is classified as a corridor avoidance area (KFP Vol. 1 III-60).

Timber Production (MA 15). The goal of MA 15 is to produce timber volumes suitable for harvest by conventional methods while providing for other resource values such as soil, air, water, wildlife, recreation and forage for domestic livestock. This MA has standards and guidelines for providing optimum timber production by ensuring full stocking through natural and artificial regeneration, and maintaining optimal volume growth through stocking control by thinning. Most roads are open for motorized recreation. Transmission line corridors are permitted (KFP Vol. 1 III-66).

Timber with Viewing (MA 16). The goal of MA 16 is to produce timber while providing for a pleasing view. This MA is characterized by productive forest land that has moderate viewing sensitivity. There are no identified habitats for threatened or endangered species. Most roads are open for motorized recreation. Transmission line corridors are permitted (KFP Vol. 1 III-71).

Viewing with Timber (MA 17). The goal of MA 17 is to provide landscapes that are pleasing to the viewer, while producing a level of timber production that is compatible with visual resource protection. Roads are generally located so they are not visible from major travel corridors. Transmission line corridors are permitted (KFP Vol. 1 III-76).

Regeneration Problem Areas (MA 18). MA 18 occurs on areas of slope in excess of 40 percent where timber productivity is moderate to high. This MA is distinguished by the difficulty in establishing coniferous regeneration after timber harvest. The goals of this MA are to maintain the existing coniferous vegetation until techniques and practices are available to ensure that timber can be harvested and the area adequately regenerated within 5 years of harvest, and to maintain viable populations of existing native wildlife species. Because of the sensitivity of MA 18, water quality and soil erosion will be monitored as part of any surface disturbance activity. Transmission line corridors are permitted (KFP Vol. 1 III-81).

Steep Lands (MA 19). MA 19 occurs on steep slopes and breaklands over 60 percent where timber productivity is moderate to high. The soil is usually erodible or the land unstable due to steepness. The goal of MA 19 is to ensure soil stability and water quality by maintaining vegetation in a healthy condition and by minimizing surface disturbance. While many wildlife species use these areas, they are not known to be essential to any species (KFP Vol. 1 III-83).

Electric Transmission Corridor (MA 23). The goal for MA 23 is to provide for the transmission of electricity in a safe and efficient manner. The goal is also to protect the adjacent wilderness character, contribute to the diversity of surrounding wildlife habitat, and provide as much security as possible for the grizzly bear. The VQO is maximum modification (KFP Vol. 1 III-113).

Low Productivity Areas (MA 24). This MA consists of moderate to steep slopes, is usually rocky with thin soils, and often occurs on glacially-scoured ridgetops, walls, or talus slopes. MA 24 is generally located at mid to high elevations and has relatively little productive capacity for many of the surface resources. The goal for MA 24 is to manage primarily for site protection, and for any wildlife resources that may exist (KFP Vol. 1 III-116).

Mineral Development (MA 31). The goal of MA 31 is to provide mineral production workers with safe and healthful working areas that are in concert with the surrounding MAs as much as possible. Additional sites for this MA will be provided as demand and successful mineral discoveries permit. The VQO is maximum modification (KFP amendments).

Riparian Areas. In 1995, the KNF amended the KFP to adopt the INFS (USDA Forest Service 1995) to establish stream, wetland, and landslide-prone area protection zones called RHCAs. These RHCAs are designated along most of the streams in the land use analysis area. Section 3.6, *Aquatic Life and Fisheries* provides more information about the standards and guidelines for managing activities within a RHCA.

3.15.4 Environmental Consequences

3.15.4.1 Alternative 1 – No Mine

The changes in land use associated with a mine would not occur. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands. Disturbances on private land at the Libby Adit Site would remain until reclaimed in accordance with existing permits and approvals. Use of National Forest System lands would continue to be managed in accordance with the KFP. Existing land use of private land in the Little Cherry Creek Tailings Impoundment Site and along the Bear Creek Road (NFS road #278) would continue.

3.15.4.2 Alternative 2 – MMC's Proposed Mine

Most of the proposed mine facilities would be on National Forest System lands. The management emphasis of these lands is listed in Table 138. Most of the lands are currently managed for mineral development, wildlife habitat, recreation, and commercial timber production. During the life of the operation, use of the lands within the permit areas would be devoted to mining and associated activities. The operating permit area and the disturbance along the Bear Creek access road (NFS road #278) would total 3,628 acres; about 2,582 acres would be disturbed. Adjacent land use during the operation would be affected to some extent; these impacts are described in other sections on recreation, noise, scenic resources, and wildlife. Disturbance at the Libby Adit Site, Rock Lake Ventilation Adit Site, and portions of the Little Cherry Creek Impoundment Site (286 acres) are private lands owned by MMC (Table 139). LAD Area 2 would be immediately adjacent to private land along Libby Creek (Figure 78). Disturbance associated with the Little Cherry Creek Impoundment Site and LAD Area 2 may result in indirect effects on adjacent private lands. These effects on air quality, aquatic life and fisheries, surface water hydrology, scenery, and sound are discussed in greater detail in sections 3.4.4, 3.6.4, 3.11.4, 3.17.4, and

Table 139. Summary of Land Ownership and Disturbance Areas for each Mine Alternative.

Ownership	Alternative 2 – MMC's Proposed Mine	Alternative 3 – Agency Mitigated Poorman Impoundment Alternative	Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative
National Forest System Land	2,288	1,549	1,639
MMC Owned	286	16	276
Other Private	9	9	9
Total	2,582	1,565	1,924

All units are in acres.

Source: GIS analysis by ERO Resources Corp. using KNF data.

3.20.4. Widening of the Bear Creek Road would affect about 9 acres of private land in three separate parcels between 1 and 3 miles south of the road's intersection with US 2.

MMC would purchase 2,758 acres of private lands to mitigate for habitat losses not offset by KNF's road access changes. In some instances, MMC may purchase a conservation easement with fee title remaining with the private party. The conveyance of title or a conservation easement on private land would restrict future residential and commercial development on 2,758 acres of private lands.

All lands disturbed by the project would be revegetated and, except for the Bear Creek Road and the tailings impoundment facilities, would return to pre-mine uses and productivity over time. The Bear Creek Road from US 2 to the Bear Creek Bridge would not be restored to its narrower pre-mining width. Successful reclamation would result in reforestation of disturbed lands. The goal of reclamation would be to restore lands to productive use. The Little Cherry Creek Tailings Impoundment and the upper part of the Diversion Channel would not support pre-mining timber production. The disturbance associated with the Bear Creek Road widening also would not support pre-mining timber production.

In all alternatives, the KFP would be amended for portions of the mine permit areas that are not currently designated for mineral development (MA 31). A few areas currently designated for mineral development also would be reallocated to other Management Areas. In Alternative 2, 1,816 acres would be reallocated to MA 31 (Table 140). Under MA 31, land management in the mine permit areas would change from the present direction for uses listed in Table 140 to long-term management for mineral development. The MA that would require the most change is currently MA 14, which is managed for grizzly bear habitat. Because the permit area at the Ramsey Plant Site is better defined than in 1993, 25 acres at the site would be reallocated from MA 31 back to MA 2, semi-primitive non-motorized recreation. Similarly, 5 acres at the Little Cherry Creek Impoundment Site would be reallocated back to MA 14, grizzly bear habitat. Maps showing areas of proposed reallocation are available at the KNF.

3.15.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Like Alternative 2, most of the proposed mine facilities would be on National Forest System lands currently managed for wildlife habitat, recreation, mineral development, and commercial timber production. During the life of the operation, use of the lands within the permit areas would be devoted to mining and associated activities. The operating permitted area and the disturbance along the Bear Creek access road (NFS road #278) would total 2,157 acres; about 1,565 acres would be disturbed. Effects of Alternative 3 would be similar to Alternative 2. The Libby Adit Site is private land owned by MMC. The Poorman Impoundment Site would be immediately west of private land along Libby Creek, with the same indirect effects on adjacent private land as Alternative 2. Effects of widening of the Bear Creek Road would be the same as Alternative 2.

Table 140. Acres of National Forest System Land to be Reallocated by Management Area for each Mine Alternative.

Management Area Allocation	Alternative 1 – No Mine (Existing Conditions)	Alternative 2 – MMC's Proposed Mine		Alternative 3 – Agency Mitigated Poorman Impoundment Alternative		Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative	
	(Acres)	With Project (acres)	Change (Acres)	With Project (acres)	Change (Acres)	With Project (acres)	Change (Acres)
MA 2-Semi-primitive non-motorized recreation	2,402	2,219	-183	2,392	-10	2,393	-9
MA 6-Developed recreation sites	86	86	0	86	-<1	86	-<1
MA 7-Existing wilderness	66	66	0	66	0	66	0
MA 11-Big game winter range/timber	1,099	1,099	0	1,099	0	1,099	0
MA 13-Old growth timber†	2,388	2,016	-372	2,129	-259	2,044	-344
MA 14-Grizzly habitat	3,552	2,767	-785	3,166	-386	3,256	-296
MA 15- Timber production	121	121	0	121	0	121	0
MA 16-Timber with viewing	1,858	1,385	-473	1,752	-106	1,385	-473
MA 17-Viewing with timber	329	295	-34	329	0	295	-34
MA 18-Regeneration problem areas	12	12	0	12	0	12	0
MA 19-Steep lands	14	14	0	14	0	14	0
MA 23-Electric transmission corridor	200	180	-20	178	-22	178	-22
MA 31-Mineral development	1,108	2,975	1,867	1,891	783	2,286	1,178
Total	13,235	13,235		13,235		13,235	

Acreage based on the permit areas surrounding the adit sites, plant site, tailings impoundment, and in Alternative 2, LAD Areas.
†The KNF would reallocate 797 acres of old growth in Alternative 3 and 828 acres in Alternative 4 to MA 13 (Table 179). The reallocated stands of old growth have not been identified specifically, and would be before issuance of a ROD.
Source: GIS analysis by ERO Resources Corp. using KNF data.

MMC would acquire or place a conservation easement on 5,387 acres of private land for grizzly bear mitigation in Alternative 3. MMC also would convey land used for isolated wetland mitigation along Little Cherry Creek to the Forest Service. The conveyance of title or a conservation easement on private land would restrict future residential and commercial development on these lands.

All lands disturbed by the project would be revegetated and, except for the Bear Creek Road and the tailings impoundment facilities, would return to pre-mine uses and productivity over time. The Poorman Tailings Impoundment and the disturbance associated with the Bear Creek Road widening would not support pre-mining timber production.

In Alternative 3, the KFP would be amended to reallocate 783 acres to MA 31 (Table 140). Under MA 31, land management in the mine permit areas would change from the present direction for uses listed in Table 140 to long-term management for mineral development. The MAs that would require the most change is MA 13 (259 acres of old growth timber) and MA 14 (386 acres of grizzly bear habitat). Because the permit area would not include Ramsey Plant Site, 150 acres at the Ramsey Plant Site would be reallocated back to MA 2, semi-primitive non-motorized recreation. Similarly, 466 acres at the Little Cherry Creek drainage (outside of the permit area for the tailings impoundment) would be reallocated back to MA 14, grizzly bear habitat. Maps showing areas of proposed reallocation are available at the KNF.

3.15.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Like the other alternatives, most of the proposed mine facilities in Alternative 4 would be on National Forest System lands currently managed for grizzly bear habitat. Management emphasis of the permit area of other facilities is mineral development, recreation, and commercial timber production. During the life of the operation, use of the lands within the permit areas would be devoted to mining and associated activities. The permitted area and the disturbance along the Bear Creek access road (NFS road #278) would total 2,979 acres; about 1,924 acres would be disturbed. Effects of Alternative 4 would be similar to Alternative 2. Land use of MMC's private land at the Libby Adit Site, Rock Lake Ventilation Adit Site, and the Little Cherry Creek Impoundment Site would be the same as Alternative 2. Indirect effects of the Little Cherry Creek Impoundment Site on adjacent private land, and the effects of widening of the Bear Creek Road would be the same as Alternative 2.

MMC would acquire or place a conservation easement on 6,151 acres of private land for grizzly bear mitigation in Alternative 4. The conveyance of isolated wetland mitigation lands would be the same as Alternative 3. The conveyance of title or a conservation easement on private land would restrict future residential and commercial development on these lands.

All lands disturbed by the project would be revegetated and, except for the Bear Creek Road and the tailings impoundment facilities, would return to pre-mine uses and productivity over time. The Little Cherry Creek Tailings Impoundment, upper part of the Diversion Channel, and the disturbance associated with the Bear Creek Road widening would not support pre-mining timber production.

The KFP would be amended to change the management allocation to mineral development (MA 31) on 1,178 acres from the present direction for uses listed in Table 140. About 344 acres of the land to be reallocated is currently MA 13 (old growth timber) and 296 acres are MA 14 (grizzly bear habitat). The permit area would not include Ramsey Plant Site, and 150 acres at the Ramsey Plant Site would be reallocated from MA 31 back to MA 2, semi-primitive non-motorized recreation. Similarly, 228 acres at the Little Cherry Creek Impoundment Site outside of the permit area for the tailings impoundment would be reallocated back to MA 14, grizzly bear habitat. Maps showing areas of proposed reallocation are available at the KNF.

3.15.4.5 Alternative A – No Transmission Line

In Alternative A, the transmission line, Sedlak Park Substation, and the loop line for the Montanore Project would not be built. No changes in land use in Alternative A would occur. Use of National Forest System lands would continue to be managed in accordance with the KFP. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands. Existing land use of State land along West Fisher Creek, Plum Creek lands, and private land along US 2 and at scattered parcels in the Miller Creek, West Fisher Creek and Standard Creek drainages would continue.

3.15.4.6 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

3.15.4.6.1 Direct Effects

In the North Miller Creek Alternative, the alignment would cross Plum Creek land in the Fisher River valley and in three sections immediately west of the Fisher River (Figure 78). These segments would parallel existing road corridors (roads on Plum Creek lands, US 2 and NFS road #385). Alternatives B through E-R would use or parallel existing road corridors, including open, gated, barriered, or impassable roads. The North Miller Creek Alternative would have 5.1 miles of centerline within 100 feet of an existing road (Table 141).

Table 141. Use of Existing Road Corridors.

Alternative	Miles of Centerline within 100 Feet of Existing Road Corridors
Alternative B – North Miller Creek Alternative	5.1
Alternative C-R – Modified North Miller Creek	3.8
Alternative D-R – Miller Creek	3.6
Alternative E-R – West Fisher Creek	5.9

Source: GIS analysis by ERO Resources Corp. using KNF data.

All transmission line alternatives would include the Sedlak Park Substation and loop line (steel monopoles would be used). The Sedlak Park Substation and loop line would affect 4.4 acres of Plum Creek land, all of which are covered by the conservation easement. About 7.2 miles of Plum Creek land would be crossed, 5.4 miles of which are covered by the conservation easement with FWP. Two sections of Plum Creek land west of the Fisher River not covered by the conservation easement with FWP would be crossed. Clearing of up to 129 acres of Plum Creek land, which is compatible with Plum Creek's land management, would be needed for the transmission line (Table 142). About 10 acres of additional clearing would be needed for access road construction on private land (Table 143). Following construction, the transmission line could restrict cable logging in areas adjacent to the line. Plum Creek land is managed primarily for timber production; some dispersed recreation also occurs on Plum Creek land. This alternative would cross less than 0.1 mile of other private land near the Fisher River.

Table 142. Summary of Land Ownership within Clearing Areas for each Transmission Line Alternative.

Ownership	Alternative B – North Miller Creek		Alternative C-R – Modified North Miller Creek		Alternative D-R – Miller Creek		Alternative E-R – West Fisher Creek	
	(ac.)†	(mi.)	(ac.)	(mi.)	(ac.)	(mi.)	(ac.)	(mi.)
National Forest System Land	168	9.3	206	8.5	220	9.1	200	8.3
State of Montana	0	0.0	6	0.2	6	0.2	25	1.1
Plum Creek (with conservation easement)	97	5.4	86	3.6	86	3.6	89	3.7
Other Plum Creek	32	1.8	19	0.8	19	0.8	49	2.0
Other Private	1	<0.1	0	0.0	0	0.0	0	0.0
Total	297	16.4	317	13.1	331	13.7	363	15.1

All values are in acres.
†Acreage is based on a 150-foot clearing width for monopoles (Alternative B) and 200-foot width for H-frame structures (other alternatives except for a short segment of the West Fisher Creek Alternative that has monopoles). Actual acreage cleared would be less than listed and would depend on tree height, slope, and line clearance above the ground.
Totals may vary slightly due to rounding.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Table 143. Estimated Road Construction or Reconstruction in Each Transmission Line Alternative.

MA Direction on Road Development†	Alternative B – North Miller Creek		Alternative C-R – Modified North Miller Creek		Alternative D-R – Miller Creek		Alternative E-R – West Fisher Creek	
	(ac.)	(mi.)	(ac.)	(mi.)	(ac.)	(mi.)	(ac.)	(mi.)
National Forest System Lands - Road Construction Allowed (MAs 15, 16, 23, 31)	5.8	1.9	1.4	0.4	5.2	1.7	1.4	0.5
National Forest System Lands - Road Construction Restricted (MAs 2, 6, 10, 11, 12, 13, 14, 18, 19, 24)	14.9	5.0	3.0	1.0	5.3	1.7	4.9	1.6
State Lands	0.0	0.0	0.5	0.2	0.5	0.2	0.4	0.2
Private Lands	10.0	3.3	4.5	1.5	4.5	1.5	5.0	1.6
Total	30.7	10.2	9.4	3.1	15.5	5.1	11.7	3.9

New roads and roads with extensive requirements for upgrading are assumed to be 25 feet wide. Values are rounded to the nearest 0.1 acre and mile, and conversion between the two may vary due to rounding.
†See Table 138. for MA descriptions. Values reflect MA status after KFP amendment.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Table 144. Acres of KNF land to be Reallocated by Management Area for each Transmission Line Alternative.

Management Area Emphasis	Timber Harvest Suitability	Alternative A	Alternative B – North Miller Creek		Alternative C-R – Modified North Miller Creek		Alternative D-R – Miller Creek		Alternative E-R – West Fisher Creek	
		(Acres)	With Project (acres)	Change (Acres)	With Project (acres)	Change (Acres)	With Project (acres)	Change (Acres)	With Project (acres)	Change (Acres)
MA 2-Semi-primitive non-motorized recreation	Unsuitable	862	890	28	988	126	988	126	988	126
MA 6-Developed recreation sites	Unsuitable	270	270	0	270	0	271	1	271	1
MA 10-Big game winter range	Unsuitable	224	224	0	224	<1	224	<1	220	-4
MA 11-Big game winter range/Timber	Suitable	3,055	2,910	-145	2,918	-137	3,048	-7	2,843	-212
MA 12-Big game summer range	Suitable	2,846	2,827	-19	2,826	-20	2,732	-114	2,725	-121
MA 13-Old growth timber†	Unsuitable	794	790	-4	807	13	806	12	814	20
MA 14-Grizzly habitat	Suitable	971	970	-1	990	19	1,007	36	1,002	31
MA 15-Timber production	Suitable	2,265	2,265	0	2,265	0	2,265	0	2,265	0
MA 16-Timber with viewing	Suitable	531	531	0	531	0	531	0	531	0
MA 18-Regeneration problem areas	Unsuitable	1,067	1,067	0	1,067	0	1,067	0	1,067	0
MA 19-Steep lands	Unsuitable	408	408	0	408	0	408	0	408	0
MA 23-Electric transmission corridor	Unsuitable	233	374	141	232	-1	179	-54	392	159
MA 24-Low productivity areas	Unsuitable	342	342	0	342	0	342	0	342	0
MA 31-Mineral development	Unsuitable	142	142	0	142	0	142	0	142	0
Total		14,010	14,010		14,010		14,010		14,010	

Acreage calculated on the basis of a 500-foot corridor along transmission line centerline to allow for flexibility during final design of the line.
†The KNF would reallocate 36 acres of old growth in Alternative C-R, 12 acres in Alternative D-R, and 3 acres in Alternative E-R (Table 180). The reallocated stands of old growth have not been identified specifically, and would be before issuance of a ROD.
Source: GIS analysis by ERO Resources Corp. using KNF data.

MMC would purchase 68 acres of private lands to mitigate for habitat losses not offset by KNF's road access changes. In some instances, MMC may purchase a conservation easement with fee title remaining with the private party. The conveyance of title or a conservation easement on private land would restrict future residential and commercial development on 68 acres of private lands.

Alternative B would remove 104 acres of timber production on lands covered by FWP's conservation easement. MMC did not propose to mitigate for this loss of timber production.

The remaining 9.3 miles of North Miller Creek Alternative would be on National Forest System lands managed by the KNF. Because the alternative uses the same alignment that was approved in 1993, about a third of the alignment (3.1 miles) would cross lands currently managed for electric transmission corridors. The line would cross 3.0 miles of land that the KFP has identified as corridor avoidance areas (Figure 79). Of the 3.0 miles of corridor avoidance areas, most (2.5 miles) are currently managed for big game winter range (MA 11), with the remaining 0.5 mile is split between four different MAs. Fourteen residences are within 0.5 mile of this alignment (Figure 79), 11 of which are greater than 450 feet from the centerline of the right-of-way and the remaining three are within 450 feet. About 1,760 feet of this alternative would pass through the Libby Creek Recreational Gold Panning Area.

All transmission line alternatives would require construction of between 3 and 10 miles of new access roads or extensive upgrading of existing access roads. About 1.9 miles of roads would be constructed in areas where road construction is allowed under the KFP, and 5 miles of roads would be in areas where road construction is restricted in some manner (Table 143). For example, MA 11 indicates roads will normally be closed during big game winter use (December 1 to April 30). MMC proposes to restrict motorized activity associated with transmission line construction from April 1 to June 15 within bear habitat in the Miller Creek and Midas Creek drainages. MMC also would restrict transmission line construction during the winter in big-game winter range areas (MA 11).

3.15.4.6.2 Forest Plan Amendment

The North Miller Creek Alternative would require a KFP amendment on lands that would be reallocated, as shown in Table 144. MA 11 (big game winter range/timber) would be reduced by 145 acres and MA 23, electric transmission corridor, would increase by 141 acres. Maps showing areas of proposed reallocation are available at the KNF.

3.15.4.7 Alternative C-R – Modified North Miller Creek Transmission Line Alternative

3.15.4.7.1 Direct Effects

The Modified North Miller Creek Alternative would affect Plum Creek land in the Fisher River valley and in three sections immediately west of the Fisher River similar to the North Miller Creek Alternative (Figure 78). About 4.3 miles of Plum Creek land would be crossed, all of which are covered by the conservation easement with FWP. The Sedlak Park Substation and loop line would affect 4.4 acres of Plum Creek land, all of which are covered by the conservation easement. No other private land would be affected (Table 142). This alternative would use H-frame structures, which have a wider clearing width than the monopoles proposed in Alternative B; up to 105 acres of Plum Creek land and 6 acres of State land would require clearing for the transmission line. Some additional clearing would be needed for access road construction (Table

143). Alternative C-R would have 3.8 miles of centerline within an existing road corridor (Table 141).

The remaining 8.5 miles of the Modified North Miller Creek Alternative would be on National Forest System lands. All four residences within 0.5 mile of this alignment are more than 450 feet from the centerline. Like Alternative B, 1,750 feet of Alternative C-R would pass through the Libby Creek Recreational Gold Panning Area in the same location.

A minimum of 26 structures (about 4.2 miles of line) would be set using a helicopter, minimizing new access road construction or extensive upgrading of closed roads). Additional structures may be set using a helicopter at the contractor's discretion. About 0.4 mile of roads would be constructed in areas where road construction is allowed currently under the KFP, and 1 mile of roads would be in areas where road construction is restricted currently in some manner (Table 143).

Alternative C-R would physically disturb 13 acres of grizzly bear habitat and remove 91 acres of timber production on lands covered by FWP's conservation easement. As mitigation, MMC would acquire or place a conservation easement on 26 acres of private land for grizzly bear mitigation in Alternative C-R. In addition, MMC would convey title or a conservation easement to FWP to up to 91 acres of private land. The acquisition of or placement of a conservation easement on private land would restrict future residential and commercial development on these lands.

3.15.4.7.2 Forest Plan Amendment

The Modified North Miller Creek Alternative would require a KFP amendment on lands that would be reallocated to MA 23. The net change to each management area is shown in Table 144. Most of the lands that would be reallocated would be MA 11, big game winter range/timber (137 acres) and MA 2, semi-primitive non-motorized recreation (126 acres). Maps showing areas of proposed reallocation are available at the KNF.

3.15.4.8 Alternative D-R – Miller Creek Transmission Line Alternative

3.15.4.8.1 Direct Effects

The Miller Creek Alternative would have essentially the same effect on Plum Creek land in the Fisher River valley and in three sections immediately west of the Fisher River as the Modified North Miller Creek Alternative. This alternative also would use H-frame structures; up to 105 acres of Plum Creek and 6 acres of State land would require clearing for the transmission line. Some additional clearing would be needed for access road construction. It would make least use of existing road corridors, with 3.6 miles of centerline within 100 feet of existing roads (Table 141).

The remaining 9.1 miles of the Miller Creek Alternative would be on National Forest System lands. All six residences within 0.5 mile of this alignment are more than 450 feet from the centerline. About 2,120 feet of the alignment would pass through the Libby Creek Recreational Gold Panning Area.

A minimum of 16 structures (about 2.4 miles of line) would be set using a helicopter; additional structures may be set using a helicopter at the contractor's discretion. About 1.7 mile of roads would be constructed in areas where road construction is allowed currently under the KFP, and 1.7 mile of roads would be in areas where road construction is restricted currently in some manner (Table 143).

MMC would acquire or place a conservation easement on 40 acres of private land for grizzly bear mitigation in Alternative D-R. The acquisition of or placement of a conservation easement on private land would restrict future residential and commercial development on these lands. The mitigation for loss of 91 acres of timber production on lands covered by FWP's conservation easement would be the same as Alternative C-R.

3.15.4.8.2 Forest Plan Amendment

The Miller Creek Alternative would require a KFP amendment on lands that would be reallocated as shown in Table 144. MA 12, which currently is managed for big game summer range would decrease by 114 acres, and MA 2 which is managed for semi-primitive non-motorized recreation would increase by 126 acres. Like Alternative C-R, most of the land that would be reallocated from MA 23 to MA 2 is in the Ramsey Creek drainage. Maps showing areas of proposed reallocation are available at the KNF.

3.15.4.9 Alternative E-R – West Fisher Creek Transmission Line Alternative

3.15.4.9.1 Direct Effects

The West Fisher Creek Alternative would cross 5.7 miles of Plum Creek lands, 3.7 miles of which is covered under the conservation easement. This alternative would use H-frame structures, except in the section of State land west of the Fisher River (Figure 78). Up to 138 acres of Plum Creek land would require clearing for the transmission line. Some additional clearing would be needed for access road construction. The Sedlak Park Substation and loop line would affect 4.4 acres of Plum Creek land, all of which are covered by the conservation easement. No other private land would be affected. Up to 25 acres of State land would require clearing for construction of the transmission line.

The remaining 8.3 miles of the West Fisher Creek Alternative would be on National Forest System lands. All six residences within 0.5 mile of this alignment are more than 450 feet from the centerline. About 2,120 feet of the alignment would pass through the Libby Creek Recreational Gold Panning Area. Alternative E-R would make the best use of corridors, with 5.9 miles of the centerline within 100 feet of existing roads (Table 141).

A minimum of 31 structures (about 4.5 miles of line) would be set using a helicopter; additional structures may be set using a helicopter at the contractor's discretion. About 0.5 mile of roads would be required in areas where road construction is allowed currently under the KFP, and 1.6 miles of roads in areas where road construction is not currently allowed (Table 143).

Alternative C-R would physically disturb 15 acres of grizzly bear habitat and remove 94 acres of timber production on lands covered by FWP's conservation easement. As mitigation, MMC would acquire or place a conservation easement on 30 acres of private land for grizzly bear mitigation in Alternative E-R. In addition, MMC would convey title or a conservation easement to FWP to up to 94 acres. The acquisition of or placement of a conservation easement on private land would restrict future residential and commercial development on these lands.

3.15.4.9.2 Forest Plan Amendment

The West Fisher Creek Alternative would require an amendment on lands that would be reallocated as shown in Table 144. Most of the lands that would be reallocated would be MA 11 (big game winter range/timber), which would decrease by 212 acres. MA 23 electric transmission corridor would increase by 159 acres, and MA 2 semi-primitive non-motorized recreation would increase by 126 acres. Maps showing areas of proposed reallocation are available at the KNF.

3.15.4.10 Cumulative Effects

Past actions, such as past mining and road construction, have altered the existing land use. Areas disturbed by past mining and road construction do not provide for timber production or wildlife habitat. Past KFP amendments have changed the MA designations of National Forest System lands. In 1987 when the KFP was issued, the KNF had 1,690 acres allocated to MA 23; MA 31 was not established. Since 1987, the KFP has been amended to allocate 3,473 acres to MA 23 and 1,245 acres to MA 31. In the land use cumulative effects analysis area, previous amendments have allocated 233 acres to MA 23 and 1,108 acres to MA 31. The Rock Creek Project and the Montanore Project would cumulatively increase the amount of National Forest System lands on the KNF managed for transmission line corridors and mineral development.

3.15.4.11 Regulatory/Forest Plan Consistency

Following the amendments to the KFP described in this section and in section 2.12*, Forest Plan Amendment*, the mine and transmission line alternatives would comply with the management area designations of the KFP. Other sections of Chapter 3 discuss compliance with the KFP. If the selected transmission line were approved by the FWP, it would comply with the FWP-Plum Creek conservation easement.

3.15.4.12 Irreversible and Irretrievable Commitments

The tailings impoundment area, about 600 acres in each mine alternative, would be managed for mineral development following operations, and would no longer be managed as suitable for timber production. The area covered by asphalt and gravel by widening the Bear Creek Road would not be returned to pre-mine uses. Timber would be harvested sooner in areas cleared for project facilities. Continued tree clearing along the transmission line would reduce timber production during the life of the project. These resources would be irretrievably affected. Any indirect development associated with the project, such as new permanent residential or commercial development in or around Libby, would likely be permanent.

3.15.4.13 Short-term Uses and Long-term Productivity

In the short term, mine operations would dominate land use on about 2,700 to 3,700 acres, depending on the alternative. Similarly, timber production on 300 to 350 acres, depending on the transmission line alignment, would be eliminated along the transmission line clearing width and access roads. Actual clearing width and lost timber production would be slightly less, and would depend on tree height, slope, and line clearance above the ground. After operations ceased, land uses in most areas affected by the mine, Sedlak Park Substation and loop line, and transmission line would return to pre-mine uses. In addition, 3,000 to 3,800 acres of private land, depending on the alternative, would be acquired and legally dedicated to long-term grizzly bear habitat mitigation.

3.15.4.14 Unavoidable Adverse Environmental Effects

During mine and transmission line construction and operations, all action alternatives would unavoidably alter land use in the land use analysis area.

3.16 Recreation

3.16.1 Regulatory Framework

3.16.1.1 Kootenai Forest Plan

The Forest-wide management direction objectives for recreation outlined in the KFP allows for the maintenance and expansion of trails and developed recreation opportunities (such as campgrounds, picnic areas, and boat launches) as needed to prevent resource damage or to accommodate increased demand, and the expansion of groomed cross-country ski trails and snowmobile trails. The Forest Travel Planning process is used to review, evaluate, and implement the goals and standards of various MAs, with regard to roads, trails, and motorized vehicle use. All recreation activities and management will be based on Recreation Opportunity Spectrum (ROS) inventory (USDA Forest Service 1987a). Management emphasis for individual MAs is described in in Table 138. Executive Order 12962 mandates disclosure of effects on recreational fishing as part of a nationwide effort to conserve, restore, and enhance aquatic systems and provide for increased recreational fishing opportunities.

3.16.1.2 State and Local Plans

Outdoor recreation is an important part of the lifestyle and economy throughout Montana. Recreation survey data presented in the Montana Statewide Comprehensive Outdoor Recreation Plan (SCORP) cited fishing, hunting, and backpacking to be among the top five outdoor recreation activity for Montana residents. Over the next 35 years, SCORP projected increases in developed and undeveloped skiing, challenge activities like mountain climbing, rock climbing, and motorized water activities. Activities that will see large decreases in per capita participation include visiting primitive areas, hunting, and fishing (FWP 2014a).

The FWP manages wildlife populations and establishes limits on fishing and hunting activities statewide including on National Forest System lands. The FWP has several general statewide goals that relate to recreational use in the analysis area (FWP 2009). The FWP's goals are to provide quality opportunities for public appreciation and enjoyment of fish, wildlife, and parks resources, and maintain and enhance the health of Montana's natural environment and the vitality of its fish, wildlife, cultural, and historic resources through the 21st century. The FWP's goals are not enforceable standards. Lincoln County does not have a comprehensive recreation plan.

One 640-acre parcel of State land would be crossed by the West Fisher Creek transmission line alignment. Another parcel of State land is crossed by the Libby Creek Road, which would be used for access during the Evaluation and Construction Phases. The DNRC manages the surface and mineral resources for the benefit of the common schools and six administrative land offices, under the direction of the State Board of Land Commissioners. Hunting also occurs on State land (Power Engineers 2005c).

3.16.2 Analysis Area and Methods

The analysis area includes the area west of US 2, primarily east of the Cabinet Mountains ridge line (except for a ventilation adit located near Rock Lake on the west side of the ridge line), south from the Bear Creek Road corridor and north from NFS road #231. The four transmission line alternative alignment corridors also are included in the analysis area.

A land use inventory of the analysis area, which refined and updated existing recreation-related data, was used for the evaluation of recreation effects (Power Engineers 2005c). One of the components contained in the land use inventory included parks, recreation, and preservation areas. The analysis of recreational impacts was based on the number of roads and trails proposed for closure and the effect these closures would have on recreational access in the area. In addition, secondary effects associated with diminished recreation quality on lands adjacent to mining activities were evaluated.

The analysis of potential changes in ROS classes was based on ROS delineation procedures developed by the Forest Service (USDA Forest Service 2003c). Based on the ROS delineation procedures, the analysis area for the ROS analysis included a 0.5-mile buffer around any road to be used by the project; any new road; and any road proposed for access changes. For roads near the CMW, the buffer was extended 3 miles into the CMW. The analysis only considered National Forest System lands in the analysis area. Anticipated changes to ROS classes along existing and proposed road corridors, adjacent to proposed mine facilities, and along proposed transmission line corridors were mapped and quantified. The analysis considered changes during two mine phases: during construction when the maximum effect of motorized road use would occur and when all of the access changes would have been implemented; and during post-closure when all motorized activity associated with the project would cease.

Changes to ROS classes were evaluated during the summer, when the maximum effect of motorized road use would occur. MMC's and the agencies' proposed access changes would reduce winter motorized activities in some drainages (see Table 28 and Table 29 in Chapter 2). The effects on winter-time ROS would not be significant. Consequently, the disclosure requirements of 40 CFR 1502.22 are not applicable. The anticipated changes in ROS classes are described in this section. Maps showing existing and anticipated ROS classes are available in the project record.

3.16.3 Affected Environment

3.16.3.1 Recreational Opportunities and Uses

Northwest Montana is known for its lakes, rivers, and mountains that provide a variety of recreational opportunities. National Forest System lands make up a large percentage of the Lincoln County land base and offer public access for a variety of motorized and non-motorized recreational activities including: hunting for big game and upland game birds, fishing, hiking, wildlife observation, photography, backpacking, horseback riding, snowmobiling, cross-country skiing, mountain biking, picnicking, sightseeing, off highway vehicle (OHV) use, rock hounding, and camping. Recreational use in the analysis area occurs largely within the 350,000-acre Libby Ranger District. Recreational use of the Libby Ranger District is highest in the summer with camping, hiking, and fishing on the weekends being the major activities. These activities in the analysis area are concentrated at Howard Lake and along popular hiking trails. Recreation activities continue to take place during fall, although use declines. Fall use of the analysis area is mainly dispersed hunting and berry picking.

In the last two decades, the number and types of users have increased in the analysis area, partly as a result of growth in the Flathead Valley and Missoula (Kocis *et al.* 2003). The analysis area provides different types of user experiences; the CMW and the small drainages provide users with a more solitary experience compared to the more structured user experience at Howard Lake or the Libby Creek Recreational Gold Panning Area. The KNF has management responsibility for recreational uses of these lands.

KNF uses the ROS inventory as a tool for defining classes of outdoor recreation opportunity environments, making management decisions, and as a way to communicate recreation priorities with the public (USDA Forest Service 1982). ROS classifies recreational opportunities into six categories: Primitive, Semi-Primitive Non-Motorized, Semi-Primitive Motorized, Roaded Natural, Roaded Modified, and Rural (Table 145) (USDA Forest Service 1990).

Based on an updated ROS mapping protocol (USDA Forest Service 2003c), current ROS classes for the Poorman Creek and Ramsey Creek drainages are Semi-Primitive Motorized, while the Little Cherry Creek drainage and most of the Libby Creek drainage are classified as Roaded Natural and Semi-Primitive Motorized. In the transmission line corridor areas, current ROS classes for the West Fisher Creek, Miller Creek and Midas Creek drainages Roaded Natural, with areas of Semi-Primitive Motorized and Semi-Primitive Non-Motorized in areas between the drainages. All of the CMW in the analysis area was mapped as Semi-Primitive Non-Motorized because of roads extending within 3 miles of the CMW boundary.

Table 145. Description of ROS Classes.

ROS Class	Description
Primitive	Characterized by essentially unmodified natural environment of fairly large size. Interaction between users is fairly low and evidence of other users is minimal. Motorized use is not permitted.
Semi-Primitive Non-Motorized	Characterized by predominantly natural or natural-appearing environment of moderate to large size. Interaction between users is low, but there is often evidence of other users. Motorized use is not permitted.
Semi-Primitive Motorized	Characterized by predominantly natural or natural-appearing environment of moderate to large size. Concentration of users is low, but there is often evidence of other users. Motorized use is permitted.
Roaded Natural	Characterized by predominantly natural appearing environment with moderate evidence of human sights/sounds. Interaction between users is may be low to moderate, with evidence of other users prevalent. Conventional motorized use is provided for in the construction and design of facilities.
Roaded Modified	Characterized by modified natural environment with moderate to high evidence of human sights/sounds. Interaction between users is moderate to high, with evidence of other users prevalent. Conventional motorized use is provided for in the construction and design of facilities.
Rural	Characterized by substantially modified natural environment. Resource modification and utilization practices are primarily to enhance specific recreation activities and to maintain vegetation cover and soil. Sights and sounds of man are readily evident, and the interaction between users is often moderate to high. Facilities for intensified motorized use and parking are available.

Source: KFP, USDA Forest Service 1987.

3.16.3.1.1 Hunting

In Montana, 19 percent of residents hunt, the highest level of participation in the nation (FWP 2007). Every fall, hunters frequent the hunting districts close to Libby. The FWP conducts an annual statewide harvest survey to determine hunter activity throughout the state. Data for hunter activity in the analysis area are summarized in Table 146. The Libby Ranger District has 14 permitted outfitters with five operating in the south end of the district.

Table 146. Analysis Area Hunter Activity by Hunting District.

Hunting District	Location	Species	Year	Hunters	Hunter Days
103	East of US 2	Elk	2011	1,990	16,409
104	West of US 2	Elk	2011	1,345	11,658
100	West of US 2 and East of Montana 58	Goat	2011	6	63
105	West of US 2	Moose	2011	20	272
106	East of US 2	Moose	2011	12	147
123	West of US 2	Sheep	2011	4	56
103	East of US 2	White-tailed and Mule Deer	2011	2,852	20,163
104	West of US 2	White-tailed and Mule Deer	2011	1,988	15,186

Note: The analysis area generally includes only small portions of the much larger Hunting Districts. Hunter days are defined as the number of days or partial days spent hunting by active hunters.
Source: FWP 2012.

Hunting opportunities also are available on private lands as a result of FWP actions through the block management program and conservation easements. The block management program is a cooperative effort between FWP, landowners, and land management agencies to provide free public hunting access to private and isolated public land. Other lands with conservation easements generally offer some level of public hunting access. Hunting in the analysis area occurs on Plum Creek lands covered by a conservation easement, other private lands and also on state school trust land. Hunting on private land is subject to landowner discretion.

3.16.3.1.2 Fishing

Fishing opportunities within the analysis area occur primarily in easily accessible streams and rivers and at Howard Lake. Other lakes in the CMW, including Leigh Lake, Rock Lake, and Geiger Lake, provide additional fishing opportunities. Fishing is a relatively minor activity in Libby Creek, Poorman Creek, Howard Creek and West Fisher Creek. Most fishing in the analysis area occurs on the Fisher River and Howard Lake. For example, total angler days between 2003 and 2009 averaged 3,685 days on Fisher River, 990 days on Howard Lake, and 385 days on Libby Creek (FWP 2012). The proportion of angler days on the Fisher River and Libby Creek that occurs in the analysis are is unknown. The FWP does not track fishing use of Little Cherry Creek, Standard Creek, and Miller Creek because they provide a very small portion of the recreational fishing opportunity.

3.16.3.1.3 Scenic Driving

Scenic driving occurs along the forest roads within the analysis area. The most heavily used roads are the Libby Creek Road (NFS road #231), the Bear Creek Road (NFS road #278), and US 2. Less traveled roads used for scenic driving connect with these primary roads.

3.16.3.1.4 Camping and Picnicking

Howard Lake Campground is the only fee campground within the analysis area. This campground offers swimming, fishing, hiking, boating, a water well, RV sites, and toilets. A maintained trail provides access to dispersed camping on one side of the lake. Easy access to Libby Creek and Libby Lakes trailhead facilitates other recreational opportunities in the area. Average annual use by campers paying the fee for Howard Lake Campground during the 2010 and 2011 seasons was 240 campsites (595 campers) (KNF 2011). Recreationists engaged in day use activities dominate Howard Lake Campground. Recreation visits to Howard Lake are about 3,000 annually in 2004 (Power Engineers 2005c).

Camping at dispersed sites is widely scattered throughout the analysis area. Dispersed camping is generally associated with roads and occurs primarily during the summer and fall months.

3.16.3.1.5 Forest Product Gathering

Firewood gathering, Christmas tree cutting, and huckleberry and mushroom picking occur in the analysis area. Firewood is collected primarily in the spring and fall, but because of the large number of wood-burning stoves in the area, firewood collection is constant. The Forest Service considers huckleberry picking to be an important recreational use of the area, although no information is available concerning the number of individuals who visit the area for this purpose, or the economic values that may result (Jeresek, pers. comm. 2006). Huckleberry season (late summer through early fall) brings many people to the area to take part in the berry harvest. The Forest Service estimates that about 80 percent of the pickers are local residents (Jeresek, pers. comm. 2006).

3.16.3.1.6 Gold Panning

The Libby Creek Recreational Gold Panning Area offers the general public the opportunity to pan for gold in a historical area of placer mining. The area has no developed parking lots or camping facilities. Camping at the area is primitive with dispersed sites.

3.16.3.1.7 Winter Activities

Winter activities include ice fishing, cross-country skiing, and snowmobiling. Winter activities in the analysis area are the most common near Bear Creek and Poorman Creek, which provide good areas for skiing and snowmobiling. Bear Creek Road is plowed all winter by Lincoln County to about 1 mile north of Bear Creek, providing skiing and snowmobiling access to Bear Creek and Poorman Creek areas. Libby Creek Road is currently plowed by Lincoln County to Crazyman Road (NFS road #6209), about 1 mile south of US 2. Some winter activities occur on the unplowed portion of Libby Creek Road. Ice fishing occurs on Howard Lake.

3.16.3.1.8 Trails

Several National Forest System trails access the CMW within the east side of the analysis area (Bear Creek south to West Fisher Creek) (Figure 80). These trails are: Trail 119 Libby Creek, Trail 820 Ramsey Creek, Trail 129 Poorman Creek, Trail 821 Cable Creek, Trail 116 Standard Creek, and Trail 117 Great Northern Mountain. Other trails near the transmission line alternatives include Trail 716 Libby Divide, Trail 118 Miller Creek, Trail 6S Divide 6 Trail, and Trail 859 Kenelty Caves Trail. Some of the National Forest System trails are on roads that are closed to motorized use (Power Engineers 2005c). Other trails within or in proximity to the analysis area are shown in Figure 80.

The Leigh Lake trailhead is the highest used trailhead in the analysis area. The trail is accessible from May 1 to September 30. Between 2001 and 2003, the average number of annual visitors at Leigh Lake was 2,827 and the average number of visitor days (equivalent to one person using the resource for 12 hours) was 3,485 (Power Engineers 2005c). Data was not available for other trails. These trails are generally lightly used, with most of the activity occurring in the summer and fall.

Seasonal use data for managed trailheads and unmanaged trailheads indicate a gradual increase in wilderness use since 1988. Seasonal use data reflect high use during the summer (about 85 percent of total), moderate use during the fall (about 10 percent), and light use during the winter (about 5 percent) (MMI 2005a). The Forest Service estimates total annual visitation to the entire wilderness to be 12,100 (USDA Forest Service 2009)

3.16.4 Environmental Consequences

The road closures described below would restrict both summer and winter recreation access for a variety of recreational uses, including hiking, hunting, fishing, OHV use, snowmobiling, cross-country skiing, berry picking, dispersed camping, and other uses in the affected areas. Secondary effects on recreation activities on lands adjacent to mine facilities would occur from mine- and construction-related noise and disturbance.

3.16.4.1 Alternative 1 – No Mine

Alternative 1 would have no impact upon recreation in the analysis area. Access to roads and trails would continue as in the past. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands. Visitors to the area may experience increased noise levels from activities at the Libby Adit Site. These effects would be temporary and there would be no long-term effects on visitors' recreational experiences if no mine were constructed.

3.16.4.2 Alternative 2 – MMC's Proposed Mine

3.16.4.2.1 Short-term Effects During Construction, Operations, and Closure Phases

In general, recreational use and access to the analysis area would continue, although the configuration of some access roads would change slightly and the overall character of recreation opportunities within or adjacent to mine facilities would change substantially. Short-term effects during mine construction, operations, and reclamation would include restricted public access, increased noise, and increased night lighting within and adjacent to the mine facility areas. Public motorized and non-motorized access would be restricted to mine and agency personnel in all permit areas. These effects would reduce the amount of area available for hunting and other dispersed recreation activities. The combination of mine development and improved recreational access may displace some dispersed recreation activities (such as hunting, hiking, and dispersed camping) within the analysis area to other portions of the KNF, since individuals who are currently accustomed to these areas may use other areas of the forest with fewer visitors and developed facilities. The overall effect on recreation use and opportunity in the KNF would be negligible.

The proposed mine and associated facilities in Alternative 2 would reduce public recreational access due to road closures. Public motorized and non-motorized access would be restricted to mine and agency personnel in all permit areas. Specific road closures would include the Little Cherry Loop Road (NFS road #6212) within the proposed Little Cherry Creek Tailings Impoundment Site, the Poorman Creek Road (NFS road #2317) in the lower portion of the Poorman Creek drainage, and NFS road #4784 in the Bear Creek drainage (which is already proposed for an access change as part of the Rock Creek Project mitigation). The South Fork Miller Creek road (NFS road #4724) would be closed on a seasonal basis.

Before mine operations, Libby Creek Road (NFS road #231) and Upper Libby Creek Road NFS road #2316 would be continue to be plowed in the winter as part of a 2-year Libby Adit evaluation program and a 1-year Bear Creek Road (NFS road #278) reconstruction. The improvements to the Bear Creek Road would improve recreational access to the area and would safely accommodate mine-related and public traffic. Because the Bear Creek Road would be plowed in the winter, its use would improve winter recreation access to areas near the road. Similarly, the Libby Creek Road would be plowed for 2 to 3 years during construction, improving winter recreation access to areas off of the road. Snowmobile and cross country skiing use of the Libby Creek Road and parts of Upper Libby Creek Road during the Evaluation and Construction Phases, and of the Bear Creek Road during the Operations Phase, would be eliminated.

Access restrictions at the permit area boundary of each mine facility would eliminate access to all roads within the permit boundary that are currently closed to motorized use but open to non-motorized use. These closures would eliminate all public recreation access to the Poorman Creek and Ramsey Creek drainages (NFS road #2317 and NFS road #4781, respectively) (Figure 17). Similarly, non-motorized access to existing trails in the Poorman Creek (Trail 129) and Ramsey Creek (Trail 820) would be lost. Non-motorized trail access up the Libby Creek drainage (Trail 119) would not be affected (trail locations are shown on Figure 80).

The overall character of the trail user experience would be altered in the Libby Creek drainage due to noise, traffic, and visual effects associated with the proposed facilities. Within the CMW and the adjacent Cabinet Face East IRA, the recreational enjoyment of trails, lakes, and overall wilderness values in the upper Ramsey Creek drainage may be adversely affected due to the construction, operation, and reclamation of the Ramsey Plant Site. Visual effects on user experience due to the construction and operation of proposed facilities are described in section 3.17, *Scenery*. The proposed Rock Lake Ventilation Adit, located east of Rock Lake on a small parcel of private land outside of the CMW, would potentially be visible from some locations within the CMW. The surface features at the ventilation shaft and the overall effect of those features would be minimal and would not affect recreation. The Howard Lake Campground and the Libby Creek Recreational Gold Panning Area would not be directly affected by any of the proposed facilities or road closures, but these and other recreation resources may be subject to increased use due to better road access and familiarity among mine employees in the area.

In Alternative 2, Little Cherry Creek would be diverted in a permanent Diversion Channel around the impoundment. Most of the diversion would be within the operating permit area for the tailings impoundment, and access would be restricted. The KNF and the FWP estimated a loss of 383 angler-hours of recreational fishing opportunity. The fisheries mitigation proposed by MMC in Alternative 2 was identified in the KNF's 1993 ROD (USDA Forest Service 1993) as adequate mitigation for the loss of recreational opportunity. The 1992 Final EIS effects analysis and 1993 ROD mitigation did not consider the likely need for a pumpback well system to prevent tailings seepage from reaching surface water. Flow in the diverted Little Cherry Creek would be substantially reduced during operations and closure, as the pumpback well system, as long as it operated, would likely eliminate very low flow in the diverted creek. The loss of available habitat in the diverted Little Cherry Creek would adversely affect the redband trout population in the diverted creek because the remaining habitat would not support the population at its current numbers, if at all.

3.16.4.2.2 Changes to Recreation Setting

During mine operations, the level of mine facility development proposed in Alternative 2 would change the ROS classes for some portions of the analysis area (Table 147). The Ramsey Creek drainage within the analysis area would change from Semi-Primitive Motorized to Rural in character. The Little Cherry Creek drainage and most of the Libby Creek drainage would primarily change from Roaded Natural to Rural (the upper portions of the Libby Creek drainage, west of the adit site, would remain Semi-Primitive Motorized). As in all action alternatives, the Bear Creek Road (NFS road #278) corridor would remain Roaded Natural from US 2 to the

Table 147. Estimated Change in Acres of ROS Class within the Mine and Transmission Line Analysis Area.

ROS Class	Rural		Roaded Natural		Semi-Primitive Motorized		Semi-Primitive Non-Motorized	
	Acres	% change	Acres	% change	Acres	% change	Acres	% change
Existing Conditions	0		33,530		11,424		27,487	
Alternative 2B								
Construction	9,439	See note	28,393	-15%	7,553	-34%	27,056	-2%
Reclamation	0	0%	33,529	0%	11,399	0%	27,514	0%
Alternative 3C-R								
Construction	5,606	See note	28,773	-14%	2,430	-79%	35,633	30%
Reclamation	0	0%	31,549	-6%	3,701	-68%	37,191	35%
Alternative 3D-R								
Construction	5,606	See note	27,417	-18%	2,749	-76%	36,669	33%
Reclamation	0	0%	31,549	-6%	3,944	-65%	36,948	34%
Alternative 3E-R								
Construction	5,606	See note	27,106	-19%	3,060	-73%	36,669	33%
Reclamation	0	0%	31,549	-6%	3,944	-65%	36,948	34%
Alternative 4C-R								
Construction	6,905	See note	27,341	-18%	2,440	-79%	35,756	30%
Reclamation	0	0%	31,396	-6%	4,109	-64%	36,936	34%
Alternative 4D-R								
Construction	6,905	See note	25,985	-23%	2,759	-76%	36,792	34%
Reclamation	0	0%	31,396	-6%	4,109	-64%	36,936	34%
Alternative 4E-R								
Construction	6,905	See note	25,675	-23%	3,069	-73%	36,792	34%
Reclamation	0	0%	31,396	-6%	4,109	-64%	36,936	34%

Notes: ROS categories of Primitive and Roaded Modified were not identified in the analysis area and are not shown in this table. Total analysis area is 72,441 acres.
% increase in rural ROS setting during Construction is meaningless as existing Rural ROS is 0 acres.
Source: GIS analysis by ERO Resources Corp. using KNF ROS delineation procedures.

impoundment site, and would change to Rural near the impoundment site, LAD Areas, and plant site.

These changes from less developed to more developed recreation settings would likely displace some recreationists seeking a more remote and dispersed recreation experiences. Most of the Libby Creek Road (NFS road #231) would remain as Roaded Natural, except for small portions nearest the mine facilities that would change to Rural. The changes in ROS in the mine area during the Construction Phase would continue during the Operations Phase.

3.16.4.2.3 Long-term Effects After Closure

The long-term effects on recreation after completion of mine operations and reclamation include the elimination or closure of several roads within the permit boundary. Motorized access to the Little Cherry Creek Loop road (NFS road #6212) within the Little Cherry Creek Tailings Impoundment Site would change due to the tailings impoundment, reducing motorized access for scenic driving, hunting, fishing, and other uses.

Over the long term, public access would be restored to portions of NFS road #5182 through the Little Cherry Creek Tailings Impoundment Site and NFS road #4781 through LAD Area 2. The restoration of access along NFS road #4781 would provide long-term motorized access to the Poorman Creek drainage (NFS road #2317/Trail 129) and both motorized and non-motorized access to the Ramsey Creek drainage (motorized access along NFS road #4781 and non-motorized access to Trail 820).

No long-term effects on trail-user access or experiences in the CMW, the Howard Lake Campground, and the Libby Creek Recreational Gold Panning Area would occur. T the long-term ROS classes throughout the analysis area would return to preexisting categories as disturbed areas became successfully revegetated and tree cover returned to pre-mine conditions (see descriptions of reclamation and revegetation plans in Chapter 2). The increased access and familiarity of the area for recreation would likely displace current dispersed users in and around the analysis area.

Flow in the diverted Little Cherry Creek would likely be eliminated if a pumpback well system was installed and continued to operate. The diverted creek would not be capable of supporting redband trout. Flow from the tailings impoundment at closure would be directed toward Bear Creek, with flow in the diverted Little Cherry Creek estimated to be 45 percent less than existing flow. Reestablishment of the redband trout population in Little Cherry Creek would not likely occur after the pumpback wells ceased operating and flows increased. Recreational fishing opportunity in the diverted creek would be eliminated or substantially reduced. MMC's proposed mitigation would partially offset the loss of fishing opportunity.

3.16.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

3.16.4.3.1 Short-term Effects During Construction, Operations, and Closure Phases

The overall short-term effects of Alternative 3 on recreation would be similar to Alternative 2, except as discussed below. Public motorized and non-motorized access would be restricted to mine and agency personnel in all permit areas.

Noise levels between 45 and 55 dBA from the Libby Plant Site may adversely affect recreational use and enjoyment of the Libby Creek Recreational Gold Panning Area (see section 3.20.4, *Environmental Consequences* of the *Sound, Electrical and Magnetic Fields, Radio and TV Effects* section). Visual effects on user experience due to the construction and operation of proposed facilities are described in section 3.17.4, *Environmental Consequences* of the *Scenery* section.

The specific configuration of the Little Cherry Loop Road (NFS road #6212) closure and other road closures within the proposed Poorman Tailings Impoundment Site would be different from Alternative 2, but the effect of the closures (restricting both motorized and non-motorized recreation access) would be the same.

Non-motorized recreation and trail access to the upper Poorman Creek drainage (NFS road #2317/Trail 129) would be retained and improved due to the development of a recreational parking area adjacent to LAD Area 1 along Poorman Creek Road (NFS road #2317). The recreational enjoyment of the Libby Creek Trail (Trail 119), west of the Libby Adit Site, and overall wilderness values in the CMW would be altered in the upper Libby Creek drainage due to noise, traffic, and visual effects associated with the proposed facilities in the Libby Creek drainage. Unlike Alternative 2, non-motorized recreation access would be permitted through the permit area boundary on NFS road #4781/Trail 820 to the upper Ramsey Creek drainage. The improvements to the Bear Creek Road (NFS road #278) would improve recreational access to the area. Because the Bear Creek Road would be plowed in the winter, it would improve winter recreation access to the analysis area (although the existing snowmobile use of the road would be affected).

In Alternatives 3 and 4, MMC would fund access changes on numerous roads for wildlife mitigation (see Table 28 and Table 29 in Chapter 2). Seven roads totaling 14.8 miles that are currently open would be barriered year-long. Four roads totaling 9.3 miles would be gated seasonally between April 1 and June 15. In addition, MMC would decommission or place into intermittent stored service NFS road #4784 (upper Bear Creek Road) if the Rock Creek Mine mitigation restricting the road with a barrier had not been implemented before Forest Service authorization to initiate the Evaluation Phase. These closures would eliminate motorized recreational access and use, such as camping and hunting, in these locations, but would not affect the overall quality or accessibility or recreation in the analysis area. Non-motorized access would be maintained. Other access changes, such as changing access restrictions from a gate to a barrier or converting restricted roads to trails, would not affect recreation access. The development of a scenic overlook along the Bear Creek Road (NFS road #231) downstream of the Midas Creek crossing with views of the tailings impoundment and interpretive information about the mine would benefit recreation opportunities by providing an additional amenity in the area. Overall recreation effects would be mitigated through funding a campground host from Memorial Day through Labor Day at Howard Lake Campground during the Construction and Operations Phases of the mine.

The agencies' proposed water resources monitoring would require monitoring of water resources in the East Fork Rock Creek, East Fork Bull River, and Swamp Creek drainages (see Appendix C). Increased use by project personnel conducting the monitoring would decrease opportunities for solitude or a primitive and unconfined type of recreation in the East Fork Rock Creek, East Fork Bull River, and Swamp Creek drainages.

Channels affected by the Poorman Tailings Impoundment Site are not fish-bearing and do not provide recreational fishing access. Alternative 3 would not affect recreational fishing opportunities.

3.16.4.3.2 Changes to Recreation Setting

The level of mine facility development proposed in Alternative 3 would change the ROS classes for the analysis area (Table 147). Most of the Libby Creek drainage within the analysis area would change in character from Roaded Natural to Rural, while the upper portions of the drainage would change from Semi-Primitive Motorized to Semi-Primitive Non-Motorized due to road closures. Likewise, most of the Ramsey, Poorman, and Bear Creek drainages would change to Semi-Primitive Non-Motorized due to road closures. A permanent increase of 8,200 to 9,200 acres, depending on the transmission line alternative, would occur in the Semi-Primitive Non-Motorized class.

Most of the decrease would be in the Semi-Primitive Motorized class, which would decrease between 8,400 and 9,000 acres, depending on the transmission line alternative. The southern portion of the Little Cherry Creek drainage would change from Roaded Natural to Rural. As in all action alternatives, the NFS road #278 corridor would not change (Roaded Natural) from US 2 to the impoundment site, but would change to Rural near the impoundment site, LAD Areas, and plant site. The changes in ROS in the mine area during the Construction Phase would continue during the Operations Phase.

Changes from less developed to more developed recreation settings near the mine development facilities would likely displace some recreationists seeking a more remote and dispersed recreation experience, but those types of experiences would be increased in most of the upper drainages that would change to a less developed, non-motorized recreation setting.

3.16.4.3.3 Long-term Effects After Closure

The long-term effects of the mine operations, after closure and reclamation are complete, would include the elimination of several roads within the tailings impoundment site, including NFS road #6212.

Long-term recreational access to the roads and trails in the Poorman, Ramsey, and Libby Creek drainages would be similar to existing conditions. Roads and trails closed for wildlife mitigation would no longer be used for motorized access. No long-term effects on trail-user access or experiences in the CMW, the Howard Lake Campground, and the Libby Creek Recreational Gold Panning Area would occur. New recreation amenities, including a recreational parking area along Poorman Creek Road (NFS road #2317) and a scenic overlook along Libby Creek Road (NFS road #231) would provide long-term recreation benefits. A permanent increase of 9,500 to 9,700 acres, depending on the transmission line alternative, would occur in Semi-Primitive Non-Motorized characteristics.

3.16.4.4 Effectiveness of Agencies' Proposed Mitigation

While the effects of the mine alternatives would result in the loss of some recreation opportunities and aesthetic changes near mine facilities, the proposed mitigation measures would mitigate some of the impacts on recreation. These measures include:

- Construction of a scenic overlook with interpretive signs with views of the tailings impoundment on NFS road #231 would provide an amenity for visitors who are curious about or interested in the function and purpose of the mine.

- Pay the reimbursement funding for a volunteer campground host from Memorial Day through Labor Day at Howard Lake campground using an Volunteer Services Agreement for Natural Resources agencies (Optional Form 301a) throughout the life of the project would enhance the level of service and quality of the experience for campground guests, potentially offsetting some of the aesthetic impacts of the nearby mine.
- Inspection and maintenance of access changes (e.g., road and trail closures) would help ensure that appropriate visitor access is safe and easily understood.
- Development of a small parking area along Poorman Creek Road would offset some of the road and trail closures by proving a new amenity and giving visitors a clear transition point between the road closure and new or existing trail access opportunities.
- Development of a new hiking trail between Poorman and Ramsey Creeks would provide non-motorized access to upper Ramsey Creek which would offset some of the effects of road closures and may provide new non-motorized recreation opportunities.

During operations, these mitigation measures would be effective in reducing the impact on the mine on some recreationists. These measures would not address the effects on all visitors, due to the individual nature of dispersed recreation in and near the analysis area.

3.16.4.5 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

The effects of the plant site, adits, and LAD Areas in Alternative 4 on recreation and recreation setting would be the same as those described under Alternative 3. The effects of the tailings impoundment in Alternative 4 on recreation would be the same as those described under Alternative 2. Additional fisheries mitigation would compensate for all lost aquatic habitat and recreational fishing opportunity in diverted Little Cherry Creek. The long-term effect on ROS classes would be the similar to Alternative 3. Proposed mitigation would be the same as Alternative 3. A permanent increase of 9,500 acres would occur in Semi-Primitive Non-Motorized class. Most of the decrease would be in the Semi-Primitive Motorized class, which would decrease between 8,400 and 9,000 acres, depending on the transmission line alternative.

3.16.4.6 Alternative A – No Transmission Line

Alternative A would not affect recreation in the analysis area. Access to roads and trails would continue as it is currently. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands. The Sedlak Park Substation and the loop line to BPA's Noxon-Libby line would not be constructed.

3.16.4.7 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

The North Miller Creek Alternative would have the greatest amount of new access roads (10.2 miles) for the construction and maintenance of the transmission line (Table 143). These roads would be closed to motorized vehicles. These new roads would benefit non-motorized recreation access (*i.e.*, walk-in hunting and fishing access, hiking, berry picking) on both National Forest System lands and on private lands where public access was permitted.

Alternative B would cross through the Libby Creek Recreational Gold Panning Area for a distance of 1,760 feet, and also would cross Trails 118, 716, and 820 (Figure 80). Transmission line construction would adversely affect the short-term use and enjoyment of these areas due to increased noise, traffic, and construction activity. During mine operations, the existence of the transmission line would alter the scenic integrity and landscape character of trail corridors and the Gold Panning Area. The alteration of scenic integrity in these localized areas would have minor adverse effects on enjoyment of recreational amenities that would be crossed by the transmission line. Alternative B would not be visible from Howard Lake and would have no effect on Howard Lake recreation.

The ROS classes of most of the transmission line corridor would not change, except for a segment of Semi-Primitive Motorized that would change to Roaded Natural in the area north of Miller Creek. This change from a less developed to a more developed recreation setting may displace some recreationists seeking a more remote and dispersed recreation experience. The ROS change would return to existing conditions (Semi-Primitive Motorized) after the transmission line was constructed, but would be affected again when the transmission line was removed at the end of operations. Over the long term, the ROS classes in this area would return to existing conditions (Semi-Primitive Motorized).

Construction of the Sedlak Park Substation and the loop line to BPA's Noxon-Libby line would not adversely affect recreation. Both would be located on private land.

3.16.4.8 Alternative C-R – Modified North Miller Creek Transmission Line Alternative

Alternative C-R would benefit non-motorized recreation access by providing 3 miles of new access roads on both National Forest System and private lands where public access is permitted (Table 143). These new road corridors would enhance non-motorized recreation access. The length of new roads in Alternative C-R (and subsequent recreation benefits) would be the least among the transmission line alternatives. Alternative C-R would cross trails 65, 118, 716, and 859 (Figure 80), as well as the Libby Creek Recreational Gold Panning Area for a distance of 1,750 feet. The adverse effects on trails and the Gold Panning Area would be the same as Alternative B. Alternative C-R would not be visible from Howard Lake and would have no effect on Howard Lake recreation.

The ROS classes of most of the transmission line corridor would not change, except for a segment of Semi-Primitive Motorized that would change to Roaded Natural in the area north of Miller Creek. This change from a less developed to a more developed recreation setting may displace some recreationists seeking a more remote and dispersed recreation experience. The ROS change would be similar to existing conditions (Semi-Primitive Motorized and Semi-Primitive Non-Motorized) after the transmission line was constructed, but would be affected again when the transmission line was removed at the end of operations. Over the long term, the ROS classes in most of this area would return to existing conditions (Semi-Primitive Motorized), while some of the area would change to a less developed setting of Semi-Primitive Non-Motorized.

Construction of the Sedlak Park Substation and the loop line to BPA's Noxon-Libby line would not adversely affect recreation. Both would be located on private land.

3.16.4.9 Alternative D-R – Miller Creek Transmission Line Alternative

Alternative D-R would have more miles (5.1 miles) of new access roads (and related benefits to non-motorized recreation access) than Alternative C-R. Alternative D-R would cross trails 65, 300, 505, 716, and 859, (Figure 80), as well as the Libby Creek Recreational Gold Panning Area for a distance of 2,120 feet. The effects on trails and the Gold Panning Area would be the same as Alternative B. About 0.4 miles of the Alternative D-R transmission line corridor would be visible from Howard Lake. Such visual effects may diminish the quality of the recreation experience for some visitors.

The ROS classes of most the transmission line corridor would not change, except for a small segment near the eastern edge that would change from Semi-Primitive Non-Motorized to Roaded Natural. This change from a less developed to a more developed recreation setting may displace some recreationists seeking a more remote and dispersed recreation experience. The ROS change would return to existing conditions (Semi-Primitive Motorized) after the transmission line was constructed, but would be affected again when the transmission line was removed at the end of operations. Over the long term, the ROS classes in this area would return to existing conditions (Semi-Primitive Motorized).

Construction of the Sedlak Park Substation and the loop line to BPA's Noxon-Libby line would not adversely affect recreation. Both would be located on private land.

3.16.4.10 Alternative E-R – West Fisher Creek Transmission Line Alternative

The length of new access roads in Alternative E-R (and related benefits to non-motorized recreation access) (4.0 miles) would be greater than Alternative C-R, but less than Alternative B and D. Alternative E-R would cross trails 65, 505, 716, and 859 (Figure 80), as well as the Libby Creek Recreational Gold Panning Area for a distance of 2,120 feet. The effects on trails and the Gold Panning Area would be the same as Alternative B. About 0.4 miles of the Alternative E-R transmission line corridor would be highly visible from Howard Lake. Such visual effects may diminish the quality of the recreation experience for some visitors. These changes would not substantially affect the ROS classes.

Construction of the Sedlak Park Substation and the loop line to BPA's Noxon-Libby line would not adversely affect recreation. Both would be located on private land.

3.16.4.11 Cumulative Effects

Past actions within the analysis area include the establishment of forest access roads and logging roads and the development of the Howard Lake Campground and Libby Creek Recreational Gold Panning Area. These past actions have resulted in the existing recreation setting described above under section 3.16.3, *Affected Environment*. Population increases due to these projects would slightly increase demand for recreational opportunities in the region. Even with this increased demand, an abundance of outdoor recreational opportunities would remain for residents and visitors.

3.16.4.12 Regulatory/Forest Plan Consistency

All of the proposed mine and transmission line alternatives would be consistent with the recreation standards in the KFP. The effect of the mine and transmission line alternatives on the ROS classes is disclosed. This analysis complies with Executive Order 12962 that mandates disclosure of effects on recreational fishing.

3.16.4.13 Irreversible and Irretrievable Commitments

The recreational experience of some users may be irretrievably affected by the project, due to loss of access to particular areas, increased noise, or visual impacts. These effects, combined with increased knowledge of and access to the general analysis area, would likely displace some dispersed recreation (hunting, hiking, and dispersed camping) to other areas of the forest. Long-term road closures within the tailings impoundment and other areas for grizzly bear mitigation in all action alternatives would result in an irretrievable loss of recreational access.

3.16.4.14 Short-term Uses and Long-term Productivity

All of the action alternatives would include both short-term and long-term road closures within the permit boundary. Short-term closures would have the greatest effect on recreation access in Alternative 2, which would restrict access to the Ramsey and Poorman creek drainages. Long-term road closures in all action alternatives would reduce recreation access within and adjacent to the tailings impoundment. The long-term effects of the proposed project on recreation access in the analysis area would be small.

The noise and visual effects of the proposed project would be most noticeable during the 16 to 19 years of operations. Noise would return to pre-mine levels when reclamation activities ceased, while visual effects would be reduced over time as revegetation efforts were completed and the forest cover re-established in disturbed areas. Over the long term, the proposed project would not affect the ability of the analysis area to provide a variety of forest recreation opportunities.

3.16.4.15 Unavoidable Adverse Environmental Effects

Alternatives 2, 3, and 4 would restrict access and recreational use along the Little Cherry Creek Loop Road (NFS road #6212), which would be restricted to public motorized and non-motorized access. Alternative 2 would restrict recreational access to the Ramsey Creek and Poorman Creek drainages. In addition, all of the proposed transmission line alternatives would alter the scenic integrity of the Libby Creek Recreational Gold Panning Area, as well as several trail corridors. The proposed mine alternatives would adversely affect some recreational experiences due to noise and visual impacts. These aesthetic impacts would be concentrated in the Ramsey and Libby creek drainages in Alternative 2, the Libby Creek drainage in Alternatives 3 and 4, and along NFS road #278 (Tailings Impoundment Sites) in all mine alternatives.

3.17 Scenery

3.17.1 Regulatory Framework

The Organic Administration Act authorizes the Forest Service to regulate the occupancy and use of National Forest System lands. The Forest Service's locatable minerals regulations are promulgated at 36 CFR 228, Subpart A. The regulations apply to operations conducted under the U.S. mining laws as they affect surface resources on National Forest System lands under the jurisdiction of the Secretary of Agriculture. One of these regulations (36 CFR 228.8) requires that mining activity be conducted, where feasible, to minimize adverse environmental impacts on National Forest surface resources. 36 CFR 228.8 also requires that mining operators to the extent practicable, harmonize operations with scenic values through such measures as the design and location of operating facilities, including roads and other means of access, vegetation screening of operations, and construction of structures and improvements which blend with the landscape (36 CFR 228.8(d)).

Under the current KFP, the KNF uses the USDA Forest Service Visual Management System (VMS) to inventory visual resources and to provide measurable scenery management standards on the KNF (USDA Forest Service 1974). VQOs were determined by the KNF for the entire KNF following an analysis of characteristic landscapes and sensitivity levels. The five VQOs are: Preservation, Retention, Partial Retention, Modification, and Maximum Modification; these terms are defined in the *Glossary*. Development of measurable standards or objectives for the visual management is the purpose of assigning VQOs. Each VQO describes a degree of acceptable alteration of a characteristic landscape based on the importance of aesthetic resources to the users. VQOs are an important part of the KFP because many national forest users and nearby residents value the forest's intrinsic aesthetic resources.

In mine Alternatives 2, 3, and 4, the KNF would amend the KFP by reallocating to MA 31 all areas within the operating permit areas of LAD Areas 1 and 2, and portions of the plant site and tailings impoundment currently not in MA 31. MA designations, goals, and standards are described in detail in Table 138. In addition, a proposed road and facility corridor that would cross MA 13 would be reallocated to MA 31. MA 31 has a VQO of Maximum Modification. Therefore, the applicable VQO for all mine facilities would be Maximum Modification. In transmission line Alternatives B, C-R, D-R, and E-R, the KNF would amend the KFP by reallocating certain areas disturbed by the 230-kV transmission line on National Forest System lands as MA 23. MA 23 has a VQO of Maximum Modification. The MAs that would not be reallocated to MA 23 currently have a VQO of Modification. The applicable VQO for all transmission line alternatives would be Maximum Modification or Modification.

3.17.2 Analysis Area and Methods

3.17.2.1 Analysis Area

The analysis area was determined by the location of the proposed mine facilities, the location of four transmission line alternatives and the visible portions of proposed project facilities that would affect the characteristic landscapes and sensitivity levels of observation points used in visual baseline reports. Changes to characteristic landscapes would include loss of vegetation and landform modifications at and near the proposed facilities, and sensitivity levels would be lowered by the presence of mine facilities not already existing within a given view. Scenery in the analysis area includes the summit and shoulder terrain of the Cabinet Mountains, forested mountains, and valleys adjacent to and east of the Cabinet Mountains; and a 6-mile portion of US 2 east of the Cabinet Mountains (Figure 82).

3.17.2.2 Methods

Several previous visual resource reports and additional analysis were used to describe and assess effects on scenery. MMC assessed visual resources near the mine facilities alternatives, excluding the transmission line alternatives, in 2005 (Maxim Technologies.2005). The report assessed the visual effects of proposed mine facilities using two USDA Forest Service methods for analysis. Both methods used KNF user data and observation points from a previous visual resource baseline study (Woodward-Clyde Consultants 1989d).

Several transmission line alternatives developed by MMC for its MFSA certificate application were assessed in a visual impacts report (Power Engineers, Inc. 2006b). The report used the same two methods as the Maxim Technologies report to analyze visual impacts.

In addition to the use of previous visual resources reports, the lead agencies assessed current mine and transmission line alternatives from 11 key observation points (KOP) selected by the KNF and DEQ (Holdeman Landscape Architecture 2006). KOP selection and landscape character regions were determined during a site visit in 2006. Criteria for KOP selection was based on recreational uses of specific KNF roads, scenic overlooks, and Howard Lake (Table 148). The USDA Forest Service VMS method was used to describe impacts on scenery for the mine facilities alternatives. The VMS method of analysis directly associated project impacts on applicable VQOs.

Table 148. Reasons for Selecting KOPs.

KOP	Reason for Selection	KOP	Reason for Selection
1	High use NFS road with a parking pullout	7	High use NFS road
2	High use scenic overlook with unobstructed views of Cabinet Mountains	8	High use NFS road
3	Hiking trail destination at the top of Elephant Peak	9	Intersection of two high use roads (NFS road and U.S. highway)
4	High use NFS road with a parking pullout and scenic overlook sign	10	High use U.S. highway
5	High use Howard Lake boat ramp	11	Permanent residences
6	High use NFS road		

Visual analysis of the transmission line alternatives consisted of two viewshed analyses. One viewshed analysis was performed from each of the 11 KOPs. Vegetation was included in the analysis by adding an average tree height to the digital terrain model to determine the length of each transmission line alternative visible from each KOP. Different tree heights were estimated for timber harvested areas from KNF data identifying the dates of harvesting. Digital polygons were developed to represent the shape of the tree clearing areas required for the lines, structures, and access roads. The digital polygons were “elevated” electronically above the ground to the various tree heights. The total length of transmission line alternative visible from each KOP was determined using GIS. A qualitative analysis is also provided regarding the level and type of use at each KOP. The qualitative analysis was developed from field observations and photographic simulations from four of the 11 KOPs (Figure 82).

The second viewshed analysis was performed from the corridor of each transmission line alternative. The same polygons used in the first analysis were used in the second one. This analysis determined the number of KOPs, length of high-use roads, and acres of CMW visible from each transmission line corridor. Roads used in the analysis were NFS roads #4776, #4724, #231, #385, and US 2.

The visibility of the transmission line from the Howard Lake Campground was evaluated in two transmission line alternatives, Miller Creek and West Fisher Creek. These two alternatives would use the same alignment east of the lake and campground. Using digital elevation data, a profile of the ground surface was developed for each transmission line structure near the lake. Trees 75 feet high between the viewer on the west side of the lake and the transmission line were used to determine line visibility. The analysis is on file in the project record.

3.17.3 Affected Environment

The analysis area is characterized visually by the summit peaks of the Cabinet Mountains surrounded by the adjacent densely forested mountains and valleys, with some flat, open creek or stream valleys of dense low-growing herbaceous vegetation interspersed with the forest. The four transmission line alternatives and mine facilities alternatives would be located in montane forest and valley characteristic landscapes within the KNF. Multiple alpine peaks in the Cabinet Mountains are also an important part of views from most of the key observation points. Current sources of night lighting are activities at the Libby Adit and limited residential development on private land.

3.17.3.1 Landscape Character

An area's appearance, called landscape character, is based on the area's physical characteristics, includes the visible combination of physical, biological, and cultural attributes. An existing landscape character may range from predominantly natural landscapes to those heavily influenced by cultural features. The existing landscape character description includes the natural scenic attributes of the landscape in combination with the existing land use pattern. Three identifiable landscape characters are found in the analysis area: alpine, montane forest, and montane valley as described in the following sections.

3.17.3.1.1 Alpine Landscape Character

The alpine landscape character is defined by a portion of the Cabinet Mountains along a north-south line from Snowshoe Peak to Baree Mountain (about 35 miles long and 7 miles wide), centered along the range's highest peaks; and includes some mountainous areas below timberline known as the Cabinet Shoulders. Mountain summit landforms with dominant vertical and steep slopes above timberline typify the alpine characteristic landscape. Near mountaintops and above timberline, areas of snow are frequently present. The summit topography possesses strong contrasting characteristics with the sky and landforms below.

The mountain slopes below and near timberline support sparse populations of evergreen trees with a ground cover of shrubs and grasses. The forested portion of the alpine characteristic landscape also includes large, mostly bare rock formations, creating many open areas among the trees. This region has the highest elevations (8,738 feet at Snowshoe Peak) in the analysis area.

Although no mine facilities or transmission line alternatives would be located in the alpine characteristic landscape, one KOP is located in this area. Additionally, this characteristic landscape is an important component of the views from most of the other KOPs. This characteristic landscape is the highest quality scenery as defined by the VMS.

The KOP in the alpine characteristic landscape is located on Elephant Peak in the CMW. Views from this location are unobstructed in nearly all directions; are mostly absent of artificial forms; and include a large variety of landforms, rock forms, water forms, colors, and textures. The views from this KOP are representative of most of the Cabinet Mountains peaks and some of the CMW above timberline. Most of the proposed mine facilities, not including the tailings impoundments, and portions of all four transmission line alternatives would be visible from this KOP.

3.17.3.1.2 Montane Forest Landscape Character

Most mine and transmission line alternatives would be located in the montane forest landscape character. Densely forested mountain landforms typify this landscape. Due to the high density and the height of the forest near roads, only a small number of long-distance views exist from roads. Most views along roads are of the forest and restricted to short distances.

The analysis area has few developed recreational facilities; most observation points are from roads, mountains, and hill tops, or at the edge of the forest. An exception is the developed campground area at Howard Lake, which has a KOP located on the beach next to the lake. Timber harvest areas have created some openings in the forest along roads that provide views of the Cabinet Mountain summits and valleys below. These few locations offer tree-framed views with a large variety of mountainous landforms, vegetation communities, and sky conditions. KOPs 1, 2, 4, and 6 are located in montane forests.

3.17.3.1.3 Montane Valley Landscape Character

Gentle to nearly flat landforms with creeks or streams define the montane valley landscape character, which is interspersed within the montane forest characteristic landscape. Some mine facilities and transmission line alternatives would be located in the montane valley characteristic landscape. Montane valleys include forested areas similar to the adjacent mountains and openings with low-growing herbaceous vegetation and deciduous shrubs and trees concentrated along creeks. Views of the Cabinet Mountain summits are visible from the valleys with low-growing vegetation. Valley areas also include the only buildings visible from KOPs in the analysis area. All of the buildings are residences or associated outbuildings, and most of the residences are located along US 2. Due to the relatively small quantity, very low density, and partial obscurity by low density vegetation, these structures rarely distract from scenic views by travelers and other recreationists.

Some timber harvest areas of the KNF and adjacent private lands are visible from KOPs located in montane valleys. A few timber harvest areas are immediately adjacent to the public roads and are therefore highly visible. Timber harvest areas on mountainsides are typically only partially visible due to the screening effects of vegetation and topography. KOPs 7, 8, 9, 10, and 11 are located in montane valleys.

3.17.3.2 Concern Levels and Visibility

Concern levels, from low to high, were established from user survey information for individual observation points to determine the importance of visual resources to the visitors. Concern levels of visitors were identified from visitor use monitoring data collected by the KNF (Kocis *et al.* 2003). The largest groups of visitors to the KNF are local residents from the towns of Libby, Troy, and Eureka. Forest scenery consistently ranked highest in importance for wilderness, developed day use areas, overnight facility users, and some private residences with views of proposed facilities. Concern levels at private residences in the analysis area are high. Views from private residences are typically long-term and often influence specific uses of private properties.

3.17.3.3 Visual Quality Objectives

Areas currently managed for Partial Retention, Modification and Maximum Modification VQO comprise most of the analysis area (Figure 81). The LAD Areas, Poorman Impoundment Site and transmission line corridors primarily have a Modification VQO. To meet the Modification VQO, management activities may visually dominate the characteristic landscape (Table 149). With a Modification VQO, activities of vegetation and/or landform alteration must borrow from the existing undisturbed form, line, color, and texture so as to match the surrounding characteristic landscape. Portions of the Ramsey Plant Site, Little Cherry Creek Impoundment Site, and the south side of Miller Creek along the transmission line corridors have a Maximum Modification

Table 149. VQO Definitions.

VQO Class	Description of Management Prescription
Preservation	Areas managed to meet VQO of Preservation allow ecological changes only. Management activities, except for very low visual impact recreation facilities, are prohibited.
Retention	Areas managed to meet VQO of Retention provide for management activities that are not visually evident. Activities may only repeat form, line, color, and texture which are frequently found in the characteristic landscape. Changes in the qualities of size, amount, intensity, direction, and pattern should not be evident.
Partial Retention	Areas managed to meet VQO of Partial Retention permit management activities that remain visually subordinate to the characteristic landscape. Activities may repeat form, line, color, or texture common to the characteristic landscape, and may also introduce form, line, color, or texture which are found infrequently or not at all in the characteristic landscape.
Modification	Areas managed to meet VQO of Modification allow management activities that may visually dominate the original characteristic landscape. However, activities of vegetative and landform alteration must borrow from naturally established form, line, color, or texture so completely and at such a scale that its visual characteristics are those of natural occurrences with the surrounding area or character type.
Maximum Modification	Areas managed to meet VQO of Maximum Modification permit management activities of vegetative and landform alterations that may dominate the characteristic landscape. However, when viewed as a background, the visual characteristics must be those of natural occurrences with the surrounding area or character type. When viewed as foreground or middleground, they may not appear to completely borrow from naturally established form, line, color, or texture. Alterations may also be out of scale or contain detail that is incongruent with natural occurrences as seen in foreground or middleground.

Source: USDA Forest Service 1974.

VQO. Management activities may dominate the characteristic landscape in a Maximum Modification VQO. Small areas of Partial Retention VQO are found in the mine area and along the transmission line corridors.

3.17.4 Environmental Consequences

3.17.4.1 Alternative 1 – No Mine

The existing scenery from KOPs and acreage of existing VQOs would not change in the No Mine Alternative. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150, would remain in effect. The DEQ's approval of revisions to DEQ Operating Permit #00150 (Minor Revisions 06-001 and 06-002) also would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands. The existing Libby Adit Site disturbances would remain, and would be visible only from KOP 4 in a montane forest at a NFS road #231 Pullout (Figure 82). Disturbances on private land at the Libby Adit Site would remain until reclaimed in accordance with existing permits and approvals.

3.17.4.2 Alternative 2 – MMC's Proposed Mine

For all action alternatives, and for the duration of the mine's and transmission line's operations, mine facilities, presence of haul vehicles, and introduction of night lighting at all mine facilities and along NFS roads would alter views from KOPs and other locations. Following mine closure, reclamation of most mine facilities would return disturbed areas to a condition similar to a timber harvested area. The tailings impoundment would not be restored to match any existing condition in the KNF and would result in a permanent change in scenery.

The widening and paving of Bear Creek Road would be evident but remain visually subordinate to the surrounding area because a road exists at the same location. The new Bear Creek Road would noticeably alter scenic integrity from forest visitors on the road. The creation of a new access road between the impoundment site and LAD areas would noticeably alter the line, color, texture, and form of the existing forest. The new access road would be highly evident from KOPs 2 and 3, some other KNF locations.

3.17.4.2.1 Libby Adit Site and Rock Lake Ventilation Adit

The entire existing disturbance at the Libby Adit Site is on private land and new disturbance at the site in all mine alternatives would be minimal. Activity at the site would increase during all mine phases in all mine alternatives. The existing Libby Adit Site would continue to alter scenic integrity from the scenic overlook at KOP 2, Elephant Peak (KOP 3), the south NFS road #231 pullout (KOP 4), a portion of NFS roads #231 and #4776, portions of the CMW, and a portion of a private land parcel along Libby Creek northeast of the adit site (Figure 82). Viewing significance, as defined by the VMS Concern Levels from the three KOPs and two roads would be high due to high visitor use and long viewing duration due to stationary viewers or a high viewing angle above the site's location. The visible landscape character would be changed through landform modifications and vegetation pattern interruptions. The change would alter scenic integrity by introducing noticeable contrasts of new buildings, fencing, night lighting, and the presence of mine traffic. The visual absorption level of the Libby Adit Site is high, indicating a substantial capacity to accommodate change. Noticeable changes from KOP 4 would be substantial due to a direct unobstructed line of sight to the adit and long duration views. Because of the screening effects of trees and topography, a relatively small portion of the adit site would remain visible from a private land parcel southeast of the site. Because the Libby Adit Site is and the Rock Lake Ventilation Adit would be located on private land, no VQO criteria apply. Following the mine closure, regrading and revegetation would create areas with similar landscape characteristics to the existing timber harvested areas and unpaved, abandoned roads.

The Rock Lake Ventilation Adit would be an air ventilation opening on the ground, about 15 feet by 15 feet in size, and covered by a metal grate. No mine materials would be transferred to or from this location, and a temporary construction disturbance would be limited (less than 1 acre) because the adit would be constructed from the mine underground. The adit would be located on the west side of the Cabinet Mountains and, therefore, not visible from 10 of the 11 KOPs. The adit would be very difficult to see from KOP 3, Elephant Peak, because of the site's relatively small size and the screening effects of topography. Some views of the adit from Rock Lake would be partially obscured by topography and timberline vegetation. Following the mine closure, regrading would create an area with similar landscape characteristics to the existing treeless areas at timberline.

3.17.4.2.2 Ramsey Plant Site

Construction and use of the Ramsey Plant Site would alter the scenic integrity from the scenic overlook at KOP 2, Elephant Peak (KOP 3), a portion of NFS roads #231 and #4776C, and portions of the CMW (Figure 82). Viewing significance would be high due to high visitor use along NFS road #4776C and at KOP 2, and the high view angle above the plant site and unobstructed view from Elephant Peak (KOP 11). Although Elephant Peak is 1 mile from the plant site, it receives very low visitor use due to its remote location and non-motorized accessibility. Because the plant site and adit entrances would be between two vegetated ridges to the north and south, views from the roads would be very short duration and partially obscured by vegetation; views from the CMW would be partially or entirely obstructed by topography and vegetation.

Landscape character would be changed over the short term due to the construction of the plant facilities, specifically to the vegetation pattern and land use. These changes would alter scenic integrity by introducing noticeable contrasts. The visual absorption capability of the plant site is high, indicating a substantial capacity to accommodate change, and the area of disturbance would be relatively small in most views.

Following the mine closure, regrading and revegetation would create areas with similar landscape characteristics to the existing timber harvested areas. In Alternative 2, the KFP would be amended to change those areas in a current Management Area with a VQO of Retention at the Plant Site to an MA with a VQO of Maximum Modification. The entire plant site would meet all Maximum Modification VQO criteria during construction, operations, and post-closure.

3.17.4.2.3 LAD Areas

Use of the two LAD Areas would alter the scenic integrity over the short term from the representative viewpoint along NFS road #4776C at KOP 2, the scenic overlook at KOP 3, a portion of NFS roads #231 and #4776, and portions of the CMW (Figure 82). Viewing significance from the two KOPs and two roads is high due to high visitor use and/or close proximity to the LAD Areas. Views from the KOPs are also long duration, while views from the two roads are short duration and partially obscured by vegetation. Viewing significance from the private land parcel east and south of the LAD Areas would be high due to potential long duration viewing times and close viewer proximity to the LAD Areas. The private land parcel north of Bear Creek would not be affected due to the screening effects of trees and topography.

The visible landscape character, such as the landform, vegetation pattern, and land use, would be changed over the short term due to the use of the LAD Areas. These changes would alter scenic integrity by introducing noticeable and substantial contrasts. The visual absorption capability of the LAD Areas is high, indicating a substantial capacity to accommodate change. For example, tree clearings would have some similar landscape characteristics to the tree harvested areas in the same vicinity as the LAD Areas. Following the mine closure, regrading and revegetation of the LAD Areas would potentially create areas with landscape characteristics identical to the existing timber harvested areas.

The KFP in this alternative would be amended to change the current MA with a VQO of Partial Retention at the LAD Areas to an MA with a VQO of Maximum Modification. The LAD Areas would meet all Maximum Modification VQO criteria during construction, operations, and post-closure.

3.17.4.2.4 Little Cherry Creek Tailings Impoundment Site

The Little Cherry Creek Tailings Impoundment Site would alter scenic integrity from KOPs 1, 2, and 3, a portion of NFS roads #231 and #4776, and portions of the CMW. Viewing significance from the three KOPs and two roads is high due to high visitor use, close proximity to the impoundment, long viewing duration, and a high viewing angle above the impoundment site. From KOP 2, the scenic overlook, about one-fourth of the impoundment site would be obstructed from view due to the screening effects of topography and vegetation. Although the visual absorption capability of the tailings impoundment location is moderate, its relatively large size in all views would create noticeable contrasts in landscape character and substantial alterations in scenic integrity. A visual simulation of the Little Cherry Creek Tailings Impoundment Site from KOP 2, a representative view from NFS road #4776C, is presented in Appendix I.

KOPs 1, 2, and 3, would have a mostly unobscured direct line of sight and view of a majority of the tailings impoundment. Because each KOP is a destination for scenic viewing, these views are also long in duration. KOPs 1 and 2 receive high visitor use. These two points are easily accessed by all vehicle types and are located relatively close to Libby and US 2. Local residents often bring out-of-town visitors to these KOPs for scenic viewing.

Views of the tailings impoundment from NFS roads #231 and #4776 would be partially obscured by vegetation. Openings in the vegetation also would frame, and emphasize views of the tailings impoundment. Although these views would be mostly from slow-moving vehicles with short-viewing durations, the tailings impoundment would be visible from about 2 miles of NFS road #231, and about 1 mile of NFS road #4776. From NFS road #231 views of the tailings impoundment would be mostly perpendicular to the direction of travel, and from NFS road #4776 views would be directly in line with the direction of travel to the northwest. These two roads are the main vehicular access to KOPs 1 and 2.

Above timberline, dispersed recreational users in some areas of the CMW, would have unobstructed views of the entire tailings impoundment. Views from the CMW below timberline would be similar, but would be partially obscured by vegetation. The landform contrast and relatively large size of the tailings impoundment would create a noticeable interruption of scenic integrity from KOP 3, Elephant Peak, most locations in the CMW east of the major peaks ridgeline, and up to 6 miles away.

Scenic integrity and landscape character from the private land parcel southeast of the impoundment dam, about 0.5 mile (2,700 feet) between dam and nearest property line, would be permanently altered. Scenic integrity would be reduced in northwesterly views from the north end of the private parcel due to a view of the impoundment dam face partially obscured by trees and topography. Scenic integrity would be minimally reduced in northwesterly views from the southern portion of private land due to the increasing screening effects of the forest with increasing distance from the impoundment. The perceived size of the impoundment also would diminish with increasing viewing distance.

Scenic integrity and landscape character from the private land parcel north of the impoundment site, about 0.25 mile (1,400 feet) between impoundment site and nearest property line, would not be affected, or affected only nominally. Visibility of the impoundment site, in southerly views only, would be mostly, or completely, obscured by topography and trees.

The visual absorption capability of the tailings impoundment location and surrounding vicinity is moderate, indicating a moderate capacity to accommodate noticeable change. Disturbances of landform, major disruptions of vegetation patterns, or substantial changes in land use at the impoundment site would be highly noticeable. The line, color, texture, and form of the existing forest vegetation and topography would be in high contrast with the adjacent unaffected vegetation and landforms. Following the mine closure, revegetation of the tailings impoundment would restore some color and texture characteristics similar to the adjacent undisturbed vegetation. Because of the large size and contrasting form, the tailings impoundment would remain an interruption of the scenic integrity of the site. Following mine closure, revegetation of the tailings impoundment would partially reduce color and texture contrasts between the tailings impoundment and surrounding landscape.

The KFP in this alternative would be amended to change those areas in MAs with VQOs of Partial Retention or Modification at the impoundment area to an MA with a VQO of Maximum Modification. The entire tailings impoundment would meet all Maximum Modification VQO criteria during construction, operations, and post-closure.

3.17.4.2.5 Change in VQO

As discussed in previous sections, the KFP in all mine alternatives would be amended to change the current MAs with varying VQOs of the plant site, LAD Areas, and tailings impoundment to an MA with a VQO of Maximum Modification. The change in VQO in the combined mine and transmission line alternatives is shown in Table 150.

None of the alternatives would change the extent of Preservation VQO. Alternative 2 would reduce Retention, Partial Retention, and Modification VQOs and increase Maximum Modification VQO.

Table 150. Change in VQO in the Analysis Area by Combined Mine-Transmission Line Alternative.

VQO	Alternative 1 No Action	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative			Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative		
		TL-B	TL-C	TL-D	TL-E	TL-C	TL-D	TL-E
Preservation	66	66 (0)	66 (0)	66 (0)	66 (0)	66 (0)	66 (0)	66 (0)
Retention	2,402	2,245 (-157)	2,517 (+115)	2,517 (+115)	2,517 (+115)	2,517 (+115)	2,517 (+115)	2,517 (+115)
Partial Retention	4,180	3,773 (-407)	3,961 (-219)	3,960 (-220)	3,965 (-215)	3,849 (-331)	3,849 (-331)	3,853 (-327)
Modification	15,190	13,767 (-1,422)	14,552 (-638)	14,604 (-586)	14,388 (-802)	14,275 (-915)	14,327 (-863)	14,111 (-1,079)
Maximum Modification	3,727	5,714 (+1,987)	4,469 (+742)	4,418 (+691)	4,629 (+902)	4,858 (+1,131)	4,806 (+1,079)	5,018 (+1,291)

Number in parentheses is the reduction in acres of each VQO due to the alternative compared to Alternative 1, No Mine/No Transmission Line.
Source: GIS analysis by ERO Resources Corp. using KNF data.

3.17.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

In the agencies' mine and transmission line alternatives, MMC would implement a number of measures to harmonize operations with scenic values. MMC would complete vegetation clearing operations and painting of structures under the supervision of an agency representative with experience in landscape architecture and revegetation. Where practicable, MMC would create clearing edges with shapes directly related to topography, existing vegetation community densities and ages, surface drainage patterns, existing forest species diversity, and view characteristics from KOPs. MMC would avoid straight line or right-angle clearing area edges. MMC would paint structures to blend in with the surrounding landscape. MMC would not create symmetrically-shaped clearing areas.

MMC would transition forested clearing area edges into existing treeless areas by varying the density of the cleared edge under the supervision of an agency representative. MMC would mark only trees to be removed with water-based paint, and not mark any trees to remain. MMC would cut all tree trunks at 6 inches or less above the existing grade in clearing areas located in sensitive foreground areas such as within 1,000 feet of residences, roads, and recreation areas. These locations would be determined and identified by an agency representative before clearing operations.

3.17.4.3.1 Libby Creek and Rock Lake Adits

Effects on scenery at the Libby Adit Site would be slightly greater than Alternative 2 because of a larger area of contrasts created by the Upper Libby Adit and additional area of disturbance. Although the disturbed area would remain relatively small in the views from KOPs 2 and 3, the roads, and the CMW, the larger size of the contrasts would create a slightly greater visual distraction. Effects on scenic integrity and landscape character due to the Rock Lake Ventilation

Adit, located on MMC private land, would be the same as Alternative 2. MMC would, where possible, screen the Rock Lake Ventilation Adit from view using native materials.

3.17.4.3.2 Libby Plant Site

Construction and use of the Libby Plant Site would alter the scenic integrity from KOPs 2, 3, and 4, a portion of NFS roads #231 and #4776C, portions of the CMW, and the private land parcel east of the plant site (Figure 82). The plant site would be located on a ridge between the Libby and Ramsey Creek valleys and would be highly visible. Viewing significance from KOP 2 is high due to high visitor use along NFS road #4776C, the high view angle above the plant site, and an unobstructed view of the entire plant site. Views from KOP 3 and Elephant Peak would have similar characteristics. Views from NFS roads #231 and #4776C would be short duration and partially obscured by vegetation. Views from CMW in the forest also would be partially obstructed by vegetation. Views from CMW above timberline would be completely unobstructed. Only a relatively small portion of the plant site would be visible from the private land parcel due to the screening effects of trees and topography.

The landscape character would change due to the construction of the plant facilities, specifically to the vegetation pattern, landform, and land use. These changes would alter scenic integrity by introducing noticeable contrasts. The visual absorption capability of the plant site is low, indicating a small capacity to accommodate change. Following the mine closure, regrading and revegetation would potentially create areas with similar landscape characteristics to the existing timber harvested areas. The KFP amendment in this alternative would change the current MA with a VQO of Modification to an MA with a VQO of Maximum Modification. The plant site would meet all Maximum Modification VQO criteria during construction, operations, and post-closure.

3.17.4.3.3 Poorman Tailings Impoundment Site

Effects on scenic integrity and landscape character due to the Poorman Tailings Impoundment Site would be similar to the Little Cherry Creek Tailings Impoundment Site in Alternatives 2 and 4. Because of the impoundment's location, the entire impoundment site would be visible from the scenic overlook at KOP 3. All other scenic integrity, landscape character, and visual absorption capability characteristics would be the same as Alternatives 2 and 4. The tailings impoundment site would meet all applicable Maximum Modification VQO criteria. A visual simulation of the Poorman Tailings Impoundment Site from KOP 2 is presented in Appendix I.

Scenic integrity and landscape character from the private land parcel due east of the impoundment dam, about 0.06 miles (350 feet) between dam and nearest property line, would be permanently and substantially altered. Scenic integrity would be substantially reduced in westerly views from the north end of the private parcel due to a mostly unobstructed view of the 270-foot high impoundment dam face. Scenic integrity would be moderately reduced in northwesterly views from the southern portion of this parcel due to the increasing screening effects of the forest with increasing distance from the impoundment. The size of the impoundment also would be diminishing with increasing viewing distance.

Scenic integrity and landscape character from the private land parcel north of the impoundment site, about 1.1 miles (5,700 feet) between impoundment site and nearest property line, would not be affected, or affected only nominally. Visibility of the impoundment site in southerly views only, would be mostly, or completely, obscured by topography and trees. Following mine closure, revegetation of the tailings impoundment would partially reduce color and texture contrasts between the tailings impoundment and surrounding landscape.

The KFP in this alternative would be amended to change those areas in current MAs with VQOs of Partial Retention or Modification at the impoundment area to an MA with a VQO of Maximum Modification. The tailings impoundment would meet all Maximum Modification VQO criteria during construction, operations, and post-closure.

3.17.4.3.4 Change in VQO

Alternative 3, in combination with the transmission line alternatives, would reduce Partial Retention and Modification VQOs and increase Retention and Maximum Modification VQOs (Table 150).

3.17.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Effects on scenic integrity and landscape character due to the Libby Plant Site, Libby Adit Site, upper Libby Adit Site, and Rock Lake Ventilation Adit would be the same as for Alternative 3. Effects on scenic integrity and landscape character due to the Little Cherry Creek Tailings Impoundment Site would be the same as for Alternative 2.

Alternative 4, in combination would all transmission line alternatives would reduce Partial Retention and Modification VQOs and increase Retention and Maximum Modification VQOs (Table 150). The reduction in Partial Retention and Modification would be less than Alternative 2 and more than Alternative 3.

3.17.4.5 Alternative A – No Transmission Line

The analysis area's existing scenic integrity and landscape character as viewed from KOPs would not change in Alternative A. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands. The visual effect of the Libby Adit would remain until it was reclaimed in accordance with existing permits and approvals.

3.17.4.6 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

The segments of the North Miller Creek Alternative visible from the viewing locations, KOPs, high use roads, and the CMW, are shown on Figure 82. This alternative would be visible from the most KOPs. About 6.4 miles of transmission line would be visible from five of the 11 KOPs, 3, 8, 9, 10, and 11 (Table 151). KOPs 8, 9, and 11 are located on private land. Visibility of the transmission line, structures, and tree clearing area would be very low and partially obscured from KOPs 8 and 9 due to the screening effects of topographic changes and trees. Effects on KOPs would be negligible because a relatively small portion of the tops of the transmission line structures would be visible above evergreen treetops, and the visible tops would be a very small size within the views. Additionally, the tops of the structures would be relatively small portions of views from the KOPs. This alternative would have visibility of the transmission line from the most acres of CMW and second least miles from high use roads (Table 152). The length of high

Table 151. Transmission Line Length Visible from KOPs.

KOP	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
1	—	—	—	—
2	—	—	—	—
3	2.83	0.58	—	—
4	—	—	—	—
5	—	—	0.42	0.42
6	—	—	—	—
7	—	—	—	—
8	0.24	—	—	—
9	1.78	0.31	0.31	0.17
10	0.74	0.04	0.04	0.04
11	0.83	—	—	—
Total	6.42	0.93	0.77	0.63

All units are miles.
— = Not visible from KOP.
KOP = Key Observation Point.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Table 152. Visibility of Transmission Line from KOPs, Roads, and the CMW.

Location	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
KOPs (number)	5	3	3	3
High use roads (miles)	11.19	9.89	11.92	11.99
CMW (acres)	1,630	1,480	1,450	1,470

KOP = key observation point.
CMW = Cabinet Mountains Wilderness.
Source: GIS analysis by ERO Resources Corp. using KNF data.

use roads with transmission line visibility would be the same as Alternative D-R. The KFP in this alternative would be amended to change those areas in an MA with VQOs of Retention or Partial Retention to an MA with a VQO of Maximum Modification. This alternative would meet all Modification and Maximum Modification VQO criteria.

BPA's Sedlak Park Substation and loop line would be on private land owned by Plum Creek. It is not be subject to Forest Service visual management standards. The substation's perimeter would be illuminated during nighttime hours, and lighting would be directed downward to mitigate light and glare. One residence would have a direct view of the proposed substation location.

3.17.4.7 Alternative C-R – Modified North Miller Creek Transmission Line Alternative

The agencies' transmission line alternatives incorporated several mitigations to avoid or minimize effects on visual resources. All agency alternatives use an alignment that route the line on an east-facing ridge immediately north of the Sedlak Park Substation instead of following the Fisher River, reducing visibility from US 2. All agency alternatives also would use wooden H-frame structures, which are shorter and would be less visible. During final design, MMC would submit a final Vegetation Removal and Disposition Plan for lead agencies' approval. The plan's goal would be to minimize vegetation clearing, particularly in riparian areas. The agencies modified MMC's proposed Environmental Specifications to incorporate current transmission line construction practices. The agencies' Environmental Specifications, shown in Appendix D, would be implemented to guide line construction, operation, maintenance, and decommissioning activities in all of the agencies' transmission line alternatives. The agencies' Environmental Specifications also include sensitive areas, such as high visibility areas, where special measures would be taken to reduce impacts during construction and reclamation activities. In all of the agencies' transmission line alternatives, MMC would implement the measures to harmonize operations with scenic values discussed under Alternative 3.

The segments of the Modified North Miller Creek Alternative visible from the viewing locations, KOPs, high use roads, and the CMW, are shown on Figure 82. About 0.9 miles of transmission line would be visible from three of the 11 KOPs (Table 151). Visibility of the transmission line, structures, and tree clearing area would be very low and partially obscured from KOPs 9 and 10 due to the screening effects of topographic changes and trees. Effects on KOP 3 would be the same as for Alternative B.

This alternative would have visibility of the transmission line from the second most acres of CMW, and least miles from high use roads (Table 152). The KFP in this alternative would be amended to change those areas in an MA with VQOs of Retention or Partial Retention to an MA with a VQO of Maximum Modification. This alternative would meet all Modification and Maximum Modification VQO criteria. The visual effect of BPA's Sedlak Park Substation would be the same as Alternative B.

3.17.4.8 Alternative D-R – Miller Creek Transmission Line Alternative

The segments of the Miller Creek Alternative visible from the viewing locations, KOPs, high use roads, and the CMW, are shown on Figure 82. About 0.8 mile of transmission line would be visible from three of the 11 KOPs (Table 151). Visibility of the transmission line, structures, and tree clearing area would be very low and partially obscured from KOPs 9 and 10 due to the screening effects of topographic changes and trees. Effects on KOP 5, at Howard Lake, would be high visibility, high contrast, and noticeable change to the existing line, color, and texture of the forest. Most visitors to Howard Lake would have unobstructed views of a portion of this alternative. A photographic simulation of the view from the Howard Lake boat ramp with Alternative D-R is in Appendix I.

This alternative would have visibility of the transmission line from the least acres of CMW, and the second most miles from high use roads (Table 152). The KFP in this alternative would be amended to change those areas in an MA with VQOs of Retention or Partial Retention to an MA with a VQO of Maximum Modification. This alternative would meet all Modification and

Maximum Modification VQO criteria. The visual effect of BPA's Sedlak Park Substation would be the same as Alternative B.

3.17.4.9 Alternative E-R – West Fisher Creek Transmission Line Alternative

The segments of the West Fisher Alternative visible from the viewing locations, KOPs, high use roads, and the CMW, are shown on Figure 82. About 0.6 mile of transmission line would be visible from three of the 11 KOPs (Table 151). Effects from KOPs 5, 9, and 10 would be the same as Alternative D-R.

This alternative would have visibility of the transmission line from the second least acres of CMW, and most miles from high use roads (Table 152). The KFP in this alternative would be amended to change those areas in an MA with VQOs of Retention or Partial to an MA with a VQO of Maximum Modification. This alternative would meet all Modification and Maximum Modification VQO criteria. The visual effect of BPA's Sedlak Park Substation would be the same as Alternative B.

Based on all KOP, road, and CMW locations with transmission line visibility, Alternative B would have the greatest length of high transmission line visibility at 3.8 miles. Alternative D-R would have the greatest length of transmission line with no visibility of 1.5 miles (Table 153).

Table 153. Visibility Levels of Transmission Line Alternatives.

Visibility	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
No Visibility	2.1	2.5	1.5	1.7
Low	2.5	2.8	4.1	2.8
Moderate	8.0	5.8	6.6	8.1
High	3.8	2.1	1.6	2.7

All units are in miles.
Source: GIS analysis by ERO Resources Corp.

3.17.4.10 Effectiveness of Agencies' Proposed Mitigation

In Alternatives 3 and 4, MMC would regrade and shape flat surfaces to blend with the adjacent landscape and have natural dendritic drainages. Additional fill would be used as necessary to create smooth transitions between human-made and natural landforms whenever project facilities were reclaimed. MMC also would develop a design to recontour faces of the tailings impoundment dams to more closely blend with the surrounding landscape than proposed in Alternative 2. Although reclaimed areas would generally have noticeably different lines, colors, and textures, the mitigation measures included in the reclamation process in Alternatives 3 and 4 would reduce or eliminate some of these contrasts. For example, the visible effects of vegetation color contrasts would no longer be apparent sometime after reclamation. At the proposed tailings impoundment location, mitigation measures would reduce but not eliminate the effects of the line, color, and texture contrasts. The proposed tailings impoundment site would always have noticeable contrasts to the surrounding forest and landforms.

The effectiveness of other mitigation measures would include:

- Lighted mine facilities and roads used for mining operations would remain highly visible at night. Although shields or baffles at the light sources would prevent most glare from the bulb, the ambient light would be highly visible because the facility locations and roads are mostly dark, except at the Libby Adit.
- Grading to minimize disturbance area for mine facilities would reduce, but not eliminate visible contrasts with the surrounding landforms.
- Following mining operations, placement of waste rock underground in existing disturbed areas, or into the tailings impoundment would eliminate the visible contrasts of color and texture, and minimize areas of disturbance.
- Completing the vegetation clearing operation under the supervision of an agency representative would minimize the areas of disturbance and therefore minimize the visibility of mine facilities and the transmission line. Creating clearing edges with varying shapes responding to the composition of the adjacent forest, existing topography, and views from KOPs would reduce, and possibly eliminate visibility of some mine facilities and the transmission line from some KOPs, and minimize the contrasts of line. Varying the density of the clearing edges would also minimize the visibility of the edges.
- Marking trees for removal as opposed for preservation would not leave paint markings on trees remaining in the vicinity of the proposed facilities and along the transmission line clearing corridor.
- Cutting all trees in clearing areas to within 6” of the ground and within 1,000’ of KOPs, would reduce, but not eliminate, the visible presence of cut tree trunks, and the contrasts of color and texture.
- Locating mine facilities and the transmission line below the horizon line as viewed from the KOPs reduces, but does not eliminate, visibility and the contrasts of line, color, and texture of the facilities and transmission line.

During operations, mitigation measures of the transmission line alternatives would also reduce the noticeable contrasts created by the presence of the line, structures, new roads, and tree clearing corridors. These facilities would remain visible throughout operations. Although the use of wood poles, non-specular conductors, and non-reflective insulators would reduce the contrasts of texture with the surrounding forest and the reflection of light, these facilities would remain visible. Variations in the width and shape of the forest clearing corridors would create some forest edge characteristics edges similar to naturally-formed clearings. Leaving a variety of species and tree sizes at the clearing edges would also create the appearance of naturally-formed clearing edges. Clearing corridors would remain highly visible and in contrast with the surrounding forest. Following the mine closure and reclamation, the visible effects of the transmission line would be eliminated when tree height and density matched the surrounding forest.

During operations, mitigation measures of the mine facilities’ night lighting would reduce the amount of visible artificial light. Although light fixture baffles and directional light sources diminish the amount of ambient light emanating from a fixture, some ambient light would remain, and the light source would remain visible from some locations.

3.17.4.11 Cumulative Effects

Past actions of timber harvest and road construction have altered the scenic integrity of characteristic landscapes of the analysis area. Roads have created linear features visible throughout the analysis area. Timber harvests have altered the line, color, and texture of the undisturbed landscape. The future construction and operation activities of the Poker Hill Rock Quarry near NFS road #231 would affect the scenic integrity of views from the road. Both the quarry and planned mine facilities would be visible from NFS road #231. Timber harvest associated with the Miller-West Fisher Vegetation Management Project also would affect views from NFS roads #231 and #385. Cumulative visual impacts would occur for wilderness hikers visiting Ojibway Peak where views extend toward both the East Fork Rock Creek west of the Cabinet Mountains and Libby Creek east of the Cabinet Mountains. From a small area on the peak, both the preferred mill site for the Rock Creek Project and the Libby Plant Site and Libby Adit for the Montanore Project would be visible. Indirect impacts may occur for CMW visitors to other wilderness peaks, as either project may be visible from some wilderness viewpoints.

3.17.4.12 Regulatory/Forest Plan Consistency

3.17.4.12.1 Organic Administration Act and Forest Service Locatable Minerals Regulations

The Forest Service is responsible for ensuring that mine operations on National Forest System lands comply with Forest Service locatable mineral regulations (36 CFR 228 Subpart A) for environmental protection. One of these regulations (36 CFR 228.8) requires that mining activity be conducted, where feasible, to minimize adverse environmental impacts on National Forest surface resources. 36 CFR 228.8(d) also requires that mining operators, to the extent practicable, harmonize operations with scenic values through such measures as the design and location of operating facilities, including roads and other means of access, vegetative screening of operations, and construction of structures and improvements which blend with the landscape.

Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8(d). In this alternative, MMC did not propose to implement practicable measures to harmonize operations with scenic values.

The agencies' alternatives (Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R) were developed and incorporated feasible and practicable measures to minimize adverse environmental impacts and harmonize operations with scenic values. Transmission Line Alternatives C-R, D-R, and E-R were developed and revised to address visual issues. The alignment of the line was moved away from private property and located away from the Hwy 2 corridor to reduce visual impacts of the line. The structure type was modified from a monopole to a h frame to reduce visual impacts as well. Mitigation measures in Alternatives 3 and 4, would include regrading and shaping of flat surfaces to blend with the adjacent landscape and have natural dendritic drainages. Additional fill would be used as necessary to create smooth transitions between human-made and natural landforms. MMC also would develop a design to recontour faces of the tailings impoundment dams to more closely blend with the surrounding landscape than proposed in Alternative 2. Additional mitigation measures include baffling or shielding night light, painting of structures to blend in with surrounding landscape minimizing the visibility of the clearing edges. Measures are further described in the previous discussion on *Effectiveness of Agencies' Proposed Mitigation*.

3.17.4.12.2 Kootenai Forest Plan

All mine and transmission line alternatives would meet all VQO criteria for National Forest System lands following the KFP amendment in each agency alternative. There are no visual regulatory requirements for BPA's Sedlak Park Substation and loop line situated on private land.

3.17.4.13 Irreversible and Irretrievable Commitments

Landform changes caused by the tailings impoundments would alter the scenery and would be an irreversible commitment of visual resources. Changes in scenery from other mine facilities would be an irretrievable commitment of resources. At the mine closure, disturbed areas would be regraded and revegetated, and all buildings and other constructed facilities would be removed. Reclaimed areas would have noticeably different lines, colors, and textures than the adjacent undisturbed landscape.

3.17.4.14 Short-term Uses and Long-term Productivity

Short-term uses affecting scenery would include construction of all proposed mine facilities and the transmission line. In addition, there would be the short-term effects from the presence of fugitive dust from construction activities, night lighting for construction operations, and vehicle traffic.

Long-term effects on scenery would be loss of vegetation and landform changes at all mine facilities and along the transmission line during the life of the mine. Following mine closure, landscape reclamation at all mine facilities, except the tailings impoundment, would create areas similar in appearance to abandoned roads and timber harvest areas. The tailings impoundment would have physical characteristics in substantial contrast to the surrounding landscape. The scenic integrity and landscape character changes at the impoundment site would be noticeable indefinitely.

3.17.4.15 Unavoidable Adverse Environmental Effects

Visual impacts of all action alternatives would be unavoidable. Existing settings and landscapes in the analysis would be altered during mine operation and for several decades following operations.

3.18 Social/Economics

3.18.1 Regulatory Framework

3.18.1.1 Forest Plan

The KFP guides all natural resource management activities and establishes management standards for the KNF (USDA Forest Service 1987a). The KFP establishes management direction in the form of prescriptions consisting of goals, objectives, standards, and guidelines. Goals provide information on the long-range management intent. The objectives and standards of both the forest as a whole and individual MAs must support the goals. MA designations, goals, and standards are described in detail in section 3.15.3.2.2*, Management Area Goals and Standards*. All activities conducted on the KNF must contribute to the realization of the goals. The goal for mineral development is to "encourage responsible development of mineral resources in a manner that recognizes national and local needs and provides for economically and environmentally sound exploration, extraction, and reclamation." The KFP also establishes a goal of providing a sustained yield of timber volume responsive to market demands and supportive of a stable base of economic growth in the dependent geographic area. Management direction for the analysis area is described in more detail in section 3.15.3.2*, Kootenai National Forest Land Management Plan.*

3.18.1.2 Hard Rock Mining Impact Act

The Hard Rock Mining Impact Act is designed to assist local governments in handling financial impacts caused by large-scale mineral development projects. A new mineral development may result in the need for local governments to provide additional services and facilities before mine-related revenues become available. The resulting costs can create a fiscal burden for local taxpayers. The Hard Rock Mining Impact Board (HRMIB) oversees an established process for identifying and mitigating fiscal impacts on local governments through the development of a Hard Rock Mining Impact Plan. Under the Impact Act, each new large-scale hard-rock mineral development in Montana is required to prepare a local government fiscal Impact Plan. In the plan, the developer is to identify and commit to pay all increased capital and net operating costs to local government units that will result from the mineral development.

MMC updated the Impact Plan with the cooperation of the affected local governments (Western Economic Services, LLC 2005) and submitted it to Lincoln County for its review. Lincoln County approved the updated plan in 2007. Because the Montanore Project as currently proposed would change employment projections, MMC submitted an amendment for consideration by the HRMIB. The HRMIB approved the amendment in 2008.

3.18.1.3 Major Facility Siting Act

The purposes of the MFSA for the construction of electric transmission lines are to: ensure the protection of the state's environmental resources; ensure the consideration of socioeconomic impacts; provide citizens with an opportunity to participate in facility siting decisions; and establish a coordinated and efficient method for the processing of all authorizations required for regulated facilities. The MFSA directs the DEQ to approve a facility if, in conjunction with other findings, the DEQ finds and determines that the facility would minimize adverse environmental impacts considering the state of available technology and the nature and economics of the various alternatives.

3.18.2 Analysis Area and Methods

The socioeconomic analysis area is based on various factors that may influence the location and magnitude of potential socioeconomic impacts. Some of these factors include:

- The location of and access to the ore body and to the proposed permit area
- The likely residence area for people working at the mine (existing residents and/or any in-migrating project employees)
- The rate and magnitude of in-migration (which will be influenced by the availability of a trained or trainable local workforce and a developer-sponsored training program)
- The rate and magnitude of population and employee turnover (including student population turnover in schools, employee turnover at the mine, and employee turnover from existing jobs to employment with the Montanore Project)
- The availability and location of existing housing and potential housing and the capacity and condition of existing local services and facilities
- The people directly/indirectly affected economically by the proposed mining operation (*e.g.*, from wages and taxes)
- The willingness and ability of community residents and local government personnel to deal with change
- The allocation and magnitude of costs associated with in-migration of workers and allocation of tax revenues
- Impacts on Sanders County from removing ore and processing in Lincoln County

Based on these factors, the socioeconomic analysis area for the proposed project is Lincoln County and the Towns of Libby, Troy, and Eureka. Affected jurisdictions in the analysis area include the incorporated municipalities of Libby and Troy as well as the Libby, Troy, and Eureka School Districts (Western Economic Services, LLC 2005).

Economic effects on Sanders County would result primarily from the distribution of metal mines tax revenues to Sanders County. Relevant baseline information in Sanders County is provided in section 3.18.3.7*, Fiscal Conditions* because socioeconomic effects are likely to be limited to direct payments to Sanders County that would be distributed among various county agencies. Other baseline data for Sanders County related to population, housing, income, employment, and quality of life are not provided for because in-migrating mineworkers are not expected to establish residency there, and effects on Sanders County would be negligible (Western Economic Services, LLC 2005). Unless otherwise specified, socioeconomic data contained in this section are based on information provided in the *2005 Socioeconomic Report for the Mines Management Montanore Project* (Western Economic Services, LLC 2006).

3.18.3 Affected Environment

3.18.3.1 Population and Demographics

3.18.3.1.1 Historical Population Trends and Characteristics

Since 1950, Lincoln County has experienced relatively substantial fluctuations in its population. Lincoln County experienced the largest increase in population (44 percent) between 1960 and 1970 due to construction of Libby Dam. Between 1970 and 1980, Lincoln County's population declined by about 1.7 percent. This decline is attributable to the out-migration of construction workers when Libby Dam was completed. The population recovered, by almost 8 percent, from 17,481 people in 1990 to 18,837 people in 2000 (Table 154). The U.S. Census Bureau's 2010 population estimate of 19,687 people in Lincoln County indicates that the population has grown by 4.5 percent since 2000 (U.S. Census Bureau 2012a).

Table 154. Lincoln County Population Characteristics (1970-2010).

Year	1970	1980	1990	2000	2010
Lincoln County	18,063	17,752	17,481	18,837	19,687
% Change		-1.7	-1.5	7.8	4.5
Libby	3,286	2,748	2,532	2,626	2,628
% Change		-16.4	-7.9	3.7	<0.1
Eureka	1,195	1,119	1,043	1,017	1,037
% Change		-6.4	-6.8	-2.5	2.0
Troy	1,046	1,088	953	957	938
% Change		4.0	-12.4	0.4	-2.0
Montana	694,409	786,690	799,065	902,125	989,415
% Change		13.3	1.6	12.9	9.7

Source: Western Economic Services, LLC 2006; U.S. Census Bureau 2012a.

In 2010, the median age for both males and females in Lincoln County was 49 years, compared to 40 years in the state. Lincoln County has experienced an increase in the number of older residents due in part to the popularity of second homes in rural mountain communities. From 2000 to 2010, people between the ages of 55 to 64 increased from 2,459 to 3,675 (49.5 percent) and people 65 or older increased from 2,859 to 4,040 (41.3 percent). For the state of Montana over the same period, the number of people between the ages 55 to 64 increased from 85,119 to 138,858 (63.1 percent), and the number of people 65 and older increased from 120,949 to 146,742 (21.3 percent).

3.18.3.1.2 Major Population Centers

Major population centers in Lincoln County include the towns of Libby, Troy, and Eureka. Libby is the largest town in Lincoln County, with about 23 percent of the population (Table 154). Each town's 2010 population was within 5 percent of 2000 populations. Population trends in Libby are similar to those described for the county. Libby has a higher percentage (22.5 percent) of its population over 65 years of age compared to Lincoln County (20.5 percent) and the state of Montana (14.8 percent) (U.S. Census Bureau 2012b).

3.18.3.1.3 Population Projections

Under current conditions, the Lincoln County population is projected to increase by 0.8 percent per year, rising from 19,687 people in 2010 to 22,740 people by 2030 (Table 155). Population projections for municipalities within Lincoln County were obtained by applying county population actual and projected growth rates from 1970 to 2030 to the municipalities. The population in Libby is expected to increase by 518 persons from 2,628 people in 2010 to 3,146 people in 2030. Eureka's population is expected to increase by 181 people and Troy's population is expected to increase by 225. Much of the projected population growth is attributed to expected increases in retirees and other older, affluent newcomers (Lincoln County 2009).

Table 155. Population Projections for Lincoln County and Municipalities (2010 – 2030).

Year	2010	2015	2020	2025	2030
Lincoln County	19,687	19,738	20,483	21,505	22,740
Libby	2,628	2,731	2,834	2,975	3,146
Eureka	1,037	1,057	1,097	1,152	1,218
Troy	938	1,009	1,047	1,100	1,163

Source: Western Economic Services, LLC 2006.

3.18.3.1.4 Minority Populations

Census data for Lincoln County are broken down within Census Tracts to show the distribution of minorities within the county. Libby is located almost entirely in Census Tract 2. Eureka is part of Census Tract 4 and Troy is part of Census Tract 5 (Table 156). In the 2010 Census, racial minorities represented 4.1 percent of the total County population. Another 2.3 percent of the County population falls under the category of individuals of two or more races.

Table 156. Population by Race and Ethnicity.

Race	Census Tract 1	Census Tract 2	Census Tract 3	Census Tract 4	Census Tract 5	Total	% Total Population
White	3,446	2,268	3,773	5,977	3,417	18,881	95.9
Black	6	3	3	7	4	23	0.1
American Indian or Alaskan Native	29	31	29	62	31	182	0.9
Asian	10	10	14	13	13	60	0.3
Native Hawaiian and Other Pacific Islander	4	1	1	1	2	9	0.0
Some Other Race	6	9	19	31	6	71	0.4
Two or More Races	88	57	83	130	103	461	2.3
Total	3,589	2,379	3,922	6,221	3,576	19,687	100.0
Hispanic	50	64	101	188	59	462	2.4

Source: U.S. Census Bureau 2012c.

3.18.3.1.5 Disabled Populations

Disability is categorized by the Census Bureau into communicative, physical, and mental domains. Broadly, disability is an umbrella term for impairments, activity limitations, and participation restrictions. In the 2000 Census, 4,012 people, or about 21.3 percent of the population in Lincoln County were classified as disabled; this compares to about 12.8 percent of the state population. The large numbered of disabled people can be attributed in part to former vermiculite mine workers from the W.R. Grace Mine who suffer from asbestos-related diseases. Specifically, for a 20-year period (1979 to 1998) examined, asbestosis mortality in Libby was 40 to 80 times higher than expected and lung cancer mortality was 1.2 to 1.3 times higher than expected when compared to Montana and the United States (Agency for Toxic Substances and Disease Registry 2002).

3.18.3.2 Employment

Employment conditions for Lincoln County are presented in terms of historical employment trends, current types of employment, and baseline (i.e., with no mine) employment projections. Lincoln County's economy has typically centered on natural resource extraction industries such as mining and logging. Mining has historically been a dominant feature of the Lincoln County economy. The Rainey Creek and Fisher River Districts, east of Libby, and the Sylvanite and Keystone Districts, north of Troy, were productive mining areas before the 1940s. Gold, silver, copper, zinc, and lead were extracted from mines throughout Lincoln County. Until 1990, when the W.R. Grace mine was closed, Lincoln County was also the world's largest producer of vermiculite. Mining sector businesses represented 0.6 percent of all businesses, but about 7.0 percent of all County employment in 1986. In 2010, mining sector businesses represented 1.1 percent of all businesses and accounted for 4.6 percent of all County employment (Montana Department of Labor and Industry 2012a).

According to the Montana Department of Labor and Industry, lumber and wood products represented 42.1 percent (16 of 38) of all manufacturing establishments and 89.7 percent (651 of 726) of all manufacturing employment in 2000 in Lincoln County when Owens & Hurst Lumber, Plum Creek Lumber, and Stimson Lumber Company were the three largest lumber and wood product employers. During 2010, the latest data available, the lumber and wood products industry represented 27.6 percent (8 of 29) of all manufacturing establishments, and employment had declined to 24.1 percent (48 of 199) of manufacturing employment in Lincoln County. The strength of the lumber and wood products industry in Lincoln County has historically been tied to the strength of the national housing and construction market, as well as the local availability of timber. Between 1993 and 2005, five lumber mills closed, leaving only Plum Creek with continuing operations in Lincoln County.

In 2010, the top three employment sectors in Lincoln County were government and government enterprises, retail trade, and construction. The government and government enterprises sector, with 15 percent of total employment, was the largest sector in Lincoln County. The retail trade sector was the next largest with 11.9 percent of total employment followed by the construction sector with 8.6 percent of total employment (Table 157). Contributing to many sectors is a vibrant recreation industry that provides visitors numerous camping, hiking, skiing, snowmobiling, hunting and fishing, wildlife viewing, and other recreation opportunities.

The top 9 private employers for Lincoln County during the second quarter of 2011, listed in alphabetical order, were A Full LiveLife Agency, Genesis Inc., Harlow's School Bus Service, Libby Care Center, Mountain View Manor, Rosauer's Food and Drug, St John's Lutheran Hospital, Stein's IGA, and Town Pump (Montana Department of Labor and Industry 2012a).

Table 157. Lincoln County Employment Trends (2008 - 2010) for Major Industrial Sectors.

Industrial Sector	2008		2009		2010	
	Persons	%	Persons	%	Persons	%
Forestry, Fishing, and Related Activities	496	5.2	388	4.2	388	4.2
Mining	282	3.0	249	2.7	273	3.0
Construction	946	9.9	853	9.2	788	8.6
Manufacturing	413	4.3	359	3.9	353	3.8
Retail Trade	1,123	11.8	1,114	12.1	1,088	11.9
Government and Government Enterprises	1,354	14.2	1,382	15.0	1,373	15.0
Total Employment	9,537		9,241		9,176	

Employment based on the number of full- and part-time jobs.
Source: U.S. Bureau of Economic Analysis 2012a.

The labor force in Lincoln County, defined as persons working or seeking work, increased by 287 persons, from 7,623 in 2005 to 7,910 in 2010. This is an increase of 3.8 percent compared to an increase of 3.5 percent statewide over the same period. In Lincoln County, the average annual unemployment rate, the number of unemployed persons as a percentage of the labor force, increased from 7.4 percent in 2005 to 15.6 percent in 2010 (Montana Department of Labor and Industry 2012a). This was about twice the average annual unemployment rate of Montana, which was 7.2 percent during 2010 (Montana Department of Labor and Industry. 2012b).

Total employment in Lincoln County is projected to increase to 12,572 people by 2030. This increase represents an average annual growth rate of 1.3 percent between 2003 and 2030, higher than the historical 1970-2002 growth rate of 0.5 percent (Western Economic Services, LLC 2006).

3.18.3.3 Income

The 2010 median family income in 2010 in Lincoln County was $39,600, about 28.9 percent lower than the state-wide median family income of $55,725. Lincoln County’s per capita personal income, adjusted for inflation, was $28,404 in 2010, compared to $36,159 in Montana. This represents an increase of 37.5 percent since 1969 compared to an increase of 79.1 percent statewide over the same period (U.S. Bureau of Economic Analysis 2012b). Lincoln County’s average wage of $31,213 per year in 2010 was lower than the statewide average of $34,610 per year. The top-paying sectors of the economy included mining ($62,571 per year), government ($42,928 per year), and forestry and logging ($42,318 per year).

Between 2006 and 2010, Lincoln County had a greater percent (38.4 percent) of households earning less than $25,000 a year than in the state of Montana (27.5 percent). A total of 3,548 households in Lincoln County had incomes of less than $25,000. Census Tract 4, in which Eureka is located, had the highest concentration in the county, with 27.8 percent of households with incomes of less than $25,000 (U.S. Census Bureau 2012a).

3.18.3.4 Economic Activities that Rely on Natural Resources

The following sections briefly describe economic activities in the study area that rely on natural resources such as recreation, logging, mineral exploration, and agriculture. The *Logging*, *Mineral Exploration*, and *Agriculture* sections only discuss relevant activities near the analysis area, and are not designed to discuss all of Lincoln County. Additional information on these activities is discussed in sections 3.15, *Land Use* and 3.16, *Recreation.*

3.18.3.4.1 Recreation

National Forest System lands make up a large percentage of the Lincoln County land base and offer public access for a variety of motorized and non-motorized recreational activities including: hunting for big game and upland and migratory game birds, fishing, hiking, wildlife observation, berry picking, photography, backpacking, horseback riding, snowmobiling, mountain biking, picnicking, sightseeing, OHV use, amateur geology, and camping. Visitation estimates for 2007 on the KNF were 892,000 ± 18.9 percent. Greater than 72 percent of these visits were from people who lived within 100 miles of the KNF (USDA Forest Service 2011d).

Most of the visits to the KNF are day visits. The average visit to the KNF lasts about 10 hours; more than half of the visits to the KNF last less than five hours. Less than 10 percent of the visits involve recreating at more than one location on the KNF. Because of the local nature of the visiting population, frequent visitors are quite common. More than 38 percent of all visits are made by people who visit more than 50 times per year. Conversely, only about 25 percent of the visits are made by people who visit, at most, five times per year (USDA Forest Service 2011d).

3.18.3.4.2 Logging

The National Forest System lands of the Libby Ranger District provide about 6 to 8 million board feet (mmbf) of timber annually. No KNF timber sales are currently under contract in the land use analysis area as of 2012. As discussed in section 3.3, *Reasonable Foreseeable Future Actions or Conditions*, the KNF completed an EIS on the Miller-West Fisher Vegetation Management Project in the land use analysis area. Timber harvest activity also occurs on private, forest-industry lands. The amount of timber harvested has declined in the past 10 years. Small-scale timber harvests occur in the range of 2 to 6 mmbf annually on the private lands in the land use analysis area. Logging has taken place along Libby Creek on public lands since the late 1960s. Timber was harvested from upper Libby Creek and Ramsey Creek following the Libby Creek Road extension in the mid-1970s, resulting in a number of clear-cut areas within the analysis area. Plum Creek has harvested several tracts of private land on lower Miller Creek and along the Fisher River (Power Engineers, Inc. 2005c).

3.18.3.4.3 Mineral Exploration

Some mineral activity occurs near the proposed mine. This activity includes small placer operations on Libby and Big Cherry creeks, small lode mining operations along Libby Creek, Snowshoe Creek, at the headwaters of the West Fisher Creek, and in the Prospect Hill area, four miles south of Libby. A number of mineral operators do some form of work along the east face of the Cabinet Mountains each year (Power Engineers, Inc. 2005c).

3.18.3.4.4 Agriculture

No prime and unique farmland was identified near the proposed mining facilities; some land along US 2 is used for hay and grazing. In addition, no land is enrolled in the Conservation Reserve Program, and no grazing allotments are present on nearby National Forest System lands

(Power Engineers, Inc. 2005c). Four commercial apiaries are located near the proposed mining facilities. Commercial apiaries are used for honey production and/or pollination.

3.18.3.5 Housing

In 2010, the U.S. Census Bureau reported that Lincoln County had 11,413 year-round housing units and that Sanders County had 6,678 year-round housing units. These were increases of 22.5 percent in available housing in Lincoln County and 26.7 percent in Sanders County since 2000. Overall, the percent of owner-occupied housing units in both counties (about 76.2 percent in Lincoln County and 75.1 percent in Sanders County) was higher than the state's 68 percent in 2010.

3.18.3.6 Public Services and Infrastructure

3.18.3.6.1 Schools

Eight elementary schools, eight middle schools, and three high schools are located in Lincoln County. Troy, Libby, and Eureka have an elementary, middle, and high school each. Fortine, McCormick, Sylvanite, Yaak and Trego have an elementary/middle school each. Total school enrollment for public schools in Lincoln County declined by 22.9 percent between 2000 and 2010. In 2011, Libby K-12 Schools consolidated their middle and high schools.

3.18.3.6.2 Law Enforcement

Law enforcement services in the Lincoln County study area are provided by the Lincoln County Sheriff's Office, the Montana Highway Patrol, the Eureka Police Department, the Troy Police Department, and the Libby Police Department. Twenty-one full-time law enforcement officers were employed in Lincoln County in 2003. Two jail facilities occur within the study area: a 24-cell adult jail in Libby; and a 4-bed juvenile holding facility in Troy.

3.18.3.6.3 Fire Protection

Fire protection in Lincoln County is provided by nine fire departments. The rural/city Libby Fire Department has two fire marshals and 29 volunteers, and the Troy rural/city Fire Department has 25 volunteers. The Montana DNRC and the Forest Service are responsible for fire protection in lands under their jurisdictions.

3.18.3.6.4 Health Care Facilities

The healthcare needs of Lincoln County are provided by St. John's Lutheran Hospital, Northwest Community Health Center, Libby Clinic, The Center for Asbestos Related Disease, Libby Care Center, Troy Medical Arts Building, and multiple dental practices. In 2012, St. John's Lutheran Hospital began construction of a new hospital located adjacent to the existing hospital. The hospital will retain its status as a 25-bed Critical Access Hospital with the new construction.

3.18.3.6.5 Water Supply

More than 50 percent of the households in Lincoln County use private wells for their water supply. About 4,750 households in Libby; 1,000 households in Troy; and 1,100 households in Eureka are served by a municipal water system. Libby obtains its water from Flower Creek. Troy receives its municipal water supply from two wells and O'Brien Creek.

3.18.3.6.6 Wastewater Treatment

Libby has operated a public wastewater treatment facility since 1964 and converted from a primary to a secondary treatment facility (*i.e.*, an activated sludge oxidation ditch system) in 1985. In Troy, sewer service is obtained for a fee of $36.27 per month for residential and $40.97 per month for commercial service.

3.18.3.6.7 Utilities

Residential telephone service in the Lincoln County study area is provided by Frontier, a subsidiary of Citizens Communications. The long distance service is provided by AT&T. Electric service for Libby is provided by Flathead Electric Cooperative. Lincoln Electric Cooperative is an electric distribution cooperative headquartered in Eureka, providing electricity service to northeast Lincoln County. Northern Energy provides propane to the local area. Northern Lights, Inc. is the electricity provider in the Troy area. Heating sources in the analysis area include oil, propane, wood, and electricity.

3.18.3.7 Fiscal Conditions

The proposed project would affect the public budgets of Lincoln and Sanders counties; Libby, Troy, Eureka; and those cities' school districts. Basic descriptions of key budget areas for each of these jurisdictions are presented in the following sections.

3.18.3.7.1 Lincoln County

Taxable valuation for Lincoln County increased from $30.78 million in FY 2009 to $31.24 million in FY 2010. This is an increase of $460,000, or 1.5 percent. Countywide levies increased slightly, from 115.85 mills in FY 2009 to 115.95 mills in FY 2010. Total funds appropriated for Lincoln County in 2011 were $6.05 million, representing a 17.8 percent increase over the period from 2007 to 2011 (Montana State University 2011).

3.18.3.7.2 Municipalities

Taxable valuation for Libby was $2.8 million in 2010. From 2006 to 2010, taxable valuation for Libby increased 12.8 percent. Taxable valuation for Libby in 2011 remained at $2.8 million. Total funds appropriated for Libby for 2010 were $1.31 million, representing a 27.2 percent increase from 2006 to 2010. Total funds appropriated in 2011 were $1.33 million.

Taxable valuation for Troy was $772,830 in 2010. From 2006 to 2010, taxable valuation for Troy increased 6.1 percent. Taxable valuation for Troy in 2011 increased to $796,890. Total funds appropriated for Troy for 2010 were $537,880, representing a 43.5 percent increase from 2006 to 2010. Total funds appropriated in 2011 were $529,700. Taxable valuation for Eureka was $987,820 in 2010. From 2006 to 2010, taxable valuation for Eureka increased 5.9 percent. Taxable valuation for Eureka in 2011 increased to $993,830. Total funds appropriated for Eureka for 2010 were $357,350, representing a 67.8 percent decrease from 2006 to 2010. Total funds appropriated in 2011 decreased further to $301,702.

3.18.3.7.3 School Districts

The taxable valuation for all school districts in Lincoln County increased from $30.75 million in FY 2009 to $33.79 million in FY 2011. Countywide mill levies to support schools have remained at about the same level since the early 1990s. Taxable valuation for Troy Public Schools experienced a slight decline from FY 2009 to FY 2010 compared to the other school districts in the County. Taxable valuation for the elementary school declined by 1.1 percent, from $5.49

million in 2009 to $5.43 million in 2010 and then increased to $6.25 million in 2011. Troy High School The taxable valuation for Troy High School declined 3.5 percent, from $6.97 million in 2009 to $6.93 million in 2010. Taxable valuation for Libby K-12 Public Schools experienced an increase of 5.4 percent, from $12.3 million in 2009 to $12.97 million in 2011 (Lincoln County Superintendent of Schools 2009, 2010, 2011).

From 2009 to 2011, Eureka Public Schools experienced an increase of 11.8 percent for the elementary school in taxable valuation, increasing from $8.97 million in FY 2009 to $10.03 million in 2011. Taxable valuation for Fortine Elementary School experienced an increase of 10 percent, from $1.3 million in 2009 to $1.43 million in FY 2011. Taxable valuation for McCormick-Sylvanite Elementary School experienced an increase of 34.8 percent, from $678,646 in FY 2009 to $914,862 in FY 2011. Taxable valuation for Yaak Elementary School experienced an increase of 10.1 percent, from $669,172 in FY 2009 to $736,484 in 2011 (Lincoln County Superintendent of Schools 2009, 2010, 2011).

3.18.3.7.4 Sanders County

Total taxable valuation in Sanders County increased from $31.82 million in FY 2009 to $33.29 million in FY 2010. This is an increase of $1.47 million, or 4.6 percent. Countywide levies decreased, from 97.66 mills in FY 2009 to 96.65 mills in FY 2010. Total funds appropriated for Sanders County increased in 2011 were $10.76 million, representing a 13.1 percent decrease over the period from 2007 to 2011 (Montana State University 2011).

3.18.3.8 Quality of Life and Lifestyle

Social structure and interaction in Lincoln County have been shaped primarily by geographic isolation, migration, and settlement; a resource-extractive economy; global influences on the economy; and a cyclical economy. A cultural overview for the analysis area is provided in section 3.7*, Cultural Resources*.

Libby area residents have adapted to the cyclic nature of the economy by living off the land (*i.e.*, hunting, fishing, gardening, firewood gathering, and berry picking). Local residents tend to acquire vehicles, homes, and other possessions that are functional rather than ostentatious (Western Economic Services, LLC 2006). Residents of Lincoln County, because of their livelihoods, are closely linked to the natural environment and have a conservation ethic. Residents do not favor preservation that would prohibit development of natural resources, but rather favor promoting stability through healthy local economies, lifestyles, and use of natural resources in a sustainable fashion.

A quality of life survey conducted with Lincoln County residents indicates that residents highly valued the natural environment and rural, small town atmosphere of the area (Western Economic Services, LLC 2006). Limited economic opportunities were cited as the largest drawback of the area, although residents felt positive about Lincoln County as a place to live.

Community services were generally viewed as average, with the exception of fire protection and rescue, which were rated above average. Day-to-day shopping varied from Libby, to Kalispell, Missoula, or other avenues such as catalogues and the internet, and respondents cited the limited selection of goods as a drawback to local businesses. Shopping for major purchases was generally done in Libby, Spokane, or Missoula.

Social problems in the area reported by survey respondents include drug and alcohol abuse, family problems or domestic abuse, poverty, and unemployment. Alcoholism and drug abuse were cited most frequently by about half of the respondents. Libby is also now in the midst of addressing hundreds of deaths and illnesses linked to former vermiculite mining operations.

In the 1920s, mining of a large vermiculite deposit north of Libby began. W.R. Grace owned and operated a vermiculite mine and vermiculite processing facilities in Libby from 1963 to 1990. The vermiculite deposits in Libby were contaminated with a form of asbestos similar to tremolite. Asbestos is regulated under the Clean Air Act as a hazardous air pollutant. Studies have shown that exposure to asbestos can cause life-threatening diseases, including asbestosis, lung cancer and mesothelioma. Mining and processing activities resulted in the spread of vermiculite – and the associated asbestos fibers – to numerous homes, businesses, and schools throughout the town. In addition, children played in the discarded batches, and local residents brought home bags of vermiculite to pour into attics for insulation or use in their gardens. Health studies on residents of the Libby area show increased incidence of many types of asbestos-related disease, including a rate of lung cancer that is 30 percent higher than expected when compared with rates in other areas of Montana and the United States. The health problems resulting from the vermiculite mine have resulted in premature deaths, increased health costs, and social division in the Libby area.

The analysis area, like much of the Intermountain West, has seen an increase in rural residences. Many of these rural residences are second homes. The census does not count second-home owners as part of a community's population, thus the impacts of second homes are not readily apparent from changes in population. These second homes can have an impact on local government finances and quality of life issues.

Tourism in the analysis area is a growing industry as it is in all of Montana. Lincoln County is seeking to diversify its economy from mining and timber, and tourism promises to become more important to the area's economic well-being. Multiple efforts are underway to increase the tourism based income in Lincoln County (Lincoln County 2009).

3.18.4 Environmental Consequences

The socioeconomic effects for the No Action Alternatives and the action alternatives were evaluated. The impacts for all of the action alternatives would be the same, so the discussion of Alternatives 2 through 4 and the transmission line alternatives, which include the Sedlak Park Substation and loop line, were combined.

3.18.4.1 Alternative 1 – No Mine and Alternative A – No Transmission Line

In the No Action alternatives for the mine and the transmission line, the proposed mine, transmission line, and Sedlak Park Substation and loop line would not be built, and existing patterns and trends described in section 3.18.3, *Affected Environment* would continue to drive the social structure and economy of the area. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands. Economic effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

3.18.4.2 All Action Mine and Transmission Line Alternatives

3.18.4.2.1 Employment and Income Effects

The USDA Forest Service produced an analysis of potential employment and labor income effects from the proposed Montanore Project during specific years within the four project phases (termed the "Forest Service Effects Analysis" in this section) for use in this EIS (USDA Forest Service 2007c; updated 2012). The Forest Service Effects Analysis estimates employment and labor income of the proposed project during specific years within the four project phases:

- Construction Phase at Year 3 of the proposed project (peak employment during the Construction Phase)
- Production phase at project Years 4 through 19
- Post-mining Closure Phase at Years 20 through 22
- Reclamation and monitoring phase at Years 23 through 42

Project employment and income and the duration of the mine-life phases could vary from projections, depending upon construction progress and the resources applied by MMC toward full-scale operations. Mineral and input market conditions also could cause operations to be curtailed or shut down on short notice at any point during projected mine life.

Employment and income impacts were estimated in the Forest Service Effects Analysis using input-output analysis. Input-output analysis is a means of examining relationships within an economy between businesses, and between businesses and final consumers. Three types of economic impacts (effects) are identified in the analysis: direct, indirect, and induced. Direct effects are production changes associated with the immediate effects of changes in expenditure tied to mine construction, production, post-mining closure, and reclamation/monitoring. Indirect effects are production changes resulting from spending in all phases of operations in industries that supply products and services to construction, production, mine closure, and reclamation and monitoring. Induced effects are changes in economic activity resulting from households spending income earned directly or indirectly as a result of all phases of the proposed project. The sum of indirect and induced effects are referred to as secondary effects, which is the term used in the remainder of the discussion.

Direct employment and labor income effects were estimated using information provided by MMC and a previous EIS for the Montanore Project (USDA Forest Service *et al*. 1992). Indirect effects were estimated using non-labor expenditure information provided by MMC and IMPLAN (MIG 2004). Induced effects were estimated using IMPLAN. Other specific information on the methodological approach and assumptions used in the analysis presented below can be found within the Forest Service Effects Analysis report. Projected employment and labor income effects identified in the Forest Service Effects Analysis are presented below.

3.18.4.2.2 Construction and Production Employment and Income Effects

The estimated total employment during the Construction Phase of the proposed project would be 623 jobs at Year 3 (Table 158). About 21 percent of the direct employment would be construction related and the remainder attributable to production. The input-output model estimated that there would be about 312 secondary jobs associated with the estimated 311 direct jobs related to construction and operations.

Employment during the production phase would vary with the production rate (Table 158). For production Years 4 through 8, total employment would vary from about 547 jobs in Year 4 to about 447 jobs in Years 5 through 8. After construction is completed but before reaching full production, fewer employees are needed than for the Construction Phase. Secondary employment would account for about 236 jobs in Year 4 and would drop to about 201 jobs during Years 5 through 8. In Year 9, the production rate is expected to increase from 12,500 tons per day to 17,000 tons per day. Direct mine employment would increase from 246 jobs to 450 jobs during this production increase. Secondary employment also would increase from about 201 jobs to 336 jobs. At Year 14, production is expected to increase from 17,000 tons per day to 20,000 tons per day. When production increased, direct employment would remain at 450 jobs and secondary employment would increase slightly.

Table 158. Construction and Production Employment Estimates.

Category	Construction Phase	Production Phase			
Project Year	**3**	**4**	**5-8**	**9-13**	**14-19**
Production rate (tons per day)	0	12,500	12,500	17,000	20,000
Employment					
Construction (direct)	65[†]	65[†]	0	0	0
Operations (direct)	246	246	246	450	450
Secondary employment	312	236	201	336	352
Total construction and operations	623	547	447	786	802

[†]Includes estimated 23-person crew required for construction of the 230-kV transmission line.
Source: MMC 2008.

At Year 3 of the proposed project, direct labor income would be about $42.7 million and total labor income would be $50.3 million (Table 159). About 21 percent of the direct labor income would be construction related and the remainder is attributable to production. The 23-person crew required for construction of the 230-kV transmission line would account for about 35 percent or $3.1 million of the direct labor income for construction in Year 3. Estimated total labor income would range from a low of $39.3 million/per year in project Years 5 through 8 to a peak of $63.5 million per year in Years 14 through 19 during the production phase. The increased labor income would correspond to the expansion in mine production. In general, estimated total labor income would exceed $39 million annually. On a per-job basis, direct annual labor income for construction and operations employment would average about $137,000 and $113,000, respectively. Annual labor income for secondary employment would be about $36,000 per job.

Table 159. Construction and Production Annual Labor Income Estimates.

Category	Peak Construction Phase	Production Phase			
Project Year	**3**	**4**	**5-8**	**9-13**	**14-19**
Production rate (tpd)	0	12,500	12,500	17,000	20,000
Labor Income					
Construction (direct)	$8.9	$6.6	$0.0	$0.0	$0.0
Operations (direct)	$33.8	$25.1	$31.8	$43.2	$50.8
Secondary labor income	$7.6	$8.3	$7.5	$11.7	$12.7
Total construction and operations income	$50.3	$40.0	$39.3	$54.9	$63.5

Income shown in 2010 Million $. Actual totals may differ from values shown due to rounding.
Source: USDA Forest Service 2007c; updated 2012.

3.18.4.2.3 Post-mining Closure, and Reclamation and Monitoring Employment and Income Effects

MMC expects the post-mining Closure Phase of the proposed project to last about 3 years. Total employment would be about 227 jobs for the first 2 years and would decline to about 129 jobs in the third year (Table 160). Secondary employment would account for about 37 percent of the total employment during the post-mining Closure Phase.

The reclamation and monitoring phase of the proposed project would follow the post-mining phase and last about 20 years. This phase also would include consolidation of the tailings and placement of the final cover on the tailings impoundment described in section 2.4.3.1.6, *Tailings Impoundment and Borrow Areas*. Total employment (about 79 jobs) would peak in the first 2 years of this phase and decline to about 32 jobs thereafter. Secondary employment would account for about 37 percent of the total employment during this phase of the proposed project. The second phase would consist of longer-term maintenance of specific facilities, such as the Libby Adit Water Treatment Plant or the seepage collection facilities at the tailings impoundment. MMC would maintain and operate these facilities until BHES Order limits or applicable nondegradation criteria in all receiving waters could be met by any project discharge. MMC also would continue monitoring as long as the MPDES permit is in effect. As long as post-closure water treatment operated, the agencies would require a bond for the operation and maintenance of the water treatment plant. Human activity associated with facility maintenance and monitoring is expected to be limited and indistinguishable from current recreational use. The length of time that the second phase of closure activities would occur is not known but may be decades or more.

Table 160. Post-mining and Reclamation Employment Estimates.

Category	Post-mining Closure Phase			Reclamation and Monitoring Phase		
Project Year	**20**	**21**	**22**	**23**	**24**	**25-42**
Contractors (direct)	0	75	50	25[†]	25[†]	10
Company workforce (direct)	125	50	25	25	25	10
Secondary employment	102	92	54	29	29	12
Total contractors and company	227	217	129	79	79	32

[†] Includes estimated 23-person crew required for removal of the 230-kV transmission line.
Source: MMC 2008 and USDA Forest Service 2007c; updated 2012.

Table 161 provides estimated labor income in 2010 dollars for the post-mining closure, and reclamation and monitoring phase of the proposed project. Direct labor income was based on a workforce consisting of operations, technical, administrative, and environmental services skills. Total labor income during the post-mining phase of the proposed project would be about $16.2 and $14.7 million for the first and second year respectively and would decline to about $8.7 million in the third year. Secondary labor income accounts for about 14 percent of the total labor income during the post-mining Closure Phase.

Total labor income (about $4.7 million) would peak in the first 2 years of the reclamation and monitoring phase, and would decline to about $1.8 million thereafter. The 23-person crew required for removal of the 230-kV transmission line would account for about 92 percent or $2.6 million of the total labor income for direct contractors in each of the first 2 years of the reclamation and monitoring phase. Secondary labor income accounts for about 15 percent of the total labor income during this phase of the proposed project.

Table 161. Post-mining and Reclamation Labor Income Estimates.

Category	Post-mining Closure Phase			Reclamation and Monitoring Phase		
Project Year	**20**	**21**	**22**	**23**	**24**	**25-42**
Contractors (direct)	$0.0	$6.9	$4.6	$1.2	$1.2	$0.5
Company workforce (direct)	$14.1	$5.7	$2.8	$2.8	$2.8	$1.1
Secondary labor income	$2.1	$2.1	$1.3	$0.7	$0.7	$0.2
Total contractors and company income	$16.2	$14.7	$8.7	$4.7	$4.7	$1.8

Income shown in 2010 Million $. Actual totals may differ from values shown due to rounding.
Source: USDA Forest Service 2007c; updated 2012.

The mine would become one of the largest single employers in the area, so any changes in operation or production would impact employment levels. Once the local economy had adjusted to a particular operating level, any reductions-in-force would release individuals whose life style would be attuned to mine wage rates and who would find very few opportunities for comparable employment in the local market. Any shutdown of operations for a few weeks or months would cause a sudden drop in local area income while laid off workers, expecting a resumption of operations, would be unlikely to seek other work. While the affected communities, government jurisdictions, and businesses can plan for mine closure, effects of closure after the planned 20-year production period would decrease employment earnings. Unless other large mining projects are operating in the area at the time, closure of the Montanore mine would eliminate many of the resource commodity sector jobs expected to exist in the local area economy in 2030.

3.18.4.2.4 Population Effects

The employment and income effects analysis summarized above assumed that all direct employment demand would be met from the Lincoln County labor supply. This assumption scenario could occur if a large local population, or a high rate of unemployment in the relevant skill sets, provided a large pool of available labor. Lincoln County does have a higher than average unemployment rate in comparison to neighboring counties and the state as a whole, but given the number of workers needed and the specialized skills required for the construction and production phases of the proposed project, all employment demand may not be met by Lincoln County residents. If that happens, some mine workers may move to the area or commute from locations outside of Lincoln County.

Recent experience for large projects indicates that mining and construction workers will tolerate one-way commuting times of about one hour. Beyond that distance, workers may be more likely to relocate closer to the project site (USDA Forest Service and DEQ 2001). For the Montanore Project, this implies a local employment area that could include all of Lincoln County including the towns of Libby, Troy, and Eureka. If non-local workers (*e.g.*, residents outside of Lincoln County) were to move into Lincoln County for project-related jobs, population within Lincoln County would increase above the baseline projections described in the *Affected Environment* section.

Since the proposed Montanore Project is classified as a "large-scale mineral development," according to the requirements in the Montana Hard-Rock Mining Impact Act, the project proponent is required to evaluate potential impacts on affected local government units as a result of in-migrating workers and their families and prepare a Hard-Rock Mining Impact Plan (Impact Plan). The Impact Plan for the Montanore Project was prepared in 2005 and approved by Lincoln County in 2007. The Impact Plan estimates the number of in-migrating direct and secondary workers and their family members associated with the project. Net in-migration in the first year would be 171 people, and is expected to peak to a net of an additional 429 people in the fourth year of the project at the beginning of the production phase and level off for the rest of the production years (Table 162).

Table 162. Estimated Net Population In-Migration into Lincoln County by Project Year.

Category	Construction Phase			Production Phase		Total
Project Year	**1**	**2**	**3**	**4**	**5**	**1 to 5**
Project Workers	43	81	97	98	92	411
Worker's Family	64	139	191	193	195	782
Secondary Workers and Family	65	118	138	139	126	586
Total	172	338	426	430	413	1,779
Percent Addition to 2010 Lincoln County Population (19,687)	0.9%	1.7%	2.2%	2.2%	2.1%	9.0%

Source: Western Economic Services, LLC 2005.

3.18.4.2.5 Community Effects

The Impact Plan projected the allocations of in-migrating population to various settlement locations in Lincoln County including Libby, Troy, Eureka, and rural areas. In-migration in rural Lincoln County would be a net of 110 people in Year 1, and peak in Year 4 to a net of an additional 275 people. About one-third of the net in-migrating population is expected to settle in Libby (Table 163).

The in-migration projections above incorporate the expectation that housing would be the primary limiting factor for the settlement of in-migrating workers, at least during early project years. Specifically, these projections assume that, with or without assistance from MMC, some temporary housing facilities would be developed on private lands. Such facilities would enable more workers to settle in this area than existing housing allows. Development of new housing on private lands to meet the needs of the entire expected non-local contract construction labor force is unlikely. Because of housing constraints, many would be forced to commute longer distances. Individuals hired for long-term mine jobs may initially have difficulty finding local housing depending on the housing stock available following the preliminary wave of hiring. Some would have to settle initially in communities farther from the mine and then relocate to permanent residences in the Libby/Troy/Eureka area after contract construction workers had left the area (Western Economic Services, LLC 2005).

As noted in the Alternatives 1 and A, discussion of land use trends, population growth in the area is converting areas of private land from timber or agricultural production and open space use into residential subdivisions and ranchettes. The demand on public land resources is also shifting away from traditional resource commodity production toward a greater emphasis on recreation, and aesthetic values. Mine development would add to population and housing demand pressures. Land use demand driven by mine development would differ somewhat from the existing pattern driven by retiree and recreation/tourism/amenity in-migrant population growth. Barring mine shutdowns, mine operations workers would have the kind of jobs with above-average wages that would allow them to purchase or build homes. Some in-migrants hired into secondary and replacement jobs would be in the same situation. Others would be more likely to prefer rental housing or mobile home spaces. In-migration during mine operations would place less strain on local housing supplies than would the earlier influx of construction workers. The development of local businesses catering to new residential areas and commuting mine workers also is expected.

Table 163. Expected Net In-Migrating Population Settlement Locations by Project Year.

Category	Construction Phase			Production Phase		Total§
Project Year	1	2	3	4	5	1 to 5
Direct Construction and Production Employees and Families						
Libby	35	72	94	95	94	390
Troy	2	5	6	6	6	25
Eureka	1	2	3	3	3	12
Rural Lincoln County†	69	141	184	186	183	763
Total	107	220	287	290	286	1,190
Secondary Employees and Families						
Libby	21	39	45	46	41	192
Troy	1	3	3	3	3	13
Eureka	1	1	1	1	1	5
Rural Lincoln County	41	76	89	89	81	376
Total	64	119	138	139	126	586
Combined Total Net In-Migration by Area						
Libby	56	111	139	141	135	582
Troy	3	8	9	9	9	38
Eureka	2	3	4	4	4	17
Rural Lincoln County	110	217	273	275	264	1,139
Total	171	339	425	429	412	1,776

§Total in Table 162 varies from the total in Table 163 due to rounding.
†Lincoln County is predominantly a rural county. Urban development is concentrated in the incorporated areas of Eureka, Libby, Rexford and Troy.
Source: Western Economic Services, LLC 2005.

While some construction in-migrants is expected to become long-term residents and would seek to become integrated into the community, others would be well aware of their temporary status and unlikely to participate. An influx of temporary residents with large cash incomes, few ties to the community, and limited social activities in which to engage may pose problems for limited law enforcement resources. The extent these phenomena would surface in the western Lincoln County communities is difficult to predict. The agencies expect some detrimental effects from the influx and departure of the large contract construction workforce. Large influxes of workers and their families would likely impact the social structure of Libby, Troy and surrounding rural areas in terms of local values, school attendance, and community character. Such incoming workers may or may not share the local values of the area and may not have as strong of ties on average to the community as long-time residents. Also, large influxes and/or out-migrations of workers could disrupt both the local social fabric of communities like Libby and their economic viability (both positively and negatively). The Bakken shale development in eastern Montana and North Dakota is an extreme example of some of these impacts, with such impacts from Montanore expected to be much smaller. It is possible that a few longtime residents could leave the area as a result of the influx of workers, but that number would likely be low.

3.18.4.2.6 Public Services

Local governments would need to serve fluctuating populations. Impacts on specific local governmental units within the study area due to in-migrating workers and their families depend entirely upon where the in-migrants choose to reside. In addition to housing-related factors affecting settlement patterns, in-migrants also would consider the availability of public services in making their residency choices.

Local government service-providers would have to respond to an estimated 171 net in-migrants in the first year of mine construction and an expected peak in the fourth project year of an additional 429 total net in-migrants. The population increases during mine startup could cause difficulty for some service providers in responding to demands, requiring change in staffing and resource allocation. Because Lincoln County school enrollments were projected to decline over the next 10 to 15 years (if the mine were not developed), the arrival of students associated with mine operations would not be expected to pose an enrollment problem for the school system. There may be some challenges with staffing and maintaining appropriate classroom size with the addition of new students.

Small communities that lack temporary housing facilities as well as a wide range of public and private services may experience law enforcement problems when a large temporary work force with no community ties, above-average income, marginal housing, and a high percentage of individuals who are not accompanied by families suddenly arrives. If such problems were to develop in association with the startup Construction Phase of the Montanore Project, the problems would be more likely to occur in the communities located nearest to the mine site based on the probable settlement patterns of the work force.

Community fire, emergency, medical, and social service providers may have a hard time adjusting their staffing to the increases in service demands associated with mine construction and startup. Obtaining and training new staff takes time, and the fire and ambulance services, in particular, could experience difficulty finding and training additional volunteers. Any fiscal impacts on local government service providers would be mitigated through payments as established in the Hard Rock Mining Impact Plan (Western Economic Services 2005). These service providers would benefit from the additional tax revenues generated by the mine and should be able to adapt to the long-term changes in demand associated with mine operations. It is anticipated that the mine would maintain its own ambulance and would support and cooperate with local emergency service providers.

3.18.4.2.7 Fiscal Effects

The proposed project would increase local and state government revenues and expenses. The Impact Plan included an analysis of project-related revenues and costs to affected local governments from the mine operations and population increases. Affected local government units within the defined Impact Plan study area include:

- Lincoln County Government (including special districts)
- City of Libby
- City of Troy
- City of Eureka
- Libby School District
- Troy Elementary School District

- Troy High School District
- Eureka Elementary School District
- Lincoln County High School District

New project-related revenues to local governments would come from three primary sources: property taxes on the mine land, plant, and equipment; the gross proceeds tax on the value of ore produced; and property taxes on new homes and commercial facilities built as a result of mine development. The project would increase costs for cities, schools, and counties through mine-related in-migration and resulting increases in local government service costs. The additional tax revenue would largely be used by local governments to pay for capital outlays, personnel, and support costs.

Lincoln County and the Libby, Troy, and Eureka school districts would be the primary recipients of tax revenues from the mine and mill facilities, but Montana law provides for tax-base sharing among affected Montana local government units when a mine is designated as a large-scale mineral development.

When construction of mine facilities was completed, the property tax revenue would be about $2.35 million represented by the land and improvements (*i.e.*, Class 4 property) and all the business equipment (*i.e.*, Class 8 property) (Western Economic Services, LLC 2005). The overall tax revenue would decline as the mine facilities and equipment portion depreciated, reaching fully depreciated values in 10 to 15 years. Annual local tax revenues would depend on local mill levy rates, state property tax equalization, and property tax prepayments and credits.

Montana levies a metal mines license tax on a mine's annual gross revenues in excess of $250,000. This is a percentage tax on the value of ore concentrate shipped to the refinery. Tax revenues would fluctuate depending on silver and copper prices and the project's annual production levels. By law, 75 percent of these revenues would be allocated to Montana's general fund. The remaining 25 percent would be allocated to Lincoln County, and distributed through the county to appropriate departments and districts. The county would be required to reserve at least 37.5 percent of this revenue in a trust fund account. All money not allocated to the trust fund account is distributed as follows; 33.3 percent to elementary school districts, 33.3 percent to high school districts, and 33.3 percent for general planning functions (*e.g.*, economic development activities).

Table 164 summarizes projected fiscal effects from the project. Net impact on local governments would start with a $180,242 deficit in Year 1, followed by net surpluses starting in Year 2 with a net surplus of about $4.8 million in Year 5. MMC's proposed mitigation of $180,000 would mitigate for the Year 1 fiscal deficit. While Sanders County would not have workers migrating into the county due directly or indirectly to the Montanore Project, Sanders County would receive $208,000 in gross proceeds tax in Year 4 and $546,000 in Year 5 (Western Economic Services, LLC 2005). The projected fiscal effects shown in Table 164 should be considered a representative estimate of actual fiscal effects, which would depend on a number of currently unknown factors and future local government conditions.

3.18.4.2.8 Quality of Life and Lifestyle

In addition to the effects disclosed in the *Community Effects* section, the Montanore Project would have minor effects on social well-being and quality of life in the analysis area. Mining and other natural resource development has been an important part of the local economy for many years. The ongoing national and regional growth of recreation and tourism would also be a factor, as recreation/tourism would continue to help shape the economy in the analysis area. The analysis area, which is accustomed to yearly recreation and tourism booms, should be able to accommodate the projected short-term mine construction population influx with little difficulty even if the mine construction peak coincides with the peak tourism season. Individuals and social groups within the community would perceive project-related benefits, such as increased economic opportunity, and costs such as social problems associated with population growth, from the variable perspective of their own values, beliefs, and goals. Such perceptions would of course vary. Increased income within the analysis area would create new opportunities in the retail sales and service sector. Some residents believe the proposed project would revitalize and stabilize the depressed local economy.

Table 164. Net Local Government Fiscal Impact due to Montanore.

Category	Construction Phase			Production Phase	
Project Year	**1**	**2**	**3**	**4**	**5**
Costs					
Direct Worker Local Government Costs	$253,797	$563,239	$786,312	$798,962	$813,366
Indirect Worker Local Government Costs	$128,987	$236,679	$277,825	$281,063	$255,531
Total Costs to Units of Local Government	**$382,784**	**$799,918**	**$1,064,137**	**$1,080,025**	**$1,068,897**
Revenues					
Montanore Taxes:					
Metal Mines License Tax (to Lincoln County[†])	0	0	0	$215,000	$565,000
Gross Proceeds Metal Mines Tax (to Lincoln County[‡])	0	0	0	$832,000	$2,184,000
Gross Proceeds Metal Mines Tax (to Sanders County)	0	0	0	$208,000	$546,000
Montana Property Tax (land & improvements)	$10,000	$740,000	$1,290,000	$2,060,000	$2,060,000
Montana Property Tax (business equipment)	$80,000	$150,000	$210,000	$290,000	$290,000
Indirect Worker - Commercial Property Tax	$12,998	$23,774	$27,787	$28,017	$25,355
Direct Worker - Commercial Property Tax	$21,549	$44,204	$57,778	$58,445	$57,568
Indirect Workers - Residential Property Tax	$32,419	$59,296	$69,307	$69,880	$63,241
Direct Workers - Residential Property Tax	$45,576	$85,212	$102,036	$103,163	$97,269
Total	**$202,541**	**$1,102,485**	**$1,756,908**	**$3,864,505**	**$5,888,432**
Impact	**$-180,242**	**$302,567**	**$692,771**	**$2,784,479**	**$4,819,535**

[†]According to MCA 15-1-501 the Montana Metal Mines License Tax is allocated as follows: 57 percent to the state general fund, 2.5 percent to the hard rock mining impact trust account, 8.5 percent to the hard rock mining reclamation debt service fund, 7.0 percent to the reclamation and development grants program state special revenue account, and 25.0 percent to the county or counties identified as experiencing fiscal and economic impacts.
[‡]The allocation of the Montana Gross Proceeds Tax, a Class 2 Property Tax, was settled in the early 1990s.
Source: Western Economic Services, LLC 2005.

Negative perceptions of project development may be attributed to people with various other points of view. Many residents express anxiety at the prospect of a major mineral development project, based on their experience with and perceptions of other mining projects. These concerns primarily are that the Montanore Project might generate similar problems, and that state and federal agencies might not adequately monitor and enforce applicable laws and regulations. Persons having these views want their feelings known, but are not necessarily opposed to development of the Montanore Project. Projections for increased housing demand during mine development and operation suggest that most property values (including second homes) in the area would increase, but the value of some specific parcels or types of properties could be affected negatively for some periods during mine construction, operation, and reclamation. It is also possible that the use of a parcel to its current owner, that is its ability to serve the specific purposes for which the property was purchased, may be impacted negatively even though its potential market value may not decrease.

3.18.4.3 Effectiveness of Agencies' Proposed Mitigation

Implementation of the 2005 Hard Rock Mining Impact Plan (Western Economic Services 2005) would effectively mitigate for financial impacts on local governments from the proposed project.

3.18.4.4 Cumulative Effects

In addition to the proposed Montanore Project, the proposed Rock Creek Project would affect Lincoln County. Other mineral activities in the area (*i.e.*, primarily small exploration projects) and the regional timber industry are not expected to lead to major developments in the reasonably foreseeable future.

The Rock Creek Project is a proposed underground copper and silver mine and mill/concentrator complex near Noxon, in Sanders County, Montana. The project is owned by Revett. The nearest town to the proposed Rock Creek development is Noxon, an unincorporated town on MT 200 in Sanders County. Access to the Rock Creek mine would be from the Noxon area, and mine facilities also would be located in Sanders County.

The KNF is preparing a Supplemental Environmental Impact Statement (EIS) for the Rock Creek Project to address deficiencies identified by a Federal District Court in a 2001 Final EIS. The Supplemental EIS also will disclose effects on resources that may be substantially affected by changes in circumstances or new information. Based on the Supplemental EIS and Record of Decision (ROD) schedule and a projected 5-year evaluation and construction period, the earliest the Rock Creek Project could go into production is late 2019. Mine life of the Rock Creek operation is estimated to be 28 years. Annual earnings from direct and secondary mine-related employment would be about $30.3 million during the Construction Phase and $38.8 million during the production phase.

The estimated total annual direct employment during the Construction Phase for the Rock Creek Project would be 232 workers, with an estimated total annual direct employment of 344 employees during operations (USDA Forest Service 2013f). The peak population increase associated with Rock Creek development in the Noxon/Heron/Trout Creek area (*i.e.*, western Sanders County) is projected to be about 328 people during project construction. The projected long-term population increase in the Noxon/Heron/Trout Creek area attributable to the Rock Creek Project is estimated to be about 378 people. The total peak population increase in Lincoln County from the Rock Creek Project during operations is estimated to be about 280 people. Most effects of the Rock Creek Project would occur in the Noxon/Heron/Trout Creek area (USDA Forest Service and DEQ 2001).

A key factor determining the number of in-migrating workers for both the Rock Creek Project and the Montanore Project is the fate of the Troy Mine. The Troy Mine resumed operations in 2004 and, in 2012, has an estimated mine life of 7 years. Exploration at Troy Mine is continuing. Upon closure of the Troy Mine, a skilled workforce of 150 may be available either to the Rock Creek or Montanore projects. Depending on the timing of each project's start-up, there would be some direct competition for former Troy workers. Because much of the Troy Mine workforce already lives in the Libby area, some of these workers is expected to seek employment with MMC at Montanore to avoid the longer commuting distance to the Rock Creek Project. Assuming Troy Mine closure and Rock Creek Project startup are relatively concurrent, many current Troy Mine workers would continue employment with Revett for the Rock Creek operation because of employee seniority and benefit vesting in Revett.

With the availability of the Troy Mine workforce for one or both of the new projects and current unemployment rates in Lincoln and Sanders counties, 80 percent local hiring for both projects would be still possible. The percentage of local hiring would also depend on workers with the correct skills within the unemployed labor force. If only one of the two projects is developed (either Rock Creek or Montanore, but not both), the displaced Troy Mine workforce may provide a substantial amount of the needed production workforce. If Rock Creek is developed, but the Montanore Project is not, some Lincoln County residents currently working at the Troy Mine may migrate to Sanders County to shorten their commute.

If the Troy Mine (with additional reserves extending the mine life), Rock Creek, and Montanore were all to operate concurrently, which is considered a possibility, the Troy Mine workforce would not be available to the two new projects, and the 80 percent local hiring assumption might not be met. This scenario would result in a larger population migration into Sanders and Lincoln counties than would result from the development of only one project. It also would result in the greatest level of community growth and disruption.

Under the most likely situation, no in-migrating workers directly associated with the proposed Montanore Project are expected to reside in Sanders County. The Montanore Project is not expected to have any cumulative effect on population or demand for public services in Sanders County. The gross proceeds tax received by Sanders County could result in some additional employment in the government sector.

3.18.4.5 Regulatory/Forest Plan Consistency

The goal for mineral development in the KFP is to "encourage responsible development of mineral resources in a manner that recognizes national and local needs and provides for economically and environmentally sound exploration, extraction, and reclamation." The proposed Montanore Project would be consistent with this goal outlined in the KFP (USDA Forest Service 1987a). The project would be consistent with the Hard Rock Mining Impact Act following implementation of the approved Hard Rock Mining Impact Plan.

3.18.4.6 Irreversible and Irretrievable Commitments

There would an irreversible commitment of mineral resources under all of the action alternatives. Economic productivity for timber or other resources from mined lands would be irretrievable lost during mine operations.

3.18.4.7 Short-term Uses and Long-term Productivity

In the short term, the project would increase costs for cities, schools, and counties through mine-related in-migration and resulting increases in local government service costs. A short-term increase in population, as well as increases wages, spending, and tax revenue would occur over the life of the mine. The increase in tax revenue along with the commitment in the Hard Rock Mining Impact Plan (Western Economic Services 2005) to pay all increased capital and net operating costs to local government units that would result from the mineral development should offset any increases in local government service costs. Over the long term following mining, population and income levels may decline, as would the cost for local governments to provide services.

3.18.4.8 Unavoidable Adverse Environmental Effects

Under all mine and transmission line alternatives, increased employment and population would place increased demands on housing and some public services, including schools. With mitigation, as outlined in the Hard Rock Mining Impact Plan (Western Economic Services 2005), the increased demands would not result in unavoidable adverse environmental effects.

3.19 Soils and Reclamation

3.19.1 Regulatory Framework

3.19.1.1 Federal Requirements

The KFP requires BMPs on National Forest System lands to limit soil erosion and to maintain soil productivity (USDA Forest Service 1987a). In addition, the regional soil quality standards (FSM 2500 – Watershed and Air Management, R1 Supplement No. 2500-99-1) and Chapter 2550 – Soil Management contains soil management objectives and policies applicable to activities on the KNF. Soil quality standards apply to lands where vegetation and water resource management (*i.e.*, timber sales, grazing pastures or allotments, wildlife habitat, and riparian areas) are the principal objectives. The standards do not apply to intensively developed sites such as mines, developed recreation sites, administrative sites, or rock quarries, as such sites are reallocated to non-timber production management. Reallocation proposed for the Montanore Project area described in section 2.12, *Forest Plan Amendment.* The standards are not intended to prohibit other resource management practices such as installing waterbars or preparing sites for planting, as long as such practices are consistent with long-term sustainability of the soil resource. Permanent roads can affect soil-hydrologic function; their evaluation is more appropriately done on a watershed basis using models and other watershed analysis techniques (FSM 2554.1 R1 Supplement; USDA-ARS National Soil Erosion Research Laboratory 1995). The standards would apply once the mining was complete and the principal objective again became vegetation management. The reclamation plan for the project would include meeting the soil quality standards as one of the long-term reclamation goals. Additional guidance is included in USDA Forest Service's Region 1 NEPA guidance for soils (USDA Forest Service 2011e).

As stated above, areas on National Forest System lands with intense long-term development (*i.e.,* where the vegetation has been removed) are reallocated to non-timber production management, and lands that are changed in management type do not have to meet the 15 percent disturbance standard. As discussed in sections 2.12, *Forest Plan Amendment* and 3.15, *Land Use*, areas to be reallocated to non-timber production management would include the tailings impoundment, plant site, limited disturbances in LAD Areas, and portions of the transmission line corridor where the vegetation would be removed.

The Organic Administration Act authorizes the Forest Service to regulate the occupancy and use of National Forest System lands. The Forest Service's locatable minerals regulations are promulgated at 36 CFR 228, Subpart A. The regulations apply to operations conducted under the U.S. mining laws as they affect surface resources on National Forest System lands under the jurisdiction of the Secretary of Agriculture. One of these regulations (36 CFR 228.8) requires that mining activity be conducted, where feasible, to minimize adverse environmental impacts on National Forest surface resources. 36 CFR 228.8 also requires that mining operators construct and maintain all roads so as to assure adequate drainage and minimize or, where practicable, eliminate damage to soil, water, and other resource values; and reclaim the surface disturbed in operations by taking such measures as preventing or controlling onsite and off-site damage to the environment and forest surface resources. For the Montanore Project, the KNF emphasizes protection of the soil resource and implementation of restoration practices where necessary on National Forest System lands. Standards and BMPs identified in the KFP would be included as mitigation measures where appropriate and would be used to guide MMC's implementation of the project.

3.19.1.2 State Requirements

MMRA requires that all lands disturbed by mining be reclaimed to a post-mine land use that has stability and utility comparable to that of the pre-mining landscape. The DEQ must evaluate MMC's proposed reclamation plan for areas to be revegetated to ensure that the soil needed to reclaim mine site disturbances would be salvaged and replaced, and areas revegetated to comparable stability and utility. The MFSA directs the DEQ to approve a facility if, in conjunction with other findings, the DEQ finds and determines that the facility would minimize adverse environmental impact, considering the state of available technology and the nature and economics of the various alternatives.

3.19.2 Analysis Area and Methods

The analysis area for soils consists of the areas that would be disturbed by facility construction under each alternative and are shown on Figure 83. The Libby Loadout would be in the previously disturbed Kootenai Business Park; therefore, the loadout is not discussed further.

Soil investigations for the mine area facilities and the transmission line corridors were conducted in 1988 and 1989 by NMC to provide soil information for land use management and reclamation (Western Resource Development Corp. 1989b, 1989c). A detailed soil survey using standard USDA soil survey methods was performed in an "intensive study area," which included most of the Little Cherry Creek Tailings Impoundment Site and the Poorman Tailings Impoundment Site, the Ramsey Plant and Libby Adit sites, and most of the two LAD Areas. The "extensive study area" consisted of the proposed access roads, transmission line corridors and Sedlak Park Substation and loop line. Soils information from the KNF soil survey was used for the extensive study area (USDA Forest Service and Natural Resources Conservation Service 1995).

The soil baseline studies contain descriptions of field, laboratory, and interpretation methods (Western Resource Development Corp. 1989b, 1989c). Laboratory analyses were performed for selected physical and chemical parameters of the soils to assist with making interpretations important to mining operations and reclamation. Particle size analysis, percent rock fragments (>2 mm), organic matter percent, soil pH, and percent water at saturation were determined.

Soil interpretations were made for construction, management, and reclamation purposes. For the intensive survey area, soil erodibility, potential slope stability, and soil suitability were determined for each soil map unit. For the extensive study area, soil erodibility, slope failure potential, and revegetation potential were obtained from the KNF soil survey. Because the soils data for the extensive study area are more generalized, soil suitability was extrapolated from the intensive study area to provide more probable site-specific salvageable soil volumes.

Soil baseline studies and interpretations were used to analyze the likely effects for each alternative. Soil suitability was used to determine volumes of salvageable soil to be used for reclamation at each proposed disturbance area. Soil erodibility was used to assess the susceptibility of the soils to erode when disturbed and the likelihood of eroded soil reaching stream channels. Slope failure was used to evaluate soil suitability for road construction and maintenance. Revegetation potential was used to determine if any soils were unsuitable without amendments, and if soils were found to be limited, what amendments would be needed to enhance revegetation potential.

3.19.3 Affected Environment

Soils in the analysis area have been influenced by four geomorphic processes: colluvial (movement downhill as a result of gravity); fluvial (movement by flowing water from streams and rivers); glaciolacustrine (movement or deposition in lakes); and glacial (movement by glaciers). In addition to these four processes, a thin mantle of volcanic ash-influenced loess (fine textured soil deposited by wind) blankets much of the analysis area soils. The loess commonly differs sharply from the soil beneath it and varies in depth based on aspect and elevation. Soil layers formed in loess that have been influenced by volcanic ash or in glacial till have a moderate hazard of erosion. A rating of severe is assigned to soil layers having a sandy texture or a loamy or clayey texture and a content of rock fragments of less than 15 percent, such as soil layers formed in lacustrine deposits or in sandy glacial outwash (USDA Forest Service and Natural Resources Conservation Service 1995). Within the analysis area, the soils vary in age, degree of development, and fertility. Relatively young soils forming in colluvial material generally have little development, are typically high in rock fragment and, generally have low fertility (Western Resource Development Corp. 1989b, 1989c). Soils associated with alluvial processes are also relatively young, have little or no development, have abundant rock fragments, and generally have low fertility. Soils forming in glaciolacustrine sediments are of late-Wisconsin glacial age (10,000-25,000 years before present), show weak to strong development, are typically high in silts and clays with few rock fragments, and have low fertility. Other intermediate aged soils have some development, have low fertility, and have some rock fragments. The oldest soils, associated with continental glaciation, are strongly developed, have clay to silty clay textures, and are some of the more fertile soils in the permit area.

3.19.3.1 Soil Types

Soils within the analysis area can be divided into six general groups based on the parent material and the type of geomorphic process in which they formed (Figure 83). The soil group “colluvial/glacial soils” was mapped only in the intensive study areas; because of the scale of mapping, it is not shown in Figure 83. The six groups are:

- Alluvial soils that formed in rocky alluvium
- Glaciolacustrine soils that formed in fine-textured glaciolacustrine deposits
- Alpine glacial soils that formed in rocky alpine glacial drift
- Continental glacial soils that formed in rocky continental glacial drift
- Residuum/glacial soils that formed in rocky residuum and glacial drift
- Colluvial/glacial soils that formed in rocky colluvium and glacial drift

3.19.3.1.1 Alluvial Soils

The alluvial soils are deep, well drained to very poorly drained, and contain a high amount of rock fragments. They formed in gravelly and cobbly coarse-textured alluvium and have a volcanic ash surface layer. They occur on nearly level to strongly sloping alluvial and glaciofluvial terraces, terrace escarpments, drainage bottoms, old lake beds, and floodplains. These soils are moderately extensive along Poorman, Libby and Bear creeks at the Little Cherry Creek and Poorman Tailings Impoundment sites, the Ramsey Plant Site, the Libby Adit Site, and along the Fisher River valley bottom near the transmission line alignments. Narrow areas of alluvial deposits occur along all streams in the analysis area. Depth to the water table is variable, with some soils saturated most of the year. Included in this soil group within the proposed Little Cherry Creek Tailings Impoundment Site are very poorly drained areas, such as bogs and wet depressions that contain organic-rich soils.

The surface textures are generally loam, gravelly silt loam, and very gravelly sandy loam with 5 to 55 percent rock fragments. Subsoil textures are generally gravelly silt loam, extremely gravelly silt loam, and loamy sand with 15 to 75 percent rock fragments. Rocky colluvial soils occur on many toeslopes within this soil group. Organic matter content is medium to very high (3 percent to greater than 50 percent in some poorly drained areas) in the surface layers and is typically much lower in subsoil layers. The soils are very strongly acid to moderately acid (pH 4.5 to 5.7). Available water holding capacity is low to high, and soil permeability is slow to rapid. Generally, the surface layers of these soils have low to moderate susceptibility to erosion by water and low to high susceptibility below the surface layer. The soils have low to high sediment delivery efficiency, which is the relative probability of eroded soil reaching a stream channel, and they have high slope stability.

3.19.3.1.2 Glaciolacustrine Soils

Glaciolacustrine soils are deep, well drained, and relatively free of rock fragments. They formed in fine-textured glacial lake sediments and have a volcanic ash surface layer. They are found on nearly level to strongly sloping glaciolacustrine terraces and steep to very steep terrace risers. These soils are of moderate extent in the Little Cherry Creek and Poorman Tailings Impoundment sites, and they occur along the transmission line alignments and at the Sedlak Park Substation Site. Included in this soil group within the proposed Little Cherry Creek Tailings Impoundment Site are very poorly drained areas, such as bogs and wet depressions that contain organic-rich soils

The surface textures are generally silt loam with few rock fragments. Subsoil textures are generally silt loam, silty clay loam, and silty clay with few rock fragments. Clay contents in subsoil layers can exceed 45 percent. Organic matter content is medium (2 to 3 percent) in the surface layers and is typically less than 1 percent below the surface layer. The soils are strongly acid to slightly acid (pH 5.4 to 6.2). Available water holding capacity is high, and soil permeability is very slow. Generally, the surface layers of these soils have moderate to high susceptibility to erosion by water and high susceptibility below the surface layer. The soils have low to moderate sediment delivery efficiency. They generally have high slope stability, but exhibit cutbank sloughing on slopes greater than 15 percent.

3.19.3.1.3 Alpine Glacial Soils

Alpine glacial soils are deep, well drained, and contain a large percentage of rock fragments. They formed in gravelly, medium-textured glacial drift and have a surface layer of volcanic ash. They occur at higher elevations on gently to steep glacial moraines and glacial valleys. In places, rock outcrops are extensive within this soil group. These soils are moderately extensive in the valleys at the Ramsey Plant Site, Libby Adit Site, Rock Lake Ventilation Adit, and along the transmission line alignments.

The surface textures are generally gravelly silt loam with about 20 percent rock fragments. Subsoil textures are generally very gravelly silt loam with 40 to 60 percent rock fragments. Organic matter content can be very high in the surface layer due to ash influence, but drops off rapidly to less than 1 percent a few feet below the surface. The soils are generally very strongly acid to strongly acid (pH 5.0 to 5.5). Available water holding capacity is moderate, and soil permeability is moderate to high. Generally, both the surface and subsurface layers have moderate to high susceptibility to erosion by water. The soils have low to high sediment delivery efficiency. They are commonly susceptible to cutbank sloughing and raveling.

3.19.3.1.4 Continental Glacial Soils

Continental glacial soils are deep, well drained, and rocky. They formed in gravelly, fine-textured old glacial drift and have volcanic ash surface horizons. Some soils in this group formed in rocky colluvium. This soil group, which is at lower elevations than the alpine glacial soils, occurs on nearly level to very steep, continentally glaciated plains, mountain side slopes, and ridges. In places, rock outcrops are extensive within this soil group. These soils are very extensive along the transmission line alignments, at the Sedlak Park Substation Site, at the Little Cherry Creek and Poorman Tailings Impoundment sites, making up over half of the impoundment sites, and most of the Libby Plant Site and LAD Areas. Included in this soil group within the proposed tailings impoundment sites are very poorly drained areas, such as bogs and wet depressions that contain organic-rich soils.

The surface textures are generally silt loam, gravelly silt loam, and clay loam with few to 30 percent rock fragments. Subsoil textures are generally very gravelly, moderately fine and fine textures with 10 to 60 percent rock fragments. Clay contents can exceed 60 percent in the subsoil. Organic matter content is medium to high (2 to 5 percent) in the surface layer, but decreases to less than 1 percent below the surface. The soils are generally very strongly acid to moderately acid (pH 4.7 to 5.9) but can be mildly alkaline in the substratum. Available water holding capacity is moderate to high, and soil permeability is very slow to slow. Generally, both the surface and subsurface layers of these soils have moderate to high susceptibility to erosion by water. The soils have low to high sediment delivery efficiency. They are commonly susceptible to cutbank sloughing and landslides can occur in steep drainageways.

3.19.3.1.5 Residuum/Glacial Soils

Residuum/glacial soils are shallow to deep, well drained, and contain a high amount of rock fragments. They formed in gravelly medium textured glacial drift and meta-sedimentary residuum and have a volcanic ash surface layer. They occur on gently sloping to very steep glacial scoured ridge tops, glacial trough walls, and valley side slopes. They are moderately extensive in the Little Cherry Creek and Poorman Tailings Impoundment sites, and they occur along the transmission line alignments.

The surface textures are generally silt loam and gravelly silt loam with few to 30 percent rock fragments. Subsoil textures are generally very gravelly loam with up to 60 percent rock fragments. Rock outcrops occur throughout these soils. Organic matter content is moderately low in the surface layer and low below the surface. The soils are generally very strongly acid to moderately acid (pH 5.2 to 6.0). Available water holding capacity is low, and soil permeability is moderate to rapid. Generally, the surface layers of these soils have moderate susceptibility to erosion by water, and have low susceptibility to erosion by water below the surface layer. These soils have low to high sediment delivery efficiency. They commonly exhibit high slope stability but landslides can occur in steep drainageways, and sloughing and raveling can occur if cutbanks are steep. Avalanche paths occur on some very steep slopes.

3.19.3.1.6 Colluvial/Glacial Soils

The colluvial/glacial soils are moderately deep to deep, well drained, and contain high amounts of rock fragments. They formed in gravelly and cobbly medium textured colluvium and glacial drift and have volcanic ash surface layers. They occur on gently sloping to very steep colluvial and glacial side slopes, ridge tops, in cirque basins (semicircular basins near valley heads in mountains caused by glacial erosion), and in avalanche chutes and debris deposits. These soils are extensive at the Ramsey Plant Site. Several avalanche debris fans are located at the Libby Adit Site.

The surface textures are generally silt loam to extremely gravelly silt loam with 10 to 80 percent rock fragments. Subsoil textures are generally very gravelly silt loam and extremely gravelly loam, silt loam, and sandy loam with 35 to 87 percent rock fragments. Many of these soils have a large amount of stones and boulders covering the surface, and rock outcrops occur as inclusions. Organic matter content is medium to high (3 to 6 percent) in the surface layers and is typically less than 1 to 3 percent in subsoil layers. The soils are strongly acid to slightly acid (pH 5.3 to 6.1) but are extremely acid with a pH of 4.4 in areas at the Libby Adit Site. Available water holding capacity is low to moderate and soil permeability is moderate to rapid. Generally, the surface layers of these soils have low to moderate susceptibility to erosion by water and low susceptibility to erosion by water below the surface layer. The soils have moderate to high sediment delivery efficiency. Generally on shallower slopes (less than 25 to 35 percent), these soils have high slope stability and have moderate to low slope stability on steeper slopes.

3.19.3.2 Suitability for Reclamation

The soils in the analysis area are generally suitable for salvage and replacement. Relatively organic-rich surface layers range from 5 to 29 inches thick and average about 10 inches thick. Subsoils are also suitable for salvage and use in reclamation. Salvageable soil, including both surface soil and subsoil layers, ranges from 9 to 33 inches. Organic matter levels in surface soils are generally moderate to high, and pH values range from 4.4 to 6.6, but are typically between 5 and 6. Because of volcanic ash, the surface layers are typically medium textured and have a high water holding capacity. Some surface layers of colluvial/glacial soils have a moderate water holding capacity. A high water table would preclude salvage of some alluvial soils. Soils on slopes greater than 50 percent are generally unsuitable for salvage mainly because of safety considerations for equipment operators (Plantenberg, pers. comm. 2012).

The primary limitation to soil suitability for reclamation is rock fragment content. Soils with more than 50 percent rock fragments are generally considered unsuitable (Plantenberg, pers. comm. 2012), unless they are needed to control erosion on steep slopes. Surface soils commonly have 10 to 50 percent rock fragments, but glaciolacustrine surface layers are relatively free of rock fragments. Many of the colluvial/glacial soils contain high amounts of stones and boulders on the surface. Salvageable soils with stones and boulders would require special handling. Subsoil layers are more variable in texture and pH, but generally have high amounts of rock fragments, except for glaciolacustrine subsoil layers, which generally lack rock fragments. The soils are rated good to poor for road suitability. Poor ratings are typically due to steep slopes and susceptibility of slope failure. Glaciolacustrine soils are rated poor for road suitability due to slumping, and some alluvial soils are rated poor due to excess water. None of the soils in the analysis area have severe reclamation or revegetation potential constraints, *i.e.* with mitigation, there would be minor losses of soil until re-establishment of vegetation.

3.19.4 Environmental Consequences

This section addresses soil impacts resulting from the action Alternatives 2, 3, and 4. The impacts are typical of any operation where soil would be removed, stored, and replaced. The effects on soils that are common to all action alternatives are presented first, followed by the effects on soils that would be unique to each alternative. Soil impacts resulting from all action alternatives would include:

1) Soil loss from erosion of disturbed areas and losses of salvageable materials through erosion and handling
2) Changes in soil physical, chemical, and biological characteristics
3) Reduction in plant growth due to potentially harmful metals in some subsoils because of the potentially acid pH levels, and in mine wastes that would be part of the revegetated plant community rooting zone

Identification of these impacts, followed by the incorporation of the appropriate mitigation measures included in the project's operating plan and the project's reclamation plan, determine the potential success of reclaiming the land to forest cover and wildlife habitat after operations cease. With respect to soils, limited reclamation success, may result in secondary or long-term negative impacts including soil erosion, and reduced soil/site productivity.

3.19.4.1 Effects Common to All Action Alternatives

3.19.4.1.1 Soil Loss

Areas cleared of vegetation would be susceptible to erosive forces and soil loss. Loss of soil also would occur from the removal and storage of soils during mine operations and from erosion of exposed soils during reclamation and stabilization. The potential for soil erosion caused by wind or water exists during all phases of the project. In general, initial erosion rates would be increased depending on soil exposure, slope steepness, and precipitation patterns. Soil losses on undisturbed lands in northwestern Montana are commonly less than 2 tons/acre/year, but under all action alternatives, soil loss rates would likely exceed 2 tons/acre/year on all disturbed areas until vegetation was established and roads were chip-sealed or graveled. Following reclamation, soil losses of less than 2 tons/acre/year are typically needed for successful revegetation. Past silvicultural/soil rehabilitation activities have displayed that vegetation ground cover is expected to be present within a 3 to 5 year timeframe following reclamation activities, and longer on steep slopes and road cuts, especially on south- and west facing slopes.

Losses of soil at disturbances, such as Ramsey and Libby Plant Sites, Libby Adit Site, Little Cherry Creek and Poorman Tailings Impoundment sites, and soil stockpiles would be captured by sediment control BMPs. Soil losses at soil stockpiles also would be controlled by installing berms around the stockpiles.

Soil losses would occur at cut-and-fill slopes at the plant sites, at mine and transmission line access roads, and at staging areas. Fill slopes would be particularly susceptible to failure, and difficult to revegetate, and cut-and-fill slope raveling (movement of dry soils) may be difficult to control in some locations. Construction of new roads and upgrading of existing roads would cross areas where soils have a severe erosion risk, high sediment delivery potential to enter waterways, and potential for slope failure. Some roads would be reclaimed as work progressed, so surface erosion would be limited. Road-building in steep terrain typically results in accelerated erosion and sedimentation (Megahan and Kidd 1972). Increases in erosion would be highest within the first 2 years, and, after 2 years, the sediment generated by mitigation roads would be negligible (see section 3.13.4, *Water Quality*). Because precipitation is high in the area, cut-and-fill slopes would be immediately stabilized to reduce potential erosion. Road cut-and-fill slopes and other disturbances along roads would be seeded, fertilized, and stabilized with hydromulch, netting, or by other methods as soon as final grades are achieved after construction to minimize erosion and to avoid crusting of the soil surface. Soil crusting would reduce seed establishment and water infiltration and result in more runoff and erosion.

Following construction of the transmission line, interim reclamation (removal of drainage obstructions at road crossings, replacement of soil where it was removed and reseeding) would be used on transmission line access roads placed into intermittent stored service to stabilize the surface and reduce erosion. Erosion from the transportation system is analyzed in section 3.13.4, *Water Quality*. All new roads would be decommissioned at the end of operations when no longer needed and most other existing roads would be reclaimed to preoperational conditions. Some roads would be covered by the tailings impoundment in all mine action alternatives.

Unprotected road surfaces would be susceptible to erosion. Access roads operational for mine life would be chip-sealed or graveled, which would reduce potential erosion, and BMPs would be used to control drainage from road surfaces. For existing roads needing upgrading, sediment controls would be upgraded/installed and appropriate BMPs would be implemented, which would result in long-term reduction of soil loss from existing road corridors. For more information with regard to expected sediment reductions from road BMPs, see section 3.13.4, *Water Quality*.

BMPs have been proven to be an effective tool in limiting non-point source pollution (DNRC 2010, KNF 2002b, Logan 2001). If properly constructed and located, BMPs keep soil erosion to a minimum, capture sediment before it enters waterways, and protect water quality by controlling the flow of surface water over exposed areas. Additionally, BMPs help to keep soil particles in place and thereby provides a better plant growth medium for reclamation. The proper use of BMPs prevents, any eroded soil from making its way to the watershed outlet, where it would create problems downstream; the loss of surface soil also would make achieving revegetation goals more problematic. Erosion would occur during reclamation activities when salvaged soils are spread on recontoured surfaces. Areas reclaimed using direct-hauled soils (a reclamation technique whereby soil is stripped from an undisturbed area and immediately placed on a disturbed area that has been prepared for reclamation), such as road cut-and-fill slopes and in places at the Little Cherry Creek and Poorman Tailings Impoundment sites, would have less potential for erosion than areas reclaimed with stored soil. This is because protective vegetation would establish more quickly because direct-haul soils, as opposed to stored soils, are still biologically active and retain a higher level of favorable physical and chemical characteristics than soils stored for prolonged periods (U.S. Congress, Office of Technology Assessment 1986). Only a small, undetermined percentage of the total volume proposed for salvage would be direct-handled because of the timing difference between construction and reclamation.

Wind erosion of exposed soil also would contribute to soil losses. To minimize soil wind erosion, MMC would use standard BMPs, such as periodic watering of unpaved roads and disturbed surfaces, and use of mulch and tackifiers on exposed surfaces until vegetation was established.

Soil losses would occur under all action alternatives, and even with erosion and sediment control BMPs, some soil losses are expected but would be minimized. Soil losses generally would be long-term within all disturbed areas, because erosion rates would remain elevated after reclamation until the vegetation ground cover approaches predisturbance levels in about 3 to 5 years. South- and west-facing cut slopes may require more than 5 years for the vegetation ground cover to reach predisturbance levels without soil amendments. Once vegetation was well established, soil losses are expected to be similar to pre-mine rates.

3.19.4.1.2 Soil Physical, Biological, and Chemical Characteristics

Soil characteristics that would be impacted by all action alternatives would include potential changes in soil physical and chemical properties, and biological activity, including nutrient levels. Soil structure would be altered by handling, salvage, and storage operations. Changes in chemical properties such as heavy metal concentrations and soil pH may also occur at the mine facilities. These changes to the soil characteristics are discussed below.

Physical Characteristics

Changes in physical properties of the soils due to handling, salvage, and storage would result in the alteration of the natural soil profile that has developed since the last major soil disturbing event such as glacial activity, volcanic ash deposition, or flooding. This would be an unavoidable impact of salvaging and replacing soils. Some of these areas have been logged in the past, which disturbed the surface soil profile but not to the extent that mining disturbance would. Changes in soil structure, compaction (destruction of pore space continuity and soil structure), and loss of organic matter due to mixing and storage would occur. Soils salvaged and replaced in a single lift would alter the natural soil profile due to mixing of soil horizons, which would be a long-term impact. Two-lift salvage and replacement is proposed in the tailings impoundment areas that would limit some of the mixing across soil horizons, but the impacts would still be long term. The establishment of vegetation, root systems, and physical processes, such as freezing and thawing, and wetting and drying, would restart the soil-building processes and help rebuild the natural soil profile. Where the soil profile would be altered, it would require many years for soil productivity to return to pre-mine conditions. Compaction from heavy equipment would adversely affect soil plant relations due to decreased soil water-holding capacity, loss of aeration and pore space, and increased soil bulk density (Sharma and Doll 1996). Organic-rich soils, such as surface soils, and fine-grained matrix soils that have a large volume of rock fragments, are less affected, depending on the overall soil composition (Greacen and Sands 1980).

Volcanic ash-influenced soils in northwest Montana have lower initial bulk densities than soils derived from other sources. When disturbed during activities that use heavy equipment (such as logging), these soils are particularly susceptible to compaction (Page-Dumroese 1993; Geist *et al*. 2008; McDaniel and Wilson 2007), and compaction can persist for decades (Johnson *et al*. 2007; Parker *et al*. 2007). Soils with significant amounts of coarse fragments are less susceptible to compaction from heavy equipment (Luckow and Guldin 2004), and soils with higher clay contents (greater than 20 percent clay) are more effective at ameliorating the effects of compaction, due to freezing and thawing and shrink-swell actions than ash soils, which are particularly low in clay content (Parket *et al*. 2007). Volcanic ash soils within the analysis area generally have clay contents less than 23 percent (Western Resource Development Corp. 1989b, 1989c). Additionally, studies have not explored the behavior of ash-influenced soils under prolonged storage in deep piles; therefore, it is not possible to quantify the potential resistance to compaction of these soils.

Fine-textured glaciolacustrine subsoils are susceptible to compaction during the soil salvage process and have lower inherent infiltration and permeability. Non-glaciolacustrine soils in the area would not be as susceptible to this compaction because they often have greater sand and rock fragment contents.

To reduce compaction, severely compacted areas, such as roads, soil stockpile sites, and facility sites, would be ripped before soil placement, and seedbeds would be disked and harrowed before seeding. Soil compaction would be short-term in all disturbed areas with these mitigation measures, and following reclamation, compaction in re-spread soils that are ripped would be similar to pre-mine soils.

Biological Activities

Biological changes would occur in salvaged soils. Since most disturbances would not be reclaimed until the end of operations, most salvaged soils would be stockpiled for 15 years or more. Soils salvaged along transmission line roads would be re-spread within a year. Prolonged storage decreases or eliminates populations of important soil microorganisms (Abdul-Kareem and McRae 1984), such as bacteria, fungi, and algae, which are essential in soil nutrient cycling. In addition, some favorable components normally found in native soils are lost through decomposition during storage. These components include seeds of native plants, rhizomes (underground stems), and other plant parts capable of producing new plants. Replenishment of soil microorganisms would occur with interim revegetation of soil stockpiles but would be limited to the surface (the top 6 to 8 inches) of the stockpile. Most stockpiled soil would have reduced biological activity.

Mycorrhizae (important structures that develop when certain fungi and plant roots form a mutually beneficial relationship) are also eliminated in soil stored for prolonged periods. Mycorrhizae serve as highly efficient extensions of plant root systems, especially for woody species. These associations are important to consider in maximizing plant establishment and productivity because most plants depend on mycorrhizae for adequate growth and survival (Mallock *et al.* 1980). This is especially true in nutrient deficient soils. All of the salvaged soils are considered to have low fertility. Mycorrhizae are particularly important to plant phosphorus nutrition (Bolan 1991) and water uptake (Augé 2004). Thus, the association of mycorrhizae with plants in the study area is especially critical because plant-available phosphorus is expected to be low.

Chemical Characteristics

Aluminum, iron, and manganese are found in native forested soils in the area. These common metals are released by the weathering of soil parent materials, even in non-mineralized areas. They can become concentrated in a particular soil horizon by various soil-formation processes. Although typically not available to plants at neutral pH values, if soil surveys indicate soil pH is around 5.0, the agencies would require soil metal testing to identify possible naturally occurring concentrations of these and other metals. Soil samples tested had pH values from 4.3 to 7.5, with values between 5.0 and 6.0 being the most common. Samples with low pH were generally from the Little Cherry Creek and Poorman Tailings Impoundment sites, but soils with low pH potentially occur at all proposed disturbance areas. Soils having pH conditions below 5 are not proposed to be salvaged. Aluminum in particular may be slightly elevated in volcanic ash-rich loess. Elevated aluminum levels are common in the widespread volcanic forested soils of northwest Montana (McDaniel and Wilson 2007; Page-Dumroese *et al*. 2007), and native vegetation likely has adapted to the ambient soil chemistry.

Heavy metals often associated with mineralized zones, such as lead and copper could hinder plant growth. None of the rock types tested during exploration and past mining operations exhibited highly elevated leachable metal concentrations, which are metals that would become soluble in soil water (see section 3.9.4, *Environmental Geochemistry* for detailed discussion of leachable metals). Preliminary testing shows tailings materials and some of the mine waste rock would have low levels of leachable metals and no net acid generation potential. Considering these results, the mine waste materials would have limited adverse chemical impacts on re-spread soil or on plants whose roots may grow into these materials in the lower part of the rooting zone. MMC would test waste rock and tailings before soil redistribution to reconfirm these results.

3.19.4.1.3 Reclamation Success

Recognition of inherent soil properties and design of salvage programs to retain favorable properties can enhance reclamation success. Soil characteristics important to consider for analyzing impacts and assessing soil salvageability and suitability for reclamation include:

- Depth and horizon (developed soil layer) sequence
- Texture (relative proportion of sand-, silt-, and clay-sized particles)
- Coarse fragment content (size, amount, and shape (rounded or angular))
- Erodibility
- Organic matter content
- Reaction (refers to the acidity or alkalinity of the soil solution and is expressed as pH ranging from 1 to 13, where 1 is the most acidic, 7 is neutral, and 13 is most alkaline or basic)
- Slope steepness; and location and extent of rock outcrop and talus

Soil Salvage and Handling

The potential for reclamation success of disturbed lands is greatly improved when soil is salvaged and later replaced in two or more lifts to provide a suitable growth medium for plants (Montana State University 2004). MMC would salvage and replace soils on most disturbed areas, except where slopes are too steep, at soil stockpile areas, and where soils are too rocky. The primary limitations that affect soil suitability for salvage and reclamation at the site include high rock content and steep slopes, and to a lesser extent, soil texture, soil pH, and a high water table. Salvage may be limited for soils with a volume of more than 50 percent rock fragments (larger than 1/16 inch diameter) or with large rocks (greater than 2 feet in diameter). Soils with up to 60 percent rock fragments would be salvaged in some areas to provide erosion protection on the steep embankment of the Little Cherry Creek and Poorman Tailings Impoundment sites. Salvage would not be required and not be conducted on slopes exceeding 2:1 (50 percent) because of worker safety considerations. Other reclamation limitations at the site include soils with high clay content and pH levels below 5, which increase the potential for metal mobility out of soils.

Soil Amendments

Reclamation success can be enhanced on particular sites by use of soil amendments. Use of mulches and tackifiers can limit soil loss until seedlings can establish. Alkaline amendments can be added to acid soils to raise the pH. Wood based organic amendments can be added to the surface soil to increase organic matter contents, reduce compaction, reduce crusting, increase soil fertility, lower bulk density, and potentially enhance establishment of a fungal based mycorrhizae community that would enhance the establishment and growth of woody plant species. MMC has only proposed the use of mulches to reduce soil erosion.

Revegetation

The main factors relating to revegetation include scheduling of final revegetation, species selection, planting plans, and establishing success criteria to achieve long-term plant cover and density objectives. These factors determine the speed and success of reclaiming the disturbed lands to comparable stability and utility.

MMC would not implement final reclamation for most disturbances until the post-operational phase (after 15 to 20 years). Final reclamation would be done on some sites during the predevelopment period (1 to 3 years). These areas would include the Little Cherry Creek Diversion Channel (Alternatives 2 and 4), cut-and-fill slopes at plant sites, portal patio faces, and the Bear Creek access road north of the proposed Little Cherry Creek Tailings Impoundment. Disturbances reclaimed during operations would include some temporary access roads. Interim reclamation, (replacing soil where it was removed and reseeding) would occur on transmission line access roads placed into intermittent stored service. All other disturbances would be reclaimed after operations cease.

3.19.4.2 Soil Loss

3.19.4.2.1 Alternative 1 – No Mine

Under Alternative 1, the Montanore Project would not be developed. Soil resource impacts would be limited in comparison to the other alternatives. Soil loss due to erosion would be restricted to existing exploration-related or baseline data collection disturbances. All existing soil disturbances by MMC would be reclaimed in accordance with existing laws and permits. Erosion and sedimentation would occur at existing rates along NFS road #278 and other existing roads. Soil erosion losses due to rainfall, runoff, and wind would continue at natural rates at other locations in the analysis area.

3.19.4.2.2 Alternative 2 – MMC's Proposed Mine

Soil losses would occur during construction of access roads and facilities, at soil stockpiles, and when soils are salvaged and re-spread. Table 165 presents a comparison of the likely disturbances in which soil would be salvaged and salvageable soil volumes of mine facilities for each alternative. The disturbance acres in Table 165 do not include proposed soil stockpiles and existing roads because no soil would be salvaged from these areas. Soil would be salvaged from only small portions of LAD Areas such as roads and ponds. The Libby Adit Site is an existing disturbance area, and soil has already been salvaged and stockpiled at the site, so it is not included in Table 165.

Alternative 2 - Soil Losses from Construction of Facilities and Roads

Construction of mine related facilities and roads would result in soil disturbance and a loss of soil productivity on about 2,081 acres (Table 165). Much of the facility disturbances would be covered with structures, such as buildings, or other material, such as tailings and waste rock.

New roads, upgrading existing roads, and pipeline corridors would disturb 153 acres. Unprotected road surfaces would be susceptible to erosion. For access roads operational for mine life, MMC would chip-seal or gravel road surfaces, which would reduce potential erosion, and BMPs would be used to control drainage from road surfaces. For existing roads needing upgrading, MMC proposes to upgrade/install sediment controls and implement appropriate BMPs, which in the long run, would reduce total soil loss (see section 3.13.4, *Water Quality*).

Table 165. Comparison of Disturbances from Soil Salvage and Salvageable Soil for Alternatives.

Disturbance	Units	Alternative 2 – MMC's Proposed Mine	Alternative 3 – Agency Mitigated Poorman Impoundment Alternative	Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative
Tailings Impoundment/Dam†	Acre	620	590	620
Lift 1	cy	754,166	695,571	754,166
Lift 2	cy	1,224,076	1,292,699	1,224,076
Seepage Collection Pond	Acre	8	18	8
Lift 1	cy	8,927	21,461	8,927
Lift 2	cy	20,167	33,999	20,167
Borrow Areas outside tailings impoundment	Acre	419	91	228
Lift 1	cy	393,690	115,023	288,977
Lift 2	cy	393,690	85,224	212,558
Diversion Channel	Acre	40	0	40
Lift 1	cy	50,780	0	50,780
Lift 2	cy	0	0	18,486
Other potential disturbances‡	Acre	761	498	650
Lift 1	cy	943,531	605,664	798,041
Lift 2	cy	1,231,008	786,429	1,187,486
Plant Site	Acre	49	72§	72§
Lift 1	cy	118,580	139,279	139,279
Upper Libby Adit	Acre	0	1	1
Lift 1	cy	0	538	538
LAD Areas	Acre	31	0	0
Lift 1	cy	37,739	0	0
Lift 2	cy	0	0	0
Roads	Acre	153	197	209
Lift 1	cy	372,198	154,024	154,379
Lift 2	cy	0	184,347	193,851
TOTAL	Acre	2,081	1,441	1,791
Lift 1	cy	2,679,611	1,731,560	2,195,087
Lift 2	cy	2,868,941	2,382,698	2,856,624

†Values are for dam and impoundment only. Entire tailings impoundment areas also include Seepage Collection Pond, borrow areas outside tailings impoundment footprint, Diversion Channel (Alternatives 2 and 4), and other potential disturbances shown elsewhere in table.
‡Includes roads, storage areas, ditches, pipelines, etc. Does not include soil stockpiles and existing roads.
§Soils not mapped at intensive level, suitable lift-2 soils likely present; does not include soil stockpile areas and existing roads; acreage may differ from disturbance acres presented in Table 9 for Alternative 2, Table 20 for Alternative 3, and Table 34 for Alternative 4 in Chapter 2.
cy = cubic yard.
Source: GIS analysis by ERO Resources Corp. using soils mapping in Western Resource Development Corp. 1989b, 1989c.

Areas of culvert replacement and/or extension and bridge construction at Ramsey Creek and Poorman Creek would be subject to erosion until stabilized. Short-term increases in sedimentation may occur as a result.

MMC proposed a 10,800-foot Little Cherry Creek Diversion Channel around the tailings impoundment that would flow into Libby Creek. The Diversion Channel would consist of two main sections: an upper engineered channel (designed for the 6-hour Probable Maximum Flood flow and the riprapped channel sides for the 100-year flood flows), and two down gradient existing natural drainage channels that flow toward Libby Creek (Figure 8). These two existing channels, referred two as Drainage 10 and Drainage 5, would both receive flow from the Upper Diversion Channel, which would reduce channel impacts that can occur during peak flow events. The existing channels would not be large enough to handle the expected flow volumes; these channels would undergo channel adjustments until they stabilized. These adjustments would include bank erosion, channel scouring, and sloughing of bank material, which would contribute sediments to Libby Creek.

MMC would construct some bioengineering and structural features based on need and access in the two unnamed tributary channels to reduce flow velocities, minimize erosion in the unnamed tributaries, minimize sedimentation to Libby Creek, and create fish habitat. In addition, MMC would evaluate potential locations for creating wetlands and ponds in low gradient areas to capture and retain most of the sediments generated from the unnamed tributaries and minimize sedimentation to Libby Creek. If wetlands or ponds were not constructed to retain mobilized sediments on the Libby Creek floodplain, the additional input of sediments to Libby Creek may cause channel aggradation, which may result in bank erosion due to channel widening. Bank erosion in the unnamed tributaries and possibly sedimentation to Libby Creek would continue until the tributaries adjusted to the increased flow volumes (see section 3.6, *Aquatic Life and Fisheries*). If substantial erosion occurred once the diversion channel was operational, additional erosion control structures would be constructed as needed.

Once the tailings impoundment was reclaimed, there would be a slight increase in flow to Bear Creek from runoff from the impoundment surface. This runoff would flow to Bear Creek via a diversion ditch. The ditch would be riprapped to minimize erosion and sedimentation in Bear Creek. A small, rockfill check dam would be located just beyond the northwest end of the reclaimed impoundment. If necessary, sediment would be removed from the pond. The check dam would be designed for the 100-year flood event. Short-term erosion in the ditch and subsequent sedimentation in Bear Creek would likely occur during construction of the ditch and check dam. With the additional flow, especially after large runoff events, there could be minor adjustments to the Bear Creek channel resulting in minor scouring and bank erosion.

Alternative 2 - Soil Losses at Soil Stockpiles

All soil stockpiles would be susceptible to erosion. Soil stockpiles would be constructed with 40 percent side slopes and 33 percent sloping ramps where possible. MMC proposes to stabilize stockpiles when they reach their design capacity, and seed during the first appropriate season following stockpiling. This would leave exposed soil on steep slopes for potentially prolonged periods. If left exposed and unprotected for more than a couple of months, regardless of other characteristics, large amounts of soil may erode. To minimize sedimentation to floodplains, wetlands and streams, MMC proposes to locate soil stockpiles on gentle slopes away from drainages, install berms around stockpiles, and construct sediment traps downslope of soil stockpiles where necessary.

Apart from erosion resulting from steep slopes and exposure, each stockpile would have a different potential for erodibility. Each stockpile includes soils from adjacent or nearby salvage areas, thus the nature of each stockpile would be different in terms of soil texture and rock content. For example, soils at the Ramsey Plant Site would be salvaged in one lift and would be composed of predominately silt loam with lesser amounts of gravelly silt loam and very gravelly silt loam. Due to the high silt content and only some soils having high gravel content, these stored soils would have a moderate to high erodibility potential. Some soils at the Little Cherry Creek Tailings Impoundment Site would be salvaged in two lifts and stored separately. The surface lift, which includes the more suitable soil, would be comprised of fine-textured volcanic ash, silt loam, gravelly silt loam, and gravelly loam. First-lift stockpiles would have moderate to high erodibility potential due to the high silt content and low rock fragment content. The second lift would be composed of gravelly to very gravelly loam and clay loam. Second-lift stockpiles would have moderate erodibility potential due to higher rock fragment content and less silt.

For new roads that are to be operational for mine life, MMC proposes to stockpile soils along the entire corridor. Most of these soils have a volcanic ash surface layer and have a moderate to high erodibility potential due to the high silt content and low rock fragment content. Stockpiling soils along entire corridors would increase the surface area of exposed soil and thereby result in more soil losses than if salvaged soils were concentrated in only a few stockpiles in clearings or areas of recent timber harvest immediately adjacent to new roads.

Alternative 2 - Soil Losses from Soil Salvage and Replacement

Soil losses during salvage and replacement activities could affect the volume of soil estimated for salvage, particularly at LAD Areas and at the Libby Adit Site where salvageable soil was limited (soils have already been salvaged and stockpiled at the Libby Adit Site). This in turn would affect proposed redistribution depths at LAD Areas and at the Libby Adit Site and could potentially adversely affect reclamation success. MMC reports that previous reclaimed disturbances with less than 18 inches of re-spread soil at the Libby Adit Site have demonstrated viable vegetation cover, and MMC proposes to re-spread 18 inches of soil at disturbances in LAD Areas requiring soil replacement.

MMC proposes to store all first-lift soils salvaged from the Little Cherry Creek Tailings Impoundment Site together, including surface soils having no or few rock fragments and high erosion potential, such as glaciolacustrine soils, with surface soils having a large amount of rock fragments. This could result in having highly erosive soils on the steep surface of the embankment of the impoundment and lead to excessive erosion of surface soils exposing less fertile subsoil and affecting long-term reclamation success on the impoundment embankment.

MMC proposes to salvage some clay-rich glaciolacustrine subsoils (>40 percent clay) at the Little Cherry Creek Tailings Impoundment Site. This soil type is poorly suited as a plant growth medium due to shrinking and swelling, surface crusting, low water infiltration, slow permeability, and high erodibility potential. If this clay-rich material were used as final re-spread surface soil, plant re-establishment would be impeded and erosion would likely increase, especially on the tailings embankment.

In summary, MMC's proposed measures to control runoff and sedimentation and combined with some of the native surface soil and subsoil characteristics, such as rock fragment content, would help reduce erosion rates. If glaciolacustrine soils were used as surface soil on the impoundment, soil losses could affect reclamation success in the long term especially on the embankment of the impoundment for reasons discussed previously. Until vegetation ground cover reached predisturbance levels, anticipated to be in about 3 to 5 years in most areas, erosion rates would be higher than before disturbance. Soil losses are not expected to affect reclamation success at other disturbance areas, because sufficient soil material exists to meet MMC's proposed reclamation plan, with the possible exception at LAD Areas and at the Libby Adit Site where salvageable soil was limited.

3.19.4.2.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Alternative 3 would result in a loss of soil productivity on 1,441 acres where soil would be salvaged. It would meet soil quality standards as one of the long-term reclamation goals. In addition to the fewer disturbed acres than Alternative 2, Alternative 3 also would provide additional mitigation measures that would result in less erosion and less sedimentation to Libby Creek and its tributaries. These additional measures are described below.

On all soil stockpiles, interim seeding and mulching would be conducted incrementally as the stockpiles are being constructed and as soon as possible, regardless of season, rather than waiting until the first appropriate season after they reach design capacity. This would reduce erosion potential and potentially reduce sedimentation to drainageways.

For new roads that are to be operational for mine life, salvaged soils would be stockpiled in clearings or in areas of recent timber harvest immediately adjacent to new roads or in other nearby soil stockpiles rather than stockpiling along the entire road corridor. Consolidating soil stockpiles would improve management and control soil losses along road corridors and minimize sedimentation to nearby waterways. MMC would develop and implement a Road Management Plan addressing all roads used in the alternative. Successful implementation of the plan would ensure that erosion and sediment delivery from roads would be minimized.

A Little Cherry Creek Diversion Channel would not be needed under Alternative 3. Elimination of the Diversion Channel would reduce short-term erosion in the unnamed tributaries and sedimentation to Libby Creek. The potential long-term effects of channel aggradation and bank erosion from channel widening in Libby Creek and the potential for sedimentation and bank erosion in Bear Creek also would be eliminated. Once the tailings impoundment was reclaimed, there would be a 40 to 70 percent increase in average annual flows in Little Cherry Creek as runoff from the impoundment surface would be directed to Little Cherry Creek. This increase in flow would cause some short-term scouring and bank sloughing in Little Cherry Creek closer to the impoundment and some sedimentation farther downstream.

For soil salvage at the Poorman Tailings Impoundment Site, rocky soil would be segregated from non-rocky soil. Soil would be replaced in two lifts 24 inches thick on the embankment and impoundment surface. Rocky subsoil would be used as re-spread subsoil (15 inches thick) over the tailings embankment, and rocky surface soil would be used as the upper 9 inches of re-spread soil on the embankment. This would minimize erosion potential on the embankment. The non-rocky surface soil would be used as the upper 9 inches of re-spread soil on the rest of the impoundment on slopes less than 8 percent. The clay-rich subsoil of glaciolacustrine soils salvaged from the impoundment area would be stockpiled separately from other second-lift soils and used, along with other salvaged soil, as re-spread subsoil (15 inches thick) on top of the tailings impoundment. It could also be used to cover any sandy or gravelly soils exposed during impoundment site stripping and borrow excavation operations to minimize infiltration of water from the tailings impoundment or from the Seepage Collection Pond. An average of 24 inches of surface soils and 12 inches of subsoils at all wetlands would be excavated and used at wetland mitigation sites (see section 2.5.7.1, *Jurisdictional Wetlands and Other Waters of the U.S.*).

With the modifications to control erosion under Alternative 3, soil losses within the disturbed areas would be less and not as severe as under Alternative 2, and sedimentation to waterways would be less for Alternative 3 than for Alternative 2 (section 3.19.4.2.2, *Alternative 2 – MMC's Proposed Mine*). Because 640 fewer acres would be disturbed in Alternative 3 than in Alternative 2, Alternative 3 would have less soil loss.

3.19.4.2.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would salvage soils from 1,791 acres (Table 165). Alternative 4 would provide the same additional mitigation measures as Alternative 3, which would result in less erosion and less sedimentation to Libby Creek and its affected tributaries. MMC would develop and implement a Road Management Plan addressing all roads used in the alternative. Successful implementation of the plan would ensure that erosion and sediment delivery from roads would be minimized.

Under Alternative 4, a Little Cherry Creek Diversion Channel would be built and would consist of two main sections: an upper engineered channel and a constructed lower channel to Libby Creek using an existing drainage channel (Drainage 10 proposed in Alternative 2). The engineered channel would be the same as the engineered channel under Alternative 2 and would be designed for the 6-hour Probable Maximum Flood. It would flow into a constructed channel that would be designed to be geomorphologically stable and to handle the 2-year flow event. The natural-designed channel would have similar channel pattern, dimensions, profile, and bed material as similar-sized channels in the analysis area (see design elements listed in section 2.6.3.2, *Modified Little Cherry Creek Tailings Impoundment*). A floodplain would be constructed along the channel to allow passage of the 100-year flow.

Significant erosion and sedimentation should not occur because construction of the channel would be done in dry conditions. The majority of sediment generated would occur during initial channel flush and subsequent high flow and rainfall events. In the event of heavy precipitation during construction of the channel, significant erosion may occur. Natural and biodegradable materials and vegetation would be used along stream banks and on the floodplain to minimize erosion, stabilize the stream channel and floodplain, and minimize sedimentation to the lower channel and Libby Creek. Long-term monitoring and maintenance would be required, if necessary, until the lead agencies determine that the channel was stabilized. Even with these mitigation measures, the constructed natural-designed channel would be subject to erosion and sedimentation during construction and until vegetation stabilizes the stream banks and floodplain. Short-term increases in sedimentation to the lower channel and Libby Creek would likely occur as a result.

Following reclamation of the impoundment, the constructed channel would undergo an additional period of channel adjustment when runoff from the impoundment surface was directed to the Diversion Channel. The increase in flow would be about 50 percent higher than during operations, and would lead to new channel adjustments. This would likely cause short-term increases in sedimentation in the lower channel and Libby Creek.

For soil salvage at the Alternative 4 Little Cherry Creek Tailings Impoundment, rocky surface soil would be segregated from non-rocky surface soil. Like Alternative 3, rocky subsoil would be used as re-spread subsoil (15 inches thick) over the tailings embankment, and rocky surface soil would be used as the upper 9 inches of re-spread soil on the embankment. This would minimize erosion potential on the embankment. Non-rocky surface soil would be used as the upper 9 inches of re-spread soil on the rest of the impoundment on slopes less than 8 percent. Also like Alternative 3, clay-rich subsoil of glaciolacustrine soils salvaged from the impoundment area would be stockpiled separately from other second-lift soils and would be used, along with other salvaged soil, as re-spread subsoil (15 inches thick) on top of the tailings impoundment. It could also be used to cover any sandy or gravelly soils exposed during impoundment site stripping and borrow excavation operations to minimize infiltration of water from the tailings or from the Seepage Collection Pond, or to line the channel foundation for the Little Cherry Creek Diversion Channel.

With the modifications to control erosion under Alternative 4, soil losses within the disturbed areas would be less and not as severe as Alternative 2 and sedimentation to waterways would be less for Alternative 4 than for Alternative 2 (section 3.19.4.2.2*, Alternative 2 – MMC's Proposed Mine*). Compared to Alternative 3, Alternative 4 would disturb more acres creating greater potential for soils loss, and Alternative 4 would require the construction of the Little Cherry Creek Diversion Channel, which would increase the risk of channel erosion and sedimentation to waterways.

3.19.4.2.5 Transmission Line Alternatives

Alternative A – No Transmission Line

Under Alternative A, the transmission line, Sedlak Park Substation, and loop line for the Montanore Project would not be built. Soil erosion losses due to water and wind would continue at natural rates. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

Alternative B – North Miller Creek Alternative

MMC's proposed North Miller Creek transmission line corridor would be 16.4 miles long and would require 108 structures. This alternative is slightly longer than the lead agencies' alternatives in part because it ends at the substation at the Ramsey Plant Site where the lead agencies' alternatives end at the substation at the Libby Plant Site about 1.5 miles to the east. The centerline of the transmission line of the North Miller Creek Alternative would cross more steep areas (7.4 miles), more soils with a severe erosion hazard (6.7 miles), and more soils with high sediment delivery (5.1 miles) than the other three alternatives. The disturbance associated with structure placement would increase erosion until vegetation ground cover around the structure locations reached predisturbance vegetation ground cover levels. MMC did not specify the type of logging that would be used. For analysis purposes, the lead agencies assumed all logging would be completed conventionally without the use of a helicopter. Disturbance associated with logging operations would increase soil erosion.

The primary surface disturbance from transmission line construction would be construction of new access roads. The total disturbance for access roads, which would be either new roads or existing closed roads requiring upgrades, would be greater under this alternative (30.9 acres) than the other alternatives. The access roads would disturb 8.9 acres of soil having severe erosion risk, 6.3 acres of soil having high sediment delivery potential to waterways, 13.3 acres of soil having potential for slope failure, and 16.5 acres of slopes greater than 30 percent (Table 166). Disturbances on steeper slopes are generally more difficult to reclaim and require more mitigation measures than on shallower slopes. The majority of soils having severe erosion risks along access roads occur along Libby and Miller creeks and Fisher River. Most soils with high sediment delivery potential disturbed by access roads occur along Ramsey, Libby, and Miller creeks and Fisher River. Most soils having potential for slope failure occur along Ramsey Creek, just east of Libby Creek, and near Fisher River. Access roads on slopes exceeding 30 percent primarily occur along Ramsey Creek, between Libby and Miller creeks, north of Miller Creek, and locations east of the Fisher River (Figure 84).

Table 166. Comparison of Physical Characteristics and Erosion Risks for Transmission Line Alternatives.

Criteria	Units	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
Length of Transmission Line	Miles	16.4	13.1	13.7	15.1
Total road disturbance	Miles	10.2	3.1	5.1	3.9
	Acres	30.9	9.4	15.5	11.7
Severe erosion risk					
Centerline only	Miles	6.7	1.8	1.3	3.4
New roads + closed roads with high upgrade requirements	Acres	8.9	2.4	1.8	2.3
High sediment delivery					
Centerline only	Miles	5.1	0.5	0.5	0.5
New roads + closed roads with high upgrade requirements	Acres	6.3	0.6	0.6	0.6
Slope failure					
Centerline only	Miles	9.3	6.8	7.5	9.4
New roads + closed roads with high upgrade requirements	Acres	13.3	4.7	6.4	6.4
Slopes > 30 percent					
Centerline only	Miles	7.4	7.2	6.4	4.7
New roads + closed roads with high upgrade requirements	Acres	16.5	4.4	7.9	2.5

Source: GIS analysis by ERO Resources Corp. using vegetation mapping in USDA Forest Service and Natural Resources Conservation Service 1995.

Sediment controls and BMPs would be implemented on new and upgraded roads during construction of the transmission line to minimize erosion, sediment delivery to waterways, and slope failure. All access roads, after construction of the transmission line but during the life of the project, would be closed and placed into intermittent stored service and reclaimed with interim reclamation designed to stabilize the surface. This reclamation would include removal of drainage obstructions at road crossings, reseeding the road surface, and where soil had been salvaged from new roads, the road surface would be covered with soil and then reseeded.

After the transmission line was removed, all newly constructed roads on National Forest System lands would be decommissioned. They would be recontoured to match existing topography, obliterating the road prism, and reseeded. Where culverts were removed, stream banks would be recontoured and reseeded. Final closure status of new access roads on private lands would be based on the landowner’s discretion. With sediment controls, BMPs and short duration of exposed soil, there would be no severe reclamation constraints, no significant adverse impacts to the soil resources, and the soil losses along access roads would likely be minor until vegetation was re-established in most areas after 3 to 5 years. Vegetation re-establishment on steep areas, particularly on south- and west-facing slopes, could take longer.

In all action transmission line alternatives, the BPA would construct and operate the Sedlak Park Substation and loop line. The Sedlak Park Substation and loop line site is on a flat terrace of the Pleasant Valley Fisher River. The site is underlain by glaciolacustrine soils, which have severe erosion risk and are prone to slope failure. The BPA would prepare and implement a SWPPP during substation and loop line construction to minimize water erosion. The substation site would have a stormwater containment system. After the transmission line was removed, the substation site would be decommissioned and the site reclaimed. Soil losses at the Sedlak Park Substation and loop line site would be minimal.

Alternative C-R – Modified North Miller Creek Alternative

The Modified North Miller Creek Alternative would be 13.1 miles long, the shortest of all alternatives, require 81 structures, and end at the substation at the Libby Plant Site, which is about 1.5 miles east of the proposed substation at the Ramsey Plant Site under Alternative B. The centerline would cross 7.2 miles of steep slopes, 6.8 miles of slopes prone to failure, 1.8 miles of soils with severe erosion risk, and 0.5 miles of soils with high sediment delivery. The disturbance associated with structure placement would increase erosion until vegetation ground cover around the structure locations reached predisturbance vegetation ground cover levels. MMC would use a helicopter to harvest timber at selected locations, reducing the need for access roads (Figure 44). Conventional logging techniques would be used in other areas. Helicopter logging would result in less soil erosion than conventional logging used in Alternative B.

New access roads and closed roads with high upgrade requirements would be needed for transmission line installation and would create 9.4 acres of disturbance, the fewest of all alternatives and about 22 acres fewer than Alternative B. These roads would disturb 2.4 acres of soils having severe erosion risk, 4.7 acres of soil that have potential for slope failure, the fewest of all alternatives, and 4.4 acres of slopes greater than 30 percent. Alternative C-R (and Alternatives D-R and E-R) would affect few soils with high sediment delivery potential to waterways (0.6 acres). Most soils having severe erosion risks along access roads occur along Libby Creek in the extreme western portion of the transmission line, along Miller and West Fisher creeks, and along Fisher River. Soils having high sediment delivery potential along access roads occur only in two places, along Libby Creek and at the northeast end along the Fisher River. Most soils having potential for slope failure along access roads occur just east of Libby Creek, portions between Miller and West Fisher creeks, and east of Fisher River. Access roads on slopes exceeding 30 percent occur primarily between Libby and Miller creeks, north of Miller Creek, much of the area between Miller and West Fisher creeks, and along portions east of Fisher River (Figure 84). MMC would develop and implement a Road Management Plan addressing all roads used in the alternative. Successful implementation of the plan would help minimize erosion and sediment delivery from roads.

Sediment controls and BMPs would be implemented on new roads to minimize erosion, sediment delivery to waterways, and slope failure. As with Alternative B, new access roads on National Forest System lands would be placed into intermittent stored service after line construction was completed. Intermittent stored service roads would be closed to traffic and would be treated, which would include at a minimum removing drainage obstructions, replacing salvaged soil, seeding, and installing cross drains, so they would cause little resource risk if maintenance were not performed on them during the operation period of the mine and before their future need. Intermittent stored service is described in section 2.9.4.2*, Access Road Construction and Use*.

After removal of the transmission line, transmission line roads on National Forest Systems lands would be decommissioned. The road prism would be obliterated, all watercourses would be restored, and the road prism would be revegetated. Road decommissioning is described in section 2.9.4.2*, Access Road Construction and Use*. Unlike Alternative B, for Alternative C-R, the surface soil that had been in place on access roads for the life of the transmission line would be salvaged, the road prism obliterated, and then the surface soil replaced. The surface soil that had been in place for the life of the transmission line would have higher nutrient levels, higher organic matter content, and greater microbial activity than the underlying soil, and it would be a seed source for the native plants that had established over the life of the transmission line. This would shorten the amount of time for vegetation to re-establish, which would minimize the amount of time bare soil was exposed to erosive forces.

Newly constructed roads on Plum Creek lands would be gated after construction and managed as proposed by MMC in Alternative B. As with Alternative B, final closure status of new access roads on private lands would be based on the landowner's discretion. With fewer acres of disturbance and the shorter amount of time soil was exposed, impacts probably would be lower than those on Alternative B. With sediment controls, BMPs and short duration of exposed soil, there would be no severe reclamation constraints, no significant adverse impacts to the soil resources are expected, and the soil losses along access roads would likely be minor until vegetation was re-established in about 3 to 5 years for most areas. Vegetation re-establishment on steep areas, particularly on south- and west-facing slopes, could take longer.

Alternative D-R – Miller Creek Alternative

The Miller Creek Alternative would be 13.7 miles long, require 92 structures, and end at the substation at the Libby Plant Site. This alternative would cross the least amount of soil having severe erosion risk (1.3 miles). The centerline of this alternative would cross more soils that have potential of slope failure than Alternative C-R, but would cross fewer steep slopes than Alternative C-R. The Miller Creek Alternative would disturb fewer soils having slope failure potential and steep slopes than Alternative B (Table 166). Some areas would be logged using a helicopter, resulting in disturbances and erosion similar to Alternative C-R.

New access roads and closed roads with high upgrade requirements would create 15.5 acres of disturbance (about 16 fewer acres than Alternative B), and disturb 7.9 acres of slopes that exceed 30 percent, 0.6 acres of soils with high sediment delivery potential to waterways, and 6.4 acres of soil that have potential for slope failure. Access roads for this alternative would cross the fewest acres of soil having severe erosion risk (1.8 acres). Most soils having severe erosion risks along access roads occur along Libby Creek in the extreme western portion of the transmission line, along West Fisher Creek and Fisher River. The majority of soils with high sediment delivery potential along access roads occur only along Libby Creek and at the northeast end along the Fisher River. Most soils having potential for slope failure along access roads occur southeast of Libby Creek near Howard Lake, portions between Miller and West Fisher creeks, and east of Fisher River (Figure 84). Other effects and measures to control soil losses associated with the transmission line and corresponding access roads would be the same as Alternative C-R.

Alternative E-R – West Fisher Creek Alternative

The West Fisher Creek Alternative would be 15.1 miles long, require 103 structures, and end at the substation at the Libby Plant Site. The centerline would cross 4.7 miles of slopes greater than 30 percent, less than all other alternatives, and would cross 9.4 miles of soils that have potential of slope failure, which is essentially the same as Alternative B and more than Alternatives C-R and D-R. The centerline of Alternative E-R would cross fewer miles of soils that have severe erosion risk (3.4 miles) than Alternative B but more miles than Alternatives C-R and D-R. Some areas would be logged using a helicopter, resulting in disturbances and erosion similar to Alternative C-R.

New access roads and closed roads with high upgrade requirements would create 11.7 acres of disturbance (about 19 fewer acres than Alternative B), and would disturb 2.3 acres of soils having severe erosion risks, which occur primarily along Libby and West Fisher creeks and Fisher River. This alternative would affect 6.4 acres of soils with a potential for slope failure, which occur southeast of Libby Creek near Howard Lake, portions north of West Fisher Creek, and east of Fisher River. Access roads would cross 2.5 acres having slopes greater than 30 percent, which is less than any other alternative and occur primarily southeast of Howard Lake, along portions north of West Fisher Creek and along portions east of Fisher River (Figure 84). Other effects and measures to control soil losses associated with the transmission line and corresponding access roads would the same as Alternative C-R.

3.19.4.3 Soil Physical, Biological, and Chemical Characteristics

Soil characteristics that would be impacted by action Alternatives 2, 3, and 4 and by the transmission line action alternatives include changes in soil physical properties, biological activity, and nutrient levels. The likelihood of changes in chemical properties such as changes in heavy metal concentrations and soil pH are also discussed.

3.19.4.3.1 Alternative 1 – No Mine

Under Alternative 1, the Montanore Project would not be developed. Soil changes in physical and chemical properties, biological activities, and nutrient levels would be limited to any existing exploration-related or baseline collection disturbances. All existing exploration-related or baseline collection disturbances by MMC would be reclaimed in accordance with existing laws and permits. In all other areas, soil changes in physical and chemical properties, biological activities, and nutrient levels would continue at natural rates.

3.19.4.3.2 Alternative 2 – MMC Proposed Mine

Alternative 2 - Physical Characteristics

Single lift soil salvage and replacement would alter the natural soil profile by mixing soil horizons that developed over the past 10,000 years. MMC would use the single lift salvage and replacement method at the Ramsey Plant Site, the Libby Adit Site, the LAD Areas, and access roads. The Little Cherry Creek Tailings Impoundment Site would have soils salvaged and replaced in two lifts. This would limit impacts from mixing soil horizons but the loss of soil development and the length of time to re-establish a new soil profile would still take a long time. At other disturbance sites where soils would be salvaged using a two-lift method, the soils would be replaced using a single-lift method. There would be a long-term impact on the soil profile at these sites. Over time, natural processes would rebuild a new soil profile that may or may not resemble the predisturbance condition. The loss of soil development and the time needed to redevelop a new soil profile would be an unavoidable impact of soil disturbance.

To minimize soil compaction, MMC would rip compacted areas before redistribution of soil. Areas expected to be ripped include the adit portal areas, roads, soil stockpile sites, the dam face of Little Cherry Creek Tailings Impoundment, and facility areas. Ripping also would eliminate potential slippage at layer contacts and promote root growth. Following soil redistribution, the seedbed would be disked and harrowed on slopes 33 percent or less, which would minimize compaction of the seedbed. These practices would tend to offset compaction on many reclaimed sites. Some areas, such as road fills and as much as possible at the tailings impoundment site, would receive direct-hauled soil. If seeded immediately, and provided that soils are handled when dry, compaction would be minimal. MMC has not committed to handle soils when dry. If soils were wet when handled, some compaction is expected, especially on slopes greater than 33 percent because the seedbed on these slopes would not be disked and harrowed. The establishment of vegetation, root systems, rodent activity, and physical processes such as freezing and thawing, and wetting and drying would decrease soil compaction. In time, effects related to soil compaction of respread soils would be reduced.

Alternative 2 - Biological Activities

The loss of organic matter and mycorrhizae in soils stockpiled for prolonged periods could lower plant species diversity (Strohmayer 1999). If mycorrhizae-inoculated trees and shrubs species were readily available, MMC would use these species and would use stock raised in containers where the soil medium has been inoculated with mycorrhizae, if it were available. The loss of organic matter and mycorrhizae would be a long-term impact, and if mycorrhizae inoculation were not completed, the long-term survival and growth of woody species, in particular, may be reduced. In time, mycorrhizae would invade reclaimed sites from adjacent undisturbed areas, and species diversity would eventually increase, but not to pre-mine levels as discussed in section 3.22.1.4*, Environmental Consequences*.

Alternative 2 - Soil Nutrients

As is typical of many forest soils, nutrient levels are low to very low partially due to low soil pH. During soil storage, these levels would only decrease as organic matter and biological activity decreased and precipitation leached nutrients through the stockpiles. Soil stockpiles would contain organic debris, such as residual coniferous forest slash that was acidic, that could decrease soil pH as the material weathers.

Soils formed in volcanic ash often fix phosphorus in a form unavailable for plant uptake (McDaniel and Wilson 2007). Organic matter in the upper few inches of native soils acts as a reservoir for phosphorus. Plant-available phosphorus is released by microbial decomposition within and directly below the forest litter layer. Replaced soils would lack organic matter, as explained above; therefore, surface applications of soluble phosphorus fertilizer at the time or before seeding, as proposed by MMC, may be of little value. MMC has proposed to apply organic matter in the form of straw mulch, which has little nutrient value, and wood mulch may be used if straw mulch proved to be ineffective for successful reclamation. MMC would test areas with poor plant germination and/or growth to determine causes of unsuccessful revegetation and then take corrective actions. This would help offset organic matter and/or phosphorous deficiencies.

MMC proposes to salvage equal volumes of first-lift soils and second-lift soils at borrow sites C and D. In doing so, MMC may not necessarily segregate the most suitable soil that would be used as the upper 9 inches of respread soil. Mixing surface soil with subsoil would reduce organic matter content in first-lift replaced soils, which would affect availability of essential nutrients. This may also affect the success of plant re-establishment unless additional organic matter was applied to these areas. The same would be true with using single-lift soil salvage and replacement method at the sites mentioned above. This would mix soil horizons and thereby reduce organic matter content in first-lift replaced soil at these sites.

To minimize these impacts, MMC would complete soil tests before seeding to determine the appropriate fertilizer rates required for successful reclamation. Fertilizer and mulch would be applied on respread soils at the time and before seeding, and nitrogen fertilizer would be broadcasted over the soil surface after seeding early in the subsequent growing season. MMC's proposed soil testing program to identify fertilizer and other possible soil amendment needs, and taking corrective actions in areas of poor plant growth would help offset nutrient deficiencies in respread soils in the short term, and then when vegetation became re-established and soil building processes began on reclaimed areas, nutrient levels would eventually reach predisturbance levels.

Alternative 2 - Chemical Characteristics

Seeps from soil stockpiles in forested regions in other parts of Montana have indicated elevated levels of iron and manganese (USDA Forest Service and DEQ 2001). The levels of tannic acids increase and soil pH is reduced due to the breakdown of coniferous forest vegetation in the stockpiles. Low pH and increased levels of iron and manganese can result in complex nutrient deficiency and/or phytotoxicity problems in many plant species (Kabata-Pendias and Pendias 1984). Reduced plant growth and/or mortality would slow or severely impair reclamation. Applications of composted organic matter have helped improve plant growth on reclaimed sites with affected soils (Environmental Protection Agency 2007d). MMC has proposed to apply straw mulch but would test areas with poor plant germination and/or growth to determine causes of unsuccessful revegetation and then take corrective actions.

3.19.4.3.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

To better preserve the natural soil profile, double-lift soil salvage and replacement would be used at most disturbances, including the Poorman Tailings Impoundment Site, Libby Plant Site, and along access roads that already have existing cleared areas to store additional soil or that are near other soil stockpile areas. Single-lift salvage and replacement would be used along road segments that do not have existing cleared areas large enough to store two lifts of soil or that are not near other soil stockpile areas. Where single-lift salvage and replacement would be used for access roads, the soil profile on reclaimed access roads would be more severely impacted and require more time to rebuild than at areas reclaimed using double-lift soil replacement method. Over time, natural processes would rebuild a new soil profile that may or may not resemble the predisturbance condition. The loss of soil development and the time needed to redevelop a new soil profile would be an unavoidable impact of soil disturbance.

To minimize compaction, all salvaged soils would be handled at the low moisture content, and all disturbed areas that have been re-soiled and are to be seeded would be scarified to a depth of 6 to 12 inches before seeding to minimize compaction and improve seed establishment. The entire tailings impoundment and severely compacted areas, such as roads, soil stockpile sites, and facility sites would be ripped up to 18 inches deep with dozer ripping teeth before soil replacement to reduce compaction and break up surface crust to facilitate water infiltration and enhance rooting depth. Soil compaction would be short-term in all disturbed areas with these mitigation measures, and following reclamation compaction in re-spread soils that are ripped would be similar to pre-mine soils.

Where redistributed soils cover non-native material, such as the entire Poorman Tailings Impoundment and if any waste rock storage areas remained at the end of mining, an average of 24 inches of soil would be replaced in two lifts to provide sufficient rooting depth. Other reclaimed sites in Montana have shown that 24 inches of re-spread soil provides sufficient rooting depth (Plantenberg, pers. comm. 2006).

To promote the rebuilding of mycorrhizae in areas where trees are to be planted in respread soils that have been stored for prolonged periods, either an agencies-approved wood-based mulch would be incorporated into the upper 4 inches of re-spread soil (Plantenberg, pers. comm. 2006), and/or inoculated tree-planting stock with the appropriate mycorrhizal fungi would be used, or mycorrhizal fungi would be incorporated into the soil as pellets during seeding.

As mentioned earlier, organic matter in the upper few inches of native soils acts as a reservoir for phosphorus, and replaced soils that were stored for prolonged periods would lack organic matter. To enhance phosphorus and other nutrient levels and to increase organic matter levels, the upper 4 inches of re-spread soil would be amended with an agencies-approved wood-based organic amendment before planting. This also would stimulate the development of fungal based mycorrhizae in the new soil.

Because of the observed metal leaching and low pH problems from soil stockpiles containing large amounts of coniferous vegetation at other mine sites in Montana, most coniferous forest debris would be removed before soil salvage. This also would minimize soil nutrient losses, because low pH conditions can result in complex nutrient deficiency and/or phytotoxicity problems.

The additional mitigation measures of Alternative 3 for limiting the total loss of the natural soil profile, soil compaction, loss of soil biological activity, and reduction of nutrient levels would reduce the severity of these impacts when compared to Alternative 2. In addition, these measures would enhance reclamation success more than Alternative 2. Based on extensive reclamation experience of mined lands, the agencies anticipate that the mitigation measures would be highly effective.

3.19.4.3.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Modifications for Alternative 4 would be similar to the modifications in Alternative 3. The effects of these modifications would be similar as well. The difference would be the tailings impoundment would be at the same location as for Alternative 2, and would disturb 30 more acres than the tailings impoundment in Alternative 3, increasing the potential for soil loss. Other effects from the tailings impoundment would be the same as Alternative 3, because both Alternatives 3 and 4 would require 24 inches of soil to be re-spread over the entire impoundment including the top of the impoundment.

As with Alternative 3, to better preserve the natural soil profile, double-lift soil salvage and replacement would be used at most disturbances, including the same disturbances as Alternative 3 but also at the Little Cherry Creek Tailings Impoundment Site and the Little Cherry Creek Diversion Channel. Single-lift salvage and replacement would be used for some roads segments as Alternative 3.

3.19.4.3.5 Transmission Line Alternatives

Alternative A – No Transmission Line

In Alternative A, the transmission line, Sedlak Park Substation, and loop line for the Montanore Project would not be built. Soil changes in physical and chemical properties, biological activities, and nutrient levels would continue at natural rates. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

Alternative B – North Miller Creek Alternative

Changes in physical properties of the soils due to handling under the North Miller Creek Alternative, which includes the Sedlak Park Substation and loop line, would be similar to those listed in section 3.19.4.1, *Effects Common to All Action Alternatives*. The natural soil profile would be altered, there would be a loss of soil pore space (an increase in compaction), and a loss of organic matter due to mixing. Most of these changes in the soil (except alteration of the soil profile) would be short-term, in part because all access roads would have soil replaced (if soil were removed) and would be reseeded immediately following transmission line completion. Additionally, protective vegetation on road surfaces would establish more quickly because soils stockpiled for short durations are still biologically active and retain a higher level of favorable physical and chemical characteristics than soils stored for prolonged periods. To minimize soil compaction, MMC would rip access roads, if necessary, when no longer needed. Following soil replacement, the seedbed would be disked and harrowed, which would minimize compaction of the seedbed.

Soils would be salvaged in a single lift for new access roads and for some existing roads altering the natural soil profile that developed over thousands of years. The establishment of vegetation, root systems, and physical processes, such as freezing and thawing, and wetting and drying, would help rebuild a new soil profile, but this would be a long-term impact and would require a long time.

Alternative C-R – Modified North Miller Creek Alternative

Changes in physical, chemical and biological properties of the soils due to handling from road construction and interim reclamation under the Modified North Miller Creek Alternative would be similar to those listed under the North Miller Creek Alternative.

Because with final reclamation, the surface soil that had been in place for the life of the transmission line would be salvaged and then replaced after the road prism was obliterated, changes in physical and biological properties of the soils due to handling under the Modified North Miller Creek Alternative would be less than under the North Miller Creek Alternative. The natural soil profile would still be altered but not as severely, there would still be a loss of soil pore space (an increase in compaction), the loss of organic matter would be reduced due to less mixing of the soil, and the soil biological activity would be less affected. This would shorten the time to re-establish vegetation and for successful reclamation. The better soil handling methods and the fewer acres of disturbance under the Modified North Miller Creek Alternative (Table 166) would reduce the effects of impacts when compared to the effects in the North Miller Creek Alternative.

Alternative D-R – Miller Creek Alternative

Changes in physical, chemical, and biological properties of the soils due to handling in the Miller Creek Alternative would be similar to Alternative C-R.

Alternative E-R – West Fisher Creek Alternative

Changes in physical, chemical, and biological properties of the soils due to handling in the West Fisher Creek Alternative would be similar to Alternative C-R.

3.19.4.4 Reclamation Success

Factors important to successful reclamation include soil salvage and handling, vegetation removal and disposition, revegetation, and success criteria.

3.19.4.4.1 Alternative 1 – No Mine

Under Alternative 1, the Montanore Project would not be developed. Reclamation would be limited to any existing exploration-related or baseline collection disturbances. All existing exploration-related or baseline collection disturbances by MMC would be reclaimed in accordance with existing laws and permits.

3.19.4.4.2 Alternative 2 – MMI Proposed Mine

MMC's reclamation goal is to establish a post-mining environment compatible with existing and proposed land uses and consistent with the KFP. Specific goals of reclamation serve a number of purposes as described in MMC's reclamation plan (MMC 2007).

Alternative 2 - Soil Salvage and Handling

Table 165 presents a comparison of the likely disturbances in which soil would be salvaged and salvageable soil volumes of mine facilities for each alternative. The table shows salvageable volumes for first lift and second lift soil. Even though MMC proposes to use double-lift salvage at the Little Cherry Creek Diversion Channel and other potential disturbances within the Little Cherry Creek Tailings Impoundment, they do not propose to use a double-lift replacement at these sites. These second-lift soils would only be used on the tailings impoundment.

MMC proposes to redistribute 24 inches of soil on the embankment of the Little Cherry Creek Tailings Impoundment using a double-lift salvage and replacement method. Replaced soil depths on other disturbed areas would be 18 inches including the top of the tailings impoundment. The double-lift salvage and replacement would provide enhanced soil physical and chemical properties in the reclaimed surface soil layer. First-lift soils would have more favorable conditions for revegetation establishment, such as higher organic matter content, higher nutrient levels, and better soil structure, which has higher porosity that facilitates plant root development. This practice attempts to salvage and replace some of the natural soil profile characteristics that developed on the site since the last major climatic change.

Total soil disturbance of the Little Cherry Creek Tailings Impoundment would be 620 acres (Table 165). Soils in the impoundment area, in part, would be replaced based on soil erodibility and slope steepness. For example, the least erodible colluvial/glacial soils having the greatest rock fragment content would be used as subsoil (15 inches thick) on the embankment of the impoundment to minimize erosion potential. Rock fragments reduce the erodibility of soils by anchoring the surface. First-lift soils, would consist of both rocky and non-rocky surface soils, and would be used as surface soil over the entire impoundment including the embankment. Soil replacement on the embankment would be in two lifts; 15 inches of rocky subsoil on bottom followed by 9 inches of surface soil on top. Over the rest of the impoundment MMC proposes soil replacement in two lifts; 9 inches of second-lift soil followed by 9 inches of first-lift soil. If MMC did not use rocky soil for the upper 9 inches on the tailings embankment, erosion of the surface may occur and expose the less fertile subsoil. If this happened, successful reclamation on the tailings embankment may not be achieved.

The tailings material on the top of the impoundment would be composed of sands and silts that would not be phytotoxic (lethal or damaging to plants). It is likely that this material, especially the silts, would become hard and compacted upon drying. Without scarification or deep ripping before soil placement, this fine tailings material could become an effective barrier to root penetration and could affect long-term establishment of deep rooted plants such as trees and shrubs. Because tailings on the dam face would be coarser and because MMC proposes to deep rip the dam face before soil placement, a physical rooting barrier on the dam face would not be an issue.

Material below salvageable soil depths from borrow areas that occur outside the footprint of the Little Cherry Creek Tailings Impoundment would be used for construction on portions of the Saddle Dams, Starter Dam, Seepage Collection Dam, or toe dike. These borrow areas would create about 419 acres of disturbance (Table 165), and have an average of 14 inches of salvageable soils. About 282 acres of soil in this area have not been mapped at a site-specific intensive level. In addition, about 44 acres of soil in other disturbances in the impoundment area and 139 acres of road disturbance requiring soil salvage and replacement have not been mapped at an intensive level. Not mapping the soils at an intensive level before salvage may result in not salvaging all suitable soil and/or salvaging some unsuitable soils, such as soils having low pH conditions. If unsuitable soils were used as re-spread soils, plant establishment may be adversely affected.

The total disturbance for the Ramsey Plant Site would be 49 acres. Salvageable soil depths at the site are about 24 inches, of which MMC proposes to salvage 18 inches in one lift. The total disturbances for the Little Cherry Creek Diversion Channel would be 40 acres. Salvageable soil depths along the Diversion Channel are about 13 inches, of which MMC proposes to salvage about 9 inches in one lift. The total disturbance from roads would be about 153 acres, on which MMC proposes to salvage and replace soils in one lift. Not utilizing the double-lift salvage and replacement method would mix the relatively organic-rich and nutrient-rich surface soil layer with the poorer quality subsoil layer and place more unproductive soil on the surface. Plant establishment may be reduced and could take longer for reclamation success to be achieved.

The total soil disturbance for the LAD Areas 1 and 2 would be 31 acres. The disturbed areas at the LAD Areas would include ponds, embankments, ditches, soil stockpile areas, and access roads. LAD Area 1 also would include a waste rock disposal area. LAD Area disturbances would require soil salvage (except soil stockpile areas) and reclamation. The larger areas used for land application and disposal would require only selective thinning of trees, access road construction, and little soil removal. Salvageable soil depths at LAD Areas average about 9 inches, but MMC would respread 18 inches of soil over the disturbances at LAD Areas. Some soil likely would be hauled from elsewhere to compensate for the shortage of salvaged soil at LAD Areas. Impacts to reclaimed disturbances at the LAD Areas would be the same as other areas not having a double-lift soil replacement.

Many of the impacts resulting from soil salvage and handling would be moderate in the long term for comparable stability and utility determinations. Long-term effects could occur on the embankment of the Little Cherry Creek Tailings Impoundment if surface erosion occurred and exposed subsoil. Long-term effects could occur on the top of the impoundment if the surface were not ripped to break up any rooting barriers, at areas where unsuitable soils may be used, and at areas where the double-lift soil replacement were not used.

Alternative 2 - Vegetation Removal and Disposition

MMC has not proposed any special plan to deal with vegetation removal and disposition other than harvesting trees and burning slash. This may result in the loss of a source of native plant materials, less organic debris that could be used for BMPs, and loss of potential non-coniferous organic enrichment in stockpiled soils. Opportunities to enhance reclamation success could be lost. If too much coniferous forest debris were left on the soil and salvaged with the soil, soil pH in the stockpiles could be reduced.

Alternative 2 - Revegetation and Success Criteria

MMC has developed two final seeding/planting mixes to accommodate the differences in disturbance areas and an interim seed mix (MMC 2007). These mixes would be dominated by native species, but some introduced species would be included. Introduced species may hinder colonization of native species and could spread off the reclaimed areas. Before reclamation, MMC would submit seed mix information to the lead agencies, so that the agencies would have an opportunity to adjust seed mixes as appropriate for site conditions and to meet any KFP changes. If the agencies required removal of introduced species from seed mixes, the adverse long-term effects that introduced plant species would have on reclaimed sites and surrounding areas would be reduced.

Trees and shrubs would be planted on steeper slopes of the Little Cherry Creek Tailings Impoundment throughout the project life as areas were reclaimed, on cut-and-fill slopes at the Ramsey Plant Site, the Libby Adit Site, and portions of LAD Areas. MMC would plant trees and shrubs at the end of operations on all other disturbances including the top of the impoundment and waste rock dumps, if present at the end of operations. Trees and shrubs would not be planted on the Rock Lake Ventilation Adit, soil stockpile sites, portal patios, and along road corridors. In these areas, reforestation would occur by natural regeneration. This approach would increase the time needed to achieve a natural looking setting, to provide screening, and to achieve important wildlife habitat components. A well-established grass cover in these areas likely would retard the establishment of volunteer trees. It may take up to 20 years for settling to stop and to complete redistributing soil on top of the tailings impoundment. Delaying tree and shrub planting on top of the tailings impoundment would delay development of wildlife habitat.

MMC's proposed 18 inches of re-spread soil on top of the tailings impoundment, rather than 24 inches, and not ripping the tailings surface to break up surface crusting before soil placement may hinder tree root growth and overall growth rates likely would decline. Root systems would eventually penetrate the tailings, but the mass of roots likely would be concentrated in the upper 18 inches of soil, resulting in slower growing and possible stunted trees over time, and trees would likely be more prone to wind throw.

MMC proposes to plant 435 trees per acre; based on a survival rate of 65 percent, the final anticipated stocking rate after 15 years would be about 283 trees per acre. Shrubs would be planted at a rate of 200 stems per acre. The proposed planting rates may not meet overall wildlife or density recommendations by the agencies, and would require many years before stem densities on reclaimed sites have similar densities to that of surrounding landscapes.

The proposed planting plan includes the spacing of trees and shrubs to be continuous on slopes in strips alternating with strips that would be seeded with an herbaceous understory mixture, or would be spaced in randomly placed groupings on level to gently sloping areas. Planting in alternating strips would not match surrounding landscape features, would not meet visual quality objectives and may allow for noxious weed establishment along the planting strips.

If feasible, MMC would consider collecting seed or plant materials onsite to ensure the genetic adaptation of planting stock to local environmental conditions, and inoculating soils used for planting trees and shrubs with mycorrhizae. This would enhance the chances for survival, growth, and reproduction, which are necessary for long-term successful reclamation.

In summary, MMC's revegetation plan may affect long-term reclamation success and results. Potential effects include the introduction of non-native plant species, extended establishment time for trees and shrubs in some areas, and reduced woody plant densities. The potential for the spread of noxious weeds may also increase.

Part of MMC's reclamation goals include revegetation success criteria, which are anticipated to be met after a 3 to 5 year monitoring period. These success criteria include:

- Total plant cover would be at least 80 percent of the total cover of a specific control site or would meet a 70 percent total cover basis with at least 60 percent consisting of a live plant community
- There would be no more than three acceptable plant species that dominate a site based on the seed mix or natural plant community in the area, and noxious weeds would not be more than 10 percent of the plant community
- There would be no rills and gullies greater than 6 inches deep and/or wide

If any success criterion were not met after 3 years of monitoring, MMC would access the problems and correct any deficiencies of seed types, techniques or methods and take corrective measures. This process would continue until all revegetation goals were met.

3.19.4.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Short- and long-term reclamation objectives would remain the same as for Alternative 2. Modifications and their effects on soil salvage and handling, vegetation removal and disposition, revegetation, and success criteria are discussed below.

Alternative 3 - Soil Salvage and Handling

Soil would be salvaged and replaced in all disturbed areas, with the exception of soil stockpile areas, slopes greater than 50 percent, and cut slopes in consolidated material. Where redistributed soils cover non-native material such as the entire Poorman Tailings Impoundment and waste rock piles (if remaining at end of mine life), the replaced soil depth would average 24 inches using two lifts. This would produce soil depths more comparable to pre-mine conditions and would increase the likelihood of successful revegetation. Research generally has shown that replacement of 24 inches of soil over suitable mine waste rock would produce maximum plant productivity (Coppinger *et al.* 1993). At all other disturbances, soil replacement depths would average 18 inches. Double lift salvage and replacement also would occur at all disturbances requiring soil salvage and replacement except for some road segments and at the Upper Libby Adit, which would have 1 acre of disturbance and there would be no suitable second-lift soil. Double-lift soil salvage and replacement would be used along access roads that already have cleared areas to store additional soil or that are near other soil stockpile areas. To minimize disturbance size and tree removal, single-lift salvage and replacement would be used along road segments that do not have existing cleared areas large enough to store two lifts of soil or that are not near other soil stockpile areas. The lead agencies would identify road areas where double-lift soil salvage and replacement would be appropriate. Reclamation would be enhanced by salvaging some soils to greater depths to provide sufficient salvageable soil volumes to achieve the soil replacement goals for all potential disturbances.

About 47 acres of soil at Borrow Area 2 and the potential rock borrow area, all soils at the Libby Plant Site (106 acres), about 105 acres of soil at other potential disturbances within the Poorman Tailings Impoundment Site, and about 107 acres of soil along roads have not been mapped at an intensive, site-specific level. Before any soils would be salvaged, intensive soil surveys would be conducted in these areas to ensure the most suitable soil and necessary volumes of soil were salvaged.

Other modifications of soil salvage and handling have been discussed in section 2.5.2.5.2, *Soil Salvage and Handling Plan*. These other modifications along with thicker soil replacement depths at most disturbances, and the most suitable soil and maximum volumes would be salvaged, would help to ensure both short-term and long-term successful revegetation.

Alternative 3 - Vegetation Removal and Disposition

A Vegetation Removal and Disposition Plan that would evaluate the potential uses of vegetation removed from areas to be disturbed and would describe disposition and storage plans during mine life would be prepared. This plan would result in the maximum use of native plant materials and organic debris to enhance reclamation success. Where possible, slash of non-coniferous forest debris from timber-clearing would be salvaged and chipped to be used as mulch or as an additive to stored surface soil stockpiles. Because of the observed metal leaching from soil stockpiles containing large amounts of coniferous vegetation at other mine sites in Montana, coniferous forest debris would be removed before soil removal.

Alternative 3 - Revegetation and Success Criteria

Revegetation and success criteria would be developed for all reclaimed areas. These criteria would help ensure revegetation was successful over both the short and long term, that noxious weeds did not exceed unacceptable levels, and desired cover densities were achieved and sustained in the long term.

Alternative 3 would include more stringent requirements for mine reclamation than Alternative 2 (Table 167). A 20-year revegetation monitoring period after reseeding would be required, if necessary, under Alternative 3 to better ensure that revegetation requirements have been achieved. A longer monitoring period also would provide additional time to take corrective measures if revegetation goals had not been met.

Table 167. Mine Reclamation Requirements by Alternative.

Reclamation Requirement	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Tailings Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Tailings Impoundment Alternative
Seed Mix	Native and introduced species; interim and permanent seed mixes	Native; permanent seed mix only	Same as Alternative 3
Tree/Shrub Density After 15 Years	283 trees/acre (assumes a 65% survival rate of 435 trees/acre planted) Unspecified (200 shrubs/acre planted)	400 trees/acre 200 shrubs/acre	Same as Alternative 3
Noxious Weeds	No more than 10% noxious weeds	Less than or equal to the cover of noxious weed species present on agency-approved disturbed/reclaimed control sites in the area	Same as Alternative 3
Total Cover	60% live vegetation cover or 70% of disturbed/reclaimed control site total cover	80% of disturbed/ reclaimed control site total cover	Same as Alternative 3
Monitoring Plan	3 consecutive years of revegetation success	20 years	Same as Alternative 3
Total Acres of Vegetation Disturbance	2,582	1,539	1,886

†Priority weeds described in KFP; see Table 183.

The reclamation requirements for Alternative 3 would increase the minimum vegetation cover required after reclamation compared to Alternative 2. A total of 80 percent cover would be the goal compared to 70 percent for Alternative 2. Alternative 3 would require a sufficient planting of trees and shrubs to achieve 400 trees and 200 shrubs per acre living after 15 years, except in wetlands and meadows. Compared to Alternative 2, this would increase woody plant density. Woody plant densities under Alternative 3 would better match surrounding landscape features and would meet wildlife and density recommendations provided by the agencies.

All seed mixes would be revised so that mixes would be composed of species native to northwestern Montana (if commercially available) instead of a seed mix that that includes introduced species as proposed in Alternative 2. This would reduce the spread of aggressive introduced species both in reclaimed sites and nearby sites, and enhance the conditions for re-establishment of native species.

Rather than planting trees and shrubs along strips as proposed in Alternative 2, trees and shrubs would be planted by hand in random patterns to better resemble natural surroundings. Planting in random patterns along with increased woody plant densities, would return reclaimed sites to more natural conditions in less time than under Alternative 2.

Surface soil would be amended before seeding with an agencies-approved wood-based organic amendment to raise soil organic matter levels to a minimum of 1 percent by volume. This would increase water holding capacity of the soil, enhance nutrient levels, stimulate biological activity in the soil, and thereby, help ensure successful revegetation.

3.19.4.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Short- and long-term reclamation objectives would remain the same as for Alternative 2. Modifications to soil salvage and handling, vegetation removal and disposition, revegetation, success criteria, and monitoring are the same as described above in Alternative 3, with a few modifications described below.

Alternative 4 - Soil Salvage and Handling

In Alternative 4, as under Alternative 3, where redistributed soils cover non-native material such as the entire Little Cherry Creek Tailings Impoundment Site and waste rock piles (if remaining at end of mine life), the replaced soil depth would average 24 inches using two lifts. Sufficient salvageable soil volumes are available to achieve the soil replacement goals for all potential disturbances.

The soils at the Libby Plant Site (same as Alternative 3), about 24 acres of soils in the southwestern portion of the Borrow Area outside the impoundment footprint, 19 acres of soil at other potential disturbances within the Cherry Creek Impoundment Site and about 106 acres of soil along access roads have not been mapped at an intensive, site-specific level. Before any soils would be salvaged, MMC would conduct intensive soil surveys in these areas to ensure that the most suitable soil and necessary volumes of soil were salvaged. In addition, a two-lift soil salvage and replacement method would be conducted at the Libby Plant Site, along some portions of access roads, at other disturbances within the Little Cherry Creek Impoundment Site, and at the Little Cherry Creek Diversion Channel.

Other modifications of soil salvage and handling incorporated into Alternatives 3 and 4 have been discussed in section 2.5.2.5.2, *Soil Salvage and Handling Plan*. These modifications along with the modifications mentioned above would help ensure successful long-term revegetation.

3.19.4.4.5 Alternative A – No Transmission Line

In Alternative A, the transmission line, Sedlak Park Substation and loop line for the Montanore Project would not be built. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that do not affect National Forest System lands. Effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

3.19.4.4.6 Alternative B – MMC Proposed North Miller Creek Alternative

Alternative B - Soil Salvage and Handling

Soils would be salvaged and replaced using a single-lift method and would be handled in the same manner as explained in Alternative 2. Not using the double-lift salvage and replacement method would mix relatively organic-rich and nutrient-rich surface soil with poorer quality subsoil and place more unproductive soil on the surface, which could delay successful reclamation. Where soils are salvaged from new access roads, the soil would be stored adjacent to the disturbance.

Roads opened or constructed for transmission line access would be closed after the transmission line had been built. The road surfaces would be reseeded as an interim reclamation activity designed to stabilize the surface. Where soil had been salvaged from new roads, the road surface would be covered with soil and then reseeded. The new road prism would remain until the transmission line was removed at the end of operations. After the transmission line was removed, all newly constructed roads would be recontoured to match the existing topography, obliterating the road prism, and reseeded.

Alternative B - Vegetation Removal and Disposition

MMC has not proposed any special plan to deal with vegetation removal and disposition other than harvesting trees and burning slash. This could result in the loss of a source of native plant materials, less organic debris for BMPs such as slash filter windrows or use of chipped non-coniferous wood debris, and loss of potential organic enrichment in stockpiled soils. Opportunities to enhance reclamation success could be lost.

Alternative B - Revegetation and Success Criteria

At the end of the mine life and following redistribution of soil, all access roads would be reseeded with the same seed mixes as in Alternative 2. MMC has not proposed to plant trees on reclaimed access roads and other disturbances where trees were removed such as line stringing and tensioning sites, slash burn piles, and construction pads. MMC's revegetation plan for the transmission line access roads would have the same long-term effects as under Alternative 2, including the spread of introduced plant species, the additional years required for trees and shrubs to become established on reclaimed road surfaces and other disturbance sites, and the potential for spreading noxious weeds. The revegetation, success criteria, and monitoring would be the same as under Alternative 2.

3.19.4.4.7 Alternative C-R – Modified North Miller Creek Alternative

Alternative C-R - Soil Salvage and Handling

Under the Modified North Miller Creek Alternative, soil salvage and handling would be the same as under Alternative B for road construction and for interim reclamation. The effects on soils also would be the same.

For final decommissioning of access roads, the surface soil that had been in place on access roads for the life of the transmission line would be salvaged, the road prism obliterated, and then the surface soil replaced. The surface soil that had been in place for the life of the transmission line would have higher nutrient levels, higher organic matter content, and greater microbial activity than the underlying soil, and it would be a seed source for the native plants that had established over the life of the transmission line. This would shorten the amount of time for vegetation to re-establish. The depth of surface soil salvage would be determined by the lead agencies before final reclamation. Other soil handling methods would be in the same manner as under Alternative B.

At the end of operations, mycorrhizae and the agencies-approved wood-based mulch would be incorporated into the upper 4 inches of soil to raise the soil organic matter levels to 1 percent by volume in the recontoured road surfaces. This would shorten the amount of time to successfully reclaim all transmission line access roads.

In Alternatives C-R, D-R, and E-R, wooden structures would be used (wooden monopoles would be used for a 0.5-mile segment of Alternative E-R). Wooden poles would be treated to reduce decay; a typical preservative contains sodium, copper and petroleum compounds. Typically, soil contamination surrounding a pole is minor and does not extend beyond 10 to 24 inches away from the pole (Arisi *et al*. 2006; Brooks 1998).

Alternative C-R - Vegetation Removal and Disposition

As described in section 2.5.2.5.2*, Vegetation Removal and Disposition Plan*, a Vegetation Removal and Disposition Plan would be prepared that evaluates the potential uses of vegetation removed from areas to be disturbed. This plan would result in the maximum use of native plant materials and organic debris for BMPs to enhance reclamation success.

Alternative C-R - Revegetation and Success Criteria

Trees would be planted in all areas where trees were removed for the construction of the transmission line including access roads and other disturbances such as line stringing and tensioning sites, slash burn piles, and construction pads. Trees would be planted at a density that at the end of 5 years the approximate stand density of the adjacent forest would be attained at maturity. This standard would not apply to roads placed in intermittent stored service, but would apply when the roads would be decommissioned after the transmission line was restored. Planting trees in disturbances would require less time for trees to become establish, would better match surrounding landscape features, and would meet wildlife and density recommendations provided by the agencies.

All seed mixes for both interim reclamation and final reclamation would be revised so that mixes would be composed of species native to northwestern Montana and not contain introduced species. This would reduce the spread of aggressive introduced species both in reclaimed sites and nearby sites, and enhance the conditions for re-establishment of native species. The monitoring plan, revegetation, and success criteria (except tree and shrub densities) would be the same as under Alternative 3.

3.19.4.4.8 Alternative D-R – Miller Creek Alternative

For the Miller Creek Alternative, effects and modifications to soil salvage and handling, vegetation removal and disposition, revegetation, and success criteria would be the same as for Alternative C-R.

3.19.4.4.9 Alternative E-R – West Fisher Creek Alternative

For the West Fisher Creek Alternative effects and modifications to soil salvage and handling, vegetation removal and disposition, revegetation, and success criteria would be the same as for Alternative C-R.

3.19.4.4.10 Effectiveness of Agencies' Mitigation Measures

MMC's implementation of the agencies' numerous mitigations regarding soil salvage, stockpiling, and replacement, vegetation removal and disposition, and revegetation procedures described in Chapter 2 would be effective in ensuring all lands disturbed by mining were reclaimed to a post-mine land use and to comparable stability and utility. Salvage of 3 feet of wetland soils for use at wetland mitigation sites would be effective in providing suitable soils for wetland creation.

3.19.4.5 Cumulative Effects

Cumulative effects include the combination of direct and indirect effects from past, present, and reasonably foreseeable activities. Direct, indirect, and cumulative effects on soils are measured within each activity area. Existing system roads and designated landings on National Forest transportation system are considered dedicated lands and are not part of the soils cumulative effects. The highly variable nature of soil productivity requires site-specific analyses to adequately address reclamation needs. Assessments of cumulative effects on soil productivity are retained at the site specific boundary scale. In contrast, soil processes such as erosion regime and hydrologic functions occur at a watershed scale.

Past actions, particularly road construction, timber harvest, and mining activities have increased erosion rates in comparison to undisturbed areas in the analysis area. As vegetation in timber harvest areas return to pre-harvest conditions, erosion rates have and would continue to decrease. Cumulative effects on soils from other current and foreseeable actions would be associated primarily with potential soil loss from erosion and loss of soil productivity. Other regional current and foreseeable actions that would affect soil resources include timber harvest, mineral exploration, and new road construction. These actions would potentially occur on both public and private lands. There may also be abandoned mine waste cleanup on public and private lands, and continued commercial and residential development on private lands. The primary soil disturbance of many of these activities would be from road construction and soil removal. These actions would result in an increase in erosion and sedimentation within the Libby Creek and Fisher River watersheds, and a loss of soil productivity in areas where soil was removed, stored for prolonged periods, and then replaced.

The KNF requires the implementation of BMPs for logging, mine reclamation, and road-building operations. Private landowners are not required to use BMPs. By properly implementing and maintaining BMPs, onsite erosion and potential increases in sedimentation to creeks would be minimized, and soil erosion losses would be a minor cumulative impact.

3.19.4.6 Regulatory/Forest Plan Consistency

3.19.4.6.1 Organic Administration Act and Forest Service Locatable Minerals Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources; construct and maintain all roads so as to assure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water, and other resource values; and reclaim, where practicable, the surface disturbed in operations by taking such measures as preventing or controlling onsite and off-site damage to the environment and forest surface resources.

Minimize Adverse Environmental Impact (36 CFR 228.8)

Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8 to minimize adverse environmental impacts. MMC did not propose to implement practicable measures to minimize erosion, maximize reclamation success, or minimize effect of road usage. The agencies' alternatives (Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R) would incorporate additional feasible and practicable measures to minimize adverse environmental impacts. These measures include developing and implementing a final Road Management Plan and a Vegetation Removal and Disposition Plan; increasing the salvage and replacement of suitable soil materials for reclamation; removing a majority of coniferous forest debris removed before soil removal; and salvaging disturbed wetland soils for use in constructing new wetlands.

Roads (36 CFR 228.8(f))

In all mine and transmission line alternatives, roads would be constructed and maintained to ensure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water, and other resource values. The Environmental Specifications describe how transmission line roads would be constructed and maintained to ensure adequate drainage and to minimize or eliminate damage to resource values. The agencies' transmission line alternatives would have less new road development in the watersheds of impaired streams, in watersheds of Class 1 streams, and on soils with severe erosion risk, high sediment delivery, and slope failure. The predicted delivery of sediment from roads to streams in the agencies' mine and transmission line alternatives would be less than in MMC's alternatives. At the end of operations, all mine and transmission line alternatives would have roads no longer needed for operations. The agencies' mitigation provides more specificity regarding management of roads no longer needed for operations. Such roads would be placed either in intermittent stored service or decommissioned. Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8(f) as it relates to water quality because MMC did not propose to implement practicable measures to minimize adverse environmental impacts on soils. Mine Alternatives 3 and 4 Transmission Line Alternatives C-R, D-R, and E-R would comply with 36 CFR 228.8(f) as it relates to soils.

Compliance with 36 CFR 228.8(f) regarding roads management is discussed in section 3.6.4.11.4 *National Forest Management Act/Kootenai Forest Plan* (RF-2 through RF-5), beginning on page 453.

Reclamation (36 CFR 228.8(g))

All mine and transmission lines alternative would comply with the requirements of 36 CFR 228.8(g) regarding controlling erosion, controlling surface water runoff, and isolating toxic materials. Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8(g) to implement practicable measures to prevent or control onsite and off-site damage to the environment and forest surface resources. MMC did not propose to implement practicable measures to minimize erosion and maximize reclamation success. The agencies' alternatives would include developing and implementing a final Road Management Plan and a Vegetation Removal and Disposition Plan; increasing the salvage and replacement of suitable soil materials for reclamation; removing a majority of coniferous forest debris removed before soil removal; consolidating soil stockpiles and reclaiming them incrementally; using primarily native species in revegetation and salvaging disturbed wetland soils for use in constructing new wetlands. These measures would minimize erosion and ensure reclamation success. The agencies' alternatives would comply with 36 CFR 228.(g) as it relates to soils.

3.19.4.6.2 Kootenai Forest Plan

Proposed lands allocated for the action alternatives would be reallocated to non-timber production land. Consequently, the only standards in the KFP that would apply to these lands would be the implementation of BMPs to control erosion and sedimentation. All mine and transmission line alternatives would comply with the KFP standard to use soil and water conservation practices and BMPs to minimize nonpoint source pollution. The agencies' alternatives would include more frequent BMP monitoring than MMC's alternatives.

3.19.4.6.3 State Requirements

Alternatives 3 and 4 would comply with the MMRA regarding disturbed lands being reclaimed to a post-mining land use with stability and utility comparable to that of the pre-mining landscape. Draft findings regarding compliance with MFSA requirements are discussed in the Summary, beginning on p. S-53.

3.19.4.7 Irreversible and Irretrievable Commitments

Some soil would be irreversibly lost under all action alternatives during soil removal, construction, and operation of the mine before the re-establishment of vegetation. Some soil would be irreversibly lost under transmission line Alternatives B through E-R, especially during construction and final reclamation of access roads. Soil productivity would be irreversibly lost in large areas under Alternative 2, along portions of access roads under Alternatives 3 and 4, and along transmission line access roads under all alternatives where single-lift salvage and replacement was used, because the soil profile would be altered and would require many years for soil productivity to return to pre-mine conditions. The time required to restore soil productivity would be shortened with the use of soil amendments. A minor amount of soil productivity would be irreversibly lost under all action alternatives along NFS road #278 due to widening of the road.

Irretrievable effects on soil productivity would result from prolonged soil stockpiling and at disturbances that would not be reclaimed until the end of mine life, such as at plant sites and most of Little Cherry Creek and Poorman Tailings Impoundment sites. Irretrievable effects on soil productivity would result along transmission line access roads where road prisms would remain until final reclamation of the transmission line. These irretrievable effects would be minimized with the use of fertilizers and mulches. Irretrievable effects on soil productivity would be limited at areas under Alternatives 3 and 4 where double-lift soil salvage and replacement was used. The replaced lift soils under Alternatives 3 and 4 also would have wood-based mulch and mycorrhizae incorporated into the upper 4 inches of soil. These measures would accelerate the rebuilding processes for respread soils to reach pre-mine productivity levels. Irretrievable effects on soil productivity would be limited on access roads of transmission line under Alternatives C-R through E-R with removal and replacement of the surface soil for final reclamation, and with the addition of wood-based mulch and mycorrhizae into the upper 4 inches of soil during final reclamation.

3.19.4.8 Short-term Uses and Long-term Productivity

Soil losses due to erosion would be long-term, but would return to natural rates Once vegetation is re-established and stabilized reclaimed areas, in about 3 to 5 years following reclamation. Over steepened and south- and west-facing cut slopes may require more than 5 years for the vegetation ground cover to reach predisturbance levels without soil amendments. Decreases in soil productivity would be long-term in all reclaimed areas. The degree of soil productivity losses would vary among the action alternatives and would be more severe under Alternative 2 and under transmission line Alternatives B through E-R in areas where single-lift soil salvage and replacement would be used. These areas primarily include the Ramsey Plant Site, the Little Cherry Creek Diversion Channel, mine roads, the Libby Adit Site, and all transmission line access roads. Due to mixing of soil horizons and prolonged storage, soil profile characteristics would be drastically changed over pre-mine conditions. Soil productivity would decrease under Alternative 2 on the top of the Little Cherry Creek Tailings Impoundment if 18 inches of soil were placed over crusted fine-grained tailings, which would restrict rooting depth.

3.19.4.9 Unavoidable Adverse Environmental Effects

Loss of soil development in the area would occur in all action alternatives. Soil erosion to some degree would occur under all action alternatives, even with implementation of proposed mitigation measures. The degree of effects of soil erosion would be more severe under Alternative 2 and less under Alternatives 3 and 4 because of the additional erosion control methods and the fewer acres of soil disturbance under Alternatives 3 and 4. Loss of soil productivity would be unavoidable under all action alternatives in all disturbances where soil was removed, stored, and replaced. The degree of effects on soil productivity would be more severe under Alternative 2 and under transmission line Alternatives B through E-R where single-lift soil salvage and replacement was used.

3.20 Sound, Electrical and Magnetic Fields, Radio and TV Effects

3.20.1 Regulatory Framework

3.20.1.1 Sound

Noise is generally defined as unwanted sound, and can be intermittent or continuous, stationary or transient. Noise levels heard by humans and animals depend on several variables, including distance and ground cover between the source and receiver and atmospheric conditions. Noise can influence humans or wildlife by interfering with normal activities or diminishing the quality of the environment. Noise levels are quantified using units of decibels (dB). The dBA scale begins at zero—the sound intensity at which sound becomes audible to a young person with normal hearing. Each 10 dBA increase in sound approximates a doubling in loudness, so that 60 dBA is twice as loud as 50 dBA. People generally have difficulty detecting sound level differences of 3 dBA or less.

No federal, KNF, or county regulations govern noise levels in the analysis area (Big Sky Acoustics 2006). The EPA identifies outdoor noise levels less than or equal to 55 dBA are sufficient to protect public health and welfare in residential areas and other places where quiet is a basis for use. The MDT determines that traffic noise impacts occur if predicted 1-hour traffic noise levels are 66 dBA or greater at a residential property during the peak traffic hour (Big Sky Acoustics 2006). Noise associated with the transmission line is required to be 50 dBA or less at the edge of the right-of-way in residential and subdivided areas unless the affected landowner waives this condition (ARM 17.20.1607.2 (a)).

3.20.1.2 Electrical and Magnetic Fields

"EMF" is an abbreviation for the electric field and magnetic field associated with electric power systems. In the United States, these systems and their associated transmission lines operate at a frequency of 60 hertz (Hz), and therefore create 60-Hz EMFs. EMFs occur in the environment naturally and as a result of human activity. Naturally occurring EMFs are created by the weather and the geomagnetic field. The electric power transmission and distribution system is the principal source of environmental 60-Hz EMFs. EMFs are weak except near power lines, substations, electrical machinery, and appliances.

Electric fields from power lines are created when a voltage is placed on the conductors, a step known as energizing the line. Electric fields exist in the space surrounding an energized object and have a strength measured by the unit "volt per meter" (V/m) or 1,000 volts per meter (kV/m). Electric field strength is determined by the voltage on the line and does not change with power flow. Electric field strength attenuates rapidly with increasing distance from the power line and can be reduced by trees with foliage and houses and greatly reduced by metal and other conducting surfaces.

Magnetic fields from power lines are created whenever current flows through power lines. The strength of the field is directly dependent on the current in amperes in the line but not the voltage. Magnetic field strength near electric power lines is typically measured in milligauss (mG). Similar to electric field strength, magnetic field strength attenuates rapidly with distance from the source, but unlike electric fields, magnetic fields are not easily shielded by ordinary objects and materials. Both electrical and magnetic fields are low energy, extremely low frequency fields, and should not be confused with high energy or ionizing radiation such as X-rays and gamma rays.

No federal, KNF or county regulations govern electrical and magnetic fields in the analysis area. Montana major facility siting regulations require that the electric field strength at the edge of the right-of-way be no greater than 1 kV/m in residential and subdivided areas unless the affected landowner waives this condition and that the electric field at road crossings be no greater than 7 kV/m (ARM 17.20.1607.2(d)). Montana has no regulation concerning 60-Hz magnetic fields of power lines.

3.20.1.3 Radio and TV Effects

Radio and television interference are collectively referred to as radio noise. Radio noise is a phenomenon produced by both corona and sparking and can vary greatly based on weather conditions. Television interference is significant only for foul weather conditions. Corona occurs when the electrical field at a particular point reaches a sufficiently high value to cause ionization of the surrounding air. Corona on transmission lines can cause power loss, radio, and television interference and audible noise near the transmission line.

No KNF, state or county regulations govern radio or television interference in the analysis area. The Federal Communications Commission (FCC) regulations pertaining to the prevention of radio and television interference vary by service. Such regulations are usually included in the operating requirements section for each service.

For transmission lines with normal conductor spacings and rights-of-way, a fair-weather radio interference level of about 40 decibel-microvolts per meter (dBμV/m) at a lateral distance of 100 feet from the outermost phase has been established as a guideline for identifying design criteria for a radio noise limit (Institute of Electrical and Electronics Engineers Standard 430-1991).

3.20.2 Analysis Area and Methods

The analysis area encompasses an area potentially affected by project facilities: along the Bear Creek Road south from US 2; the area surrounding the proposed mine facilities; and the area crossed by the four transmission line alternatives and associated access roads, and the Sedlak Park Substation site and loop line area.

3.20.2.1 Sound

Woodward-Clyde Consultants collected ambient noise levels measurements at the Ramsey Plant Site and the Little Cherry Creek Tailings Impoundment Site in 1988 (Woodward-Clyde Consultants 1989c). Ambient noise levels in the analysis area are unlikely to have changed significantly since 1988. Big Sky Acoustics completed two, 5-minute noise level measurements in 2005 above the Troy Mine mill and portal (Big Sky Acoustics 2006). The Troy Mine is located about 20 miles northeast of the proposed Montanore Project and uses similar underground mining and milling techniques. Big Sky Acoustics developed predicted noise level contours that would develop under various operating conditions using noise prediction software.

3.20.2.2 Electrical and Magnetic Fields and Radio and TV Effects

Power Engineers determined electrical and magnetic fields and radio and television interference for MMC’s proposed structure configuration (Power Engineers 2005a). A steel monopole structure 90 feet in height was used in the analysis. BPA's corona and field effects program was used in the calculations. A similar calculation using BPA's corona and field effects program was made for the H-frame structures that would be used in the other three transmission line alternatives (HDR Engineering 2007).

The lead agencies completed an evaluation of the potential for environmental impacts from transmission line EMFs (Asher Sheppard Consulting 2007, 2012). The evaluation addresses the current status of scientific knowledge concerning potential health effects from exposure to transmission line EMFs. For purpose of categorizing risk of exposure of a residence to EMFs, all residences within 0.5 mile, 200 feet, and 50 feet of the centerline were identified. Residences within 0.5 miles but greater than 200 feet (as the project would be constructed) are designated as Category I homes. Category I homes would have electric field strength always less than 50 V/m and the magnetic field strength always less than 1.0 mG, regardless of the pole type. Exposures in Category I homes are characterized as having "no recognized potential for a health impact from exposure to EMFs" (Asher Sheppard Consulting 2007, 2012). Montana regulations allow the final centerline to vary by up to 250 feet of the centerline (ARM 17.20.301 (21)) unless there is a compelling reason to increase or decrease this distance. Consequently, residences within 450 feet of the mapped centerline location were considered Category I. Similarly, identification of residences within the 0.5 mile corridor requires an increased distance of 2,890 feet from the mapped right-of-way centerline. Residences within 200 feet but greater than 50 feet from the centerline (as it would be constructed) are in Category II. At lateral distances from 50 feet from the centerline) to 200 feet away, the electric field strength would be no greater than 0.75 kV/m and the magnetic field strength no greater than 5 mG. This maximum electric field strength is below the level set by the Montana regulation for electric field strength and both the electric and magnetic field strengths are below the exposure levels for the general public recommended as reference levels or maximum permissible levels. Exposures at distances of 50 to 200 feet from the centerline (as it would be constructed) are characterized as having "questionable potential for a health impact from exposure to EMFs."

3.20.3 Affected Environment

3.20.3.1 Sound

Except for the Libby Adit Site, existing sound levels in the analysis area are low, characteristic of rural areas and wilderness (Table 168). Nighttime sound levels are 4 to 12 dB lower than daytime levels due to cessation of many human-related activities. Wind conditions during the monitoring period were low, less than 15 mph, eliminating wind as a significant sound source. Natural sound sources include wind, wildlife, water flow, thunder, and wind-induced noise such as the rustling of foliage. Other sound sources include vehicles, such as trucks or airplanes, and man. The overall contribution from human activities is small, and the predominant sound sources are natural. Wildernesses typically have very low noise levels. The Rock Creek Project Final EIS reported daytime noise levels at the CMW boundary of 25 to 27 dBA (USDA Forest Service and DEQ 2001).

Large-lot residential properties, ranches, and cabins are found along US 2 near Libby Creek Road (NFS road #231), Bear Creek Road (NFS road #278), the Fisher River, Pleasant Valley, and Schrieber Lake. Twenty residences or cabins are within 1 mile of the four transmission line alternatives. Most of these properties are within 0.5 mile of US 2.

Table 168. Summary of Ambient Sound Measurements.

Measurement Period	Little Cherry Creek Impoundment Site	Ramsey Plant Site
Midweek		
Day (Ld)	39.0	41.3
Night (Ln)	35.5	28.8
Average 24-hour (Ldn)	42.6	40.5
Weekend		
Day(Ld)	28.6	40.1
Night (Ln)	22.7	31.3
Average 24-hour (Ldn)	30.6	40.6

Source: Woodward-Clyde Consultants, Inc. 1989a.

3.20.4 Environmental Consequences

3.20.4.1 Sound

3.20.4.1.1 Alternative 1 – No Mine

The analysis area would continue to have quiet sound levels characteristic of rural areas and wilderness lands. Existing noise levels would not change. Activities on private land at the Libby Adit Site would remain until reclaimed in accordance with existing permits and approvals. These activities would increase ambient noise levels near the adit.

3.20.4.1.2 Alternative 2 – MMC's Proposed Mine

Construction Phase

During the Construction Phase, noise would be produced by heavy equipment, such as scrapers, bulldozers, graders, loaders, and rock trucks. The noise produced by diesel-powered equipment typically is 85 dBA at a distance of 50 feet from the equipment. Equipment noise can vary considerably depending on age, condition, manufacturer, use during a time period, and a changing distance from the equipment to a listener location. To minimize equipment noise, MMC would supplement backup beepers on surface equipment with strobe light-type warning devices and the sound level of the backup beepers would be reduced to the minimum level necessary to comply with safety regulations.

Generators would be used to supply power as the adits were developed, and each generator is predicted to produce a noise level of about 82 dBA at 50 feet. Ventilation fans would be located outside of the adit portals, and include inlet and discharge attenuators to meet a total noise level of 85 dBA at 3 feet (Big Sky Acoustics 2006). Noise from the generators and fans would extend into the CMW, reaching about 30 dBA along the ridge between Elephant Peak and Bald Eagle Peak (Big Sky Acoustics 2006). These sound levels in the CMW would be slightly above existing levels, affecting recreational users of this portion of the CMW. Noise from generators would cease after 2 to 3 years when the transmission line was completed.

Highest noise levels would be generated periodically at the Ramsey Plant Site as a result of blasting. Blasting noise near the surface during the preproduction phase is predicted to be equal to 122 dBA at 0.6 mile from the Ramsey Plant Site, and equal to the existing ambient noise level at up to about 8 miles from the site. Blasting noise would be greatest during initial adit construction; as the adits go deeper, blasting noise would decrease. The Rock Lake Ventilation Adit would be constructed from the mine to the surface. Very short-term blasting would be necessary when the adit daylighted on private land east of and above Rock Lake.

Construction Phase activities also would include: hauling of waste rock to the Little Cherry Creek Impoundment Site; excavation of borrow material from the Little Cherry Creek Impoundment Site; and construction of a Starter Dam, Diversion Channel and Seepage Collection Dam at the Little Cherry Creek Impoundment Site. Noise levels between 30 and 40 dBA would be experienced in areas within 2.5 miles of the source, depending on the topography and atmospheric conditions. Some blasting may be necessary in the upper part of the diversion channel. Elevated noise levels from blasting would be short and intermittent.

Construction truck traffic over a 1-year period to and from the Plant Site, Tailings Impoundment Site, and Libby Loadout would increase noise levels on the Libby Creek Road (NFS road #231) while the Bear Creek Road was reconstructed. Trucks with properly operating mufflers is expected to generate up to an estimated 86 dBA at 50 feet. Trucks using Jake brakes with straight pipe mufflers would produce sound levels of 98 dB(A) at 50 feet, and would be audible at distances of up to 1 mile. Similar noise levels would occur along the Bear Creek Road (NFS road #278) during the construction period. The noise effects would be similar to those of trucks transporting logs from a timber sale. These haul trucks would affect residences adjacent to the access road.

Operations Phase

Noise at the Ramsey Plant Site would be slightly less during operations than during the Construction Phase. Ore would be processed inside the mill buildings. Noise from enclosed milling operations is typically audible as a low level hum, and was measured as 49 dBA at about 328 feet near the Troy Mine plant (Big Sky Acoustics 2006). Noise levels greater than the EPA guideline of 55 dBA would occur in the immediate vicinity of the Ramsey Plant Site, but would decrease substantially with distance from the mill. For example, noise levels at the Troy Mine were 49 dBA 330 feet from the mill. Noise levels between 30 and 55 dBA would extend into the CMW to Elephant Peak and down the Ramsey Creek drainage to about the LAD Area 1 (Big Sky Acoustics 2006). At all project facilities, backup beepers on surface equipment would be supplemented with strobe light-type warning devices. The sound level of the backup beepers would be reduced to the minimum level necessary to comply with safety regulations. These sound levels in the CMW would be slightly above existing levels, affecting recreational users of this portion of the CMW.

The air-intake fan associated with the Rock Lake Ventilation Adit would be located inside the mine, and not at the portal. The walls of the raise and adit would reduce the noise from the fan at the surface. Noise level at the portal of the Rock Lake Ventilation Adit is estimated to be 16 dBA and would not be audible over ambient noise levels (Big Sky Acoustics 2006).

Noise at the Little Cherry Creek Impoundment Site and LAD Areas would be generated by heavy equipment during construction and by occasional vehicular traffic, pumps and associated equipment, and bulldozers during operations. The sound from bulldozers would be periodic. In general, the production phase noise levels are predicted to be equal to 55 dBA within about 0.2 mile of the facility, and would be equal to the lowest measured existing ambient noise level of 30 dBA within about 2.5 miles of the sites (Big Sky Acoustics 2006).

Truck and train traffic and heavy equipment would increase noise at the Libby Loadout. Loadout activities would generate sound levels similar to other operations. The increased noise levels would be less noticeable because of higher ambient noise levels.

Closure Phase

After operations cease, MMC would remove all facilities from the plant and adit sites. Reclamation at the Ramsey Plant Site, the Libby Adit Site, and the Rock Lake Ventilation Adit Site would take several years. Noise at these locations would be generated by heavy equipment during reclamation and by occasional vehicular traffic. Heavy equipment also would be used at the tailings impoundment. The decommissioning and closure period is expected to require a minimum of 10 years, and possibly up to 25 years of monitoring (Klohn Crippen Consultants 2005). Reclamation activities would generate sound levels similar to the Operations Phase. At the end of reclamation, noise levels at all project facilities would return to pre-mine levels. Traffic and activities associated with any long-term monitoring or water treatment would generate slightly increased noise levels.

3.20.4.1.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Noise sources and general magnitude of effects during all phases of operations in Alternative 3 would be similar to Alternative 2. Ventilation adits would be in Libby Creek and near Rock Lake. During construction of the adits, elevated noise levels would extend up and down the Libby Creek drainage in a similar manner as in Ramsey Creek in Alternative 2. Noise from the generators and fans would extend into the CMW, reaching about 30 dBA along the ridge between Elephant Peak and Ojibway Peak. Noise from generators would cease after 2 to 3 years when the transmission line was completed.

Construction of the Libby Plant Site would increase noise levels in the lower Ramsey Creek drainage and in the Libby Creek drainage east of the Libby Adit. Recreational users at the Libby Gold Panning Recreation Area would experience noise levels between 45 and 55 dBA.

3.20.4.1.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Noise sources and general magnitude of effects during all phases of operations at the Libby Plant Site, Upper Libby Adit Site and LAD Areas 1 and 2 in Alternative 4 would be the same as in Alternative 3. Noise effects at the Little Cherry Creek Impoundment Site would be the same as Alternative 2.

3.20.4.1.5 Alternative A – No Transmission Line

In Alternative A, the transmission line, substation, and loop line for the Montanore Project would not be built. Noise levels associated with the existing 230-kV BPA transmission line would not change. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands. Effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

3.20.4.1.6 Alternative B – MMC's Proposed Transmission Line

Noise During Transmission Line Construction, Operations, and Decommissioning

Transmission line construction would temporarily increase daytime ambient noise levels along the transmission line corridor. During the estimated 6-month transmission line construction period, construction equipment such as bulldozers, loaders, and haul trucks would generate 100 to 120 dB(A) at 50 feet. Chain saws and logging trucks used in forest clearing for the line would generate similar noise levels. These sounds would generally occur in hilly, forested areas, which would serve to reduce sound audibility. A helicopter may be used for four activities, depending on the construction contractor, structure placement, line stringing, timber harvest, and annual inspection and maintenance. Helicopters may be used for logging steep terrain. Logging may take one to two months, depending on the area logged. Structure placement and line stringing would take a week or two each. Annual inspections may take about a week. Increased noise levels would be audible to residences along US 2 (Figure 79) and recreational users at the Libby Creek Recreation Gold Panning Area and on trails along the alignment of this alternative. Similar helicopter noise would be audible during annual inspections of the line. When the line and structures were removed at mine closure, noise from helicopters, vehicles and other heavy equipment would be audible residences along US 2 and recreational users at the Libby Creek Recreation Gold Panning Area and on trails along the alignment. Some residents may perceive air pressure changes as vibrations from the helicopter use.

Because of generally low ambient background noise levels, the transmission line clearing, road construction, and line construction activities would be generally audible for about 2.5 miles, depending on the topography and atmospheric conditions. This could include the campground at Howard Lake and homes and recreational use areas along the Fisher River valley. Equipment trucks or logging trucks could extend the audible area. All off-site truck traffic would temporarily increase noise levels at residences adjacent to travel routes to and from the construction area. The effects would be similar to logging trucks transporting logs from an active timber sale area. The increased noise levels would be short-term, and would return to ambient levels when the noise-generating activity was completed.

Transmission Line Noise

The proposed 230-kV electrical power transmission line would produce soft hissing and crackling sounds in wet weather. In fair weather, these noises are virtually inaudible. During the light rains or wet snows which occur about 10 percent of the time in the analysis area, the transmission line would produce a noise level of about 50 dB(A) at the edge of the right-of-way (Power Engineers 2005a). The closest residence to MMC's proposed centerline would be about 380 feet away; two other residences along US 2 are within 450 feet from the centerline. The proposed centerline may vary up to 250 feet from the final centerline in final design. Expected noise levels at a residence about 380 feet from the centerline during a light rain or wet snows would be between 40 and 45 dBA (Power Engineers 2005a). This sound level would be slightly above naturally occurring levels and would be faintly discernible. The sound level would be less than 20 dBA during fair weather, and would not be audible over existing sounds.

Noise During Substation Construction, Operations, and Decommissioning

Noise generated during construction of the Sedlak Park Substation would be similar to construction of the mine facilities. Typical construction equipment generates noise between 60 to 70 dBA at 400 feet from the site, which is about the distance to the nearest residence. Construction would take 12 to 18 months. Because BPA's Sedlak Park Substation would not contain a transformer, there would be no audible hum emanating from the substation. Whenever breakers were to open and close, an audible noise would be heard by those in close proximity to the substation. The noise would be infrequent, occurring no more than a few times per year, and would be no louder than the noise from a shotgun blast.

3.20.4.1.7 Transmission Line Alternatives C-R, D-R, and E-R

Noise During Transmission Line Construction, Operations, and Decommissioning

Noise sources and general magnitude of effects during all phases of construction operations, and decommissioning in Alternatives C-R, D-R and E-R would be similar to Alternative B. Noise associated with BPA's Sedlak Park Substation also would be the same as Alternative B.

Selected structures would be constructed and timber harvested with helicopter. Depending on the alternative, noise levels in the upper part of the Miller Creek tributary (Alternative C-R), Miller Creek (Alternative D-R) and along West Fisher Creek and Standard Creek (Alternative E-R) would experience noise from helicopters, heavy equipment, and chain saws between the work location and staging area during construction. Similar noise levels would be audible during annual inspections, and final line decommissioning. Helicopters would be used for five activities: logging, structure placement, line stringing, and annual inspection and maintenance, and decommissioning. Logging may take one to two months and structure placement and line stringing would take a week or two each. Annual inspections may take about a week. Increased noise levels would be audible at private residences along US 2 where the alignment crosses the Fisher River, at private residences near Howard Lake in Alternatives D-R and E-R, and at a private residence along West Fisher Creek in Alternative E-R. In Alternatives C-R, D-R and E-R, recreational users at the Libby Creek Recreation Gold Panning Area and on trails along the alignment would experience higher noise levels during construction, annual inspections, and decommissioning. The increased noise levels would be short-term, and would return to ambient levels when the noise-generating activity is completed.

The alignment in the Miller Creek and West Fisher Creek Alternatives would follow NFS road #231 east of Howard Lake. At the closest location, the alignment in these two alternatives would be about 1,300 feet east of the Howard Lake Campground and about 1,000 feet east of the eastern shore of Howard Lake. Recreational users at the campground and Howard Lake would experience higher noise levels during construction, annual inspections, and decommissioning. The increased noise levels would be short-term, and would return to ambient levels when the noise-generating activity is completed.

Transmission Line Noise

All residences are more than 450 feet of the centerline of the agencies' alternatives. As part of these alternatives, the centerline would be no closer than 200 feet from any residence during final design. Expected noise levels at a residence 200 feet from the centerline during a light rain would be about 42 dBA and less than 40 dBA at 300 feet (HDR Engineering, Inc. 2007) and probably would not be noticeable over existing noise levels.

3.20.4.1.8 Effectiveness of Agencies' Mitigation Measures

The Libby Plant Site in the agencies' mine alternatives would be about 2 miles farther from the CMW than the Ramsey Plant Site proposed by MMC. The Libby Plant Site would effectively minimize noise in the CMW. The agencies' mitigation of placing the centerline no closer than 200 feet from any residence would be effective in minimizing transmission line noise effects.

3.20.4.2 Electrical and Magnetic Fields

3.20.4.2.1 Alternative A – No Transmission Line

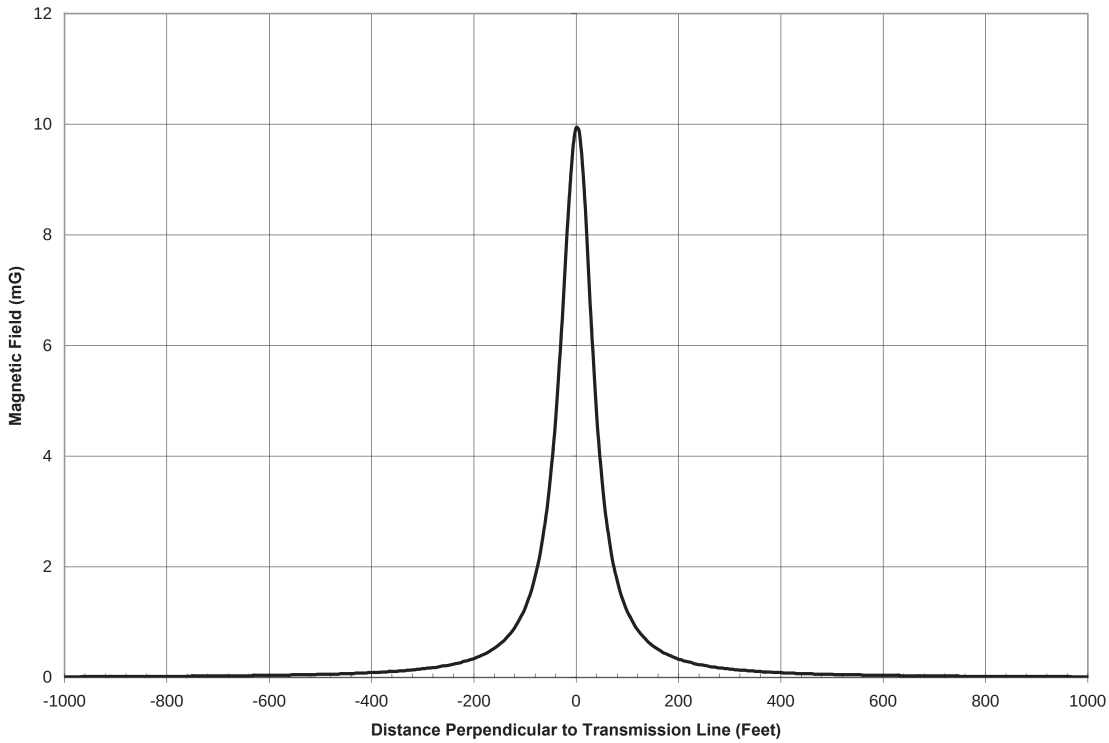
In Alternative A, the transmission line, substation, and loop line for the Montanore Project would not be built. Existing electrical and magnetic fields associated with the existing 230-kV BPA transmission line would not change. If existing residences are typical of others in the United States, average residential electric fields would be less than 10 V/m and magnetic fields of the order of 1 mG or less. EMFs of these levels are not known to have the potential for an adverse effect on health. In this alternative, the residences would have no recognized potential of an EMF health impact.

3.20.4.2.2 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Within 0.5 mile of this alignment, 14 residences are present, of which 11 are greater than 450 feet from the centerline of the right-of-way and the remaining three are within 450 feet. Because the final alignment could vary by up to 250 feet of the centerline analyzed in this EIS (ARM 17.20.301 (21)), three residences may be within 200 feet of the centerline depending on final transmission line alignment. At lateral distances from the edge of the right-of-way (50 feet from the centerline) to 200 feet away, the electric field strength would range from about 0.75 kV/m at 50 feet to about 0.05 kV/m (or 50 V/m) at 200 feet. The magnetic field strength would be about 4 mG at 50 feet and less than 1 mG at 200 feet (Chart 20). This maximum electric field strength at 50 feet would be below the level set by Montana regulation for subdivided and residential areas for electric field strength and both the electric and magnetic field strengths at 50 feet would be below the exposure levels for the general public recommended as reference levels or maximum permissible levels (Asher Sheppard Consulting 2007, 2012).

The Sedlak Park Substation would the closest electrical facility to a residence in all alternatives. The substation would be about 350 feet south of BPA's existing 230-kV centerline. The edge of the substation would be 600 feet from the residence, and the electric field strength would be less than about 0.05 kV/m (or 50 V/m) and the magnetic field strength would be less than 1.0 mG. Based on the electric and magnetic field strengths recommended in guidelines as reference levels or maximum permissible levels for the general public, and the current state of scientific research on EMFs, the substation would be categorized as having no recognized potential for a health impact from exposure to EMFs.

Chart 20. Calculated Magnetic Field Strength for MMC's Proposed Monopole Structures.



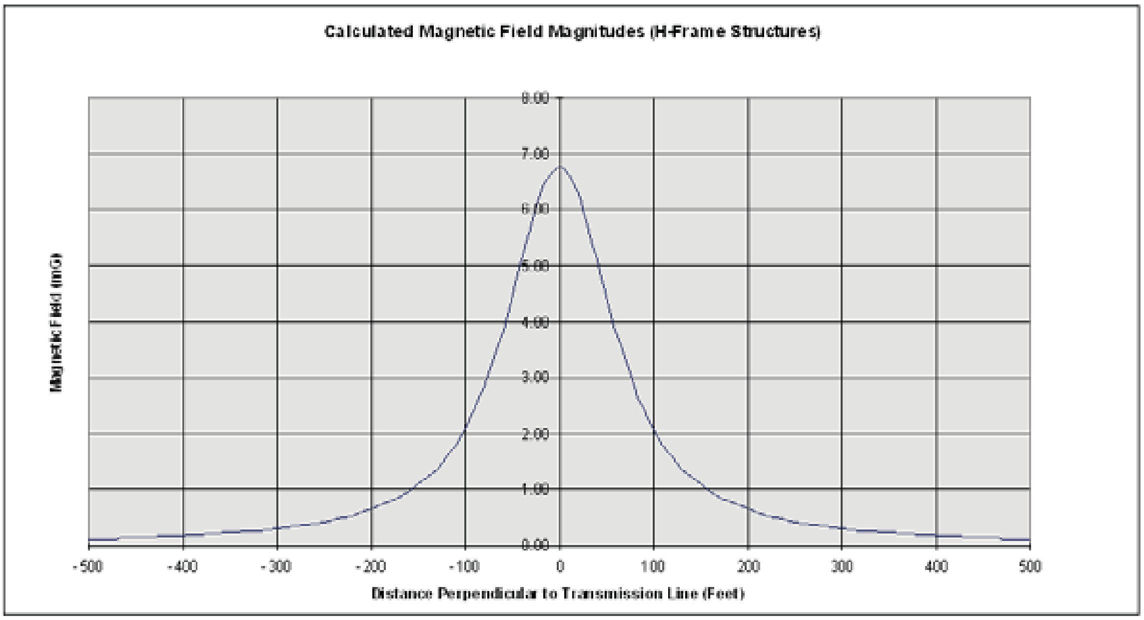
Source: POWER Engineers (2005), Fig. 5.

3.20.4.2.3 Transmission Line Alternatives C-R, D-R, and E-R

All four residences along the Modified North Miller Creek Alternative and all six residences along the Miller Creek Alternative and West Fisher Creek Alternative within 0.5 mile are greater than 450 feet from the proposed centerline. The electric field strength would be less than about 0.05 kV/m (or 50 V/m) and the magnetic field strength would be less than 1.0 mG (Chart 21). Based on the electric and magnetic field strengths recommended in guidelines as reference levels or maximum permissible levels for the general public, and the current state of scientific research on EMFs, these alternatives are categorized as having no recognized potential for a health impact from exposure to EMFs (Asher Sheppard Consulting 2007, 2012).

All residences are more than 450 feet of the proposed centerline of the agencies' alternatives. As part of these alternatives, the centerline would be no closer than 200 feet from any residence during final design. For residences 200 feet or more from the centerline, the electric field strength would be about 0.05 kV/m (or 50 V/m) and the magnetic field strength would be less than 1 mG. Based on the electric and magnetic field strengths recommended in guidelines as reference levels or maximum permissible levels for the general public, and the current state of scientific research on EMFs, all agencies' alternatives are categorized as having no recognized potential for a health impact from exposure to EMFs (Asher Sheppard Consulting 2007, 2012).

Chart 21. Calculated Magnetic Field Strength for Agencies' Proposed H-Frame Structures.



Source: HDR Engineering, Inc. 2007.

3.20.4.2.4 Effectiveness of Agencies' Mitigation Measures

The agencies' mitigation of routing the alignments in the agencies' alternatives more than 200 feet from the proposed centerline would be effective in minimizing exposure to magnetic fields. All residences are more than 450 feet of the centerline of the agencies' alternatives. As part of these alternatives, the centerline would be no closer than 200 feet from any residence during final design. All agencies' alternatives are categorized as having no recognized potential for a health impact from exposure to EMFs.

3.20.4.3 Radio and TV Effects

3.20.4.3.1 Alternative A – No Transmission Line

In Alternative A, the transmission line, substation, and loop line for the Montanore Project would not be built. Radio and TV interference associated with the existing 230-kV BPA transmission line would not change.

3.20.4.3.2 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

The transmission line would generate radio noise that may interfere with AM radio and television reception close to the line. FM broadcasts and 2-way communications generally would not be affected. The effect of the line on AM radio and TV interference would decrease rapidly as distance from the line increases. The closest residence to the North Miller Creek Alternative is 380 feet from the proposed centerline, west of US 2 (Asher Sheppard Consulting 2007, 2012). Under Montana's regulations, the proposed centerline may vary up to 250 feet from the final centerline in final design. The calculated radio interference at the closest residence of MMC's proposed centerline (380 feet) would be between 40 and 45 dBμV/m for the rain-weather condition and around 25 dBμV/m for the fair-weather condition. The calculated television interference at the closest residence (380 feet) would be about 8 dBμV/m for the rain-weather condition. A guideline for radio noise is a fair-weather level of about 40 dBμV/m at a lateral distance of 100 feet from the outermost phase (Power Engineers, Inc. 2006a).

If interference were to occur once the line was energized, MMC or the operating utility would correct the interference as required by FCC regulations and MMC's Environmental Specifications (MMI 2005b). Correction of interference would depend on site-specific circumstances. According to FCC regulations, the line must not degrade radio or TV reception beyond current levels. Typically, changes in line operation or measures such as installation of remote antennae correct most interference problems (Power Engineers, Inc. 2006a). Possible radio and TV interference problems along the transmission line typically cannot be accurately identified until the final line location and design are known.

3.20.4.3.3 Transmission Line Alternatives C-R, D-R, and E-R

The three other transmission line alternatives would use the eastern alignment and route the line east of the most of the residences along US 2. All residences are greater than 450 feet of the centerline of the agencies' alternatives and would not be affected by radio interference. The agencies' Environmental Specifications (Appendix D) would govern radio and television interference.

3.20.4.4 Cumulative Effects

Past actions and current actions, such as the activity at the Libby Adit Site, and vehicular traffic and NFS roads, have increased ambient noise levels over that of an undisturbed forest. The existing BPA transmission line also has EMF near the line. The KNF's Miller-West Fisher Vegetation Management Project will consist of vegetative treatments including timber harvest, slash treatment, site preparation, prescribed burning, tree planting, precommercial thinning, construction of new roads, road storage and decommissioning activities, road reconstruction, and implementation of BMPs. Depending on the timing of these activities and construction of the transmission line, noise from equipment and helicopters may be cumulatively greater in the Miller Creek and West Fisher Creek drainages. Many of the reasonably foreseeable actions would use the same roads as the Montanore Project. The reasonably foreseeable actions and the Montanore Project would cumulatively increase traffic noise near access roads. Cumulative noise levels would be unlikely to exceed 55 dBA. The Rock Creek and Montanore projects would not have cumulative effects.

3.20.4.5 Regulatory/Forest Plan Consistency

The applicable Montana administrative rules require that the electric field strength at the edge of the right-of-way be no greater than 1 kV/m in residential and subdivided areas and at road crossings be no greater than 7 kV/m. Calculations performed under assumptions of line operating conditions that would produce maximum strength electric and magnetic fields do not exceed these restrictions (Power Engineers 2005a, HDR Engineering, Inc. 2007). Montana has no rule or regulation concerning 60-Hz magnetic fields of power lines. Montana also requires that transmission lines be constructed in conformity with the National Electric Safety Code. All proposed transmission line alternatives would meet this requirement. In addition, MMC would be required to prevent unacceptable interference with stationary radio, television, and other communication systems as a condition of the certificate. In summary, all transmission line alternatives would comply with Montana rules concerning EMF levels and transmission line safety.

3.20.4.6 Irreversible and Irretrievable Commitments

The quiet sound levels characteristic of the analysis area would be irretrievably lost during the Construction, Operations, and Closure Phases.

3.20.4.7 Short-term Uses and Long-term Productivity

Elevated noise and EMF levels in all action alternatives would cease at mine closure and transmission line decommissioning, and would be a short-term use of the existing environment.

3.20.4.8 Unavoidable Adverse Environmental Effects

Elevated noise levels in upper Libby Creek would occur during the reclamation of the Libby Adit in the No Action Alternative. Similar noise levels would occur during construction, operations, and reclamation would occur between Libby Creek and the Cabinet Mountains in all mine action alternatives. Elevated noise from equipment and helicopter use in drainages in which the transmission line would be built would occur in all transmission line action alternatives.

3.21 Transportation

The transportation resource consists of a network of roadways that would be used during activities related to the proposed mine and transmission line. This section discusses the effects on roadway level of service and safety. Effects on public access in the analysis area are discussed in section 3.16, *Recreation*.

3.21.1 Regulatory Framework

The roads analysis complies with regulations governing the administration of the Forest Transportation System (36 CFR 212) and with the Forest Service Transportation Administrative Policy FSM Chapter 7700 (2001). The Forest Service regulations intended to help ensure that additions to the National Forest System road network are those deemed essential for resource management and use; that construction, reconstruction, and maintenance of roads minimize adverse environmental impacts; and that unneeded roads are decommissioned and restoration of ecological processes are initiated. Current Forest Service roads policy requires a science-based transportation analysis (USDA Forest Service 1999b). The Forest Service's locatable minerals regulations (36 CFR 228.8) require mine operators to construct and maintain all roads so as to assure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water, and other resource values.

KFP goals, objectives, and standards that apply to Forest System Roads (roads wholly or partly within or adjacent to and serving the National Forest System and which are necessary for the protection, administration and utilization of the National Forest System and the use and development of its resources) are discussed below. Applicable general Forest-wide goals and objectives address road densities, soil erosion, and water quality concerns. Applicable KFP standards governing roads are that development activities will be rigorously examined to ensure that the minimum number and length of roads are constructed to the minimum standard necessary. The KFP, which incorporates INFS standards, establishes stream, wetland, and landslide-prone area protection zones called RHCAs, and set standards and guidelines for managing activities that potentially affect conditions within the RHCAs. INFS standards applicable to roads are discussed in section 3.6*, Aquatic Life and Fisheries.*

US 2 is a federal highway owned and maintained by the MDT. Any modification of the existing Bear Creek Road/US 2 intersection or Libby Creek Road/US 2 intersection, and construction of an approach road to the Sedlak Park Substation would be in MDT's right of way. Approval for these activities in MDT's right of way would be under its jurisdiction.

3.21.2 Analysis Area and Methods

3.21.2.1 Analysis Area

In Alternative 2, MMC would use US 2, NFS road #278 (Bear Creek Road), 1.7 miles of new access road, and NFS road #4781 (Ramsey Creek Road) to access the plant site and tailings impoundment. About 10 miles of the Bear Creek Road (NFS road #278), from US 2 to the Bear Creek bridge, would be chip-sealed. The road width would be upgraded to 20 to 29 feet wide. US 2 would be used from Libby, Montana (US 2 milepost (MP) 32.7) to the intersection with Bear Creek Road (MP 39.7). NFS road #6210 (between Ramsey Creek and Libby Creek) would be used as an access road to the Libby Adit. While the Bear Creek Road is upgraded in the first 2 years, NFS road #231 (Libby Creek Road) would be used for access.

In Alternatives 3 and 4, MMC would use the same segment of US 2 between Libby and the intersection with Bear Creek Road, and the Bear Creek Road to the tailings impoundment site. The Bear Creek Road would be paved with hot mix asphalt, and the asphalt road surface would then be chip-sealed. The roadway width would be upgraded to two 12-foot wide travel lanes and two shoulders of 1 foot, for a total width of 26 feet. Additional widening would be necessary on curves and short segments of new road would be needed.

During transmission line construction, MMC would use US 2 from Libby to Sedlak Park (MP 58.8). Depending on the transmission line alternative selected, MMC would use other NFS roads, such as the Miller Creek Road (NFS road #385), or the Libby Creek Road (NFS road #231). Proposed road use and new road construction in each transmission line alternative is discussed in Chapter 2. None of the new roads would be open to public access; these roads would only be used by MMC for access to the transmission line.

No airports, air strips, helipads, or metal pipelines are in the analysis area; these areas are not discussed further. Ken Justice, a pilot with the ALERT Air Ambulance Service at the Kalispell Regional Medical Center indicated US 2 is not used as a corridor for helicopters and that the preferred route is the Kootenai River corridor (Justice, pers. comm. 2008). No railroads are near the mine area or transmission line corridors. Concentrate would be shipped via rail from the Libby Loadout. MMC’s concentrate shipments would be relatively small, and effects on rail traffic are not discussed further.

3.21.2.2 Methods

To establish the base traffic conditions, the amount of traffic on the roadway system during the time period of the proposed mine operations without mine-related traffic was estimated. The proposed mine traffic was then added to the base levels, and the extent to which the mine traffic affects the service level of the roadway network was then determined. Safety was analyzed by calculating the additional number of accidents that may result from the increases in mine-related traffic. Intersections within the roadway network were examined to determine if the roadways need to be modified to accommodate increased levels of traffic. Because transmission line access roads would be used most heavily during construction and line decommissioning, and traffic volumes would be relatively small and short-term, an assessment of traffic congestion and safety was not completed on them.

3.21.2.2.1 Time Period

The analysis area includes the roadways to be used by mine traffic during start up, operating, and Closure Phases. For purposes of analysis, the lead agencies assumed construction would start in 2010. Mine start up construction activities would last 3 years until 2013. The mine would operate until 2029, for 16 years. Three additional years of operation may occur.

After operations are completed, the mine would be closed. For purposes of this transportation analysis, the reclamation and monitoring activities are assumed to last 10 years, until 2039. Upon completion of mining operations, traffic volumes would be greatest during the first two years for reclamation activities. Traffic would be minimal during post-closure monitoring activities. The analyses were projected for 19 years, starting in 2010. Although actual timelines for the mine may change from the timeline proposed (for example, if construction would start in 2014 instead of

2010), the magnitude and duration of the effects of mine-related traffic on the transportation system would remain relatively the same.

3.21.2.2.2 Traffic Volumes

MMC provided estimates of mine-related daily traffic volumes and vehicle types anticipated to use the roadway system during operation of the proposed mine (MMI 2005a, MMC 2008). The MDT and the KNF provided traffic data for US 2 and National Forest System roads. Future traffic volumes were estimated using traffic volumes in 2002 as the base year and the growth rate experienced on US 2 (1.2 percent). MMC's volumes and types were added to the traffic data supplied by the MDT and the KNF. In addition to traffic data, the MDT supplied design plans for the segments of US 2 from Libby to the Libby Creek Road turnoff; these design plans were used to complete the intersection safety analysis at US 2 and Bear Creek Road.

3.21.2.2.3 Traffic Congestion

The quality of service that a roadway provides is a measure of the amount of traffic congestion on a roadway for a particular volume of traffic. The quality of service is measured using the concept of levels of service (LOS). Six LOSs are as defined by the Transportation Research Board (TRB) in the Highway Capacity Manual. The six LOSs are A, B, C, D, E, and F, with LOS of A being the least congested, or best condition, and LOS of F being the most congested, or worst condition. Any roadway section determined to be functioning at LOS A, B or C is considered to be operating acceptably (Highway Capacity Manual 2000).

An LOS analysis was completed for US 2 and for the intersection of US 2 and Bear Creek Road. These analyses were completed for peak hour traffic during the day and represent the maximum amount of traffic congestion expected. For most of the time, the roadways would not experience the peak hour traffic used in the analysis.

For two-lane highways, such as US 2, each LOS is defined by percent time spent following another vehicle and average travel speed, as shown in Table 169. US 2 is a class 1 highway, which is a highway where efficient mobility is paramount. For intersections without traffic lights, such as the two-way, stop-controlled (TWSC) intersection at US 2 and Bear Creek Road, each LOS is defined by a range of delay times, measured in seconds that an individual vehicle will experience completing an individual turning movement during the peak hour volume (Highway Capacity Manual 2000). The LOS criteria for TWSC intersections are also shown in Table 169. The intersection of US 2 and the Libby Loadout access road was not analyzed due to the low level of anticipated use by MMC-related vehicles, which would be about one truck per hour during day shift operating hours.

The intersections of US 2 and Libby Creek Road and US 2 and the proposed Sedlak Park Substation access did not warrant analysis because the limited amount of traffic that would use them during construction activities would not affect the operation of the intersection. Congestion on Bear Creek Road and Libby Creek Road also was not analyzed because the Highway Capacity Manual analysis methods do not apply to recreational roads. A recreational road is not used for mobility, or to get from point A to point B in the fastest time, which is the basis of the two-lane highway analysis in the Highway Capacity Manual.

3.21.2.2.4 Safety

The safety of a particular section of highway is measured by the number of crashes per million vehicle miles traveled, called the accident rate. Typically, if there are no changes to a portion of

Table 169. Level of Service Criteria Used in Congestion Analysis.

Level of Service	Criteria for Two-Lane Highways in Class 1		Criteria for TWSC Intersections
	Percent Time Spent Following	Average Travel Speed (mph)	Average Control Delay (sec/vehicle)
A	< 35	> 55	0 to 10
B	> 35 to 50	> 50-55	>10 to 15
C	> 50 to 65	> 45 to 50	>15 to 25
D	> 65 to 80	> 40 to 45	>25 to 35
E	> 80	> 40	> 35 to 50
F	Applies whenever the flow rate exceeds the segment capacity		> 50

TWSC = two-way, stop-controlled.
Source: Highway Capacity Manual 2000.

highway that could affect the number of crashes and the roadway congestion is not severe, then as the amount of traffic increases, the number of accidents also increases proportionally by the accident rate. Because the proposed mine project would result in increased traffic on the area roadways, the number of accidents also may increase. The additional number of accidents that may result from the mine-related traffic was calculated for existing and future traffic conditions.

The intersection of US 2 and Bear Creek Road also was analyzed to determine if the intersection met current sight distance requirements and if turning lanes were required based on additional mine-related traffic. The sight distance and turning lane requirements for the intersection were analyzed using current MDT design criteria from the Montana Road Design Manual (MDT 2000).

3.21.3 Affected Environment

3.21.3.1 US 2

US 2 is a Non-Interstate National Highway and the northernmost U.S. highway. It provides access for eastbound and westbound travel across the continental United States. In Montana, the MDT classifies US 2 as a principle arterial.

Average annual daily traffic volumes along US 2 near the intersection of US 2 and NFS road #278 (Bear Creek Road) from 2002 through 2011 ranged from 1,740 vehicles per day in 2002 to 1,940 vehicles per day in 2010. The data were used to develop traffic growth rates for this section of roadway in the analysis (MDT 2012).

Within the analysis area, from the city of Libby (MP 32.7) to the intersection with MT 482 in the city of White Haven (MP 36.1), US 2 is a two-way, four-lane, undivided highway with a total width of 68 feet. The road consists of 12-feet travel lanes, 10-feet shoulders, and is bounded on both edges by curb and gutter. South of the intersection with MT 482, US 2 reduces in width to a two-way, three-lane, undivided highway. The eastbound direction remains at two lanes to MP 36.6. The westbound direction is a single travel lane. The roadway edges change from a curb and gutter to a shoulder and ditch section. At MP 36.6, US 2 reduces to a two-way, two-lane highway that is a total width of 46 feet and consists of 12-feet travel lanes and 11-feet shoulders. The shoulder width remains 11 feet until MP 37.4, where it reduces to 1.5 feet. The narrow shoulder condition continues to Libby Creek Road.

Proceeding east from the city limit boundary for the town of Libby, the posted regulatory speed limit is 40 mph to MP 33.4 (0.6 mile), increases to 50 mph to the end of the three-lane roadway section at MP 36.4 (east of White Haven), and increases to 70 mph for passenger vehicles, and 65 mph for trucks on the remainder of the two-lane roadway within the analysis area. The roadway surface is asphalt. Based on roadway plans provided by MDT, the roadway geometry is curvilinear and the terrain is level between Libby and White Haven and rolling east of White Haven. Initially constructed in the 1930s, the road was resurfaced and rehabilitated in 1998 and 1999.

Accident information including accident rates for US 2 from MP 39.0 to MP 40.5 was supplied by MDT. Accident information is presented in Table 170. The accident rate for US 2 between MP 39.0 to MP 40.5 is 2.33 accidents per million vehicle miles traveled for the 7-year period 2001 to 2007, higher than the statewide average. The accident rate for all rural non-interstate national highways in Montana from 2006 to 2010 was 1.04 accidents per million vehicle miles traveled. From 2007 to 2011, 16 accidents occurred near the intersection of US 2 and Bear Creek Road. Most of the accidents were due to improper or inattentive driving or wildlife on the road (MDT 2012). No data for crash rates on Bear Creek Road or Libby Creek Road are available.

3.21.3.2 NFS Road #278 (Bear Creek Road)

Bear Creek Road intersects US 2 at MP 39.7, 7.0 miles east of the Libby city limit boundary. It functions primarily as a recreational road, providing access to the KNF. The first 0.75 mile of Bear Creek Road is a two-way, two-lane roadway with a total width ranging from 18 to 20 feet. The remainder of the roadway is two-way, single-lane with a total width of about 14 feet. The first 9.5 miles is paved with hot mix asphalt, and the asphalt road surface is chip-sealed and in poor condition Bear Creek Road crosses Bear Creek at MP 9.5; the bridge across Bear Creek is 14 feet wide. The remainder of the road is a native (dirt) surface. The road is designed for speeds of 25 mph. The degree of intervisible turnouts is 50 percent; an intervisible turnout is an area designed to allow vehicles to pass and so spaced to provide visibility between the turnouts. The roadway geometry is curvilinear with various curves in several locations. The roadway profile is mountainous. The Bear Creek Road in its current alignment is owned by the Forest Service. The KNF holds easements for those segments that cross private land.

Table 170. US 2 Accident Data (MP 39.0 to MP 40.5).

Year	Total Number of Crashes	Total Number of Fatal Crashes	Total Number of Injury Crashes	Total Number of Property Damage Only Crashes
2007	5	0	4	1
2008	1	0	0	1
2009	8	0	2	6
2010	1	0	0	1
2011	1	0	0	1
Total	16	0	6	10

MP = milepost.
Source: MDT 2012.

Because the roadway is not an all-weather road (Stantus, pers. comm. 2006b), it is closed during spring frost break-up for vehicles weighing over 10,000 pounds. All types of vehicles can travel on the roadway except when mud and snow conditions limit use to 4-wheel drive (USDA Forest Service *et al.* 1992). There has been little maintenance to the roadway and several areas of the roadway have settled due to subsurface instability.

Yearly traffic volumes supplied by the KNF from 1986 through 1991 (Table 171) were used to develop traffic growth rates and peak hour traffic volumes. According to the KNF, the actual existing volumes may be lower than the provided volumes due to significant decreases in timber operations since 1991 (Lampton, pers. comm. 2006).

Table 171. Estimated Yearly Traffic on Bear Creek Road.

1986	1987	1988	1989	1990	1991
15,957	18,773	13,175	17,355	19,150	13,615

Source: Stantus 2006a.

3.21.3.3 NFS Road #231 (Libby Creek Road)

Libby Creek Road intersects US 2 at MP 42.0, 9.3 miles east of the Libby city limit boundary. It functions as a recreational road providing access to the KNF. Libby Creek Road has a two-way, two-lane width of 22 feet and a chip-seal paved surface for the first 0.5 mile. The road then narrows to a two-way, single-lane width varying from 14 to 16 feet with a gravel surface until the bridge at MP 9.2 (Lampton, pers. comm. 2006). This road segment is designed for speeds of 25 mph and the degree of intervisible turnouts is 75 percent. At MP 9.2 (intersection with Bear Creek Road) and proceeding until MP 10.6, the road changes to a two-way, single-lane width of 12 feet and maintains the gravel surface. This road segment is designed for speeds of 20 mph and the degree of intervisible turnouts is 50 percent. From MP 10.6 to the end of the road, the roadway surface is native and the two-way, single lane roadway width is 12 feet. This road segment is designed for speeds of 15 mph and there are no intervisible turnouts (USDA Forest Service *et al.* 1992). The roadway geometry is curvilinear with very sharp curves in several locations. The roadway profile is mountainous. The Forest Service does not post speed limits on the road.

Lincoln County owns three segments of the Libby Creek Road that would be used in all mine and transmission line alternatives: a 0.7-mile segment beginning at the northern intersection with US

2; a 2.8-mile segment from the intersection with the Bear Creek Road south to the intersection of NFS road #4779 near Howard Creek; and a 2.8-mile segment beginning at the southern intersection with US 2. The remainder of the Libby Creek Road is owed by the Forest Service. The KNF holds easements for those segments that cross private or State land.

The Libby Creek Road is not built to an all-weather standard and, like Bear Creek Road, is closed during spring frost break-up to vehicles weighing over 10,000 pounds. All vehicles can generally use the roadway except during snow and mud conditions when travel is limited to 4-wheel drive (USDA Forest Service *et al.* 1992). Some culverts and surfacing have been replaced in the last 5 years (Stantus, pers. comm. 2006b).

3.21.3.4 Other National Forest System Roads

The Forest Service manages all other National Forest System roads in the analysis area that would be used in the alternatives. Some roads on private and State lands would be used during transmission line construction and decommissioning. The access status of some National Forest System roads would be changed as a result of the wildlife mitigation. Table 28 and Table 29 provide a complete description of these road access changes.

3.21.4 Environmental Consequences

3.21.4.1 Congestion

3.21.4.1.1 Alternative 1 – No Mine

Without the proposed mine, traffic on US 2 from White Haven to Bear Creek Road would grow at an annual rate of 1.2 percent, increasing from a predicted 1,914 vehicles per day in 2010 to 2,401 vehicles in 2029. This would result in peak hour traffic of 288 vehicles per hour in 2010 and 361 vehicles per hour in 2029. For the entire 19-year period from 2010 to 2029, US 2 would function at LOS C in this two-lane section of the roadway, due to the limited passing opportunities and the percent of time vehicles spent following other vehicles. Between Libby and White Haven, traffic would grow at 1.2 percent annually with traffic increasing from 5,075 vehicles per day in 2010 to 6,370 vehicles per day in 2029. Peak hour traffic would be 760 vehicles per hour in 2010 and 960 vehicles per hour in 2029. This four-lane section would operate at LOS A through 2027.

The traffic on Bear Creek Road averaged 16,338 vehicles per year between 1986 and 1991 (Table 171). Assuming traffic on the Bear Creek Road increased at the same rate as traffic on US 2, average annual traffic would be 20,493 vehicles in 2010. Without the proposed mine, traffic would grow at an annual rate of 1.2 percent increasing to 25,707 vehicles per year in 2029. No improvements would be completed to Bear Creek Road under this alternative. A negligible increase in traffic volumes along the Bear Creek Road and NFS roads #4781 and #6210 would occur during ongoing activities at the Libby Adit.

Peak-hour traffic entering US 2 from Bear Creek Road would experience a LOS B through 2029. The increase in traffic also would not affect peak hour traffic turning left from US 2 onto Bear Creek Road. It would experience a LOS A during the entire 19-year period from 2010 to 2029.

3.21.4.1.2 Alternative 2 – MMC's Proposed Mine

The low volume of traffic generated by the proposed mine would not adversely affect the operation of US 2. The proposed mine would generate an additional 132 vehicles per day on US 2, including 52 trucks and six buses. US 2 would continue to function at LOS C during the peak hour period in the two-lane section during the entire 19-year period from 2010 to 2029. The additional mine-related traffic also would not affect the four-lane section of the roadway, which would still function at LOS A through 2027.

The US 2/Bear Creek Road intersection would remain at LOS B during operations with the addition of mine-related traffic to the existing traffic entering US 2 from Bear Creek Road. Peak hour traffic turning left from US 2 onto Bear Creek Road also would not experience a reduction in LOS due to the mine-related traffic and would still operate at a LOS A.

Traffic on Bear Creek Road (NFS road #278) would increase in all mine alternatives. Annual traffic would be about three times existing levels throughout the life of the mine (Table 172). To accommodate the increased traffic, about 10 miles of the Bear Creek Road (NFS road #278), from US 2 to the Bear Creek bridge, would be chip-and-seal paved and upgraded to 20 to 29 feet wide. Several short segments of the Bear Creek Road around the Little Cherry Creek Impoundment and Diversion Channel also would be realigned under this alternative. Reconstruction is anticipated to take 2 years. The reconstruction of Bear Creek Road would minimize future congestion because the roadway would be upgraded to a uniform width that would accommodate two-way traffic in separate lanes. When the mill ceased operations in the Closure Phase, traffic volumes would be substantially less than shown in Table 172.

Table 172. Estimated Traffic on Bear Creek Road (NFS road #278) with Mine, all Mine Alternatives.

Year	Estimated Annual Traffic without Mine (Vehicles per Year)	Estimated Mine Traffic (Vehicles per Year)	Estimated Traffic With Mine (Vehicles per Year)	% Increase
2010	20,493	48,048	68,541	234%
2015	21,753	48,048	69,801	221%
2020	23,090	48,048	71,138	208%
2025	24,509	48,048	72,557	196%
2029	25,707	48,048	73,755	187%

MMC would continue to plow and use the Libby Creek Road (NFS road #231) and the Upper Libby Creek Road (NFS road #2316) year-round during the 2-year evaluation program and the 1-year period during reconstruction of the Bear Creek Road. The use would increase traffic on the two roads, and would keep open roads previously closed in the winter. The addition of mine-related traffic to the existing traffic entering US 2 from Libby Creek Road in 2010 would not affect the LOS and would remain LOS B during 3-year period.

The Forest Service would require MMC to include the terms of road use in its amended Plan of Operations before using Libby Creek Road during mine evaluation and construction activities. The Plan of Operations would include the requirement for a monetary deposit for gravel replacement and conditions for dust control. Approved plan requirements for road use would be determined by the level of use anticipated by MMC.

Six roads currently open, Little Cherry Loop Road (NFS road #6212), a 1.6-mile long segment of Little Cherry Bear Creek Road (NFS road #5182), NFS road #8838, a 1-mile long segment of

Poorman Creek Road (NFS road #2317), 0.2 mile of NFS road #5170, and a 0.7-mile long segment of Ramsey Creek Road (NFS road #4781), would be gated and used for mine traffic only during operations. The gates on the Little Cherry Loop Road (NFS road #6212) and the Poorman Creek Road (NFS road #2317) would be near the intersection with the Bear Creek Road on the north end and the tailings impoundment permit area boundary on the south end. Gating the Little Cherry Loop Road (NFS road #6212) would restrict motorized access to NFS roads #5182 and #8838. The gate on the Poorman Creek Road (NFS road #2317) would be near its intersection with the Bear Creek Road south of Poorman Creek. Gating the Poorman Creek Road (NFS road #2317) would restrict motorized access to the Ramsey Creek Road (NFS road #4781) and NFS road #5170 (Figure 17).

At the end of operations, gates on formerly open roads would be removed and the roads would reopen to motorized access. An exception would be a segment of the Little Cherry Loop Road (NFS road #6212) that would be covered by the tailings impoundment and would no longer provide a loop between the Bear Creek Road. Traffic on the Bear Creek Road would increase over the long term due to the loss of the Little Cherry Loop Road beneath the impoundment and the anticipated improvements.

3.21.4.1.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Alternative 3 would have similar effects on congestion and level of service as Alternative 2. The US 2/Bear Creek Road intersection would remain at LOS B during operations with the addition of mine-related traffic to the existing traffic entering US 2 from Bear Creek Road. Creation of a supply staging area in Libby and consolidating shipments to the mine area would slightly reduce traffic from that estimated for Alternative 2 (Table 172).

The public and mine traffic would use the Bear Creek Road (NFS road #278) from US 2 to where a new Libby Plant Access Road would parallel it, in the center of the Poorman Impoundment Site near the intersection of NFS road #6201. MMC would surface the existing NFS road #278 (Bear Creek Road) from the junction with NFS road #6201 to NFS road #231 (Libby Creek Road) with 6 inches of gravel 16 feet wide. The Libby Plant Access road would be used solely for mine traffic except for two segments of the road where there would be mixed mine haul and public traffic (Figure 29). Mine haul traffic would be mine haul trucks carrying waste rock to the impoundment area from the mine adit and may exceed the 20-ton limit for vehicles on area highways. The bridge on NFS road #6212 across Poorman Creek would be removed during construction and the road south of Poorman Creek to the intersection of NFS road #278 would be decommissioned. A gate on the road would be installed near the tailings impoundment permit area boundary on the north end. Depending on timing of project construction, the KNF may need administrative access to NFS road #6212P to allow access to a gravel pit at the road's terminus. At the end of mine operations, the connection between the Bear Creek Road and the Libby Creek Road (NFS road #231) would exist via the new Libby Plant Access Road and the Poorman Creek Road (NFS road #2317). The bridge over Poorman creek on this new Libby Plant Access Road would remain for public access and use.

The Poorman Creek Road would remain open to motorized access from the intersection with the Bear Creek Road to its current closure location at the intersection of NFS road #2317B. A small parking area would provide parking for non-motorized access up Poorman Creek.

At the end of operations, gates on formerly open roads would be removed and the roads would reopen to motorized access. An exception would be a segment of the Little Cherry Loop Road

(NFS road #6212) that would be covered by the tailings impoundment and would no longer provide a loop between the Bear Creek Road. Traffic on the segment of the Bear Creek Road between Poorman and Bear creeks would increase over the long term due to the loss of the Little Cherry Loop Road beneath the impoundment. About 3.2 miles of the Ramsey Creek Road (NFS road #4781) would be barriered and closed to administrative use for grizzly bear mitigation in Alternative 3. This change would reduce administrative access to the Ramsey Creek drainage.

3.21.4.1.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would have similar effects on congestion and level of service as Alternative 2. The public and mine traffic access for Bear Creek Road would be the same as described in Alternative 3. The US 2/Bear Creek Road intersection would remain at LOS B during operations with the addition of mine-related traffic to the existing traffic entering US 2 from Bear Creek Road.

The gates on the Little Cherry Loop Road (NFS road #6212) and the Poorman Creek Road (NFS road #2317) would be near the intersection with the Bear Creek Road on the north end and the tailings impoundment permit area boundary on the south end. Gating the Little Cherry Loop Road (NFS road #6212) would restrict motorized access to NFS roads #5182 and #8838.

The Poorman Creek Road would remain open to motorized access from the intersection with the Bear Creek Road to its current closure location at the intersection of NFS road #2317B. A small parking area would provide parking for non-motorized access up Poorman Creek.

At the end of operations, gates on formerly open roads would be removed and the roads would reopen to motorized access. An exception would be a segment of the Little Cherry Loop Road (NFS road #6212) that would be covered by the tailings impoundment and would no longer provide a loop between the Bear Creek Road. Traffic on the segment of the Bear Creek Road between Poorman and Bear creeks would increase over the long term due to the loss of the Little Cherry Loop Road beneath the impoundment. About 3.2 miles of the Ramsey Creek Road (NFS road #4781) would be barriered and closed to administrative use for grizzly bear mitigation in Alternative 4. This change would reduce administrative access to the Ramsey Creek drainage.

3.21.4.1.5 Alternative A – No Transmission Line

Without the traffic related to the transmission line initial construction and continued operations and maintenance, the LOS on US 2 and related roadways would operate at acceptable levels, similar to those experienced on US 2 without the mine-related traffic. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands. Effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

3.21.4.1.6 All Transmission Line Alternatives

The traffic generated by the initial construction, continued operations and maintenance and final decommissioning of any of the transmission line alternatives would have no significant effect on the traffic congestion of the affected roadways and intersections due to the low volumes of traffic generated. Short, intermittent delays on US 2 would occur during transmission line stringing operations. Guard structures would be placed on either side of US 2 to prevent the line from failing across the highway. Similar delays would occur and similar procedures would be used on currently open NFS roads, such as NFS road #231 or #385, used in the construction of the transmission line. Similar short, intermittent delays on U.S. would occur during the initial months of construction of the Sedlak Park Substation Site. These delays would not adversely affect traffic congestion on US 2.

3.21.4.2 Safety

3.21.4.2.1 Alternative 1 – No Mine

By the end of 2010, between the eastern city limit of Libby to the town of White Haven, US 2 is projected to have experienced an estimated 7 accidents without mine traffic. For 2010, US 2 will have experienced 3 accidents from White Haven to Bear Creek Road. In 2029, the accidents between Libby and White Haven would increase to 9 accidents and 4 accidents between White Haven and Bear Creek Road. The increase in accidents would be due to the increase in traffic volumes during that same period.

3.21.4.2.2 Alternative 2 – MMC's Proposal

On US 2, the proposed mine would generate an additional 132 vehicles per day over the base traffic volume without the mine and would result in an additional 0.4 accidents per year from 2010 to 2029, for a total of 8 additional accidents over the 19-year life of the proposed mine. The increased number of accidents would be due to the increase in traffic volumes, would be short-term, and would return to a number without the mine at the end of the project.

The intersection of US 2 and Bear Creek Road meets current MDT sight distance requirements for left and right turning vehicles from Bear Creek Road onto US 2. The intersection also meets the stopping sight distance requirements for vehicles turning from US 2 onto Bear Creek Road. Turn lanes for eastbound US 2 traffic turning right onto Bear Creek Road and westbound US 2 traffic turning left onto Bear Creek Road would not be warranted based on the expected traffic volumes in 2010 or 2029. The Bear Creek Road is a public approach to US 2. MMC would evaluate the Bear Creek Road/US 2 and the Kootenai Business Park access road/US 2 intersections for the largest design vehicle and modify the intersections if the approach of either intersection did not meet the design requirements for that vehicle. The approach would be designed to maintain the transportation system level of service or safety in the analysis area.

On the Bear Creek Road and the Libby Creek Road, no accident data are available to calculate the anticipated number of accidents due to the increase in traffic from the proposed mine. On the Bear Creek Road, MMC would reconstruct the segment between US 2 and the Bear Creek bridge to a consistent two-lane width that is appropriate for two-way traffic to pass unobstructed. The minimal mine-related traffic on Libby Creek Road during the time period that Bear Creek Road was reconstructed would have no adverse effect on the safety of Libby Creek Road.

MMC would design the Bear Creek Road for speeds of 35 to 45 mph, an increase from the current design speed of 25 mph. Design exceptions for slower speeds may be needed on some curves. Mine Safety and Health Administration regulations (30 CFR 56, Subpart H) require that all mines establish and follow rules governing speed, right-of-way, direction of movement, and the use of headlights to assure appropriate visibility, and that equipment operating speeds be consistent with conditions of roadways, grades, clearance, visibility, traffic, and the type of equipment used. MMC would post warning signs for speed limits and other important road conditions and require all mine-related vehicles to follow all traffic control restrictions, such as speed. The effect of road improvements and higher speeds may lead to a slight increase in accidents. The minimal mine-related traffic on Libby Creek Road during the time period that Bear Creek Road was reconstructed would have no adverse effect on the safety of Libby Creek Road.

MMC would reconstruct the Bear Creek Road from US 2 to the Ramsey Access Road to a roadway width of 20 to 29 feet. MMC has not assessed if the easements across private land held by the Forest Service would allow for widening to the proposed width. Mine haul traffic and public traffic would share two segments of roads, a 2.5-mile segment of the Bear Creek Road between the Little Cherry Creek Impoundment Site to the Ramsey Access Road and a 0.6-mile segment of NFS road #2316 east of the Libby Adit Site (Figure 29). MMC's proposed widths would not safely accommodate mine haul traffic and public traffic. The Mine Safety and Health Administration (Mine Safety and Health Administration 1999) recommends a road width of 56 feet wide to accommodate joint-use traffic safely.

MMC would inspect the Bear Creek bridge for load capacity, but expects it would be sufficient for mine use. The bridge width, which is currently 14 feet, would be inconsistent with the width of the improved Bear Creek Road. Because mine traffic and public traffic would share the Bear Creek Road north of the Little Cherry Creek Impoundment, the narrow bridge width may lead to safety concerns. (See Alternative 3 for agency-mitigated measures to address these concerns.)

The Bear Creek Road between the intersection with Libby Creek Road and the new Ramsey Plant Access Road would not be reconstructed and would remain in its current unpaved condition.

3.21.4.2.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative and Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

These alternatives would have the same effect on the number of accidents on US 2 as Alternative 2. The roadway width would be upgraded to two 12-foot wide travel lanes and two shoulders of 1 foot, for a total width of 26 feet. Additional widening would be necessary on curves and short segments of new road would be needed. A reconstructed bridge at Bear Creek widened to 26 feet would be safer than the existing bridge. The new bridges would be long enough to convey a 100-year flow event, to comply with INFS standards and Forest Service guidance, such as fish passage or conveyance of adequate flows (USDA Forest Service 1995, 2008a).MMC would complete a preliminary and final design of the reconstructed road. If preliminary design indicates the reconstructed road would exceed the current right-of-way width across private land, MMC will make a reasonable effort during the Evaluation Phase to secure all necessary easements to accommodate the needed road right-of-way width.

Public and mine haul traffic would share 1.8 miles of road in Alternative 3 and 3.8 miles of road in Alternative 4 (Figure 38). The joint-use road segments would be widened to widths recommended by the Mine Safety and Health Administration (Mine Safety and Health Administration 1999). For a 16-foot wide haul vehicle, the road width would be 56 feet wide to safely accommodate joint-use traffic. All bridge would be reconstructed to a width compatible with the reconstructed width of the adjacent road segment. A wider road width would safely accommodate joint-use traffic.

In Alternative 3, MMC would surface the existing NFS road #278 (Bear Creek Road) from the junction with NFS road #6201 to NFS road #231 (Libby Creek Road) with 6 inches of gravel 16 feet wide (Figure 29). Similarly, MMC would surface the Bear Creek Road from new Libby Plant access road to the Libby Creek Road in Alternative 4 (Figure 38). This surfacing would ensure the safe transition from the improved section north of the new Libby Plant Access Road and the unimproved section to the Libby Creek Road.

Modifications to the intersection of US 2 and the Bear Creek Road and to the intersection of US 2 and the Kootenai Business Park access road would be required if the approach did not meet the design requirements for the largest design vehicle. Any modification to US 2 would require the approval of the MDT. This mitigation would maintain the transportation system level of service and safety in the analysis area.

Before initiating the Construction Phase, MMC would submit a traffic impact study report to the agencies and MDT that address the requirements of MDT's System Impact Action Process (Montana Department of Transportation 2007). The study would identify measures necessary to maintain safe public roads and highways and acceptable operational levels of service.

3.21.4.2.4 Effectiveness of Agencies' Mitigation Measures

Widening roads, culverts, and bridges to an appropriate width would be effective in minimizing conflict between mine traffic and other road users. Graveling a section of the existing NFS road #278 (Bear Creek Road) would be effective in maintenance requirements on the Bear Creek Road. Proper design and implementation of any necessary improvements of US 2 and its intersections that would be identified in the traffic impact study would be effective in maintaining the transportation system level of service and safety on US 2. Developing and implementing a transportation plan and a road management plan would be effective in minimizing project-related traffic and indirect environmental effects.

3.21.4.2.5 Alternative A – No Transmission Line

Without the traffic related to the initial construction and continued operations and maintenance of the transmission line, substation and loop line, the safety on US 2 and related roadways would be similar to those experienced on US 2 without the mine-related traffic. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands. Effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

3.21.4.2.6 All Transmission Line Alternatives

None of transmission line alternatives, which include the Sedlak Park Substation and loop line, would result in adverse impacts on the safety of the transportation network due to the minimal volume of traffic that would be generated by the transmission line construction, continued operations and maintenance, and final decommissioning. The approach to the Sedlak Park Substation would be designed not to affect the transportation system level of service or safety in the analysis area.

3.21.4.3 Cumulative Effects

The KNF's Miller-West Fisher Vegetation Management Project will consist of vegetative treatments including timber harvest, slash treatment, site preparation, prescribed burning, tree planting, precommercial thinning, construction of new roads, road storage and decommissioning activities, road reconstruction, and implementation of BMPs. Depending on the timing of these activities and construction of the transmission line, traffic volumes may be cumulatively greater in the Miller Creek and West Fisher Creek drainages. Many of the other reasonably foreseeable actions would use the same roads as the Montanore Project. The reasonably foreseeable actions and the Montanore Project would cumulatively increase traffic volumes near access roads. The additional traffic would not adversely affect the level of service on US 2 or lead to adverse congestion.

3.21.4.4 Regulatory/Forest Plan Consistency

All action alternatives would be consistent with the KFP standards regarding roads, regulations governing the administration of the Forest Transportation System (36 CFR 212), and with the Forest Service Transportation Administrative Policy FSM Chapter 7700 (2001). All roads to be built for the project would be constructed, maintained, and decommissioned to minimize adverse environmental impact, in accordance with the Forest Service locatable minerals regulations (36 CFR 228.8). Only the minimum number of roads would be constructed to the minimum standard necessary. Unneeded roads used during construction would be decommissioned. Compliance with 36 CFR 228.8(f) regarding roads management is discussed in section 3.6.4.11.4 *National Forest Management Act/Kootenai Forest Plan* (RF-2 through RF-5), beginning on page 453.

3.21.4.5 Irreversible and Irretrievable Commitments

All mine alternatives would increase traffic on the roadways, thereby increasing the fuel used by vehicles beyond the no-mine alternative. Fuel is a non-renewable resource; thus, an increase in traffic related to the mine alternative would result in an irreversible commitment of resources. All mine alternatives would increase the number of accidents during the mine's operation and closure. Increased accidents would be an irreversible commitment of resources.

3.21.4.6 Short-term Uses and Long-term Productivity

During the mine's and transmission line construction, operation and closure, increased traffic congestion and accidents could occur on roads and highways used in the project, and would cease at the end of the closure period.

3.21.4.7 Unavoidable Adverse Environmental Effects

During the mine's operation and closure, traffic congestion and accidents would occur on roads and highways used in the project. Increased congestion and accidents would cease at the end of the closure period.

3.22 Vegetation

3.22.1 Vegetation Communities

3.22.1.1 Regulatory Framework

The Organic Administration Act authorizes the Forest Service to regulate the occupancy and use of National Forest System lands. The Forest Service's locatable minerals regulations are promulgated at 36 CFR 228, Subpart A. The regulations apply to operations conducted under the U.S. mining laws as they affect surface resources on National Forest System lands under the jurisdiction of the Secretary of Agriculture. One of these regulations (36 CFR 228.8) requires that mining activity be conducted, where feasible, to minimize adverse environmental impacts on National Forest surface resources.

The National Forest Management Act requires the Secretary of Agriculture to promulgate regulations specifying guidelines for land management plans that "provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives…" The "specific land area" (scale) for providing diversity is established in the framework as the area covered by the Forest Plan, or the entire KNF. One of the KFP goals is to "maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species… and in sufficient quality and quantity to maintain habitat diversity representative of existing conditions" (II-1 #7). Riparian areas within the KNF are managed according to RMOs established in the INFS. The RMOs and RHCAs are discussed in section 3.6, *Aquatic Life and Fisheries*.

Sensitive species are designated by the Regional Forester (FSM 2670.5). FSM 2672.42 directs the Forest Service to conduct a biological evaluation (BE) to analyze impacts on sensitive species. The sensitive species analysis in this document meets the requirements for a BE as outlined in FSM 2672.42. FSM 2670.22 requires that the Forest Service develop and implement management practices to ensure that sensitive species do not become threatened or endangered because of Forest Service actions and maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands. Any decision on the Montanore Project cannot result in loss of sensitive species viability or create significant trends toward federal listing (FSM 2670.32). Sensitive plant species identified within the analysis area are the northern beechfern or the crenulated moonwort.

For lands affected by the transmission line, the MFSA directs the DEQ to approve a facility if, in conjunction with other findings, the DEQ finds and determines that the facility would minimize adverse environmental impacts, considering the state of available technology and the nature and economics of the various alternatives. If approved, DEQ would require that disturbances from the transmission line would be reclaimed to standards set by administrative rule (ARM 17.20.1902 (10)(b)).

The MMRA requires that lands affected by mining must meet the post-mine land uses. The DEQ evaluates in its environmental documents whether the revegetation plans for mine facilities would adequately meet the post-mine land uses.

3.22.1.2 Analysis Area and Methods

3.22.1.2.1 Analysis Area

The analysis area consists of all areas that would be disturbed by construction of the mine, transmission line, substation and loop line under any alternative (Figure 85) and streams that may be indirectly affected by changes in hydrology. The vegetation at the Libby Loadout has been completely disturbed and the loadout is not discussed further.

3.22.1.2.2 Impact Analysis Methods

Vegetation mapping for the analysis area was obtained from baseline inventories (Western Resource Development Corp. 1989d, 1989e; Westech 2005d, 2005e; Geomatrix 2009b; Hydrometrics, Inc. in MMI 2005a). Coniferous forest includes old growth forest. Old growth and previously harvested coniferous forest mapping for National Forest System lands was provided by the KNF as GIS data layers. Old growth and previously harvested coniferous forest on non-National Forest System lands was mapped based on aerial photography and field verified by KNF biologists. Where they overlapped, community types were determined in the following priority order: wetland/riparian, old growth forest, which was mapped as coniferous forest, and previously harvested coniferous forest. All areas that were not previously harvested coniferous forest or wetland/riparian were mapped as coniferous forest vegetation community.

Impacts of the mine alternatives on vegetation communities were determined by calculating the number of acres that would be disturbed. The mine reclamation plans of the alternatives also were compared. The analysis of transmission line, substation and loop line effects calculated the total acreage within the clearing width of each alternative. Actual acreage cleared would be less and would depend on tree height, slope, and line clearance above the ground. Vegetation communities affected by road construction for transmission line access were calculated for each alternative. For analysis purposes, it is assumed that minor disturbances of vegetation from staging and yarding areas and stringing, and tensioning sites would occur within the clearing width.

Because mine and adit dewatering, the pumpback well system operation around the impoundment, and other project activities may result in streamflow changes, indirect effects on riparian vegetation were assessed. Representative cross sections at important aquatic habitat locations were selected on Libby Creek (1 mile upstream of Little Cherry Creek), East Fork Rock Creek (1 mile upstream of the confluence with the West Fork Rock Creek), and East Fork Bull River (at the confluence with Isabella Creek) to collect data on vegetation communities, stream cross section widths, and velocity. Using baseline data and changes in streamflow predicted from the 3D groundwater model, changes in wetted perimeter were predicted (Section 3.11.4 *Surface Water Hydrology*) to assess effects on riparian vegetation.

3.22.1.3 Affected Environment

Vegetation communities have developed across the landscape in response to climate, disturbance, and other environmental factors. Historically, dominant forest species were a mix of long-lived species such as white pine, western larch, ponderosa pine, and whitebark pine and short-lived species such as lodgepole pine, and alpine fir. Currently, the forest stands in the analysis area are dominated by Douglas-fir, lodgepole pine, alpine fir, grand fir, and western hemlock, with lodgepole pine abundant on the higher-elevation, steeper slopes as a result of stand-replacing fire in the late 1800s and 1910. Changes in composition are due primarily to past management activities such as timber harvesting and fire suppression (USDA Forest Service 2001). Three dominant vegetation communities, mature coniferous forest; previously harvested young coniferous forest; and wetlands including riparian areas, are found in the analysis area; a total of 410 plant species were observed (Westech 2005d). Vegetation communities in the analysis area are shown in Figure 85 and summarized below.

3.22.1.3.1 Coniferous Forest

About 50 percent of the analysis area is composed of mature coniferous forest vegetation communities including unlogged areas. Mature coniferous forests have large economic potential associated with timber harvesting and provide habitat for a variety of wildlife and plant species. Timber harvesting generally occurs mainly where the dominant tree species are lodgepole pine, western hemlock, western redcedar, grand fir, Engelmann spruce, Douglas-fir, and western larch (Westech 2005d).

Stand structure within the KNF varies from new growth to old growth managed areas. Within the mature coniferous forest vegetation communities, the KNF has identified stands of old growth that are managed to maintain diversity and habitat for wildlife and plant species. Old growth ecosystems and the habitat they provide for wildlife species are described in section 3.22.2*, Old Growth Ecosystems*.

The KNF has established Vegetative Response Units (VRUs) to aggregate lands having similar capabilities and management potential and to assist the KNF in preparation of site-specific prescriptions. The VRU system can help managers interpret vegetation community response to management or natural disturbance and project future landscapes based on current conditions. The major VRUs in the analysis area are VRU5S and VRU5N, which are moderately cool and moist ecosystems (USDA Forest Service 1999c).

3.22.1.3.2 Previously Harvested Coniferous Forest

The previously harvested coniferous forest vegetation community includes all areas where trees were harvested, both intermediate harvest that maintained the existing stand or regeneration harvest that initiated a new stand. Most previously harvested areas have well-established conifer regeneration with western larch, western white pine, grand fir, and lodgepole pine. Higher-elevation areas are dominated by lodgepole pine, Engelmann spruce and subalpine fir; while mid to lower-elevation areas are dominated by western larch, Douglas-fir, lodgepole pine, and ponderosa pine. As with the mature coniferous forest vegetation type, understory composition and cover varies considerably with site conditions, elevation, tree cover, and stand age. In younger previously harvested coniferous forest areas, more introduced species and noxious weeds are present than in older harvested areas (Westech 2005d).

3.22.1.3.3 Wetlands and Riparian Areas

Within the analysis area, wetlands and riparian vegetation communities are present along most streams and rivers. Wetlands are also found in depressions at both tailings impoundment sites, and along the transmission line alternatives. Wetlands and wetland vegetation are discussed in section 3.23, *Wetlands and Other Waters of the U.S*.

Riparian areas along Fisher River, Libby Creek, and Miller Creek support several riparian/wetland vegetation communities including riparian coniferous forest, cottonwood forest, shrub thickets, and herbaceous fringes. Riparian coniferous forest includes western redcedar, western hemlock, and Engelmann spruce with understory species of ladyfern, devil's club, oakfern, common horsetail, clintonia, common snowberry, thimbleberry, Sitka alder, and Rocky

Mountain maple. Riparian cottonwood forests are present along Fisher River, where black cottonwood, Douglas-fir, and ponderosa pine are the dominant tree species with common snowberry, alder buckthorn, willow, and Wood's rose making up the understory. Other herbaceous species include introduced reed canarygrass, native fowl bluegrass, and introduced common tansy, a noxious weed. Shrub thickets are present along the Fisher River, Miller Creek, and upper elevation streams with stands of Douglas spirea, thinleaf or Sitka alder, willow, and alder buckthorn.

Riparian vegetation along the banks of Libby Creek at the cross section is mostly dominated by black cottonwood, Douglas-fir, spruce, Western red cedar, alder, and willow. At the cross sections of the East Fork Bull River and East Fork Rock Creek, the vegetation is dominated by Western red cedar, mountain maple, black cottonwood, Western hemlock, Pacific yew, and grand fir with Devil's club in the understory. These streams are fairly entrenched and are characterized by medium to large cobble.

3.22.1.3.4 Other Vegetation Communities

Other vegetation communities in the analysis area are present in small quantities (Westech 2005d). Mapping of the vegetation communities has been consolidated with more dominant vegetation communities in the analysis area. These small vegetation communities are described below.

The shrub-field vegetation community is found in avalanche chutes where rock outcrops, talus, or scree are present. The shrub-fields are periodically disturbed by avalanche and have low cover and low tree density. Shrub species include Rocky Mountain maple, Sitka alder, common snowberry, white spirea, pachistima, serviceberry, and bristly Nootka rose. For analysis purposes, the shrub-field vegetation community is included in the coniferous forest community.

The grassland community is found on steep convex ridges or slopes. Dominant grass species are natives including Idaho fescue, purple reedgrass, and elk sedge. Other common native herbaceous species are clubmoss, fescue sandwort, yellow buckwheat, Sandberg's lomatium, Alberta penstemon, and western groundsel. For analysis purposes, the grassland community is included in the previously harvested coniferous forest community.

The Libby Adit Site, which is private land, was revegetated, reclaimed, and subsequently has been redisturbed by MMC. The disturbed mining area is dominated by introduced forbs such as birdsfoot trefoil and Dutch clover. Grasses such as introduced red fescue and native big bluegrass also are present. Some native forbs and noxious weeds such as spotted knapweed have established as well as some native tree species. For analysis purposes, the area disturbed at the Libby Adit Site is included in the previously harvested coniferous forest community.

3.22.1.3.5 Agricultural Land

Agricultural land used for livestock grazing is located along the Fisher River and along the Bear Creek Access Road. Dominant species include introduced timothy, Kentucky bluegrass, orchard grass, white Dutch clover, and red clover. For purposes of analysis, agricultural land areas are combined with previously harvested coniferous forest community.

3.22.1.4 Environmental Consequences

3.22.1.4.1 Alternative 1 – No Mine

The No Mine Alternative would not remove or affect any vegetation communities or individual species. Monitoring wells installed as part of the baseline monitoring would be removed and the area reclaimed. Disturbances on private land at the Libby Adit Site would remain until reclaimed in accordance with existing permits and approvals. Introduced species would continue to increase from current disturbance areas.

3.22.1.4.2 Alternative 2 – MMC's Proposed Mine

Alternative 2 would result in the removal and loss of vegetation communities on up to 2,582 acres during mine operations (Table 173). The mature coniferous forests vegetation community would be most affected, with up to 1,617 acres disturbed. The mature coniferous forest vegetation communities include old growth stands, which are discussed in section 3.22.2, *Old Growth Ecosystems*. Previously harvested coniferous forest would be the second largest vegetation community impacted, with a disturbance of 925 acres. About 40 acres of riparian and wetland areas would be affected by Alternative 2. Alternative 2 would affect more mature coniferous forest communities and riparian areas than the other alternatives. Effects on other vegetation communities would be minor. Indirect effect on riparian vegetation along Libby Creek, East Fork Bull River, and East Fork Rock Creek would be negligible. The change in wetted perimeter would be greatest during the post-closure (year 38) with a 26 percent change in wetted perimeter on East Fork Bull River and a 9 percent change in wetted perimeter on East Fork Rock Creek. With mitigation, no detectible change in wetted perimeter is expected on Libby Creek. The species that occur along these streams are mostly woody and have a wide moisture tolerance, some of which can be found in uplands with a similar or higher frequency as in riparian zones. Although cottonwood and willow have greater soil moisture requirements, the changes in wetted perimeter would occur during low flow, which would be a small percentage of the growing season during most years. During dry years, the low flows and reduction in wetted perimeter may extend for a longer portion of the growing season and cause stress and possibly dieback in cottonwoods and willows.

Table 173. Vegetation Communities within Mine Alternative Disturbance Areas.

Vegetation Community	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
Mature Coniferous Forest	1,617	865	1,143
Previously Harvested Coniferous Forest	925	683	740
Wetland/Riparian Areas	40	17	41
Total	2,582	1,565	1,924

All units are acres, rounded to the nearest acre.
Source: GIS analysis by ERO Resources Corp. using vegetation mapping in Westech 2005d.

Areas in Alternative 2 that require vegetation clearing and removal would be subject to an overall loss of biodiversity and a change in species composition during mine operations. Reclamation would re-establish plant communities but the biodiversity would be less, introduced species would be more common, species composition would not be the same, and timber production would be lost until the seral forest re-established after several decades. Westech (2005d) documented 410 different plant species in the analysis area. After reclamation of mine disturbances, a forest can take many years to re-establish a community with a diversity of plants similar to but less than the original plant community. Competitive introduced species may limit the ability of native grasses and especially forbs to re-establish after the disturbance. A loss of timber production on 1,102 acres of National Forest System lands suitable for timber production and 278 acres of private lands would occur throughout mining (Table 174). The loss would exist until timber regenerated and reached merchantable size. The tailings impoundment areas, which would disturb about 600 acres in each mine alternative, would be managed for mineral development following operations, and would no longer be managed for timber production. The area covered by asphalt and gravel by widening the Bear Creek Road would not be returned to pre-mine timber production.

Table 174. Lands Suitable for Timber Production within Mine Alternative Disturbance Areas.

Type	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment Alternative
National Forest System Lands in Management Areas Suitable for Timber Harvest	1,102	1,016	813
Private Lands	278	23	268
Total	1,380	1,040	1,081

All units are acres, rounded to the nearest acre.
Source: GIS analysis by ERO Resources Corp. using KNF MA mapping and vegetation mapping in Westech 2005d.

The LAD Areas would experience a change in species composition during water application and may change again after water application was discontinued. If not managed properly, the LAD Areas may become dominated by species that favor seasonally saturated conditions, especially introduced species.

Interim reclamation would be used to revegetate disturbances from activities such as road cut-and-fill slopes and other temporary disturbances. In these locations, vegetation cover would return more quickly than those disturbed by mine operations. Some of the species in the interim mixture are introduced annual species. Upon completion of mining, disturbed areas would be reclaimed and revegetated. MMC's reclamation goal is to establish a post-mining environment comparable with existing conditions. The reclamation plan includes areas designated for reforestation, shrubs, or grasslands.

The permanent seed mix for Alternative 2 would be dominated by native species but quick establishing, more aggressive, non-native annual species are included in the seed mix. Over the long-term, reclaimed areas would likely have fewer native species than existing communities. MMC's monitoring plan, 3 consecutive years of revegetation success would be achieved before bond release would be requested. Loss of native species and some increase in introduced species is an unavoidable impact of allowing the mine disturbance.

3.22.1.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Alternative 3 would disturb up to 1,565 acres of vegetation (Table 173). The largest effect would be to the previously harvested coniferous forest vegetation communities (683 acres) and mature coniferous forest vegetation communities (865 acres). The impact on riparian and wetland areas would be about 17 acres and effects on other vegetation communities would be a small percentage of the disturbance. Effects on vegetation communities would be about 1,017 acres less than Alternative 2 because of a smaller Poorman Impoundment disturbance area. A loss of timber production on 1,016 acres of National Forest System lands suitable for timber production and 23 acres of private lands would occur throughout mining (Table 174). The loss of biodiversity, increase in introduced species, change in species composition, and loss of timber production on disturbed lands until forest regeneration would be similar to Alternative 2. Changes to MMC's reclamation plan, such as longer revegetation monitoring, elimination of non-native species and modification of soil salvage, handling, and replacement would facilitate revegetation of disturbed areas, minimize introduced species, and ensure long-term reclamation success. Indirect effects on riparian vegetation would be the same as Alternative 2.

3.22.1.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would disturb up to 1,924 acres of vegetation, including 1,143 acres of coniferous forests and 740 acres of previously harvested coniferous forest (Table 173). The impact on riparian and wetland areas would be about 41 acres. Effects on vegetation communities would be about 696 acres less than Alternative 2 because LAD Areas would not be used to treat excess water and the disturbance surrounding the Little Cherry Creek Impoundment would be less. A loss of timber production on 813 acres of National Forest System lands suitable for timber production and 268 acres of private lands would occur throughout mining (Table 174). Effects, including loss of biodiversity, an increase in introduced species, and a change in species composition, would be similar to Alternative 2. Indirect effects on riparian vegetation would be the same as Alternative 2.

3.22.1.4.5 Alternative A – No Transmission Line

In Alternative A, the transmission line, substation, and loop line for the Montanore Project would not be built. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands. Effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

3.22.1.4.6 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Alternative B would have the least effect on vegetation communities compared to the other transmission line alternatives because of a narrower clearing width (150 feet compared to 200 feet). The mature coniferous forest vegetation communities would be most affected by Alternative B. About 136 acres of mature coniferous forests, 133 acres of previously harvested coniferous forest, and 28 acres of wetland and riparian areas could be cleared (Table 175). Actual clearing would likely be less than that shown in Table 175 depending on tree height, slope, and line distance above the ground. Construction of new access roads for transmission line installation and maintenance are estimated to affect about 10 acres of mature coniferous forest, 5 acres of previously harvested coniferous forest, and less than 1 acre of wetland and riparian areas. A loss of timber production on 81 acres of National Forest System lands suitable for timber production and 135 acres of private lands would occur throughout the project until the transmission line was decommissioned and timber reached merchantable size (Table 176).

Table 175. Vegetation Communities along Transmission Line Alternatives.

Type†	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
Transmission Line Clearing Area				
Coniferous Forest	136	166	182	93
Previously Harvested Coniferous Forest	133	136	131	235
Wetland/Riparian	28	15	18	35
Subtotal	297	317	331	363
Areas Disturbed by New or Upgraded Roads				
Coniferous Forest	10	2	3	2
Previously Harvested Coniferous Forest	5	1	1	2
Wetland/Riparian	1	<1	<1	0
Subtotal	16	3	4	4
Sedlak Park Substation and Loop Line				
Coniferous Forest	<1	<1	<1	<1
Previously Harvested Coniferous Forest	4	4	4	4
Subtotal	4	4	4	4
Total	317	323	338	365

All units are acres, rounded to the nearest acre.
†Acreage is based on a 150-foot clearing width for monopoles (Alternative B) and 200-foot width for H-frame structures (other alternatives except for a short segment of the West Fisher Creek Alternative that has monopoles). Actual acreage cleared would be less than listed and would depend on tree height, slope, and line clearance above the ground.
Source: GIS analysis by ERO Resources Corp. using KNF data, and vegetation mapping in Westech 2005d and MMI 2005b.

In 2003, Plum Creek sold a conservation easement (Thompson-Fisher Conservation Easement) to the FWP on 142,000 acres in northwest Montana, some of it within the analysis area (Figure 78). The conservation easement was partially funded by the Forest Legacy Program for the purpose of preventing the land from being converted to non-forest uses. One of the stated purposes of the conservation easement is to “preserve and protect in perpetuity the right to practice commercial forest and resource management.” Vegetation communities within the area covered by conservation are shown in Table 176. MMC did not propose to mitigation for the loss of timber production on lands covered by the conservation easement.

All disturbed areas would be interim seeded with native and introduced annual grass and native shrub species when construction of the transmission line and loop line was completed. Areas where trees would be trimmed, but otherwise not disturbed, would be allowed to establish naturally as grassland or shrubland. In accordance with BPA's health and safety policy, vegetation would be prevented from growing in the Sedlak Park Substation or within 5 feet of the substation fence. Within and outside the 100-foot right of way and within the 300-foot clearing width of the substation loop line, trees that pose a risk of falling on the transmission line would be cleared over the life of the line. Roads opened or constructed for transmission line access would be closed after transmission line construction was completed. The road surface would be reseeded as an interim reclamation measure designed to stabilize the surface. Where soil was salvaged from new roads, the road surface would be covered with soil and then reseeded. The new road prism would remain during transmission line operations. Introduced species would increase during mine life from the disturbance as well as from introduced species in the interim seed mix.

The BPA would clear all trees from its proposed 4-acre Sedlak Park Substation, including the access road between US 2 and the substation. It also would clear the woody vegetation within the 300-foot-wide right-of-way for the loop line that would connect the substation to the Noxon-Libby transmission line, in order to construct, operate, and maintain the substation and loop line. When the transmission line was decommissioned, the BPA would dismantle the substation, remove the loop line, and revegetate the area assuming it had no need for the facilities.

During the final Closure Phase following mining, the transmission line would be removed, roads recontoured to match existing topography, trees along the line allowed to grow, and all disturbed areas revegetated. Grassland and shrub communities would be the quickest to establish; the coniferous forest community and riparian forest would take many years to establish because many species are relatively slow growing.

3.22.1.4.7 Alternative C-R – Modified North Miller Creek Transmission Line Alternative

The use of a 200-foot clearing width for wooden H-frame structures for Alternative C-R would result in greater vegetation disturbance than Alternative B. About 166 acres of coniferous forest, 136 acres of previously harvested coniferous forest, and 15 acres of wetland/riparian areas would be cleared and would remain cleared over the life of the transmission line (Table 175). In Alternatives C-R, D-R, and E-R, a Vegetation Clearing Plan would be developed to minimize vegetation clearing in sensitive areas, such as RHCAs. Use of a helicopter to clear timber and construct structures in areas near core grizzly bear habitat would minimize effects on vegetation communities in these areas. Road construction would affect about 2 acres of mature coniferous forest, about 1 acre of previously harvested coniferous forest, and less than 1 acre of wetlands, and riparian areas. Timber production would be eliminated on 141 acres of National Forest System lands suitable for timber production and on 117 acres of private lands until the transmission line was decommissioned and timber reached merchantable size (Table 176). MMC would convey a conservation easement to the FWP on up to 91 acres (Table 176) of private land adjacent to the Thompson/Fisher conservation easement that have similar conservation values. Acquired lands or easements would be added to the existing conservation easement.

Table 176. Vegetation Communities along Transmission Line Alternatives Covered by Thompson-Fisher Conservation Easement.

Type	Alternative B – North Miller Creek		Alternative C-R – Modified North Miller Creek		Alternative D-R – Miller Creek		Alternative E-R – West Fisher Creek	
	Total	Covered by Thompson-Fisher Conservation Easement	Total	Covered by Thompson-Fisher Conservation Easement	Total	Covered by Thompson-Fisher Conservation Easement	Total	Covered by Thompson-Fisher Conservation Easement
National Forest System Lands in Management Areas Suitable for Timber Harvest	81	0	141	0	173	0	182	0
Private Lands	135	104	117	91	117	91	169	94
Total	216	104	258	91	290	91	350	94

All units are acres, rounded to the nearest acre.
†Acreage is based on a 150-foot clearing width for monopoles (Alternative B) and 200-foot width for H-frame structures (other alternatives except for a short segment of the West Fisher Creek Alternative that has monopoles). Actual acreage cleared would be less than listed and would depend on tree height, slope, and line clearance above the ground.
Source: GIS analysis by ERO Resources Corp. using KNF and FWP data, and vegetation mapping in Westech 2005d and MMI 2005b.

New roads on National Forest System lands would be placed into intermittent stored service by using a variety of treatment methods after transmission line construction was completed. Trees would be planted in all areas where trees were removed for the construction of the transmission line including access roads and other disturbances such as line stringing and tensioning sites, slash burn piles, and construction pads. Trees would be planted at a density such that at the end of 5 years the approximate stand density of the adjacent forest would be attained at maturity. This standard would not apply to roads placed in intermittent stored service, but would apply when the roads would be decommissioned after the transmission line was restored. Planting trees in disturbances would require less time for trees to become established, would better match surrounding landscape features, and would meet wildlife and density recommendations provided by the agencies.

Effects, including loss of biodiversity, an increase in introduced species, a change in species composition, and timber production on disturbed lands, would be similar to but less than mine Alternatives 2, 3, and 4, and similar to transmission line Alternatives B and D-R, and E-R.

3.22.1.4.8 Alternative D-R – Miller Creek Transmission Line Alternative

Alternative D-R, with a clearing width of 200 feet would affect up to about 182 acres of mature coniferous forest and 131 acres of previously harvested coniferous forest, and about 18 acres of wetland/riparian areas (Table 175). Road construction would affect about 3 acres of mature coniferous forest, about 1 acre of previously harvested coniferous forest, and less than 1 acre of wetlands and riparian areas. Timber production would be eliminated on 173 acres of National Forest System lands suitable for timber production and on 117 acres of private lands until the transmission line was decommissioned and timber reached merchantable size (Table 176). MMC would convey a conservation easement to the FWP on up to 91 acres (Table 176) of private land adjacent to the Thompson/Fisher conservation easement that have similar conservation values that would be added to the existing conservation easement. Reclamation and transmission line decommissioning at the end of mining operations would be the same as Alternative C-R.

Effects, including loss of biodiversity, an increase in introduced species, a change in species composition, and timber production on disturbed lands, would be similar to but less than mine Alternatives 2, 3, and 4, and similar to transmission line Alternatives B, C-R, and E-R.

3.22.1.4.9 Alternative E-R – West Fisher Creek Transmission Line Alternative

Alternative E-R would include tree clearing widths of 150 to 200 feet, depending on location. Clearing could affect about 93 acres of mature coniferous forest and 35 acres of wetland/riparian vegetation over the life of the transmission line. This alternative would make the best use of previously harvested coniferous forest (235 acres) to reduce the amount of new tree clearing. Road construction would disturb about 2 acres of coniferous forest and 2 acres of previously harvested coniferous forest. Timber production would be eliminated on 182 acres of National Forest System lands suitable for timber production and on 169 acres of private lands until the transmission line was decommissioned and timber reached merchantable size (Table 176). MMC would convey a conservation easement to the FWP on up to 94 acres (Table 176) of private land adjacent to the Thompson/Fisher conservation easement that have similar conservation values that would be added to the existing conservation easement. Reclamation at the end mining operations would be similar to Alternatives B, C-R, and D-R.

Effects, including loss of biodiversity, increase in introduced species, a change in species composition, and timber production on disturbed lands, would be similar to but less than mine Alternatives 2, 3, and 4, and similar to transmission line Alternatives B, C-R, and D-R.

3.22.1.4.10 Effectiveness of Agencies' Proposed Mitigation

Changes to MMC's reclamation plan, such as longer revegetation monitoring, elimination of non-native species and modification of soil salvage, handling, and replacement would be effective in facilitating revegetation of disturbed areas, minimizing introduced species, and ensuring long-term reclamation success. Revegetation success and recovery time of affected vegetation communities would depend on reclamation stage (interim or post-closure), vegetation community type, proper implementation, and environmental factors such as climate and soil conditions. Implementation of the agencies' Weed Control Plan would reduce impacts on native vegetation caused by increased weed infestation due to disturbance caused by the proposed action and its alternatives. The reclamation monitoring plan in Appendix C describes measures that would be implemented to assess the effectiveness of reclamation and actions that would be taken if reclamation success criteria were not met. MMC's bond would not be released unless the specified reclamation objectives were met.

Implementation of the Vegetation Removal and Disposition Plan would be effective in reducing impacts on vegetation from transmission line construction by minimizing clearing of trees and destruction of ground cover through the use of monopoles, where appropriate, and other measures.

3.22.1.4.11 Cumulative Effects

Past actions, particularly timber harvest, road construction, wildfires, and fire suppression activities, have altered the vegetation communities in the analysis area. Vegetation cover and diversity in disturbed areas have decreased. Disturbances have increased the distribution of noxious weeds and other introduced species. In the areas surrounding the proposed Montanore Project, several projects would contribute to the cumulative effect on vegetation communities such as the Libby Creek Ventures Drilling Plan and the Miller-West Fisher Vegetation Management Project. These projects would result in various degrees of vegetation clearing, disturbance, and subsequent revegetation. The primary effects would include an incremental change in species composition and seral stage from converting mature forests to an early successional stage or to grasslands and shrubland. These changes would cumulatively affect species biodiversity and productivity in the analysis area.

3.22.1.4.12 Regulatory/Forest Plan Consistency

3.22.1.4.13 Organic Administration Act and Forest Service Locatable Minerals Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources. Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8 to minimize adverse environmental impacts. MMC did not propose to implement feasible measures to minimize the disturbance area, maximize reclamation success, or minimize vegetation clearing. The agencies' alternatives (Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R) would incorporate additional feasible and practicable measures to minimize adverse environmental impacts. These measures include minimizing the disturbance area of Alternatives 3 and 4, developing and implementing a final Road Management Plan and a Vegetation Removal and Disposition Plan; increasing the salvage and replacement of suitable soil materials for reclamation; using primarily

native species in revegetation; and salvaging disturbed wetland soils for use in constructing new wetlands.

All alternatives would comply with the KFP regarding vegetation communities. Under the proposed KFP amendment that would be implemented with each action alternative, the operating permit areas for the mine facilities and much of the transmission line corridors would be reallocated to non-timber production use. This change would ensure that the proposed use of the area matches the actual use of the area. Reclaimed plant communities would eventually re-establish diverse plant communities but the overall vegetation diversity would be less than the original plant communities and introduced species would increase. Compliance with the INFS and RHCA standards and guidelines is discussed in section 3.6, *Aquatic Life and Fisheries*. Compliance with standards for old growth is discussed in section 3.22.2, *Old Growth Ecosystems*.

3.22.1.4.14 Irreversible and Irretrievable Commitments

All of the mine alternative and transmission line alternatives would disturb native species-dominated vegetation communities, most of which would be subsequently mitigated by revegetation. Revegetated areas would eventually return to pre-disturbance productivity, but vegetation diversity would be lower than existing conditions. Decreased production of timber during mine and transmission line operations and for several decades after reclamation would be an irretrievable commitment of resources. The tailings impoundment areas, which would disturb about 600 acres in each mine alternative, would be managed for mineral development following operations, and would no longer be managed for timber production. The area covered by asphalt and gravel by widening the Bear Creek Road would not be returned to pre-mine uses. These effects would be an irretrievable commitment of resources. The loss of native plant species and increase in introduced species in all mine and transmission line alternatives would be an irreversible resource commitment.

3.22.1.4.15 Short-term Uses and Long-term Productivity

Mining operations and transmission line construction, operations, and decommissioning for all action alternatives would result in long-term impacts on vegetation communities and productivity. Productivity for forested areas would remain low following reclamation until new timber stands are established. A long-term loss of vegetation diversity from loss of native species would occur for each of the mine alternatives. Introduced species cover and production would increase on the disturbed areas.

3.22.1.4.16 Unavoidable Adverse Environmental Effects

An unavoidable loss of native species and species composition would occur during mining operations. Reclamation of disturbed areas following mining would revegetate most areas to pre-mining forested vegetation production over the long term; vegetation communities would be altered and not all native species would re-establish. Introduced species would increase. This loss of some native species and increase in introduced species would be unavoidable impacts of development.

3.22.2 Old Growth Ecosystems

This section describes vegetative characteristics of old growth forests and features particularly important to wildlife. Old growth habitat is recognized for its unique ecological characteristics that serve as important habitat for both wildlife and some species of rare plants on the KNF. According to the KFP, 58 wildlife species use habitat in old growth forest for breeding and/or feeding. While these species may not solely depend on old growth forests, they require old growth structure for part of their life cycle. Five species (barred owl, great gray owl, pileated woodpecker, boreal red-backed vole, and brown creeper) have a strong preference or possible dependence on old growth.

The KFP identified the pileated woodpecker as the management indicator species for old growth forest habitat and all associated wildlife species (KFP, Appendix 12). Effects on old growth-associated wildlife species are discussed in the pileated woodpecker analysis in section 0, *Pileated Woodpecker*. Forest Service sensitive species and state species of concern associated with old growth (flammulated owl, fisher, and northern goshawk) are also discussed in section 3.25.7, *Other Species of Interest*.

3.22.2.1 Regulatory Framework

The KFP establishes forest-wide goals, objectives, standards, guidelines, and monitoring requirements for old growth. According to KFP guidelines, "old growth should be recognized as an important habitat and managed to ensure its availability and utility to wildlife over time" (USDA Forest Service 1987a). The following standards for old growth forests are listed in the KFP:

- To maintain a minimum of 10 percent of the KNF land base below 5,500 feet in elevation in old-growth timber condition
- To maintain an even distribution of old growth habitat through most major drainages, representing the major forest types in each drainage

KNF Supplement No. 85 to FSM 2432.22 direction is to ensure that a minimum of 10 percent old growth is designated for each 3^{rd}-order drainage or compartment (or a combination thereof) before approving timber harvest (USDA Forest Service 1991).

A goal outlined in the KFP is to "Maintain diverse age classes…including old growth timber in sufficient quality and quantity to maintain viable populations of old growth dependent species and to maintain habitat diversity representative of existing conditions" (USDA Forest Service 1987a). KFP direction specifies that old growth designated as MA 13 will "be managed to retain their old growth characteristics." MA designations, goals, and standards are described in detail in section 3.15.3.2.2, *Management Area Goals and Standards*. Additional direction provided by Castaneda (2004) specifies that "harvest treatments in Forest Plan designated old growth stands (MA 13) will require a Forest Plan amendment."

The MFSA directs the DEQ to approve a facility if, in conjunction with other findings, the DEQ finds and determines that the facility would minimize adverse environmental impact, considering the state of available technology and the nature and economics of the various alternatives. The MMRA does not specifically address effects on old growth habitat. The MMRA requires that lands affected by mining meet the post-mine land uses. The DEQ evaluates in its environmental documents whether the revegetation plans for mine facilities would adequately meet the post-mine land uses.

3.22.2.2 Analysis Area and Methods

The analysis area for evaluating direct, indirect and cumulative impacts of the project on old growth in the KNF includes the Crazy and Silverfish PSUs, which are planning areas generally based on watersheds that encompass project facilities for all alternatives (Figure 86). The analysis area for evaluating direct and indirect impacts of the transmission line on old growth on private and State land consists of all lands that would be disturbed by any of the alternative transmission line alignments, substation or loop line (Figure 86).

Impacts of the mine alternatives on old growth were based on the area that would be disturbed by the mine features and associated roads. Transmission line impacts were based on the clearing width and new and improved roads associated with each alternative. Actual acreage cleared would be less and would depend on tree height, slope, and line clearance above the ground.

Management and characteristics of old growth are discussed and summarized in the following documents that are incorporated by reference: the KFP (Appendix 17, KFP II-1, 7, 22, KFP III-54), Green *et al.* (1992, errata corrected through 2011), Pfister *et al.* (2000), Kootenai Supplement No. 85 to FSM 2432.22 (USDA Forest Service 1991), and Castaneda (2004. The KFP provides a description of old growth by habitat group (warm-dry, cool-moist, warm-moist). Since the release of the KFP, new information on old growth has become available. Pfister *et al.* (2000) conducted a peer review of documents that provide old-growth descriptions and attributes, and concluded that Green *et al.* (1992, errata corrected through 2011) provides the best available source for identifying old growth. As a result, the KNF currently uses Green *et al.* (1992, errata corrected through 2011) as the primary tool for identifying potential old growth stands.

Old growth stands on National Forest System lands were identified based on data from Ranger District files and surveys and the KNF old growth GIS layer. As specified in the KNF Supplement No. 85 to FSM 2432.22, old growth stands were field-verified for the Crazy and Silverfish PSUs. Changes in old growth mapping resulting from recent field verification were incorporated into effects analysis for this Final EIS. Field verification of old growth stands was completed using both walk-through and common stand exam methods, as described in the Vegetation Update Report (Westech 2005d). Stands above 5,500 feet are not suitable for reproduction of most old growth associated wildlife species (USDA Forest Service 1987a) and are not included as part of the old growth MAs or calculations of old growth on the KNF (Figure 86).

Impacts of the alternatives on old growth on National Forest System lands were evaluated according to the following criteria:

- Acres of vertical structure removed in designated old growth. This is the area cleared of designated old growth, including both designated effective and designated replacement old growth
- Acres of vertical structure removed in undesignated effective old growth
- Road length built adjacent to or through designated old growth (in feet)
- Acres affected by edge in old growth
- Acres of interior habitat remaining in old growth
- Acres of old growth designated
- Percent of designated old growth remaining in the PSU

Effective old growth stands support the habitat conditions described in Green *et al.* (1992, errata corrected through 2011). Replacement old growth stands do not meet minimum characteristics to be currently considered old growth, but are expected to become old growth in time. Designated old growth consists of stands that have been allocated to MA 13 in the KFP. Effective old growth stands may have been identified after the KFP was published, and some have not been assigned to MA 13.

Research has indicated that certain activities, in particular regeneration harvest, within or adjacent to old growth stands may influence vegetative characteristics and wildlife use of those stands (Harris 1984; Ripple *et al.* 1991; Morrison *et al.* 1992; Province of British Columbia 1995; Russell *et al.* 2000; Russell and Jones 2001). Although the width of old growth shown to be influenced by edge varies depending on the study (Chen *et al.* 1995), research supports a three-tree height rule of thumb as the distance to which effects occur (Harris 1984; Ripple *et al.* 1991; Morrison *et al.* 1992; Province of British Columbia 1995; Russell *et al.* 2000). On the KNF, the average old growth tree height is 100 feet, based on data from the KNF Timber Stand Management Record System (TSMRS) database. Existing edge effects were estimated by applying a 300-foot buffer to harvested forest habitat (activity codes 4111-4117, 4131, 4132, 4175-4177, 4193, and 4194 or old TSMRS activity codes 4100-4134) less than 30 years old and bordering old growth stands. Effects of alternatives were estimated by applying the same buffer to any resulting old growth edge. Old growth areas 50 acres in size and greater not affected by edge effects provide interior habitat.

Old growth mapping for private and State lands along the transmission line was based on photo-interpretation of 2006 aerial imagery and field verification conducted by a Forest Service biologist in 2008. Private land in the Little Cherry Creek impoundment disturbance area has been mostly harvested and was not surveyed for old growth. Impacts on old growth on private lands were evaluated based on the extent of mapped old growth affected.

3.22.2.3 Affected Environment

Old growth forest consists of mature and over-mature stands that provide habitat for many wildlife species. The KFP Appendix 17, A17-2, classifies old growth as a "distinct successional stage" having specific characteristics. It defines the "classic" old growth stand as one that is physically imposing with tall, full-crowned trees; large standing dead material; fallen dead material; a dense canopy; and having moderated temperatures. According to Green *et al.* (1992, errata corrected through 2011) old growth "…encompasses the later stages of stand development that typically differ from earlier stages in characteristics such as tree age, tree size, number of large trees per acre, and basal area. In addition, attributes such as decadence, dead trees, the number of canopy layers, and canopy gaps are important but more difficult to describe because of high variability."

3.22.2.3.1 Existing Old Growth Stands on the KNF

Existing conditions of old growth forest in the KNF portion of the analysis area are a result of past disturbance processes, primarily historical timber harvest and wildfires (USDA Forest Service 2003b). Old growth stands occupying mesic sites in the analysis area are dominated by western hemlock and western redcedar. Common subdominant conifers at these sites include grand fir, Engelmann spruce, Douglas-fir, and western larch. While western white pine is present at these sites, the majority occur as dead snags, having succumbed to whitepine blister rust disease. Lower elevation old growth stands are mainly composed of Douglas-fir, ponderosa pine, western larch, grand fir, or lodgepole pine. Mid to upper elevation old growth sites support subalpine fir, western hemlock, western redcedar, grand fir, and Engelmann spruce (Westech 2005d). Old growth forests in the Crazy and Silverfish PSUs are shown on Figure 86.

Old growth management area designations in the PSU were made to conserve the best old growth attributes available and to provide the best distribution, size, habitat type coverage, and quality possible. These old growth stands are physically connected to other old growth stands where possible, or are interconnected to adjacent old growth stands by stands composed of age classes more than 100 years old.

The Crazy PSU contains 55,925 total acres below 5,500 feet, including 47,982 acres of National Forest System lands, 6,702 acres of private lands, and 1,241 acres of State lands. Mature coniferous forest Old growth stands on private and State lands have been mostly harvested. The 8,815 acres of old growth (all categories) remaining on National Forest System lands below 5,500 feet is about 16 percent of all lands, and 18 percent of National Forest System lands below 5,500 feet in the Crazy PSU (Table 177).

The Silverfish PSU contains 60,839 total acres below 5,500 feet, including 52,078 acres of National Forest System lands, 8,146 acres of private lands, and 615 acres of State lands. Mature coniferous forest growth stands on private and State lands have been mostly harvested, and the 6,789 acres of old growth (all categories) remaining on National Forest System lands below 5,500 feet is about 11 percent of all lands, and 13 percent of National Forest System lands below 5,500 feet in the Silverfish PSU.

Currently, total designated effective old growth and replacement old growth occupies 17.3 and 13.6 percent of National Forest System lands below 5,500 feet in the Crazy and Silverfish PSUs, respectively (Table 177). Old growth in both PSUs currently meets KNF standards for maintaining at least 10 percent of the land base in old growth (per FSM 2432.22).

Attributes of Old Growth within the Landscape

As elements of dynamic landscapes, other attributes of old growth stands such as the size of old growth blocks, their juxtaposition and connectivity with other old growth stands, their topographic position, their shapes, their edge, and their stand structure compared to neighboring stands are important to evaluate. To maintain healthy and diverse ecosystems, the full range of natural variation should be represented and landscape mosaics should be managed as a whole (Green *et al.* 1992, errata corrected through 2011). Management activities, such as timber harvest, road construction, or mining, have the potential to impact the function of old growth habitat or specific components of old growth, such as quantity of interior habitat, habitat patch sizes, and vertical structure.

Larger blocks (more than 50 acres) of old growth forest provide interior habitat and connectivity within National Forest System lands. Based on recommendations in Morrison *et al.* (1992), stands smaller than 50 acres were designated to protect additional attributes unique to old growth. Smaller patches of older, forested vegetation may be important stepping stones for dispersal of old growth-dependent wildlife species, especially in heavily fragmented landscapes. Although these patches may not meet criteria for interior conditions, their removal could prevent dispersal of some species across a larger landscape (Morrison *et al.* 1992). In the KNF, small patches of old growth habitat are largely surrounded by multi-aged stands, which also provide corridor links to larger blocks of old growth. Old growth block sizes in the Crazy and Silverfish PSUs are shown in Table 178.

Table 177. Old Growth Status in the KNF and the Crazy and Silverfish PSUs.

Old Growth Status	Crazy PSU Acres[1] (Percent[2])	Silverfish PSU Acres[1] (Percent[2])	KNF Acres[3] (Percent[2])
Total National Forest System lands	60,215	60,515	2,200,000
Total National Forest System lands below 5,500 feet elevation	47,982	52,078	1,869,222
KFP minimum standard for old growth	4,798 (10.0)	5,208 (10.0)	186,922 (10.0)
Designated old growth[4]			
Designated effective[5] old growth	7,862 (16.4)	5,251 (10.1)	139,082 (7.4)
Designated replacement[6] old growth	418 (0.9)	1,433 (2.8)	64,776 (3.4)
Designated unknown[7] (KFP)	0 (0)	0 (0)	20,238 (1.1)
Total designated effective old growth and replacement old growth[8]	8,280 (17.3)	7,102 (13.6)	227,026 (12.1)
Undesignated effective old growth and replacement old growth			
Undesignated effective old growth	488 (1.0)	47 (0.1)	51,111 (2.7)
Undesignated replacement old growth	47 (0.1)	58 (0.1)	32,941 (1.8)
Totals for both designated and undesignated old growth and replacement old growth			
Total designated and undesignated effective old growth[5]	8,350 (17.4)	5,298 (10.2)	201,577 (10.8)
Total designated and undesignated replacement old growth	465 (1.0)	1,491 (2.9)	97,717 (5.2)
All old growth below 5,500 feet (effective and replacement old growth	**8,815 (18.4)**	**6,789 (13.0)**	**299,294 (16.0)**

[1] Updated in 2010. Replacement old growth stands were designated to provide old growth in the future within the PSU.
[2] Percentage calculated based on total National Forest System lands below 5,500 feet elevation.
[3] Forest-wide acres as of July 2012.
[4] Designated old growth: old growth forest designated as an old growth MA, such as MA 13.
[5] Effective old growth: meets all the age and size class old growth requirements, contains typical old growth habitat components, and is large enough or of appropriate shape to allow species dependent on forest interiors to flourish. Effective old growth includes acres inventoried on the ground plus 60 percent of old growth determined by photo interpretation, plus 60 percent of designated unknown old growth, based on results of old growth surveys described in the KFP.
[6] Replacement old growth: stands that do not have enough old growth characteristics to be considered old growth, but that are expected to become old growth in time.
[7] Designation unknown: old growth designated as MA 13 in the KFP that has not been surveyed.
[8] Based on 100 percent of all categories of designated old growth, old growth determined by photo interpretation, and designated unknown old growth rather than 60 percent of these categories. Thus, total designated and replacement old growth is not directly additive.

All old growth in the Crazy PSU, including undesignated and designated effective and replacement old growth, comprises a total of 55 blocks ranging from 10 acres to 2,501 acres. About 55 percent of these blocks are greater than 50 acres. Although there is less old growth in the Silverfish PSU, it contains proportionately more old growth blocks over 50 acres than the Crazy PSU. All old growth in the Silverfish PSU consists of 74 blocks ranging from 1 acre to 513 acres, with about 64 percent of the old growth blocks greater than 50 acres.

Table 178. Old Growth Block Sizes in the Crazy and Silverfish PSUs.

Old Growth Status	Number of Blocks	Size Range (acres)	Number of Blocks Over 50 Acres	Percent Blocks Over 50 Acres
Crazy PSU				
Designated				
Effective	37	10 - 2,501	25	68
Replacement	11	15 - 98	2	18
Total	48	10 - 2,501	27	56
Undesignated				
Effective	5	30 - 193	3	60
Replacement	2	7 - 41	0	0
Total	7	7 - 193	3	43
Total of All Old Growth	**55**	**10 - 2,501**	**30**	**55**
Silverfish PSU				
Designated				
Effective	43	10 - 513	28	65
Replacement	26	12 - 167	11	42
Total	69	10 - 513	39	57
Undesignated				
Effective	0	0	0	0
Replacement	5	1 - 21	0	0
Total	5	1 - 21	0	0
Total of All Old Growth	**74**	**1 - 513**	**53**	**64**

Source: GIS analysis by ERO Resources Corp. using KNF data.

Stand Structure

Old growth stand structure is described by Green *et al.* (1992, errata corrected through 2011). In summary, Green identifies three structural stages that are useful in describing old growth: late seral single-story (*e.g.*, ponderosa pine, Douglas-fir, or lodgepole pine sites); late seral multi-story (*e.g.*, larch or western white pine sites); and near-climax (*e.g.*, cedar, grand fir, or subalpine fir sites). Old growth stands in the Crazy and Silverfish PSUs can be characterized as predominately multi-story or near-climax (Westech 2005d).

Disturbance

Many roads and trails in the Crazy and Silverfish PSUs either bisect or are adjacent to old growth stands. Roads facilitate pedestrian and motorized access to old growth forest habitats, resulting in increased disturbance to vegetation and wildlife. Roads also increase access for firewood cutters who may remove standing snags and down logs that are important components of old growth forests. Within existing designated old growth in the Crazy and Silverfish PSUs, 41 miles of local roads comprise 13 miles of seasonally restricted roads, 6 miles of roads closed year-round, and 22 miles of roads open year-round. Timber harvesting can affect adjacent old growth stands by altering six microclimatic factors: solar radiation, soil temperature, soil moisture, air temperature, relative humidity, and wind speed (Chen *et al.* 1995). Microclimatic changes lead to vegetation changes such as species richness, diversity, composition, and structure (Russell and Jones 2001).

Changes in vegetative conditions may, in turn, affect wildlife, resulting in changes in associated wildlife communities and influencing other factors such as predation and competition (Askins 2000) (see pileated woodpecker discussed in section 3.25.3, *Management Indicator Species*). Effects of timber harvesting extend varying distances into the uncut stands depending on a number of variables, such as aspect, slope, elevation, wind speed, and direction. The depth of influence is also related to time since harvest, with effects dissipating within 20 to 50 years, depending on the factor (Russell and Jones 2001; Ripple *et al.* 1991; Russell *et al.* 2000). In the Crazy and Silverfish PSUs, average tree growth in stands where regeneration has occurred result in tree heights (20 to 50 feet) and densities (fully stocked stands) that reduce the depth of influence from edge effects after 30 years. Table 180 shows the amount of old growth currently influenced by edge effects, including the number of existing harvested stands (stands less than 30 years old) adjacent to old growth stands. These stands create an edge influence on about 1,744 acres of old growth in the Crazy PSU and about 551 acres of old growth in the Silverfish PSU. While edge areas may result in changes in vegetation and wildlife use, the edge areas remain functional as old growth for some species. Old growth areas not impacted by edge effects provide interior habitat.

3.22.2.3.2 Existing Old Growth Stands on Private and State Lands

The majority of private or state-owned land within the analysis area has been harvested in the past 20 to 30 years (Figure 85) and is heavily roaded. Although most previously harvested areas have well-established conifer regeneration, as described in section 3.22.1, *Vegetation Communities*, these areas do not provide effective old growth habitat. Coniferous forest on private lands is primarily dominated by dry, ponderosa pine/Douglas-fir communities that do not have old growth characteristics. Old growth on private and State lands within the analysis area consists primarily of riparian old growth and occurs mainly in the Fisher River, West Fisher Creek, and Hunter Creek riparian corridors (Figure 86). No old growth stands were identified at the Sedlak Park Substation Site.

3.22.2.4 Environmental Consequences

The following section discusses the direct, indirect, and cumulative effects on old growth for each of the mine alternatives, transmission line alternatives, and combined mine-transmission line alternatives. The mine alternatives would have no effect on old growth in the Silverfish PSU. Impacts on old growth in the Crazy PSU from the mine alternatives are summarized in Table 179. Impacts on old growth in the Crazy and Silverfish PSUs from the transmission line alternatives are summarized in Table 180 and Table 181.

3.22.2.4.1 Alternative 1–- No Mine

Alternative 1 would have no direct effect on designated old growth or associated plant and wildlife species (also see pileated woodpecker discussed in section 3.25.3, *Management Indicator Species*). As shown in Table 179, the conditions for all seven measurement criteria would remain unchanged. All old growth areas would maintain their existing conditions and continue to provide habitat for those species that use the area over a long term. The most recent forest-wide old growth analysis concludes that at least 10 percent of the KNF below 5,500 feet elevation is designated for old growth management (USDA Forest Service 2007d). This alternative would not affect the current proportion of old growth (Table 179) at either the PSU or KNF scale.

Table 179. Summary of Impacts on Old Growth from the Mine Alternatives in the Crazy PSU.

Measurement Criteria	[1] No Mine/ Existing Conditions[1]	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative	[4] Agency Mitigated Little Cherry Creek Impoundment Area
Unmitigated Effects				
Vertical structure removed in designated OG (acres)[2]	0	185	228	82
Remaining designated OG in PSU (OG+ROG)	8,280	8,095	8,052	8,198
Percent of designated OG in PSU (OG+ROG)	17.3	16.9	16.8	17.1
Vertical structure removed in undesignated OG (acres)[3]	0	182	8	132
Total road length in feet adjacent or through designated OG or ROG	194,541 (0)	194,941 (-400)	195,772 (-1,231)	195,772 (-1,231)
Number of existing or proposed harvest stands adjacent to OG	78	83 (-5)	82 (-4)	82 (-4)
Edge influence in OG (acres)	1,267	1,488 (+221)	1,544 (+277)	1,481 (+214)
Interior habitat remaining in OG (acres)	7,685	7,050 (-635)	7,153 (-532)	7,194 (-491)
Mitigated Effects				
OG designated to mitigate OG physically lost (acres)[4]	N/A	0	472	428
OG designated to mitigate edge effects (acres)[5]	N/A	0	277	214
OG designated to mitigate for designated OG changed to MA 31 (acres)[5]	N/A	0	48	186
Total OG designated for mitigation (acres)	N/A		797	828
Percent of designated OG in PSU after mitigation	17.3	16.5	18.3	18.1

(#) Change from existing conditions due to the alternative.
NA = Not applicable; OG = Old growth; ROG = Replacement Old Growth.
Old growth would not be affected in the Silverfish PSU.
[1]Existing conditions for old growth may differ from that presented in the Draft EIS due to changes in old growth mapping resulting from recent field verification.
[2] Includes effective and replacement old growth.
[3] Effective old growth only.
[4] Mitigation for physical loss of old growth would be at a 2:1 ratio.
[5] Mitigation for increased edge effects or reallocation of designated old growth (MA 13) to MA 31 (Mineral Development) would be at a 1:1 ratio. MA designations, goals, and standards are described in detail in section 3.15.3.2.2, *Management Area Goals and Standards*.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Table 180. Summary of Impacts on Old Growth from the Transmission Line Alternatives in the Crazy PSU.

Measurement Criteria	Alternative A – No Transmission Line	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
Unmitigated Effects					
Vertical structure removed in designated OG (acres)[2]	0	20	0	0	0
Remaining designated OG in PSU (OG+ROG) (acres)	8,280	8,260	8,280	8,280	8,280
Percent of designated OG in PSU (effective OG+ROG)	17.3	17.2	17.3	17.3	17.3
Vertical structure removed in undesignated OG (acres)[3]	0	7	0	0	0
Total road length in feet adjacent or through designated OG or ROG	194,541	197,392 (2,851)	194,541 (0)	194,541 (0)	194,541 (0)
Number of existing or proposed harvest stands adjacent to OG	78	81 (3)	79 (1)	80 (2)	80 (2)
Edge influence in OG (acres)	1,267	1,365(+98)	1,267(0)	1,271 (+4)	1,271 (+4)
Interior habitat remaining in OG (acres)	7,685	7,560 (-125)	7,685 (0)	7,681 (-4)	7,681 (-4)
Mitigated Effects					
OG designated to mitigate OG physically lost (acres)[4]	N/A	0	0	0	0
OG designated to mitigate edge effects (acres)[5]	N/A	0	0	4	4
Total OG designated for mitigation (acres)	N/A	0	0	4	4
Percent of designated OG in PSU after mitigation	17.3	17.2	17.3	17.3	17.3

(#) Change from existing conditions due to the alternative. NA= Not applicable; OG = old growth; ROG = Replacement Old Growth.
[1]Existing conditions for old growth may differ from that presented in the Draft EIS due to changes in old growth mapping resulting from recent field verification.
[2] Includes effective and replacement old growth.
[3] Effective old growth only.
[4] Mitigation for physical loss of old growth would be at a 2:1 ratio.
[5]Mitigation for increased edge effects would be at a 1:1 ratio. Designated old growth (MA 13) within the 500-foot-wide transmission line corridor reallocated as MA 23 would be within the area accounted for by edge effects.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Table 181. Summary of Impacts on Old Growth from the Transmission Line Alternatives in the Silverfish PSU and on Private and State Lands.

Measurement Criteria	Alternative A – No Transmission Line	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
Unmitigated Effects					
Vertical structure removed in designated OG (acres)[1]	0	0	4	4	0
Remaining designated OG in PSU (OG+ROG) (acres)	7,102	7,102	7,098	7,098	7,102
Percent of designated OG in PSU (effective OG+ROG)	13.6	13.6	13.6	13.6	13.6
Vertical structure removed in undesignated OG (acres)[2]	0	2	2	0	0
Total road length in feet adjacent or through designated OG or ROG	23,027	23,027	23,143 (116)	23,143 (116)	23,027
Number of existing or proposed harvest stands adjacent to OG	18	21	22	19	19
Edge influence in OG (acres)	515	538 (+23)	532 (+17)	511 (-4)[6]	517 (+2)
Interior habitat remaining in OG (acres)	6,713	6,685 (-28)	6,674 (-39)	6,708 (-5)	6,711 (-2)
Mitigated Effects					
OG designated to mitigate OG physically lost (acres)[4]	N/A	0	12	8	0
OG designated to mitigate edge effects (acres)[5]	N/A	0	17	0	2
Total OG designated for mitigation (acres)	N/A	0	29	8	2
Percent of designated OG in PSU after mitigation	13.6	13.6	13.7	13.6	13.6
Private and State Lands					
Old growth removed (acres)	0	4	0	0	7

(#) Change from existing conditions due to the alternative. NA= Not applicable; OG = old growth; ROG = Replacement Old Growth.
[1]Existing conditions for old growth may differ from that presented in the Draft EIS due to changes in old growth mapping resulting from recent field verification.
[2] Includes effective and replacement old growth.
[3] Effective old growth only.
[4] Mitigation for physical loss of old growth would be at a 2:1 ratio.
[5]Mitigation for increased edge effects would be at a 1:1 ratio. Designated old growth (MA 13) within the 500-foot-wide transmission line corridor reallocated as MA 23 would be within the area accounted for by edge effects.
[6]Alternative D-R would result in the removal of an old growth stand that previously contributed to edge, resulting in less edge influence.
Source: GIS analysis by ERO Resources Corp. using KNF data.

3.22.2.4.2 Alternative 2 – MMC's Proposed Mine

Alternative 2 would have the greatest effect on old growth of the mine alternatives, affecting 185 acres of designated old growth and 182 acres of undesignated old growth for a total of 367 acres of old growth habitat affected in the Crazy PSU (Table 179). Old growth in the Silverfish PSU and in private or State land outside the Silverfish PSU would not be affected. Alternative 2 would result in edge effects on about 221 acres of old growth habitat and a loss of about 635 acres of interior old growth habitat. The majority of impacts on designated old growth would occur in the LAD Area 2 at the mouth of Ramsey and Poorman creeks. Trees would be selectively thinned in 200 acres of the LAD Areas where spray irrigation would occur. Although these irrigated areas would likely continue to provide suitable habitat for some old growth-associated species, old growth habitat connectivity could be reduced between the Ramsey Creek and Poorman Creek drainages for other species. All of the impacts on undesignated effective old growth would occur as a result of the Little Cherry Creek Impoundment construction, eliminating 133 acres of a 193-acre old growth block. Reducing the size of old growth blocks would diminish their capacity to support old growth-dependent plant and wildlife species. At the PSU scale, Alternative 2 would result in a 0.4 percent loss of designated old growth in the Crazy PSU. The percent of designated old growth in the Crazy and Silverfish PSUs would remain above the 10 percent minimum standard specified in the KFP.

Alternative 2 would include the construction of about 400 feet of new roads through designated old growth habitat. As a result, less than 1 acre of old growth habitat would be lost. These impacts are included in the impacts on designated and undesignated old growth shown in Table 179. Because new roads would not be open to the public and would be reclaimed at mine closure, they are not likely to reduce snag levels from firewood gathering. Use of new roads associated with mine activities would result in long-term increases in disturbance to vegetation and wildlife.

3.22.2.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Alternative 3 would affect 228 acres of designated old growth and 8 acres of undesignated old growth, for a total of 236 acres of old growth habitat in the Crazy PSU. Old growth in the Silverfish PSU and in private or State land outside the Silverfish PSU would not be affected. Relative to other alternatives, Alternative 3 would result in the most edge effects (277 acres) to old growth habitat. Alternative 3 would result in a loss of about 532 acres of interior old growth habitat (Table 179). The majority of impacts on designated old growth would occur as a result of impoundment construction, reducing old growth habitat connectivity in the Poorman Creek drainage. Reducing the size of old growth blocks would diminish their capacity to support old growth-dependent plant and wildlife species. At the PSU scale, Alternative 3 would result in a 0.5 percent loss of designated old growth in the Crazy PSU, before mitigation was implemented. The percent of designated old growth in the Crazy and Silverfish PSUs would remain above the 10 percent minimum standard specified in the KFP. Alternative 3 would include the construction of about 1,231 feet of new roads through designated old growth habitat. As a result, about 3 acres of old growth habitat would be lost. Other impacts of new roads constructed for Alternative 3 would be the same as Alternative 2. Alternative 3 would involve the reallocation of 48 acres of designated old growth (MA 13) to MA 31 (Mineral Development) that have not been accounted for in direct disturbance and indirect edge effects (Table 179). The reallocation of MAs is described in section 3.15*, Land Use*. Although the MA change would not result in disturbance to or physical loss of old growth, the change would reduce the percent of designated old growth in the PSU. The designation of 797 acres of additional old growth would mitigate this reduction (Table 179).

Alternative 3 would include mitigation described in section 2.5.7.4.4, *Key Habitats* for impacts on old growth, such as the designation of additional old growth shown in Table 179 on National Forest System lands. Designation of additional areas of old growth would not create new old growth, but would ensure that these areas are managed to retain or develop old growth characteristics. Alternative 3 mitigation would increase the percent of designated old growth in the Crazy PSU to 18.3 percent. Losses and degradation of old growth habitat may be offset by private land acquisition associated with grizzly bear habitat mitigation, if old growth habitat characteristics were present on the acquired parcels.

3.22.2.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would have the least effect on old growth habitat of the mine alternatives, affecting 82 acres of designated old growth and 132 acres of undesignated old growth, for a total of 214 acres of old growth habitat in the Crazy PSU. Old growth in the Silverfish PSU and in private or State land outside the Silverfish PSU would not be affected. At the PSU scale, Alternative 4 would result in a 0.2 percent loss of designated old growth in the Crazy PSU. Impacts of new roads constructed for Alternative 4 would be the same as those described for Alternative 3.

Alternative 4 would result in edge effects on about 214 acres of old growth habitat. Relative to the other mine alternatives, the least amount of interior old growth habitat (491 acres) would be lost as a result of Alternative 4.

Alternative 4 would involve the reallocation of 199 acres of designated old growth (MA 13) to MA 31 (Mineral Development) that have not been accounted for in direct disturbance and indirect edge effects. Although the MA change would not result in disturbance to or physical loss of old growth, the change would reduce the percent of designated old growth in the PSU. The designation of 828 acres (Table 179) of additional old growth would mitigate this reduction.

Mitigation for impacts on old growth for Alternative 4 would be similar to Alternative 3, except that Alternative 4 mitigation would increase the percent of designated old growth in the Crazy PSU to 181.1 percent.

3.22.2.4.5 Alternative A – No Transmission Line

Alternative A would have no direct effect on designated old growth or associated plant and wildlife species (also see discussion in section 0, *Key Habitats*). The conditions for all seven measurement criteria (Table 180; Table 181) would remain unchanged. All old growth areas would maintain their existing conditions, and continue to provide habitat for those species that use the area over a long term. The most recent forest-wide old growth analysis concludes that at least 10 percent of the KNF below 5,500 feet elevation is designated for old growth management. This alternative would not affect the current proportion of old growth (Table 180; Table 181) at either the PSU or KNF scale.

3.22.2.4.6 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Alternative B would have the greatest impact on old growth habitat of the transmission line alternatives, affecting 20 acres of designated old growth in the Crazy PSU (Table 180). Seven acres of undesignated old growth would be affected by Alternative B. Two acres of undesignated old growth would be affected by Alternative B in the Silverfish PSU. Designated old growth in the Silverfish PSU would not be affected by Alternative B (Table 181). Alternative B would result in edge effects on about 98 acres of old growth habitat and a loss of about 125 acres of interior old growth habitat in the Crazy PSU. In the Silverfish PSU, edge effects would occur on 23 acres, and 28 acres of interior habitat would be lost. Alternative B would remove about 4 acres of old growth habitat on private land along the Fisher River and a short portion of Miller Creek. The substation and loop line would not affect old growth habitat. Loss of old growth habitat and edge effect may be offset by private land acquisition associated with grizzly bear habitat mitigation, if old growth habitat characteristics were present on the acquired parcels.

The majority of impacts on old growth would occur in the Ramsey Creek corridor and at the confluence of Libby and Howard creeks, reducing old growth habitat connectivity in these drainages. Reducing the size of old growth blocks would diminish their capacity to support old growth-dependent plant and wildlife species. At the PSU scale, the loss of old growth would have negligible effects on the proportion of old growth in the Crazy PSU (Table 180). The percent of designated old growth in the Crazy and Silverfish PSUs would remain above the 10 percent minimum standard specified in the KFP.

Alternative B would include the construction of about 2,851 feet of new roads through designated old growth habitat, affecting less than 3 acres of old growth habitat (Table 180; Table 181). Because new roads would not be open to the public, would undergo interim reclamation after construction, and would be bladed and recontoured to match existing topography at transmission line decommissioning, the roads are not likely to reduce the amount of snag levels from firewood gathering. Use of new roads associated with transmission line construction would result in short-term disturbance to vegetation and wildlife.

3.22.2.4.7 Alternative C-R – Modified North Miller Creek Transmission Line Alternative

For Alternative C-R, no designated old growth habitat would be removed in the Crazy PSU, and 4 acres would be removed in the Silverfish PSU (Table 180; Table 181). No undesignated old growth would be removed by Alternative C-R in the Crazy PSU, while 2 acres of undesignated old growth in the Silverfish PSU would be affected. Alternative C-R would result in 17 acres of edge effects on old growth habitat in the Silverfish PSU, but would not change edge effects in the Crazy PSU Alternative C-R would result in a loss of about 39 acres of interior old growth habitat in the Silverfish PSU, but would not affect interior old growth in the Crazy PSU. Alternative C-R would not affect old growth habitat on private land (Figure 86).

The majority of impacts on old growth would occur on the ridge between Miller and West Fisher creeks and upslope of the unnamed tributary to Miller Creek. Reducing the size of old growth blocks would diminish their capacity to support old growth-dependent plant and wildlife species. At the PSU scale, the loss of old growth would have a negligible effect on the proportion of old growth composition and would not measurably impact old growth characteristics and attributes in the Crazy or Silverfish PSU or the KNF. The percent of designated old growth in the Crazy and Silverfish PSUs would remain above the 10 percent minimum standard specified in the KFP. Alternative C-R would include the construction of 116 feet of new roads through designated old growth habitat in the Silverfish PSU and none in the Crazy PSU.

Mitigation for impacts of Alternative C-R on National Forest System lands would include the designation of additional old growth shown in Table 180 and Table 181. Alternative C-R mitigation would maintain the percent of designated old growth in the Crazy PSU at 17.3 percent and increase it in the Silverfish PSU to 13.7 percent. Loss of old growth habitat and edge effect may be offset by private land acquisition associated with grizzly bear habitat mitigation, if old growth habitat characteristics were present on the acquired parcels.

3.22.2.4.8 Alternative D-R – Miller Creek Transmission Line Alternative

Effects on old growth from Alternative D-R in the Crazy PSU would be the same as Alternative C-R, except that it would result in 4 acres of edge effects on old growth habitat and would affect 4 acres of interior habitat (Table 181). Alternative D-R effects would be the same as Alternative C-R in the Silverfish PSU, except that less interior old growth habitat would be affected and edge effects would decrease by four acres due to removal of an old growth stand that previously contributed to edge.

Mitigation for impacts of Alternative D-R on National Forest System lands would include the designation of additional old growth shown in Table 180; Table 181. Alternative D-R mitigation would maintain the percent of designated old growth in the Crazy PSU at 17.3 percent and in the Silverfish PSU at 13.6 percent. The loss of old growth habitat and edge effects may be offset by private land acquisition associated with grizzly bear habitat mitigation, if old growth habitat characteristics were present on the acquired parcels.

3.22.2.4.9 Alternative E-R – West Fisher Creek Transmission Line Alternative

Effects on old growth from Alternative E-R in the Crazy PSU would be the same as Alternative D-R. In the Silverfish PSU, old growth habitat would not be affected by Alternative E-R, except for 2 acres of increased edge effects and the loss of 2 acres of interior old growth habitat (Table 180; Table 181). Alternative E-R would directly impact about 7 acres of old growth habitat on private and State land where the transmission line would cross the Fisher River and parallel West Fisher Creek (Figure 86). Impacts on old growth on non-National Forest System lands would be minimized through implementation of the Environmental Specifications (Appendix D) and Vegetation Removal and Disposition Plan. Also, the use of monopoles in old growth habitat, if incorporated into the Vegetation Removal and Disposition Plan, would require less clearing.

3.22.2.4.10 Combined Mine-Transmission Line Effects

Direct impacts of the mine alternatives in combination with the transmission line alternatives are shown in Table 182. Impacts on old growth from combined mine and transmission line alternatives before mitigation would be the greatest (395 acres of old growth removed in the Crazy and Silverfish PSUs) for MMC's proposed alternative (Alternative 2B). Old growth removed in the Crazy and Silverfish PSUs for the agencies' alternatives (Alternatives 3C-R, 3D-R, 3E-R, 4C-R, 4D-R, and 4E-R), including private and State land, would range from 214 acres for Alternative 4E-R to 242 acres for Alternatives 3C-R. The agencies' alternatives would include mitigation for impacts on old growth, such as the designation of additional old growth on National Forest System lands shown in Table 182 and implementation of the Environmental Specifications and Vegetation Removal and Disposition Plan. Designation of additional areas of old growth would not create new old growth, but would ensure that these areas are managed to retain or develop old growth characteristics. With mitigation, the agencies' combined alternatives would result in an increased proportion of designated old growth on National Forest System lands. For the agencies' alternatives, impacts on old growth on private land would be minimized through implementation of the Environmental Specifications and Vegetation Removal and Disposition Plan. The use of monopoles in old growth habitat, if incorporated into the Vegetation Removal and Disposition Plan, would require less clearing. For all combined alternatives, losses and degradation of old growth habitat may be offset by private land acquisition associated with grizzly bear habitat mitigation, if old growth habitat characteristics were present on the acquired parcels.

3.22.2.4.11 Effectiveness of agencies' Proposed Mitigation

In the agencies' alternatives, additional old growth on would be designated National Forest System lands to mitigate impacts on old growth. While the designation of additional old growth would not create new old growth, it would ensure that these areas are managed to retain or develop old growth characteristics. Old growth management area designations are made to conserve the best old growth attributes available and to provide the best distribution, size, habitat type coverage, and quality possible. While designated replacement old growth stands do not have enough characteristics to be currently considered old growth, they are expected to become old growth in time. Implementation of Environmental Specifications and Vegetation Removal and Disposition Plan would help reduce clearing of old growth. Designation of old growth would not replace old growth lost, and given the recovery time of old growth forest (200-250 years), mitigation of effects after stand-replacing disturbance would likely require centuries.

3.22.2.4.12 Cumulative Effects

Past actions, particularly timber harvest, road construction, and fire suppression activities, have altered the old growth ecosystems in the analysis area, resulting in reductions in early and late succession habitats; conditions favoring shade-tolerant, fire-intolerant species; loss of large snags and down wood; and increases in tree density and a shift to a largely mid-seral structural stage (USDA Forest Service 2003b). Firewood cutting would continue to occur where open roads provide access to old growth habitat, contributing to snag removal. Continuing development of private lands, including timber harvest, home construction, and land clearing would contribute to losses of old growth habitat in the analysis area, but would not affect the proportion of old growth on National Forest System lands. In addition, it is likely that limited amounts of old growth occur on private and State lands, based on past and current harvest practices. The No Action Alternatives (Alternative 1 and Alternative A) would not contribute to cumulative impacts on old growth.

Regeneration harvest included in the Miller-West Fisher Vegetation Management Project, which will occur in the Silverfish PSU, would not directly affect old growth. The Miller-West Fisher Vegetation Management Project will result in minor increased edge effects where regeneration harvest is proposed adjacent to old growth. Currently, total designated effective old growth and replacement old growth occupies 17.3 and 13.6 percent of National Forest System lands below 5,500 feet in the Crazy and Silverfish PSUs, respectively (Table 177), above the 10 percent minimum standard specified in the KFP. While the action alternatives, in combination with other past, current, and reasonably foreseeable actions, would result in some losses and degradation of old growth habitat, cumulative impacts on levels of old growth would likely be minimal. In addition, mitigation associated with the agencies' Alternatives 3, 4, C-R, D-R, and E-R would increase the proportion of designated old growth and promote the maintenance or development of old growth in the analysis area.

Table 182. Summary of Impacts on Old Growth from Combined Mine and Transmission Line Alternatives.

Measurement Criteria	[1] No Mine Existing Condition[1]	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Little Cherry Creek Impoundment Area		
		TL-B	TL-C-R	TL-D-R	TL-E-R	TL-C-R	TL-D-R	TL-E-R
Crazy PSU								
Unmitigated Effects								
Vertical structure removed in designated OG (acres)[2]	0	205	221	221	221	75	75	75
Remaining designated OG in PSU (OG+ROG) (acres)	8,280	8,075	8,052	8,052	8,052	8,198	8,198	8,198
Percent of designated OG in PSU (OG plus ROG)	17.3	16.8	16.8	16.8	16.8	17.1	17.1	17.1
Vertical structure removed in undesignated OG (acres)[3]	0	188	8	8	8	132	132	132
Total road length (feet) adjacent or through designated OG or ROG	194,541 (0)	197,432 (2,891)	195,772 (1,231)	195,772 (1,231)	195,772 (1,231)	195,772 (1,231)	195,772 (1,231)	195,772 (1,231)
Number of existing or proposed harvest stands adjacent to OG	78	86 (8)	82 (4)	83 (5)	83 (5)	82 (4)	83 (5)	83 (5)
Edge influence in OG (acres)	1,267	1,492 (+225)	1,544 (+277)	1,548 (+281)	1,548 (+281)	1,481 (+214)	1,485 (+218)	1, 485 (+218)
Interior habitat remaining in OG (acres)	7,685	7,028 (-657)	7,153 (-532)	7,149 (-536)	7,149, (-536)	7,194 (-491)	7,190 (-495)	7,190 (-495)
Mitigated Effects								
OG designated to mitigate OG physically lost (acres)[4]	N/A	0	472	472	472	428	428	428
OG designated to mitigate edge effects (acres)[5]	N/A	0	277	281	281	214	218	218
OG designated to mitigate for designated OG changed to MA 31 (acres)[5]	N/A	0	48	48	48	186	186	186
Total OG designated (acres)	N/A	0	797	801	801	828	828	832
Percent of designated OG in PSU (OG plus ROG)	16.8	16.4	18.3	18.3	18.3	18.1	18.1	18.1

Measurement Criteria	[1] No Mine Existing Condition[1]	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Little Cherry Creek Impoundment Area		
		TL-B	TL-C-R	TL-D-R	TL-E-R	TL-C-R	TL-D-R	TL-E-R
Silverfish PSU								
Unmitigated Effects								
Vertical structure removed in designated OG (acres)[2]	0	0	4	4	0	4	4	0
Remaining designated OG in PSU (OG+ROG) (acres)	7,102	7,102	7,098	7,098	7,102	7,098	7,098	7,102
Percent of designated OG in PSU (OG plus ROG)	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6
Vertical structure removed in undesignated OG (acres)[3]	0	2	2	0	0	2	0	0
Total road length (feet) adjacent or through designated OG or ROG	23,027	23,027 (0)	23,143 (116)	23,143 (116)	23,027 (0)	23,143 (116)	23,143 (116)	23,027 (0)
Number of existing or proposed harvest stands adjacent to OG	18	21	22	19	19	22	19	19
Edge influence in OG (acres)	515	538 (+23)	532 (+17)	511 (-4)[6]	516 (1)	532 (+17)	511 (-4)[6]	516 (1)
Interior habitat remaining in OG (acres)	6,713	6,685 (-28)	6,674 (-39)	6,708 (-5)	6,711 (-2)	6,674 (-39)	6,708 (-5)	6,711 (-2)
Mitigated Effects								
OG designated to mitigate OG physically lost (acres)[4]	N/A	0	12	8	0	12	8	0
OG designated to mitigate edge effects (acres)[5]	N/A	0	17	0	1	17	0	1
OG designated to mitigate for designated OG changed to MA 31 (acres)[5]	N/A	0	0	0	0	0	0	0
Total OG designated (acres)	N/A	0	29	8	1	29	8	0
Percent of designated OG in PSU (OG plus ROG)	N/A	13.6	13.7	13.6	13.6	13.7	13.6	13.6
Private and State Lands								
Old growth removed (acres)	0	4	0	0	7	0	0	7

(#) number in parentheses is the change due to the alternative. OG = Old growth ROG = Replacement Old Growth; N/A = Not Applicable
[1]Existing conditions for old growth may differ from that presented in the Draft EIS due to changes in old growth mapping resulting from recent field verification.
[2]Includes effective and replacement old growth. Acreage may not equal that shown in Table 179 and Table 180 and Table 181 because of overlapping effects.
[3]Effective old growth only.
[4]Mitigation for physical loss of old growth would be at a 2:1 ratio.
[5]Mitigation for increased edge effects or reallocation of designated old growth (MA 13) to MA 31 (Mineral Development) would be at a 1:1 ratio.
[6]Alternative 3-DR and 4D-R would result in the removal of an old growth stand that previously contributed to edge, resulting in less edge influence.
Source: GIS analysis by ERO Resources Corp. using KNF data.

3.22.2.4.13 Regulatory/Forest Plan Consistency

All action alternatives would require a project-specific amendment to allow harvest within designated old growth stands (MA 13). The project-specific amendment would change the current MA 13 (Designated Old Growth) designation of all harvested stands to either MA 23 (Electric Transmission Corridor) or 31 (Mineral Development). All action alternatives would be consistent with KFP direction to maintain a minimum of 10 percent old growth below 5,500 feet in elevation in each 3rd-order drainage or compartment, or a combination of compartments.

Forest-wide analysis of old growth (USDA Forest Service 2007d) indicates that at least 10 percent of the KNF below 5,500 feet is managed as old growth, as required in the KFP. Specifically, National Forest System lands below 5,500 feet include 299,294 acres (16.0 percent) of old growth or replacement old growth (Table 177). About 10.8 percent (201,577 acres) of those lands were determined to be effective old growth, and 5.2 percent (97,717 acres) were identified as replacement old growth.

The action alternatives would result in between 16.4 and 18.3 percent designated old growth below 5,500 feet elevation in the Crazy PSU, and between 13.6 and 13.7 percent designated old growth below 5,500 feet elevation in the Silverfish PSU. The KFP established that maintaining 10 percent of old growth habitat is sufficient to support viable populations of old-growth dependent species (KFP, Vol. 1, II-1, 7, III-54; Vol. 2, A17).

Other applicable standards established in the KFP for MA 13 (Designated Old Growth) include:

Recreation: All action alternatives would comply with these standards. A forest closure order exists to off-highway vehicles, which restricts the off-highway vehicles to established roads and trails.

Wildlife and Fish: All action alternatives would comply with these standards. Activities that potentially conflict with grizzlies in Management Situation 1 and 2 grizzly habitat are described in section 3.25.5.2, *Threatened and Endangered Species.*

Soil, Water, and Air: All alternatives would comply with these standards. As described in sections 3.19, *Soils and Reclamation* and 3.4, *Air Quality*, all action alternatives would comply with soil standards in the KFP and MAAQS. For all action alternatives, BMPs would be implemented to reduce erosion and sedimentation.

Riparian: Compliance with INFS standards are discussed in section 3.6, *Aquatic Life and Fisheries*.

Timber: Firewood cutting could impact snags located in old growth habitat, and this effect is taken into consideration in the cavity habitat analysis in section 3.25.2.2, *Snags and Woody Debris*. Timber harvest would occur, as shown in Table 179 and Table 180 and Table 181. All action alternatives require a project-specific amendment to allow harvest within designated old growth stands (MA 13). The project-specific amendment would change the current MA 13 (Designated Old Growth) designation of all harvested stands to either MA 23 (Electric Transmission Corridor) or 31 (Mineral Development).

Facilities: All action alternatives would comply with these standards. Some areas of MA 13 would be reallocated to MA 31 (Mineral Development) or MA 23 (Electric Transmission

Corridor) for each action alternative. For all action alternatives, some currently closed or restricted roads would be open to mine traffic, but would not be accessible to the public (see Table 13 for Alternative 2, Table 23 for Alternative 3, Table 35 for Alternative 4). All action alternatives would continue to restrict motorized access on other local roads where closures exist.

3.22.2.4.14 Irreversible and Irretrievable Commitments

All action alternatives would result in an irreversible commitment of old growth forest in the Crazy PSU and, except for Alternative E-R, the Silverfish PSU. Transmission line alternatives B and E-R would result in an irreversible commitment of old growth forest in small areas of private land along the transmission line corridor near US 2. Irretrievable commitments of old growth resources in the Silverfish PSU would occur due to indirect impacts from minor edge effects. The recovery time of old growth forest would preclude restoration for centuries following disturbance (200-250 years).

3.22.2.4.15 Short-term Uses and Long-term Productivity

Losses of old growth habitat resulting from implementation of the action alternatives would be long-term, and would be primarily in the Crazy PSU, small areas in the Silverfish PSU, and in small areas of old growth on private land along the transmission line corridor. All alternatives would result in minor edge effects, which would continue beyond the Closure Phase. If reclamation were successful and successional processes were allowed to take place, edge effects would eventually dissipate. Given the recovery time of old growth forest, direct elimination of effects after disturbance would likely require centuries (200-250 years).

3.22.2.4.16 Unavoidable Adverse Environmental Effects

Unavoidable adverse effects would occur from all action alternatives in the Crazy and Silverfish PSUs and small areas of private land along the transmission line corridor where old growth habitat would be directly removed.

3.22.3 Threatened, Endangered, and Sensitive Plant Species

The KNF monitors plant species considered to be of concern. Plant species of concern are characterized as threatened, endangered, sensitive, or Category 4 watch species. T&E species include species listed by the USFWS and protected under the ESA. Forest Service sensitive species are those species the Regional Forester determines to be a concern on National Forest System lands in the Region due to declining numbers. The KNF works closely with the MNHP, which maintains records of plant species of concern. State-listed plant species of concern are also discussed in the following sections.

3.22.3.1 Regulatory Framework

Section 3.6, *Aquatic Life and Fisheries* discusses the regulatory framework for federal-listed threatened or endangered plant species, and Forest sensitive plant species. Two Forest sensitive plant species of concern were found in the analysis area, the northern beechfern (*Phegopteris connectilis)* and crenulated moonwort *(Botrychium crenulatum)*. The KFP requires the maintenance of diverse age classes of vegetation for viable populations of all existing native, vertebrate wildlife species.

There are no regulatory requirements to protect Forest sensitive or state plant species of concern on private land. The DEQ strives to work with proponents of mine development to voluntarily limit impacts on Forest sensitive or state plant species of concern. The MFSA directs the DEQ to approve a facility if, in conjunction with other findings, the DEQ finds and determines that the facility would minimize adverse environmental impacts, considering the state of available technology and the nature and economics of the various alternatives.

3.22.3.2 Analysis Area and Methods

The analysis area consists of all areas that would be disturbed by construction of the mine, transmission line, substation and loop line under any alternative (Figure 85). Potential habitat for sensitive plants was surveyed in areas surrounding facilities as proposed in 1989. Sensitive plant surveys followed KNF guidelines and procedures and were conducted during the summers of 1988 and 1989 (Western Resource Development Corp. 1989d, 1989e), with additional updates in the summer of 2005 (Westech 2005c). During the sensitive plant survey, habitats for sensitive plants were thoroughly examined and the remainder of the analysis area was less thoroughly examined (Westech 2005c). Additional sensitive plant inventories of the Poorman Tailings Impoundment Site, the Libby Plant Site, and the Upper Libby Adit Site were conducted in June and August of 2007 (Geomatrix 2009b). Information from these surveys was used to determine effects on plant species of concern. MNHP records are used in this summary to describe the characteristics of plant species of concern found during surveys of the analysis area. No surveys specifically for Category 4 watch species were conducted in the analysis area. Category 4 watch species were identified and recorded during surveys and are included in vascular plant species lists identified in the analysis area (Westech 2005c) and are not discussed further. Surveys for sensitive plants were not completed for all segments of all transmission line alternatives because a final alignment has not been selected and suitable habitat for sensitive plants could be avoided through design and placement of the transmission line structures. Surveys for sensitive plants were not completed for the segment in Alternatives C-R, D-R, and E-R from the Sedlak Park Substation north to where the alignment crosses Alternative B segments of Alternative C-R where they differ from Alternative B, a segment of Alternative D-R, and the entire alignment of Alternative E-R. The loop line at the Sedlak Park Substation site also was not surveyed. The remaining segments of the alternatives were surveyed for sensitive plants.

The Regional Forester updated the Forest Service sensitive species list for Region 1 in 2011 (USDA Forest Service 2011f). MMC would update surveys for plant species of concern before any ground-disturbing activities in the agencies' mine and transmission line alternatives. The survey results would be submitted to the agencies for approval. If sensitive plants were identified and adverse effects could not be avoided, MMC would develop appropriate mitigation plans for the agencies' approval. The mitigation would be implemented before any ground-disturbing activities. To the extent feasible, MMC would make adjustments to structure and road locations, and other disturbing activities to reduce impacts.

3.22.3.3 Affected Environment

One federal-listed threatened plant species was identified to potentially occur in the analysis area: Spalding's campion (*Silene spaldingii*). Suitable habitat for federal-listed or candidate species was evaluated and determined to be limited in the analysis area (Westech 2005c). No federal-listed T&E plant species were found in the analysis area and T&E plant species are not discussed further.

Two Forest Service sensitive plant species were found in the analysis area: the northern beechfern (*Phegopteris connectilis*) and crenulated moonwort (*Botrychium crenulatum*). Northern beechfern is found at 22 locations in scattered populations in northwestern Montana in Flathead, Glacier, Lincoln, and Sanders counties (MNHP 2014). Three of the occurrences are on the Libby Ranger District of the KNF. Northern beechfern is found in populations ranging from 10 to 100 individuals on benches above Little Cherry Creek in the analysis area (Westech 2005c). Past timber harvesting likely led to declines in the species' abundance and distribution (MNHP 2014). The MNHP classified the northern beechfern as secure globally, but imperiled in Montana because of rarity within the state. Habitat characteristics for the northern beechfern include old growth and mature western redcedar and western hemlock, which occur in the coniferous forest community. Understory plants found with northern beechfern are queencup beadlily, devil's club and lady fern. Management goals for northern beechfern population and genetic viability associated with each are discussed in the KNF Conservation Assessment Report prepared as a result of the 1992 Montanore Project EIS (KNF 1993).

The crenulated moonwort is a small, perennial fern that has been found at several locations in western Montana. Habitat for the crenulated moonwort is mesic areas associated with streams, seeps and western red cedar and western hemlock forests but also includes roadsides and other disturbed areas. During surveys in 2005 for the Montanore Project, two populations were found in riparian areas along Libby Creek and Little Cherry Creek (Westech 2005c). Suitable habitat is present within the Poorman Impoundment Site, but crenulated moonworts were not found during 2007 surveys (Geomatrix 2007d).

Dryland forests along the transmission line corridors have potentially suitable habitat for three Forest sensitive species: taper-tipped onion (*Allium acuminatum*), common clarkia (*Clarkia rhomboidea*), and bank monkeyflower (*Mimulus clivovola*). Limited plant surveys have been done along the transmission line corridor and the presence of these species is unknown.

3.22.3.4 Environmental Consequences

3.22.3.4.1 Alternative 1 – No Mine

The No Mine Alternative would not affect any Forest sensitive or other state-listed plant species of concern.

3.22.3.4.2 Alternative 2 – MMC's Proposed Mine

In Alternative 2, two Forest sensitive and state-listed plant species of concern would be affected, the northern beechfern and the crenulated moonwort. Northern beechfern and the crenulated moonwort populations are located along Little Cherry Creek in the Tailings Impoundment Site (Westech 2005c). A population of northern beechfern and a population of crenulated moonwort would be eliminated in the Little Cherry Creek tailings impoundment site. Northern beechfern is found in 22 other locations across northwestern Montana with (MNHP 2014). The crenulated moonwort has 139 observations at more than 50 locations in Montana. The other populations of both the northern beechfern and the crenulated moonwort are currently secure so viability would not be threatened with the loss of populations in Little Cherry Creek. The KNF's Conservation Assessment (KNF1993) provides additional information on the northern beechfern. An increase in noxious weeds from disturbed ground could reduce habitat for forest sensitive and state-listed plant species of concern.

3.22.3.4.3 Alternative 3 – Agency-Mitigated Poorman Impoundment Alternative

Alternative 3 would not affect any Forest sensitive and state-listed plant species of concern since no sensitive species were identified during field surveys. MMC would update surveys for plant species of concern before any ground-disturbing activities in the agencies' alternatives. If a species of concern was identified and adverse effects could not be avoided, MMC would develop appropriate mitigation plans for the agencies' approval. The mitigation would be implemented before any ground-disturbing activities.

3.22.3.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

The effect on Forest sensitive and state-listed plant species of concern for Alternative 4 would be the same as Alternative 2. MMC would update surveys for plant species of concern before any ground-disturbing activities in the agencies' alternatives. If a species of concern was identified and adverse effects could not be avoided, MMC would develop appropriate mitigation plans for the agencies' approval. The mitigation would be implemented before any ground-disturbing activities.

3.22.3.4.5 Alternative A – No Transmission Line

In Alternative A, the transmission line, substation, and loop line for the Montanore Project would not be built. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands. Effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

3.22.3.4.6 Alternatives B

All of Alternative B was surveyed for Forest sensitive or other state-listed plant species of concern, and none were identified. Taper-tipped onion, common clarkia, and bank monkeyflower have been added as Forest sensitive species since the previous survey was conducted, and surveys would be updated before construction.

3.22.3.4.7 Alternatives C-R, D-R, and E-R

No Forest sensitive or other state-listed plant species of concern were identified along the transmission line corridors surveyed. Surveys for sensitive plants were not completed for all segments of all transmission line alternatives because a final alignment has not been selected and suitable habitat for sensitive plants could be avoided through design and placement of the transmission line structures. Surveys for sensitive plants were not completed for the segment in Alternatives C-R, D-R, and E-R from the Sedlak Park Substation north to where the alignment crosses Alternative B segments of Alternative C-R where they differ from Alternative B, a segment of Alternative D-R, and the entire alignment of Alternative E-R. The loop line alignment at the Sedlak Park Substation site also was not surveyed. The remaining segments of the alternatives were surveyed for sensitive plants.

MMC would update surveys for plant species of concern, including newly listed species, before any ground-disturbing activities in the agencies' alternatives. If a species of concern was identified and adverse effects could not be avoided, MMC would develop appropriate mitigation plans for the agencies' approval. The mitigation would be implemented before any ground-disturbing activities. To the extent feasible, MMC would make adjustments to structure and road locations, and other ground-disturbing activities to reduce impacts.

3.22.3.4.8 Effectiveness of agencies' Proposed Mitigation

Updating surveys and developing avoidance and mitigation measures would effectively minimize effects on Forest sensitive or other state-listed plant species of concern.

3.22.3.4.9 Cumulative Effects

No other reasonably foreseeable projects in the region, including the Miller-West Fisher Vegetation Management Project, would directly impact federal-listed, Forest sensitive, or state-listed plant species of concern.

3.22.3.4.10 Regulatory/Forest Plan Consistency

The No Action alternatives would not impact any sensitive plant species or their habitat. ***Alternatives 2 and 4 would impact individuals and habitat but would not likely contribute to a trend toward federal listing or cause a loss of viability for Northern beechfern and crenulated moonwort. Alternative 3 may impact individuals or habitat but would not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species. All alternatives transmission line locations may impact individuals of or habitat for taper-tipped onion, common clarkia, and bank monkeyflower but would not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species.***

3.22.3.4.11 Irreversible and Irretrievable Commitments

An irretrievable commitment of resources would occur in Alternatives 2 and 4 from the loss of two populations of Forest sensitive and state-listed plant species of concern. Reclamation of habitat upon completion of mining would not recreate the habitat or necessarily provide conditions suitable for establishment of affected species. Increases in populations of introduced species after disturbance may limit the potential for re-establishment of these species.

3.22.3.4.12 Short-term Uses and Long-term Productivity

Mine operations would result in the long-term loss of one population of northern beechfern and one population of crenulated moonwort in Alternatives 2 and 4.Reclamation of habitat following mining would not recreate the habitat for affected species. Increases in populations of introduced species after disturbance may limit the potential for re-establishment of these species.

3.22.3.4.13 Unavoidable Adverse Environmental Effects

Long-term loss of one population of northern beechfern and one population of crenulated moonwort would occur in Alternatives 2 and 4. It is currently unknown whether any populations of taper-tipped onion, common clarkia, and bank monkeyflower would be lost. Surveys for these species would occur prior to ground-disturbing activities along the selected transmission line corridor. Preconstruction surveys and development of mitigation for unavoidable impacts are discussed in section 2.5.2.5, *Final Design Process.*

3.22.4 Noxious Weeds

3.22.4.1 Regulatory Framework

The term "noxious weed" is defined in the Federal Plant Protection Act and in some individual State statutes. The term "noxious weed" means any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment. The term typically describes species of plants that have been determined to be undesirable or injurious in some capacity (USDA Forest Service 2011g). Executive Order 13112 directs federal agencies to prevent the introduction of invasive species; provide for their control; and minimize the economic, ecological, and human health impacts that invasive species cause.

The Montana County Weed Control Act (7-22-2101 *et seq.,* MCA) defines noxious weeds as "any exotic plant species established or that may be introduced in the state which may render land unfit for agriculture, forestry, livestock, wildlife, or other beneficial uses or that may harm native plant communities and that is designated a state noxious weed by rule of the Department of Agriculture; or a noxious weed by a county board." It also states that it is unlawful for any person to permit any noxious weed to propagate or go to seed on his land. The KNF has signed a memorandum with Lincoln County and has agreed to assist and cooperate with the Lincoln County Weed District in managing noxious weeds. The Forest Service's guidelines for controlling noxious weeds are provided in the FSM 2900 Invasive Species Management (USDA Forest Service 2011g), R1 Supplement 2080 Noxious Weed Management 2001, and Appendix A of the KNF Invasive Plant Management Final EIS (KNF 2007a). The Lincoln County Weed District has identified several species of noxious weeds that occur or potentially occur in Lincoln County (Lincoln County 2008). The DEQ requires that mine operations have a weed control plan approved by the local county weed control board.

3.22.4.2 Analysis Area and Methods

The analysis area consists of all areas that would be disturbed by construction of the mine, transmission line, substation and loop line under any alternative (Figure 85).

Noxious weed baseline surveys for the Montanore Project facilities as proposed in 1989 were conducted during the summers of 1988 and 1989 (Western Resource Development Corp. 1989d, 1989e). Noxious weed surveys were updated in 2005 to determine if the weed species or distribution had changed (Westech 2005b). Most proposed mine facility locations and transmission line alternatives were surveyed for noxious weeds. The areas not surveyed for threatened, endangered, or sensitive species also were not surveyed for noxious weeds. Areas not evaluated for noxious weeds are believed to have similar noxious weed infestations and would require similar control methods.

The potential for noxious weed introduction and establishment for the alternatives evaluated was determined based on existing weed populations, total amount of disturbance, and plans to control weeds and revegetate disturbed areas.

3.22.4.3 Affected Environment

Noxious weeds are categorized by the state, county, and Forest Service for management and control. Lincoln County categorizes noxious weeds in Categories I through IIIb (Lincoln County 2008). Lincoln County Category I species are weeds that cover extensive areas, Category II are well established, IIIa are potential invaders, and IIIb are new invaders. Potential invaders include noxious weeds that do not currently exist in Lincoln County but have a high probability of causing severe environmental or economic degradation. (Lincoln County 2008).

The State of Montana identifies Priority 1A, 1B, 2A, 2B, and 3. IA includes weeds not present in Montana, 1B have limited presence, 2A are common in isolated areas of Montana, 2B are abundant in Montana and widespread in many counties and Priority 3 species are regulated plants, but are not listed as Noxious Weeds in Montana. The KNF noxious weed plans (KNF Noxious Weed Handbook, Spring 2008, Edition 5.0) categorize noxious weeds into three categories; Category 1 are well established, Category 2 are new invaders and Category 3 are potential invader species, groupings that are similar to Lincoln County but have different priorities. Noxious weed categories are listed in Table 183.

Table 183. Noxious Weeds Found in the Analysis Area.

Weed Species	Scientific Name†	State Category	Lincoln County Weed Category	KNF Weed Category
Canada thistle	*Cirsium arvense*	2B	II	1
Common tansy	*Tanacetum vulgare*	2B	II	1
Meadow hawkweed	*Hieracium caespitosum*	2A	I	1
Orange hawkweed	*Hieracium aurantiacum*	2A	I	1
Ox-eye daisy	*Leucanthemum vulgare*	2B	I	1
Spotted knapweed	*Centaurea stoebe*	2B	I	1
St. Johnswort	*Hypericum perforatum*	2B	I	1
Sulphur cinquefoil	*Potentilla recta*	2B	I	1
Tall buttercup	*Ranunculus acris*	2A	IIIa	2

†Scientific name from USDA Natural Resources Conservation Service 2008.

Canada thistle is a deep-rooted, creeping perennial that is native to Eurasia. In the analysis area, Canada thistle is common in disturbed swales, mesic areas, and in wetlands where logging has occurred. Monocultures characterized by a high density of Canada thistle are present as scattered plants with low concentrations (Westech 2005b).

KNF Category 1 and 2, State Category 2A and B and 2, and Lincoln County Category I, II, and IIIa species were observed in several locations in the analysis area. Nine species of noxious weeds were found in the analysis area during the 2005 baseline vegetation studies: Canada thistle; spotted knapweed; ox-eye daisy; orange hawkweed; meadow hawkweed; St. Johnswort; sulfur cinquefoil; tall buttercup; and common tansy (Westech 2005b). In addition, Dalmatian toadflax has been found in the Miller Creek drainage, and rush skeletonweed has been found in the Miller Creek and West Fisher Creek drainages. The 1988 vegetation baseline inventory (Western Resource Development Corp. 1989d, 1989e) documented three listed noxious weeds in the analysis area as well as three noxious weeds yet to be officially listed: Canada thistle, spotted knapweed, St. Johnswort, orange hawkweed, ox-eye daisy, and tall buttercup. Meadow hawkweed, sulfur cinquefoil, and common tansy were not recorded in the initial mine analysis area in 1988 but were recorded in 2005.

Common tansy is a perennial forb that is poisonous if ingested. It is not as dominant as the other listed noxious weeds in the analysis area. This species is found most frequently along roads and in disturbed areas, and along riparian corridors. It is common in patches along the Fisher River (Westech 2005b).

Orange hawkweed is a perennial with a fibrous, creeping root system. It has clusters of orange dandelion-like heads and is the most abundant and problematic noxious weed in the Montanore analysis area. It is found mostly in logged and disturbed areas in western hemlock/western redcedar forest types. Most roadsides are dominated by orange hawkweed (Westech 2005b).

Meadow hawkweed has almost identical vegetative growth characteristics to orange hawkweed and is difficult to distinguish without flowering heads. Meadow hawkweed is less common in the analysis area than orange hawkweed, and is found primarily along roads (Westech 2005b).

Once a cultivated species, ox-eye daisy is an invasive weed that is becoming an increasing problem in the western states. Ox-eye daisy is most common along roads and in recently logged areas in the Montanore analysis area (Westech 2005b). It is invading many meadows in northwestern Montana.

Spotted knapweed is an aggressive invader that generally occurs in disturbed areas. Spotted knapweed is a perennial, taprooted Eurasian weed species that invades range and harvested forestland throughout the West. It can reduce biodiversity, wildlife and livestock forage production, and can also increase soil erosion (Montana Noxious Weed Summit Advisory Council 2008). Spotted knapweed grows best in well-drained soils. Spotted knapweed occurs throughout the analysis area, particularly along roads, on disturbed areas, and in areas where timber has been harvested and tree canopy cover is relatively open. Undisturbed areas typically do not have large infestations of spotted knapweed (Westech 2005b).

St. Johnswort is a perennial species that was introduced because of its medicinal properties. Montana’s Department of Agriculture reports that St. Johnswort covers an area of about 68,000 acres in Montana (Montana Noxious Weed Summit Advisory Council 2008). This plant is unpalatable and mildly poisonous to livestock. It is observed along roads and in recent previously harvested coniferous forests but coverage was spotty or minor (Westech 2005b).

Sulfur cinquefoil is a perennial species with well-developed creeping woody roots. Sulfur cinquefoil was recorded in Sedlak Park and along US 2 near the analysis area (Westech 2005b).

Tall buttercup is a perennial species that grows up to 3 feet tall and is poisonous to livestock if ingested. Tall buttercup was present in the 1988 baseline vegetation inventory but was not located during the 2005 baseline vegetation survey (Westech 2005b).

3.22.4.4 Environmental Consequences

3.22.4.4.1 Alternative 1 – No Mine

Introduced species such as cheatgrass and noxious weeds have increased in the analysis area between the time the baseline vegetation surveys were conducted in 1988 and 1989 and the time they were updated in 2005. This increase would continue in the future with or without the mine because of the competitiveness of the introduced species. The No Mine Alternative would not involve new land-disturbing activities and would minimize the increase in number and distribution of introduced species and noxious weeds. Noxious weeds currently present in the analysis area would continue to be subject to existing Forest Service, state, and county-wide noxious weed management practices. Noxious weeds at the Libby Adit Site would continue to be controlled in accordance with existing permits and approvals. Noxious weed control using herbicides can cause an indirect effect on adjacent native species ranging from minimal to severe depending on the type of herbicide and quality of application. Inadequate reseeding efforts to replace native species after treatment cause additional indirect effects on native plant species. The Forest Service and other land managers and owners are not required to control introduced species that are not classified as noxious weeds.

3.22.4.4.2 Alternative 2 – MMC's Proposed Mine

Alternative 2 would increase the spread and establishment of noxious weeds and other introduced species associated with ground-disturbing activities. Weeds invade disturbed ground where they easily establish and out-compete native species even with a weed control program. Weed establishment would more likely occur along roads, cut-and-fill slopes, the margins of mine facilities, soil stockpiles, and other disturbed areas. The distribution of noxious weeds and other introduced species would probably be greatest under Alternative 2 because it includes the largest area of potential disturbance (2,581 acres).

MMC's weed control program would minimize weed infestations on lands disturbed by the proposed facilities. All off-highway vehicles and earth moving equipment entering Lincoln County would be washed at a commercial facility. Special emphasis would be taken to remove soil and other plant material from the vehicle or equipment. MMC would notify KNF at least 24 hours in advance of equipment delivering to the site to provide an opportunity to inspect the equipment. Weed control during operations would primarily be through the use of herbicides. Additionally, a 3-year continuous monitoring and treatment program would be implemented (MMI 2006). Criteria in the reclamation plan for Alternative 2 require that vegetation composition would have less than 10 percent cover of noxious weeds. MMC would not be required to control other introduced species.

3.22.4.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

With 2,011 acres of disturbance, Alternative 3 would have similar potential to increase the infestation and spread of noxious weeds and other introduced species as Alternative 2, although distribution would likely be less. All weed BMPs discussed in section 2.5.3.2.5*, Noxious Weed Mitigation Measures* for Alternative 3 would be implemented, and would reduce the establishment and spread of noxious weeds, compared to Alternative 2. Weed BMPs would address the treatment and control of noxious weeds throughout all mine facilities.

The reclamation plan for reclaimed areas under Alternative 3 differs from Alternative 2 and would require that noxious weeds would have less than 10 percent cover of species listed as Category 1 (established infestations), and 0 percent cover of categories 2 and 3 (potential invaders and new invaders, as described in the KNF Noxious Weed Handbook, Spring 2008, Edition 5.0). Category 1 noxious weeds would not dominate any location greater than 400 square feet. The goal of Alternative 3 would be to use a native seed mix, if commercially available, that would reduce the spread of invasive or noxious species. In Alternative 3, shrubs and trees would be planted by hand in random patterns to prevent the spread or infestation of noxious weeds by limiting disturbance from machinery. MMC would not be required to control other introduced species.

3.22.4.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternative 4 would have the same potential to result in the establishment and spread of noxious weeds and other introduced species as described for Alternatives 2 and 3. The reclamation and weed management plans for Alternative 4 would be the same as Alternative 3. MMC would not be required to control other introduced species.

3.22.4.4.5 Alternative A – No Transmission Line

In Alternative A, the transmission line, substation, and loop line for the Montanore Project would not be built. The DEQ's approval of the mine, as permitted by DEQ Operating Permit #00150 and revised in Minor Revisions 06-001 and 06-002, would remain in effect. MMC could continue with the permitted activities on private land associated with the Libby Adit evaluation program that did not affect National Forest System lands. Effects associated with activities at the Libby Adit Site would remain until the site was reclaimed in accordance with existing permits and approvals.

3.22.4.4.6 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Alternative B would have the largest area of surface disturbance associated with new or upgraded road construction and timber clearing of the four alternatives (Table 175). New roads would be reseeded as an interim measure, but used for maintenance activities, as necessary. Surface disturbances and continued road use would increase the risk of spread of noxious weed and other introduced species and would require more monitoring and control of noxious weeds. Alternative B would have the least area of vegetation clearing, which would minimize disturbance and potential weed spreading. MMC's weed control program described in Alternative 2 would be implemented for Alternative B, and is designed to minimize weed infestations on lands disturbed by the proposed facilities. Vehicles would be cleaned before entering the area and following work in weed infested areas. BPA's plan to conduct a noxious weed survey at the proposed Sedlak Park Substation Site before and after construction of the substation and its weed control program would minimize noxious weeds at the site. MMC and the BPA would not be required to control other introduced species that are not classified as noxious weeds.

3.22.4.4.7 Effects Common to Transmission Line Alternatives C-R, D-R, and E-R

These alternatives would use a helicopter to construct between 16 and 32 structures, which would minimize new road construction or reconstruction. A helicopter would be used to clear timber in areas adjacent to core grizzly bear habitat. Roads decommissioned or placed in intermittent stored service would not be used for routine maintenance of the transmission line, but could be used for emergency repairs, such as a damaged insulator. These modifications would reduce the risk of noxious weed spread. Because these alternatives would require greater vegetation clearing along the transmission line corridor, weed spread associated with such clearing would be greater in these alternatives than Alternative B. MMC's weed control program described in Alternative 2 and modified in Alternative 3 would minimize weed infestations on lands disturbed by the transmission line facilities. BPA's plan to conduct a noxious weed survey at the proposed Sedlak Park Substation Site before and after construction of the substation and its weed control program would minimize noxious weeds at the site. MMC would coordinate with the Forest Service Weed Specialist for use of biocontrol agents as they become available. MMC and BPA would not be required to control other introduced species.

3.22.4.4.8 Effectiveness of Agencies' Proposed Mitigation

The agencies' modifications to MCC's weed control program would be effective in minimizing weed infestations on lands disturbed by the mine and transmission line facilities.

3.22.4.4.9 Cumulative Effects

Past actions, particularly timber harvest, road construction, and fire suppression, coupled with human activity have resulted in the establishment of the existing noxious weed and other introduced species populations in the analysis area. All reasonably foreseeable future projects in the area that involve ground disturbances have the potential to spread and increase the number of noxious weeds and other introduced species. Any ground-disturbing activities, activities that involve large equipment, livestock grazing, or activities that increase motor access could increase spread of noxious weeds or introduce new invaders to the area. Noxious weed and other introduced species infestations could impact sensitive plant species. The construction of both the Montanore Project and the Rock Creek Project would increase the opportunity for noxious weeds to invade the CMW from the east and west. All reasonably foreseeable actions would be subject to existing Forest Service, state, and county-wide management practices, which have proven effective in slowing the spread of targeted noxious weeds. Native species are also affected by chemical weed control programs. The Forest Service and other land managers and owners are not required to control other introduced species.

3.22.4.4.10 Regulatory/Forest Plan Consistency

Mine Alternative 2 and transmission line Alternative B would not fully comply with the KFP and Executive Order 13112. MMC did not propose to implement all weed BMPs identified in Appendix A of the KNF Invasive Plant Management Final EIS (KNF 2007a). In the agencies' mine and transmission line alternatives, all weed BMPs discussed in section 2.5.3.2.5, *Noxious Weed Mitigation Measures* would be implemented, and would reduce the establishment and spread of noxious weeds, compared to Alternatives 2 and B. Weed BMPs and other measures described in section 2.5.3.2.5, *Noxious Weed Mitigation Measures* would address the treatment and control of noxious weeds throughout all mine facilities.

3.22.4.4.11 Irreversible and Irretrievable Commitments

All alternatives have the potential to increase noxious weed and other introduced species populations, which would displace native species, and result in an irreversible loss of plant species. Chemical weed control programs would also limit native species.

3.22.4.4.12 Short-term Uses and Long-term Productivity

All alternatives have the potential to increase noxious weed and other introduced species populations, which would displace native species, and reduce their long-term productivity. Chemical weed control programs would also limit native species' productivity.

3.22.4.4.13 Unavoidable Adverse Environmental Effects

A potential unavoidable increase in noxious weed and other introduced species populations would occur under all alternatives. Invasion of noxious weeds and other introduced species as well as spraying of noxious weeds with chemicals would result in the loss of some native plant species.

3.23 Wetlands and Other Waters of the U.S.

3.23.1 Regulatory Framework

Discharges of dredged or fill material into waters of the U.S. are regulated under the Clean Water Act by the Corps of Engineers. Waters of the U.S. are defined broadly in the Corps' regulations to include a wide variety of waters and wetlands. All water bodies in the analysis area are State waters. The Corps defines "wetlands" as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (33 CFR 328.3 (b)). Under natural conditions, waters of the U.S. provide food and habitat for fish and wildlife, flood protection, erosion control, water quality improvement, and opportunities for recreation (Adamus *et al.* 1991). The term "wetlands and other wetland waters of the U.S." includes both deep-water habitats (non-wetland) and special aquatic sites, which include wetlands (Environmental Laboratory 1987).

This section discusses wetlands and other waters of the U.S. found within the analysis area. In Montana, surface water is any water of the State at the surface of the ground, including but not limited to any river, stream, creek, ravine, coulee, undeveloped spring, lake, and other natural surface source of water regardless of its character or manner of occurrence (ARM 36.12.101). The Corps determines a water to be subject to its jurisdiction if the water body is a traditionally navigable water, relatively permanent water, or a wetland that directly abuts a traditionally navigable or relatively permanent water body, or, in combination with all wetlands adjacent to that water body, has a significant nexus with traditionally navigable waters (Corps and EPA 2007).

The Corps defines springs as "any location where there is artesian flow emanating from a distinct point at any time during the growing season" (Corps 2012). In Montana, a spring is defined as a hydrologic occurrence of water involving the natural flow of water originating from beneath the land surface and arising to the surface of the ground. Any disturbances within 100 feet of a spring are regulated by the Corps (Corps 2012).

All activities that result in the discharge of fill material into wetlands or other waters of the U.S. are regulated by the Corps. Based on a Supreme Court 2001 ruling, wetlands that are isolated from other waters of the U.S., and whose only connection to interstate commerce is use by migratory birds, do not fall under Corps' jurisdiction. Such wetlands are "isolated" or "non-jurisdictional" and these terms are used synonymously.

Projects subject to the Corps' jurisdiction also must comply with the 404(b)(1) Guidelines for discharge of dredged and fill material into wetlands and other waters of the U.S. (40 CFR 230). It is anticipated that one or more Montanore Project facilities would need a 404 permit from the Corps. The 404(b)(1) Guidelines specify "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse effect on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences." An alternative is considered practicable if "it is capable of being done after taking into consideration cost, existing technology, and logistics in the light of overall project purposes." Practicable alternatives under the Guidelines assume that "alternatives that do not involve special aquatic sites are available, unless clearly demonstrated otherwise." The Guidelines also assume that "all practicable alternatives to the proposed discharge which do not involve a discharge into a special aquatic site are presumed to have less adverse effect on the aquatic ecosystem, unless clearly demonstrated otherwise" (40 CFR 230).

Federal agencies have responsibilities to avoid, minimize, and mitigate unavoidable impacts on wetlands under Executive Order 11990. Executive Order 11990 requires federal agencies to "consider factors relevant to a proposal's effect on the survival and quality of the wetlands." Federal agencies must find that there is no practicable alternative to new construction located in wetlands, and that the proposed action includes all practicable measures to minimize harm to wetlands. Agencies may take into account economic, environmental and other pertinent factors in making this finding.

In 2008, the Corps and the EPA issued regulations (33 CFR 332 and 40 CFR 230 Subpart J) regarding compensatory mitigation requirements for losses of aquatic resources, such as wetlands. These regulations require in cases where appropriate functional or condition assessment methods or other suitable metrics are available, these methods should be used where practicable to determine how much compensatory mitigation is required. If a functional or condition assessment or other suitable metric is not used, a minimum one-to-one acreage or linear foot compensation ratio must be used. Before issuance of the 2008 regulations, the Corps in Montana used ratios for various mitigation types in determining compensation requirements (Corps 2005). The Corps developed a stream mitigation procedure for projects adversely affected streams in 2010 and revised it in 2013 (Corps 2013a).

The KNF amended the KFP to establish standards for wetlands under the INFS standards (USDA Forest Service 1995). INFS standards and guidelines apply to an area within 150 feet of a wetland greater than 1 acre in size. For a wetland less than 1 acre, INFS standards and guidelines apply to an area within 100 feet of a wetland in priority watersheds and within 50 feet of a wetland in non-priority watersheds.

3.23.2 Analysis Area and Methods

3.23.2.1 Analysis Area

The analysis areas are areas where potential direct or indirect effects on wetlands and other waters of the U.S. by any of the alternatives would occur. The analysis area is the same as the analysis area used for surface water hydrology (discussed in section 3.11.2, *Analysis Area*) and shown on Figure 76.

3.23.2.2 Baseline Data Collection

3.23.2.2.1 Wetland Delineation and Functional Assessment

Wetlands and other waters were delineated within the analysis areas between 2005 and 2009 (Westech 2005e, Geomatrix 2008b; Geomatrix 2009b) following Corps methods (Environmental Laboratory 1987). Wetland boundaries were flagged and delineated using a Global Positioning System (GPS) device. Waters of the U.S. not likely to be filled with dredged or fill material, or sites where GPS coverage was lacking, were delineated from aerial photo interpretation. This included wetlands along access roads and the transmission line corridor, and on private lands. In 2011, MMC completed an inventory of the physical, chemical and biological characteristics of headwater drainages that would be directly affected by the Poorman Impoundment (Kline

Environmental Research 2012). Modifications to the location of some of the drainages mapped from 2005 to 2009 were made based on the Kline inventory. Wetlands mapped along the previous drainage alignments are considered riparian corridor wetlands (Figure 87) and were used in the impact calculation.

Wetland delineations were not completed for Alternative E-R - West Fisher Creek Alternative, a segment of Alternative D-R - Miller Creek Alternative in upper Miller Creek, segments of Alternative C-R - Modified North Miller Creek Alternative where they differ from Alternative B, and the segment in Alternatives C-R, D-R, and E-R from the Sedlak Park Substation north to where the alignment crosses Alternative B. Wetland delineations also would be needed at sites proposed in the agencies' fisheries and wildlife mitigation measures, such as road crossings where culverts would be removed.

Wetlands near the Sedlak Park Substation site were not delineated according to the 1987 Corps of Engineers Wetlands Delineation Manual. Instead, BPA environmental staff identified wetland boundaries based on the presence of hydric soil boundaries, secondary hydrologic indicators, and wetland vegetation. Wetland boundaries were recorded using a GPS device. GPS data were used by BPA to develop a substation design that would avoid and minimize impacts on wetlands and waters of the U.S. (BPA 2008).

An assessment of the jurisdictional status of each wetland was made during the wetland delineations. Wetlands and other waters were assigned as either jurisdictional wetlands, jurisdictional non-wetland waters of the U.S., or isolated wetlands. Isolated wetlands are not connected by surface flow to jurisdictional waters of the U.S. Non-wetland waters of the U.S. were delineated to the ordinary high water mark where stream channels had a defined bed and bank during the 2005 delineation (Westech 2005e). Non-wetland waters of the U.S. in the Poorman Impoundment Site were updated based on the 2011 stream survey (Kline Environmental Research 2012). The 2005 wetland delineation (Westech 2005e) and the 2009 wetland delineation (Geomatrix 2009b) have been subject to a preliminary jurisdictional determination by the Corps (Corps 2005a, 2008b). An approved jurisdictional determination of isolated wetlands in the Poorman Impoundment Site has been completed (Corps 2008c, 2014). In 2013, the Corps issued an updated preliminary jurisdictional determination of wetlands and non-wetland waters within the Poorman Impoundment Site (Corps 2013b). The Corps determined that short reaches of four drainages in the Poorman Impoundment Site lacked a defined channel and were non-jurisdictional. Other reaches were determined to be relatively permanent waters, which are subject to Corps jurisdiction (Figure 87). In the effects analysis, the lead agencies used the Corps' preliminary and approved jurisdictional determinations of the sites. The jurisdictional status of the wetlands and other waters of the U.S. is preliminary and impacts may change during the 404 permitting process.

Between 2005 and 2008, functions and services for wetlands within the analysis area were evaluated using the 1999 MDT Montana Wetland Assessment Method (Berglund 1999). In 2010, wetland functional assessments were revised following the 2008 MDT Montana Wetland Assessment Method (MDT method) (Berglund and McEldowney 2008; Geomatrix 2010d). The MDT method uses a classification system that combines the USFWS classification system (Cowardin *et al.* 1979) with a hydrogeomorphic (landscape position) approach (Brinson 1993). The MDT method provides a landscape context to the USFWS classification. The MDT method classifies wetlands as Category I, II, III, or IV. Category I wetlands are exceptionally high quality wetlands and are generally rare to uncommon. Category II wetlands are more common than

Category I wetlands, and provide habitat for sensitive plants and animals. Category III wetlands are more common than Category II or I wetlands, generally less diverse, and are often smaller than Category II or I wetlands. Category IV wetlands are generally small, isolated, and lack vegetative diversity. These wetlands provide minor wildlife habitat.

3.23.2.2.2 Hydrologic Assessment

Groundwater Levels – Poorman Impoundment Site

MMC collected groundwater data from several piezometers installed in wetlands within the Poorman Impoundment Site to provide information on seasonal and yearly variations and insight into hydrologic support of wetlands. In 2011, MMC installed three shallow piezometers in wetland WUS-15 and one nested pair in WUS-17. The three piezometers installed in the WUS-15 wetland area are not adjacent to each other because groundwater was below the maximum depth that could be augered or driven by the piezometers after initial installation. The three piezometers in wetland WUS-15 were spaced apart to assess depth to groundwater at different locations. One shallow piezometer was also installed in isolated wetland WUS-30 to a depth of 3.0 feet. In 2012, two additional piezometers were installed in WUS-17; one to a depth of 6 feet and the other to a depth of 11.8 feet. One piezometer was installed in WUS-1 (5.2 feet deep) and WUS-2 (6.3 feet deep). Water levels in each piezometer were measured periodically. To identify the source of the water, sampling and analysis of stable water isotopes (oxygen 18 and deuterium) of some of the piezometers was conducted.

Wetland Landscape Position Assessment

To determine the potential hydrologic support for wetlands without groundwater wells in the Poorman and Little Cherry Creek Impoundment sites and to assist in determining indirect effects on wetlands, ERO reviewed the topographic position of wetlands in relation to light detection and ranging (LiDAR) optical remote sensing data from which topographic maps were produced in 2012 (ERO Resources Corp. 2013). MMC's LiDAR mapping has elevation contours of 2 feet. Wetland mapping used in this assessment was completed by Westech Environmental Services, Inc. (2005) and Geomatrix (2008) for the Little Cherry Creek Impoundment Site and by Geomatrix (2009) for the Poorman Impoundment Site, with supplemental stream mapping in the Poorman Impoundment Site provided by Kline Environmental Research (2012). ERO assumed that wetlands located in topographic depressions and closed basins are primarily surface water supported. These wetlands collect and hold precipitation, snow melt, and surface water drainage into the basin. Wetlands on a slope that are either isolated, associated with a channel, or associated with a spring are assumed to be primarily groundwater supported. These wetlands are constantly draining downslope and will not retain hydrologic support without additional groundwater.

3.23.2.2.3 Libby Creek, East Fork Bull River, and East Fork Rock Creek

Cross sections on Libby Creek (1 mile upstream of Little Cherry Creek), East Fork Rock Creek (1 mile upstream of the confluence with the West Fork Rock Creek), and East Fork Bull River (at the confluence with Isabella Creek) were established to assess indirect effects on wetland vegetation from changes in stream flow (ERO Resources Corp. 2012a). Presence of wetland or riparian vegetation and the width of the vegetation zone along each stream at the cross sections were noted. The relationship between wetted perimeter and flow was determined to estimate changes to wetland vegetation.

3.23.2.3 Impact Analysis

3.23.2.3.1 Direct Effects

Impacts of the mine alternatives on wetlands and streams were determined by calculating the number of acres that would be disturbed. For analysis purposes, the lead agencies used a disturbance area to assess effects on surface resources. The disturbance area surrounding both impoundment areas encompassed most of the wetlands and streams downstream of the impoundment areas. Within the disturbance areas are facility boundaries that include the footprint of the impoundment, dam, seepage collection pond, diversion channel, borrow area, soil stockpiles, and roads. Wetlands within the facility boundary would be filled by project activities while some wetlands and other waters in the disturbance boundary that are not within the facility boundary may be avoided during final design. The effects within the disturbance boundary are presented as the total potential effects for this EIS.

Wetland mapping did not distinguish open water channels from adjacent wetlands along stream channels. For example, wetlands along Little Cherry Creek as well as the Little Cherry Creek channel were mapped as riverine wetlands. To differentiate effects on wetlands from open water, open water and channel width were subtracted from the wetland information provided by Westech and Geomatrix and incorporated into the impact analysis. An average channel width of 5.5 feet was used for Little Cherry Creek and an average width of 3 feet was used to calculate riparian corridor wetlands for the four drainages within the Poorman Impoundment Site (Geomatrix and Kline Environmental Research 2011).

As a basis for comparing transmission line alternatives, acreage of all wetlands and streams within the transmission line clearing area was calculated. Direct effects on wetlands and streams are expected to be mostly avoided by placement and location of the substation, loop line, and transmission structures outside of wetlands and streams. Unavoidable direct effects on wetlands would be determined during final design.

3.23.2.3.2 Indirect Effects

Indirect effects on wetlands near the impoundment sites from a pumpback well system were assessed by determining the primary supportive hydrology of wetlands (groundwater or surface water) (ERO Resources Corp. 2013b) and determining which groundwater-supported wetlands would be potentially affected by groundwater drawdown from a pumpback well system. In its analysis, ERO assumed that wetlands located in topographic depressions and closed basins were primarily surface water supported. These wetlands collect and hold precipitation, snow melt, and surface water drainage into the basin. Wetlands on a slope that are either isolated, associated with a channel, or associated with a spring were assumed to be primarily groundwater supported. These wetlands are constantly draining downslope and will not retain hydrologic support without additional groundwater.

MMC evaluated a pumpback well system for the Poorman Impoundment in Alternative 3 using a 3D groundwater model (Geomatrix 2010c). The lead agencies assumed any wetland within the 1-foot drawdown contour was potentially at risk of losing hydrologic support. The drawdown from the Poorman Impoundment would extend to Little Cherry Creek on the north and 5,000 feet to the south of the dam crest (Figure 73). A pumpback well system for the Little Cherry Creek impoundment in Alternatives 2 and 4 was not modeled. The lead agencies assumed drawdown from a pumpback well system in the Little Cherry Creek impoundment in Alternatives 2 and 4, if installed, 4 would extend from Bear Creek to 5,000 feet to the south of the dam crest.

The *Geology and Geochemistry and Groundwater Hydrology* sections discuss the geology of the impoundment sites. A low permeability bedrock ridge separates groundwater flow between the watershed of Little Cherry Creek and those of Drainages 5 and 10 in the Poorman Impoundment Site (Figure 66). NewFields (2014a) concluded that the bedrock ridge would limit drawdown in the Little Cherry Creek watershed, but drawdown could still extend between watersheds unless the bedrock ridge provided a complete barrier to cross-boundary groundwater flow. Wetland impacts were distinguished based on the separation of the wetland by the bedrock ridge from the impoundment. All available geologic and hydrogeologic data from the Little Cherry Creek and in the Poorman impoundment areas were reviewed and discussed in detail by NewFields (2014a).

In 2009, MMC completed a GDE inventory focusing on areas at or below about 5,600 feet on the north side of the Libby Creek watershed (Geomatrix 2009). Additional inventory in the Libby Creek drainage was conducted in 2010. The additional inventory consisted of inventorying GDEs identified in 2009 (Geomatrix 2010). An inventory of other mine areas, such as the Ramsey Creek, East Fork Rock Creek and East Fork Bull River drainages, was conducted in 2012. Additional areas were inventoried by MMC in 2013, including upper Libby Creek, upper Ramsey Creek and Ramsey Lake, upper East Fork Bull River at and above St. Paul Lake, upper East Fork Rock Creek at and above Rock Lake, and the Libby Lakes basin (MMC 2014d). In 2013, MMC surveyed GDEs, measured flows, collected water quality samples and stable isotope samples, measured groundwater levels in piezometers, and completed vegetation surveys at upper watershed area springs, seeps, streams and lakes, mostly within the CMW.

3.23.3 Affected Environment

3.23.3.1 Wetlands and Streams

In the analysis area, wetlands are primarily located adjacent to low terraces, overflow channels, and scoured depressions along perennial streams. Wetlands are also found in depressions and low gradient swales in the two tailings impoundment sites (Figure 87). Fisher River, Libby Creek, Ramsey Creek, Poorman Creek, Little Cherry Creek, Bear Creek, Howard Creek, Miller Creek, West Fisher Creek, Hunter Creek, Sedlak Creek, and other unnamed drainages are likely waters of the U.S. Section 3.11.3.2.1*, Watershed Descriptions* provides additional descriptions of these drainages. Springs, seeps, and runoff from snowmelt and precipitation result in soil saturation or inundation during spring and early summer. Sidehill and toeslope seeps are present along portions of Little Cherry Creek. These seeps range from small discrete trickles to more extensive zones of saturation along slopes where the seepage zone may extend for more than 100 feet. Sidehill and toeslope seeps are generally saturated late into the growing season.

3.23.3.1.1 Wetland Types

Forest-dominated wetland types (riverine palustrine forested, slope palustrine forested, and depressional palustrine forested) are primarily found along stream corridors and seeps, mostly in the Little Cherry Creek drainage. This wetland type is dominated by western redcedar, western hemlock, and Engelmann spruce. Understory species include devil’s club, lady fern, oakfern, arrowleaf groundsel, and common horsetail (Westech 2005e and Geomatrix 2009b).

Scrub-shrub dominated wetlands (slope palustrine scrub-shrub, depressional palustrine scrub-shrub, and riverine palustrine scrub-shrub) support Douglas spirea, thinleaf alder, alder buckthorn, and common snowberry. Understory species include inflated sedge, brown bog sedge, bluejoint reedgrass and common horsetail. Scrub-shrub-dominated wetlands are found along drainages where trees have been removed by logging, around depressions, in logged swales with poor drainage, and in oxbows of the Fisher River (Westech 2005e; Geomatrix 2009b). Scrub-shrub wetlands are found in the Little Cherry Creek, Bear Creek, and Rock Creek drainages.

Herbaceous-dominated wetlands (slope palustrine emergent and depressional palustrine emergent) are wet depressions or slope areas with poorly drained soils. Sedges such as inflated sedge, beaked sedge, and knot-sheath sedge are typically the dominant species with horsetails, rushes, and other graminoids being co-dominants (Westech 2005e; Geomatrix 2009b). Herbaceous-dominated wetlands occur within the Little Cherry Creek and Poorman Impoundment Sites.

3.23.3.1.2 Wetland Functional Assessment

Category II and III wetlands are the most common functional category and are found throughout the analysis areas. Category I, II, III, and IV wetlands are found along Little Cherry Creek in the Little Cherry Creek Impoundment Site. Category IV wetlands are uncommon and are associated with Little Cherry Creek. Category II and III wetlands are found in the Poorman Impoundment Site (Geomatrix 2010d).

Category II wetlands in the analysis area had high functional ratings for structural diversity, general wildlife habitat, known or potential habitat for special-status wildlife species, and sediment/toxicant removal. Category III wetlands are most common in the analysis area and are present in areas that previously have been logged, and usually are seasonally flooded due to spring snow melt and precipitation.

3.23.3.1.3 Springs

Numerous springs are located in the analysis area. Spring types and locations are described in section 3.10.3, *Affected Environment* in the *Groundwater Hydrology* section. Spring 26 is located at the upper end of a large slope wetland in the Poorman Impoundment Site. Based on a review of data collected on tritium and stable isotopes of oxygen and hydrogen for Spring 26 (Gurrieri 2013; NewFields 2013a), the water from Spring 26 appears to be older than 1950, suggesting the water source is likely a deep aquifer. The location of the spring and wetland on a slope provides further evidence that the water source of the wetland is groundwater (Gurrieri 2013; ERO Resources Corp. 2013). Data from other springs within the Poorman Impoundment Site were not collected.

3.23.3.1.4 Libby Creek, East Fork Bull River, and East Fork Rock Creek

Data collected by KNF on cross sections on Libby Creek, East Fork Bull River, and East Fork Rock Creek indicate these streams are dominated by medium to large cobble and are slightly to moderately entrenched. Vegetation along the banks of Libby Creek is mostly dominated by cottonwood, Douglas-fir, spruce, cedar, alder, and willow. At the cross sections of the East Fork Bull River and East Fork Rock Creek, the vegetation is dominated by western red cedar, mountain maple, black cottonwood, Western hemlock, Pacific yew and grand fir with Devil's club in the understory. The dominant species and the cobbly soils are more characteristic of riparian vegetation. Due to the lack of soil and dominance of species that have a wide moisture tolerance, wetlands that meet the criteria of the Corps are likely absent from the banks of the streams. Because vegetation along these major streams is more characteristic of riparian vegetation, these streams are discussed in section 3.22, *Vegetation* and no further discussion is provided in this section.

3.23.3.1.5 Groundwater Dependent Ecosystems

During the 2013 inventory, MMC identified wetlands, mostly associated with springs or seeps, near lower Libby Lake, upper East Fork Bull River Tributary drainage above Saint Paul Lake, upper East Fork Rock Creek drainage, and upper Libby Creek drainage (MMC 2014d). Wetlands near lower Libby Lake are supported by four separate seeps and have distinctive wetland vegetation including moss and algae. In the upper East Fork Bull River tributary drainage the GDE is a large seep/pond/wetland complex. The upper East fork Rock Creek drainage, a series of seeps run over bedrock and limited wetland vegetation to establish. In the upper Libby Creek drainage, springs and seeps provide the supportive hydrology for wetland with diverse wetland vegetation. Additional wetlands, seeps, and springs may be identified in future inventories if they were required to meet the agencies' requirements described in Appendix C. Effects on these resources would be identified through monitoring described in Appendix C.

3.23.4 Environmental Consequences

3.23.4.1 Alternative 1 – No Mine

The No Mine Alternative would not disturb or affect any wetlands or other waters of the U.S.

3.23.4.2 Alternative 2 – MMC's Proposed Mine

3.23.4.2.1 Direct Effects

Mine Facilities

Alternative 2 would have 35.6 acres of jurisdictional wetlands within the disturbance area, which includes 25.0 acres within the facility boundary (Table 184). Most of these wetlands would be forested wetlands located in the proposed Little Cherry Creek Tailings Impoundment Site. Functional Category I, II, III, and IV wetland types in the Little Cherry Creek Tailings Impoundment Site would be affected. About 1.1 acre of isolated wetlands found in small scattered locations in the Little Cherry Creek Tailings Impoundment Site would be within the disturbance area. These isolated wetlands are generally small depressions resulting from logging activity (Westech 2005e). About 28,355 linear feet of streams would be within the disturbance area of Alternative 2, while 19,700 linear feet would be within the facility boundary (Table 184). Streams and wetlands in Ramsey Creek would be bridged for access to the Ramsey Plant site and would not be affected.

Table 184. Wetlands and Streams within Mine Alternative Disturbance Areas.

Facility†	Alternative 2 – MMC's Proposed Mine		Alternative 3 – Agency Mitigated Poorman Impoundment		Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment	
	Disturbance Area	Facility Boundary	Disturbance Area	Facility Boundary	Disturbance Area	Facility Boundary
	Area of Jurisdictional Wetlands (acres)§					
Impoundment Site*	35.2	24.6	9.0	8.6	36.5	22.3
Plant Site	0.2	0.2	0.0	0.0	0.0	0.0
Roads	0.2	0.2	0.2	0.2	0.2	0.2
Subtotal	**35.6**	**25.0**	**9.2**	**8.8**	**36.7**	**22.5**
	Area of Isolated Wetlands (acres)§					
Impoundment Site*	1.1	0.5	3.3	2.9	1.1	0.5
Plant Site	0.0	0.0	0.1	0.1	0.1	0.1
Roads	<0.1	<0.1	0.1	0.1	<0.1	<0.1
Libby Adit Site	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Subtotal	**1.3**	**0.7**	**3.5**	**3.1**	**1.2**	**0.6**
Total Area	**36.9**	**25.7**	**12.7**	**11.9**	**37.9**	**23.1**
	Stream Length (linear feet)					
Impoundment Site*	27,715	19,700	13,272	9,787	26,694	17,481
Roads	640	0	1,059	0	1,059	0
Total	**28,355**	**19,700**	**14,331**	**9,787**	**27,753**	**17,481**

The jurisdictional status of the wetlands and streams is based on the Corps' preliminary and approved jurisdictional determinations (Corps 2008c, 2013b, 2014). Impacts by jurisdictional status may change during the 404 permitting process.

Units for areas are rounded to the nearest 0.1 acre; units for stream length are rounded to the nearest whole number; subtotals may vary by 0.1 acre due to rounding.

†The adits would not affect any wetlands or streams in any alternative; although bridges would be constructed for road crossings on Ramsey, Poorman, and Bear creeks and would likely not affect wetlands or streams Effects are included under the disturbance boundary effects.

§Area of streams has been subtracted from the area of wetlands.

*Impoundment site includes the impoundment footprint, dam, seepage collection pond, diversion channel, borrow area, soil stockpiles, and some roads.

Source: GIS analysis by ERO Resources Corp. using wetland data in Westech 2005e, Geomatrix 2009b, Kline Environmental Research 2012.

Effects of Mitigation Measures

This section describes the effects of MMC's mitigation measures on wetlands and other waters of the U.S. The agencies' evaluation of MMC's mitigation plan for wetlands and other waters of the U.S. is discussed in 3.23.4.10, *Proposed Mitigation and Monitoring Plans*. As part of Alternative 2, one of the possible fisheries mitigation projects proposed by MMC would be to conduct a sediment-source inventory in the watershed, and stabilize, recontour, and revegetate priority source areas, which are typically roadcuts in Libby, Hoodoo, Poorman, Midas, and Crazyman creeks. Wetland delineations at these sediment source areas have not been completed. Any wetlands and waters of the U.S. disturbed during the implementation of this mitigation are not listed in Table 184. If implemented, this mitigation in the short term would increase sedimentation in area streams and adjacent wetlands and waters of the U.S. Over the long term, this mitigation may increase the function and services of any associated wetlands and would decrease sediment delivery to waters of the U.S.

3.23.4.2.2 Indirect Effects

NEPA regulations define indirect effects as "…effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable." (40 CFR

1508.8). The discussion of indirect effects on wetlands in Alternatives 2, 3, and 4 is consistent with the NEPA definition. Under the 404(b)(1) Guidelines (40 CFR 230.11(h)(1)), "secondary effects are effects on an aquatic ecosystem that are associated with a discharge of dredged or fill materials, but do not result from the actual placement of the dredged or fill material. Information about secondary effects on aquatic ecosystems shall be considered before the time final section 404 action is taken by permitting authorities." The Corps indicated to the KNF that mine dewatering and operation of a pumpback well system are not within its scope of analysis and the effects of these activities will not be considered in its 404 permit decision. Consequently, the Corps will not require mitigation for indirect effects of mine dewatering and operation of a pumpback well system.

Mine Dewatering

Indirect effects on wetlands, springs, and seeps may occur during mine dewatering. The indirect effect on wetlands, spring, and seep habitat overlying the mine would be the same in all mine action alternatives and difficult to predict (see section 3.10.4.2.1, *Evaluation through Operations Phases*). The effect on plant species, functions, and services associated with the affected wetlands, springs, or seeps by a change in water level would be best determined by relating plant species with water abundance and quality for monitoring and evaluation. Alternative 2 does not include a survey of plant species abundance (all species) before activity and subsequent plant species abundance and water monitoring of GDEs overlying the mine. Without this type of monitoring, mining-induced changes in water level or quality may result in an unidentified loss of species, functions, and services associated with the affected wetlands, springs, or seeps.

In the upper watershed, wetlands at Rock Creek Meadows are not expected to be indirectly affected by mining or dewatering. The 3D model predicted the greatest surface flow reduction of 0.43 cfs on East Fork Rock Creek where it enters Rock Creek Meadows 16 years after mine closure (Klepfer Mining Service 2012). Although this would be a 20 percent reduction in baseflow, a perennially high water table and other tributaries that flow into Rock Creek Meadows that would not be affected by mining provide the primary hydrologic support for wetlands at Rock Creek Meadows.

Watershed Modification and Seepage Control Systems

Several wetlands and springs are present between the proposed Little Cherry Creek Tailings Impoundment and Libby Creek. Precipitation and runoff captured by the tailings impoundment and the Seepage Collection Dam would no longer flow to the former Little Cherry Creek. The pumpback well system if installed to collect seepage not collected by the underdrain system would likely lower groundwater levels and reduce groundwater discharge to springs, seeps, and wetlands downgradient of the impoundment. Flow below the Seepage Collection Dam in the former Little Cherry Creek channel would be substantially reduced. The agencies estimated the following indirect effects on streams and wetlands below the disturbance boundary:

- Reduced flow to 2,757 linear feet of Little Cherry Creek below the Seepage Collection Dam to Libby Creek all on private land. 290 linear feet occur within the disturbance boundary and are accounted for in Table 184. The 2,467 linear feet of Little Cherry Creek that would be indirectly affected are not accounted for in Table 184 or Table 185.
- Reduced flow to 1,395 linear feet of a small tributary to Little Cherry Creek below the disturbance boundary all on private land. This indirect effect has not been accounted for in Table 184 or Table 185.

- Reduced flow to 987 linear feet of a tributary to Libby Creek below the disturbance boundary on National Forest System land and 549 linear feet on private land. These indirect effects have not been accounted for in Table 184 or Table 185.
- The combined total of indirect effects on the drainages that occur outside of the disturbance boundary not accounted for in Table 184 or Table 185 would be 5,398 linear feet, of which 987 linear feet would be on National Forest System land.
- Reduced flow to 0.4 acre of wetland associated with the drainages below the disturbance boundary that occur on National Forest System lands. Another 1.3 acre of wetlands associated with the drainages below the disturbance boundary are on private land. These indirect wetland effects have not been accounted for in in Table 184 or Table 185.

In Alternative 2, MMC committed to implementing seepage control measures at the impoundment, such as pumpback recovery wells, if required to comply with applicable standards. Seepage pumpback wells could be installed along the downstream toe of the tailings dam. The wells may require active pumping, depending on the artesian pressures within the wells (Klohn Crippen 2005). A subsurface bedrock ridge occurs south of the impoundment dam (see discussion in the *Groundwater Hydrology* section). If MMC installed a pumpback well system, the effects on groundwater from pumping may be reduced or eliminated south of the bedrock ridge. Based on the assessment of groundwater-supported wetlands within a potential drawdown area north of the bedrock ridge from the disturbance boundary to Bear Creek, no jurisdictional wetlands on National Forest System land would be indirectly affected (Table 185). About 1.2 acres of jurisdictional wetland north of the ridge on National Forest System land would require more data to determine supportive hydrology. South of the ridge, an additional 0.6 acre of jurisdictional ground water-supported wetland occurs on National Forest System land. Disregarding the bedrock ridge, a total of 1.8 acres of jurisdictional wetlands and 0.2 acre of isolated wetland on National Forest System land would be potentially indirectly affected. Wetlands north of the Little Cherry Creek Impoundment Site and south of Bear Creek have not been delineated for Alternative 2; therefore, the number of wetland acres potentially indirectly affected may be greater than what is shown in Table 185.

MMC would monitor effects on existing wetlands downstream of the tailings impoundment. Monitoring of the downstream wetland areas would be completed annually for the first 5 years of mine operation. If functions and services of downstream wetlands were adversely affected, MMC, in cooperation with the lead agencies and the Corps, would develop additional wetland mitigation. MMC did not propose monitoring wetlands north or south of the impoundment. MMC’s proposed monitoring would not adequately detect potential changes to wetlands from the operation of the impoundment and pumpback well system.

Temporary indirect effects on wetlands and streams may occur during construction of the proposed Little Cherry Creek Tailings Impoundment and associated facilities due to increased sediment contributions to wetlands and streams Proposed BMPs would reduce or eliminate sediment contributions to wetlands and streams.

The flow in the unnamed drainages into which upper Little Cherry Creek would be diverted (Drainages 5 and 10) would increase and would change to perennial flow throughout their length. The drainages are not large enough to handle the expected flow volumes and downcutting and increased sediment delivery to Libby Creek would occur as the channel stabilized. Where possible, MMC would construct some bioengineering and structural features in the two drainage channels to reduce flow velocities, stabilize the channels, and create fish habitat. Short sections of these two channels are very steep, and it may be difficult to access such sections to complete any channel stabilization work. In addition, some sections of these two channels have very thick vegetation that may require clearing, which may create erosion and increase sediment delivery to the channels. Over time, the channels would stabilize and provide increased water for wetlands adjacent to the channels. The section that is currently intermittent probably would support wetlands where flow became perennial.

Table 185. Potential Indirect Wetland Effects from Groundwater Drawdown in the Tailings Impoundment Area.

Primary Hydrologic Support	Alternative 2 – MMC's Proposed Mine				Alternative 3 – Agency Mitigated Poorman Impoundment				Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment			
	North of Bedrock Ridge§ (ac)		South of Bedrock Ridge† (ac)		South of Bedrock Ridge§ (ac)		North of Bedrock Ridge† (ac)		North of Bedrock Ridge§ (ac)		South of Bedrock Ridge† (ac)	
	NFS	Private	NFS	Private	NFS	Private	NFS	Private	NFS	Private	NFS	Private
Jurisdictional Wetlands												
Groundwater-supported	0.0	0.0	0.6	0.0	2.5	0.0	1.2	0.6	0.0	0.0	0.2	0.0
Surface water-supported	0.0	0.0	1.6	0.0	0.0	0.0	1.6	0.0	0.0	0.0	1.6	0.0
Needs more data	1.2	0.0	0.0	0.0	0.0	0.0	5.8	6.2	1.2	0.0	0.0	0.0
Subtotal	*1.2*	*0.0*	*2.2*	*0.0*	*2.5*	*0.0*	*8.6*	*6.8*	*1.2*	*0.0*	*1.8*	*0.0*
Isolated Wetlands												
Groundwater-supported	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.2	0.0	<0.1	0.2	0.0
Surface water-supported	0.0	0.0	<0.1	0.0	0.0	0.0	0.0	<0.1	0.0	0.0	<0.1	0.0
Subtotal	*0.0*	*0.0*	*0.2*	*0.0*	*0.0*	*0.0*	*0.1*	*0.2*	*0.0*	*<0.1*	*0.2*	*0.0*
Total	**1.2**	**0.0**	**2.4**	**0.0**	**2.5**	**0.0**	**8.7**	**7.0**	**1.2**	**0.3**	**2.0**	**0.0**

§Wetlands have not been delineated for Alternatives 2 and 4 north of the Little Cherry Creek Impoundment Site and south of Bear Creek or for Alternative 3 south of Poorman Creek; the number of wetland acres could potentially increase after more thorough wetland mapping.
†These wetlands may not be affected if a bedrock ridge and hydrologic divide separates the impoundment from the wetlands
Source: GIS analysis by ERO Resources Corp. using data from ERO Resources Corp. (2013).

3.23.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

3.23.4.3.1 Direct Effects

Mine Facilities

Alternative 3 would have 9.2 acres of jurisdictional wetlands, 3.5 acres of isolated wetlands, and 14,331 linear feet of streams within the disturbance area (Table 184). Functional Category II and III wetland types would be affected in the Poorman Impoundment Site. Because the Poorman Impoundment would not require diversion of a perennial stream, Alternative 3 would affect fewer wetlands compared to Alternatives 2 and 4 (Figure 87). Effects on wetlands within the facility boundary only, including additional access roads, would be 8.8 acres. These wetlands would not be filled by the tailings but are within the disturbance area and likely would be filled by access roads or other project facilities. During final design, MMC would avoid wetlands to the extent practicable.

Effects of Mitigation Measures

This section describes the effects of the agencies' mitigation measures on wetlands and other waters of the U.S. The agencies' evaluation of the agencies' mitigation plan for wetlands and other waters of the U.S. is discussed in 3.23.4.10, *Proposed Mitigation and Monitoring Plans*. MMC would continue to plow the Libby Creek Road (NFS road #231) and the Upper Libby Creek Road (NFS road #2316) year-round during the 2-year evaluation program and the 1-year period during reconstruction of the Bear Creek Road. Culverts along all access roads that pose a substantial risk to riparian conditions would be replaced as necessary to comply with INFS standards and Forest Service guidance, such as fish passage or conveyance of adequate flows (USDA Forest Service 1995, 2008a). Any work in a RHCA along an access road would be completed in compliance with INFS standards and guidelines. The mitigation would increase sedimentation in area streams and adjacent wetlands and waters of the U.S. in the short term. Over the long term, the mitigation may increase the function and services of any associated wetlands and would decrease sediment delivery to waters of the U.S.

The Grizzly Bear Mitigation Plan for Alternative 3 would include 20.3 miles of proposed access changes during the Evaluation Phase and up to 20.1 miles of proposed access changes during the Construction Phase in the Rock Creek, Libby Creek, and Miller Creek watersheds (Figure 35). The Plan also would require MMC to acquire 5,387 acres of land for habitat replacement. Habitat enhancement, such as access changes and trail conversions, may be implemented on the acquired lands. Wetland delineations along the roads and trails proposed for access changes have not been completed. MMC would build and maintain gates or barriers on the roads, and complete other activities so that the roads would either be removed from service or cause little resource risk if maintenance were not performed on them during the operation period of the mine and before their future need. In most cases, culverts would be removed; such removals would occur in active stream channels requiring instream work, structure placement, and fill removal. The effect would be the same as described for road improvements along the Libby Creek Road and the Upper Libby Creek Road.

Post-Closure, a channel would be excavated through the tailings and Saddle Dam abutment to route runoff from the site toward a tributary of Little Cherry Creek. The increased flow would provide support to wetlands adjacent to Little Cherry Creek. Wetlands may develop in the unnamed tributary of Little Cherry Creek below the Saddle Dam abutment.

3.23.4.3.2 Indirect Effects

Mine Dewatering

Indirect effects on wetlands, springs, and seeps may occur during mine dewatering. In Alternative 3, MMC would complete a GDE inventory and conduct GDE monitoring in an area overlying the proposed mine and adits to evaluate indirect wetland effects (see section C.10, *Water Resources* of Appendix C). The inventory, which began in 2009, includes a vegetation survey to describe and document existing vegetation characteristics and establish a prevalence index used by the Corps to determine wetland vegetation (Corps 2008d). The prevalence index would be used to assess changes in vegetation composition and if a loss of wetland species was occurring. The monitoring would not alter the effect of Alternative 3 but would assist in determining if an impact was occurring and the scale of any impact. Other temporary indirect effects of construction would be the same as Alternative 2.

Watershed Modification and Seepage Control Systems

About 0.2 acres of riparian corridor wetlands occur below the disturbance boundary on Drainages 3 and 14. These riparian corridor wetlands would be indirectly affected by changes in hydrology related to a change in their watershed and filling of perennial springs. The 0.2-acre of indirect wetland effect would be mitigated at the Swamp Creek site.

Segments of Drainages 3, 5, 10, and 14 are found below the impoundment (Figure 87). Intermittent and/or perennial flow in the channels would likely be either reduced or eliminated. The agencies estimated the following indirect effects to streams in the Poorman Impoundment Site:

- Reduced flow to 2,326 linear feet of Drainage 3 between the Tailings Impoundment and Libby Creek. Most of this reach has persistent flow. 1,164 linear feet are within the disturbance boundary and have been accounted for in Table 184; 1,162 linear feet of Drainage 3 are outside of the disturbance boundary and not accounted for in Table 184.
- Reduced flow to 559 linear feet of Drainage 5 between the Tailings Impoundment and the Seepage Collection Pond. This reach currently has persistent flow. All of this effect is accounted for in the disturbance area impacts shown in Table 184.
- Reduced flow in 1,364 linear feet of Drainage 10. Of the 1,364 feet, 235 linear feet are below the disturbance boundary and have not been accounted for in Table 184. 1,129 linear feet are within the disturbance boundary and have been accounted for in Table 184.
- Reduced flow in 3,963 linear feet of Drainage 14 between the Tailings Impoundment and Libby Creek. This reach currently has an estimated annual flow duration of 117 days. The disturbance area impacts shown in Table 184 accounts for 633 linear feet of this effect.
- The combined total of indirect effects on the four drainages that occur outside of the disturbance boundary would be 4,727 linear feet.

MMC used a 3D model to predict the effect of the pumpback wells on the impoundment site's hydrology. To the north, the model predicted that the drawdown from the wells would extend to Little Cherry Creek, potentially affecting wetlands between the Poorman Impoundment Site and Little Cherry Creek. NewFields concluded that the bedrock ridge would limit drawdown in the

Little Cherry Creek watershed, but drawdown could still extend between watersheds unless the bedrock ridge provided a complete barrier to cross-boundary groundwater flow. According to NewFields (2014a), perched groundwater conditions occur beneath most wetlands in Little Cherry Creek and in the Poorman impoundment areas and the hydrologic support for the wetlands appears to be direct precipitation and upgradient runoff water that infiltrates into the subsurface. NewFields concluded the operation of the pumpback wells would have little or no effect on most wetlands in the Little Cherry Creek watershed.

Section 3.10.4.2 indicates operation of a pumpback well system may not affect groundwater levels and five of the springs south of Little Cherry Creek because of an apparent subsurface bedrock ridge that separates groundwater flow between the watershed of Little Cherry Creek from those of Drainages 5 and 10 in the Poorman Impoundment Site (Chen Northern 1989). Because geologic and hydrologic data from the area between the Little Cherry Creek and Poorman drainages are limited, they are not sufficient to eliminate the possibility of the pumpback well system adversely affecting surface resources, particularly groundwater-supported wetlands. The agencies are not proposing mitigation for indirect wetland effects from the pumpback wells until more investigation indicates that they would be adversely affected. The rationale for not proposing mitigation for indirect wetland effects from the pumpback wells is discussed in a following section (*Mitigation for Other Potential Indirect Effects*).

In 2012, MMC installed shallow piezometers in each of four wetlands (LCC-29, LCC-35A, LCC-36, and LCC-39A) south of Little Cherry Creek. One piezometer was installed in wetlands LLC-29 and LLC-36, two piezometers were installed in wetland LLC-35A, and three piezometers were installed in wetland LLC-39A. Water levels for five of the piezometers were measured in November 2012, two of which were dry. Water levels in the piezometers would continue to be measured monthly April through September. The purpose of the monitoring would be to assess effects on wetlands. Vegetation in these four wetlands also would be monitored, following the methods used for the GDE monitoring (see section C.10.4.2, *Groundwater Dependent Ecosystem Monitoring* in Appendix C). The monitoring would continue through the Closure Phase as long as the pumpback well system operated.

Springs SP-14 and SP-15 (Figure 70) adjacent to the impoundment site would be monitored for flow. The flow of each spring would be measured twice, once in early June or when the area was initially accessible, and once between mid-August and mid-September during a time of little or no precipitation. The monitoring would begin 1 year before construction and continue through the Closure Phase as long as the pumpback well system operated. The most accurate site-specific method for measuring spring flow would be used.

3.23.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

3.23.4.4.1 Direct Effects

Mine Facilities

Alternative 4 would directly affect 36.7 acres of jurisdictional wetlands, 1.2 acres of isolated wetlands, and 27,753 linear feet of streams within the disturbance area (Table 184). Most effects would be in the Little Cherry Creek Impoundment Site. Functional Category I, II, III, and IV wetlands would be affected in the Little Cherry Creek Impoundment site.

Effects of Mitigation Measures

The same mitigation measures described in Alternative 3 would be implemented in Alternative 4, except for the post-closure development of a channel to route runoff from the site toward a tributary of Little Cherry Creek. Any wetlands and streams disturbed during the implementation of the mitigation measures are not shown in Table 184. In the short term, these activities would increase sedimentation in area streams and adjacent wetlands and streams. After the activities were completed, and the roads became stabilized, these mitigation measures would increase the function and services of any associated wetlands and would decrease sediment delivery to streams. Access changes for grizzly bear mitigation would be the same as Alternative 3; MMC would acquire 6,151 acres of land for mitigation. The agencies' mitigation plan for wetlands and other waters of the U.S. is discussed in section 3.23.4.10, *Proposed Mitigation and Monitoring Plans*.

3.23.4.4.2 Indirect Effects

Mine Dewatering

To account for indirect effects on wetlands, springs, and seeps from mine dewatering, a GDE inventory of an area overlying the mine area, subsequent monitoring of GDEs, and implementation of any mitigation would be completed in Alternative 4, as described in Alternative 3.

Watershed Modification and Seepage Control Systems

Flow from springs SP-02, SP-10, S-12, SP-14, SP-15, and SP-29 (shown on (Figure 40) would be measured twice, once in early June when the area was initially accessible, and once between mid-August and mid-September 1 year before construction began. Springs SP-02 and SP-15 would not be monitored if they were covered by impoundment facilities. Samples from these springs would be collected 1 year before construction and analyzed for selected water quality parameters. Sampling would be repeated every 2 years until tailings disposal ceased. At each spring, a vegetation survey would be completed 1 year before construction; the use of a prevalence index to monitor changes in plant species would be the same as Alternative 3.

MMC would monitor three wetlands, LCC-24, LCC-25, and LCC-39 (shown on Figure 40), if these wetlands were not filled by project activities. MMC would use the procedures established for monitoring wetland mitigation sites described in Alternative 3 to assess vegetation characteristics and establish a prevalence index. A prevalence index would be used to assess changes in vegetation composition and to detect a loss of wetland species. Samples from any standing water in these three wetlands would be collected in mid-summer 1 year before construction began and analyzed for selected parameters. Sampling would be repeated in mid-summer every 2 years until tailings disposal ceased. The mitigation would not alter the effect of Alternative 4, but would assist in determining if an impact were occurring and the scale of any impact.

Other indirect effects would be similar to Alternative 2 but less than 0.1 acre of isolated groundwater-supported wetlands would potentially be affected by groundwater drawdown north of the ridge on National Forest System land. An additional 1.2 acres of wetlands would require additional data before determining if groundwater is the primary hydrologic support and would potentially be affected. Effects on stream channels and associated wetlands on National Forest System land below the Seepage Collection Pond would be the same as Alternative 2 except that 1,244 linear feet of channel (257 linear feet more than in Alternative 2) and 0.7 acre of wetland (0.3 acre more than in Alternative 2) would be indirectly affected below the disturbance boundary. On private land, the total linear feet of channel that would be indirectly affected would be 4,464 linear feet (53 linear feet more than in Alternative 2) and the total acres of wetland would be 1.3 (same as Alternative 2).

3.23.4.5 Alternative A – No Transmission Line

Because construction of the transmission line, substation and loop line would not occur, the No Transmission Line Alternative would have no direct or indirect effects on wetlands or streams.

3.23.4.6 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

A total of 3.6 acres of wetlands and 4,822 linear feet of streams would be within the Alternative B transmission line clearing area (Table 186). Less than 0.1 acre of wetlands and 289 linear feet of streams would be affected by new or upgraded road construction. The need for culverts or other crossing types at streams would be determined during final design. Indirect effects on wetlands from road construction would be minimized by use of drive-through dips, open-top box culverts, waterbars or crossdrains, and implementation of BMPs. After an alignment was selected and the final wetland surveys were completed, any wetlands affected by the transmission line and access roads may be subject to conditions of the 318 authorization, and, where significant impacts occur, MFSA certification requirements if not covered by other mitigations. MMC would follow its proposed Environmental Specifications (MMI 2005b) and use BMPs during construction to minimize impacts. The BPA would avoid all wetlands at the Sedlak Park Substation Site.

Table 186. Wetlands and Streams within Clearing Area of the Transmission Line Alternatives.

Project Component	Alternative B – North Miller Creek	Alternative C-R – Modified North Miller Creek	Alternative D-R – Miller Creek	Alternative E-R – West Fisher Creek
Area of Jurisdictional Wetlands (acres)†				
Transmission Line Clearing	3.6	2.0	2.0	2.0
New or Upgraded Roads	0.1	0.1	0.1	0.1
Total Area	3.7	2.1	2.1	2.1
Area of Isolated Wetlands (acres)				
Transmission Line Clearing	<0.1	0.0	0.0	0.0
New or Upgraded Roads	0.0	0.0	0.0	0.0
Total Area	<0.1	0.0	0.0	0.0
Stream Length (linear feet)				
Transmission Line Clearing	4,822	1,922	2,935	3,380
New or Upgraded Roads	289	0	0	0
Total Linear Feet	5,111	1,922	2,935	3,380

The jurisdictional status of the wetlands and streams is preliminary and impacts may change during the 404 permitting process.
Units for areas are rounded to the nearest 0.1 acre; units for stream length are rounded to the nearest whole number
†Acreage is based on a 150-foot clearing width for monopoles (Alternative B) and 200-foot width for H-frame structures (all other alternatives except for a short segment of the West Fisher Creek Alternative E-R that has monopoles). Actual acreage cleared would be less than listed and would depend on tree height, slope, and line clearance above the ground.
Source: GIS analysis by ERO Resources Corp. using MMC data.

3.23.4.7 Alternative C-R – Modified North Miller Creek Transmission Line Alternative

A total of 2.0 acres of wetlands and 1,922 linear feet of streams would be within the clearing area of Alternative C-R (Table 186). The amount of wetlands in the clearing area of Alternative C-R is the same as Alternatives D-R and E-R; Alternative C-R would have the least effect on streams compared to the other alignments. Indirect and direct effects on wetlands and streams would be avoided where practicable during structure placement. Less than 0.1 acre of wetlands would be affected by new or upgraded road construction. Indirect effects would be minimized through BMPs and appropriate stream crossings, described in the agencies' Environmental Specifications (Appendix D).

3.23.4.8 Alternative D-R – Miller Creek Transmission Line Alternative

A total of 2.0 acres of wetlands and 2,935 linear feet of streams would be within the clearing area of Alternative D-R (Table 186). No wetlands or streams would be affected by new or upgraded road construction. Indirect effects would be minimized through BMPs and appropriate stream crossings, described in the agencies' Environmental Specifications (Appendix D).

3.23.4.9 Alternative E-R – West Fisher Creek Transmission Line Alternative

A total of 2.0 acres of wetlands, and 3,380 linear feet of streams would be within the clearing area of Alternative E-R (Table 186). No wetlands or streams would be affected by new or upgraded road construction. Indirect effects would be minimized through BMPs and appropriate stream crossings, described in the agencies' Environmental Specifications (Appendix D).

3.23.4.10 Proposed Mitigation and Monitoring Plans

A variety of measures would be used to avoid, minimize, or mitigate wetland effects during construction and operation. These measures would include BMPs, such as silt fence, revegetation of disturbed areas, and restoration of temporary wetland effects. Transmission line structures would be placed to avoid wetlands.

The Corps would be responsible for developing final mitigation requirements for jurisdictional waters of the U.S. including wetlands, depending on the functions and services of the affected wetlands. MMC used the MDT functional units method, the Corps' acreage ratio method, the MDT and hydrogeomorphic functions/services assessment, and the Montana Stream Mitigation Procedure to evaluate the amount of compensation needed for direct effects on wetlands and other waters of U.S. (MMC 2014a). Projects that implement mitigation before project losses would have a lower mitigation requirement than projects that implement mitigation concurrently or after wetland losses have occurred. The Corps typically does not establish mitigation requirements for non-jurisdictional wetlands. The agencies require mitigation for non-jurisdictional wetlands in Alternatives 3 and 4.

Proposed mitigation is considered either on-site or off-site. According to the compensatory mitigation regulations, on-site means an area located on the same parcel of land as the impact site, or on a parcel of land contiguous to the impact site. Off-site means an area that is neither located on the same parcel of land as the impact site, nor on a parcel of land contiguous to the parcel containing the impact site. The Corps is responsible for determining if a mitigation site is considered on-site or off-site.

3.23.4.10.1 Alternative 2 – MMC's Proposed Mine

MMC wetland mitigation plan would involve on-site and off-site locations. MMC proposes to replace forested and herbaceous wetlands at a 2:1 ratio and herbaceous/shrub wetlands at a 1:1 ratio. Annual monitoring of mitigation sites would ensure mitigation sites were dominated by hydrophytic vegetation and had comparable functions and services to the affected wetlands although no forested wetlands are proposed to replace the affected forested wetlands. Vegetation, soils, and hydrology data would be collected annually until the Corps has determined that wetland mitigation success was achieved. On-site mitigation opportunities would involve wetland restoration and wetland creation. Opportunities for wetland mitigation include sites along Little Cherry Creek. A total of 8.8 acres of on-site mitigation is proposed for Alternative 2 (Table 187) (Figure 21). Off-site mitigation would occur outside the permit area boundary. A total of 35.8 acres of off-site mitigation is proposed mitigate for effects associated with Alternative 2 (Table 187). Acreages shown in Table 187 for Alternative 2 are those presented in MMC's Plan of Operations and Hard Rock Operating Permit Application, and do not include those at the Swamp Creek site that MMC could use if acquired by MMC. Most of the mitigation sites would be located in the Poorman Creek area.

NMC's 1993 404 permit included more detailed designs for the North Poorman, South Poorman, and Ramsey creek sites (Corps 1993). The Poorman Weather Station mitigation site was not included in NMC's 1993 404 permit and the feasibility of creating 14 acres that replaced the lost functions of the wetlands affected by Alternative 2 is uncertain.

In all alternatives, the Corps would develop final mitigation requirements for jurisdictional wetlands and other waters of the U.S. In 2008, the Corps and the EPA issued regulations (33 CFR 332 and 40 CFR 230 Subpart J) regarding compensatory mitigation requirements for losses of aquatic resources, such as wetlands. These regulations require in cases where appropriate functional or condition assessment methods or other suitable metrics are available, these methods should be used where practicable to determine how much compensatory mitigation is required. If a functional or condition assessment or other suitable metric is not used, a minimum one-to-one acreage or linear foot compensation ratio must be used. Before issuance of the 2008 regulations, the Corps in Montana used ratios for various mitigation types in determining compensation requirements (Corps 2005). The Corps developed a stream mitigation procedure for projects adversely affected streams in 2010 and revised it in 2013 (Corps 2013a). MMC's plan is conceptual and would be refined during the 404 permitting process. MMC did not update its mitigation plan for Alternative 2 to reflect the new regulations and stream mitigation procedure.

Table 187. Jurisdictional Wetland Mitigation Opportunities by Alternative.

Mitigation Type and Site Name	Alternative 2 – MMC's Proposed Mine	Alternative 3 – Agency Mitigated Poorman Impoundment	Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment
On-Site			
Little Cherry Creek	2.2	0.0	0.0
Little Cherry Creek Diversion Channel	1.6	0.0	0.0
Unspecified Little Cherry Creek Site	5.0	0.0	0.0
Total On-Site	**8.8**	**0.0**	**0.0**
Off-Site			
North Poorman Creek	3.4	0.0	3.4
South Poorman Creek	9.7	0.0	9.7
Poorman Weather Station	14.0	0.0	14.0
Libby Creek Recreational Gold Panning Area	2.0	0.0	0.0
Ramsey Creek	6.7	0.0	6.7
Swamp Creek	0.0	15.0	15.0
Total Off-Site	**35.8**	**15.0**	**48.8**
Total Mitigation	**44.6**	**15.0**	**48.8**

All units are rounded to the nearest 0.1 acre.
Wetlands mitigation sites are shown for Alternative 2 on Figure 21 and for Alternatives 3 and 4 on Figure 33 and Figure 34.
The Corps is responsible for determining if a mitigation site is considered on-site or off-site.
Source: GIS analysis by ERO Resources Corp. using MMC data.

3.23.4.10.2 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

The agencies' Wetland Mitigation Plan for Alternative 3 is described in section 2.5.7.1, *Jurisdictional Wetlands and Other Waters of the U.S.*. MMC would implement the following mitigation as part of the wetland mitigation for 9.2 acres of direct effects and 0.2 acre of indirect effects (downgradient of the disturbance boundary) on wetlands from Alternative 3 (MMC 2014a):

- Rehabilitate 15 acres of wetland at the Swamp Creek site (Figure 34)
- Preserve 3 acres of upland vegetated buffer at the Swamp Creek site

MMC would implement the following stream mitigation (MMC 2014a):

- Reconstruct three existing channels at the Swamp Creek site to add meanders and to raise the channel bottom, adding 6,500 linear feet of stream
- Replace a culvert on Little Cherry Creek with a bottomless, arched culvert
- Replace a culvert on Poorman Creek with a bottomless arched culvert
- Stabilize 400 feet of erosion on NFS road #6212
- Remove a bridge across Poorman Creek and re-establish floodplain

- Remove 21 culverts and restore adjacent riparian habitat on lands acquired for grizzly bear mitigation

The Corps will determine the final mitigation requirements with the objective of replacing lost functions and services of the affected wetlands. The Corps will determine if the mitigation sites would be sufficient to meet the mitigation requirements for 9.2 acres of direct effects and 0.2 acre of indirect effect on jurisdictional wetlands, and the KNF will make the same determination for non-jurisdictional wetlands. MMC would submit more detailed plans for the selected jurisdictional mitigation sites for final approval by the Corps. Similar more detailed plans would be submitted to the KNF for isolated wetland mitigation sites.

The following sections briefly describe the wetland and stream mitigation proposed for Alternative 3, the basis for the anticipated hydrologic support for the mitigation site, the anticipated improvement in function and services that would be provided by the mitigation sites, and the anticipated credits associated with each site. A longer description of the proposed mitigation is found in section 2.5.7.1, *Jurisdictional Wetlands and Other Waters of the U.S.* in Chapter 2, with a full description provided in MMC's revised Mitigation Design Report (MMC 2014a). The anticipated improvement in function and services is based on MMC's revised Mitigation Design Report (MMC 2014a). The Corps is responsible for determining the amount of required compensatory mitigation necessary to replace lost jurisdictional wetland and stream functions and services. The Corps will determine compliance of the proposed discharges of fill with the 404(b)(1) Guidelines. The Corps will discuss compliance with the 404(b)(1) Guidelines in its ROD or Statement of Findings on the Section 404 permit. The Corps' findings regarding the least environmentally damaging practicable alternative and compliance with the 404(b)(1) Guidelines are subject to EPA's review.

Jurisdictional Wetland Mitigation

Swamp Creek Site

The Swamp Creek site is about 4 miles east of the Montanore Project site near US 2. Swamp Creek is a potential off-site wetland mitigation site where MMC has conducted hydrologic monitoring. In August 2011, MMC installed four piezometers at the site at depths that ranged from 5 to about 9 feet below ground surface. MMC collected data twice in 2011 and four times in 2012 and 2013 (NewFields Companies and Kline Environmental Research 2014). During the growing season, groundwater levels at one piezometer within the middle of the existing wetland ranged from 0.7 feet in August 2011 to 2 feet below the ground surface in September 2012. Groundwater levels at two piezometers on the west side of the exiting wetland were greater than 2 feet below the ground surface from August to September. Early growing season (May and June) measurements of groundwater were not taken at any of the piezometers and groundwater levels are not known.

About 15 acres of wetland would be rehabilitated at the Swamp Creek site. Three acres would become woody riparian habitat and 3 acres would be preserved for an vegetated upland buffer. The site is currently a wetland, and the rehabilitation has a high likelihood of success because the supportive hydrology is present.

The site has high cover of reed canarygrass, which can form dense stands and out compete other species. MMC plans to burn the grass, followed by plowing the soil and seeding the area with wetland vegetation. The performance standards developed by MMC for Alternatives 3 and 4 include having 30 percent cover or less of reed canarygrass (see section C.4 in Appendix C). Reed canarygrass is difficult to control because it has vigorous, rapidly spreading rhizomes and forms a large seed bank. Control of reed canarygrass is most effective when it includes an integrated approach implemented in a sequential and timely order. Ongoing maintenance to control sprouting and seedling establishment may be necessary to maintain long-term reed canarygrass control (Waggy 2010). If mitigation efforts created soils conditions that were more frequently saturated or inundated, the ecological conditions would be more favorable for species with higher moisture tolerances such as sedges and bulrushes.

The Swamp Creek mitigation site would increase the capacity for the area to perform all 15 functions and three services, in comparison to existing conditions at the Swamp Creek site. In addition, the Swamp Creek site would have similar functions and services as the affected wetlands. All but three of the functions would have high ratings at the rehabilitating wetland site, and all three services would also have high ratings (MMC 2014a). Mitigation credit would accrue from rehabilitating 15 acres of wetlands at a 1.5:1 ratio and protecting an upland buffer zone of 3 acres around the new wetland areas at a 5:1 ratio. MMC estimates total credits would be 10.6 acres.

Stream Mitigation

Swamp Creek Site

Stream mitigation at the Swamp Creek site would consist of constructing about 6,500 linear feet of new meandering channels, planting a 10-foot wide riparian zone on each side of the channels totaling about 3 acres, and removal of cattle on the property to prevent grazing along the channels. Three primary drainage channels located on the Swamp Creek site would be subject to channel restoration: main Swamp Creek channel and two tributary channels from Spring #2 and Spring #3.

Proposed mitigation would have direct benefits to the functions and services of the stream reaches on the Swamp Creek mitigation site, with benefits that would extend downstream in Swamp Creek and into Libby Creek. The Swamp Creek stream mitigation sites would raise the functions from low and medium ratings to mostly high ratings. All services at the Swamp Creek site currently have a low rating, but would be increased to mostly high ratings due to the planned future public access to the site (MMC 2014a). Mitigation credit would accrue from constructing about 6,500 linear feet of new meandering channels, improving 580 feet of existing channel (Spring #1), planting a 10-foot wide riparian zone on each side of the channels totaling about 3 acres, and restricting cattle from grazing along the stream channels.

Little Cherry Creek Site

Stream mitigation at the Little Cherry Creek sites would consist of replacing a culvert on NFS road #6212 with an arched culvert, following Forest Service stream simulation techniques (USDA Forest Service 2008a). The culvert replacement would improve passage for aquatic, semi-aquatic, and terrestrial biota and increase recreational potential.

Poorman Creek Sites

Stream mitigation at the Poorman Creek sites would consist of replacing one culvert across the creek at NFS road #278, removing one bridge on a decommissioned NFS road #6212 and stabilizing 400 feet of eroding cut slope adjacent to NFS road #6212. The bridge on NFS road #6212 across Poorman Creek would be removed during construction. Replacement of the road

#278 culvert would improve passage for fish possibly up to the first natural barrier and improve passage for an indefinite distance for semi-aquatic biota, including amphibians and mammals that are associated with water. Removal of the NFS road #6212 bridge and creation of a floodplain, and restored stream and riparian habitat would add surface water storage capacity during flood conditions, which would include associated nutrient cycling and sediment retention in the reestablished floodplain. Aquatic and semi-aquatic habitat and biota would benefit from reduced sediment downstream of the removed NFS road #6212 bridge due to reduced inputs from the road crossing and stabilization of erosion along the road. Benefits of increased organic inputs, nutrient cycling, fish production, and flood and erosion protection from the restored floodplain, and benefits of reduced sediment inputs would extend into Libby Creek (MMC 2014a). This reach would also be more appealing for recreation.

Lands Acquired for Grizzly Bear Mitigation

MMC would convey the title to or a perpetual conservation easement on 5,387 acres of land to the Forest Service or private conservation organization independent of MMC for grizzly bear mitigation. All lands would be acquired before the start of the Construction Phase. The Forest Service would ensure that the specified acres of mitigation properties were managed for grizzly bear habitat in perpetuity. The grizzly bear mitigation plan also would require MMC to implement access management improvements, such as road decommissioning and culvert removal, on mitigation lands. MMC would conduct a survey to assess all mitigation lands for opportunities to improve aquatic resources. Some of the types of activities that would be conducted to mitigate streams include: culvert removal and floodplain restoration, restoration of disturbed riparian buffer areas by removing roads and revegetating, addition of woody debris to the floodplain, removal of riprap and bridge abutments below the ordinary high water mark, removal of berms and other impervious fill material, and installation of instream habitat features to increase the value to aquatic life. MMC would use the Corps' Montana Stream Mitigation Procedure and the Corps' compensatory mitigation regulations (33 CFR 332) in assessing mitigation opportunities. For the purposes of assessing stream mitigation credits, MMC identified 21 culverts that would be removed and adjacent riparian habitat would be restored on 908 linear feet of stream on potential wildlife mitigation lands (MMC 2014a). The culvert removal would improve passage for aquatic, semi-aquatic, and terrestrial biota and increase recreational potential.

Summary of MMC's Proposed Jurisdictional Mitigation and Associated Credits and Debits

MMC's estimated wetland credits would be 10.6 acres. In its revised Mitigation Design Report (MMC 2014a), MMC did not include all wetlands and streams outside of the disturbance area or streams indirectly affected below the impoundment in determining mitigation debits. Assuming all wetlands within the Alternative 3 disturbance boundary would be filled or otherwise indirectly affected by the project and that wetlands below the disturbance boundary would be indirectly affected, total impact would be 9.4 acres, which would consist of 9.2 acres of and 0.2 acre of indirectly-affected jurisdictional wetlands downgradient of the disturbance boundary. MMC did not apply for a 404 permit to fill all jurisdictional wetlands within the disturbance boundary. If jurisdictional wetlands within the disturbance boundary could not be avoided during final design, MMC would have to modify its 404 permit, if issued for the project. Mitigation for isolated wetlands is described in the next section. While MMC has demonstrated that adequate jurisdictional wetland mitigation credits are available for debits determined by MMC, final jurisdictional wetland debits and credits will be determined by the Corps during the 404 permitting process.

Total direct and indirect steam impacts associated with construction of the impoundment would be 19,058 linear feet, which includes 13,272 linear feet direct effect within the disturbance boundary, 1,059 linear feet of direct effect from roads, and 4,727 linear feet of indirect effect below the disturbance boundary to Libby Creek. The effects on streams may be reduced during final design through avoidance and minimization efforts. While MMC has demonstrated that adequate stream mitigation credits are available for debits determined by MMC, the Corps would determine if the mitigation proposed by MMC for Alternative 3 would be adequate to offset unavoidable impacts to waters of the U. S. during the 404 permitting process. The above sections describe some of the possible opportunities to meet the required mitigation credits.

Isolated Wetland Mitigation

Little Cherry Creek Sites LCM-1, LCM-2, and LCM-3

As part of the planning process, MMC identified six potential mitigation sites adjacent to wetlands in the Little Cherry Creek Impoundment area. From 2010 to 2012, a total of eleven piezometers were installed at the six potential wetland mitigation sites at depths ranging from 3.2 to 5.1 feet. Depth to groundwater in the piezometers was measured once in 2010 and four times in 2011, 2012, and 2013, although often depth to groundwater was greater than the well depth (NewFields Companies and Kline Environmental Research 2014). Based on groundwater data, MMC identified Little Cherry Creek Mitigation Sites LCM-1, LCM-2, and LCM-3 with a combined total of 4.5 acres to meet a portion of its mitigation requirements. Groundwater levels measured in the piezometers show the water table is typically less than 2 feet below the ground surface in the spring and early summer and then declines until late summer.

Numerous small depressions would be excavated and lined with low permeability soil at the Little Cherry Creek sites LCM-1, LCM-2, and LCM-3 to create areas with palustrine emergent wetlands and seasonal open water areas. Surface water from snowmelt and direct rainfall would be the primary water source. If the title to or a perpetual conservation easement on Little Cherry Creek mitigation sites had not already been conveyed as part of the grizzly bear mitigation plan, MMC would convey the title to or a perpetual conservation easement on the Little Cherry Creek mitigation sites to the Forest Service after the Forest Service has determined the sites' performance standards had been met. Conveyed lands would be the isolated wetland mitigation sites, upland buffers, and adjacent existing wetlands contiguous to National Forest System lands. If a perpetual conservation easement was conveyed, the easement would allow for public access to the property. The proposed Little Cherry Creek wetland mitigation sites would improve the capacity of the area to perform all 15 functions and three services, in comparison to the existing upland conditions. The new wetlands generally would have similar or improved functions and services as the affected wetlands. Two of the functions (short- and long-term surface water storage; general wildlife habitat) would have high ratings for the new wetland sites, while all of the other functions and services except general fish habitat would have a medium rating (MMC 2014a). Mitigation credit would accrue from creating 4.5 acres of wetlands in uplands near the existing wetlands at a 2:1 ratio, and protecting an upland buffer zone of 2.5 acres around the new wetland areas at a 5:1 ratio. The agencies estimate credits would be 2.75 acres (Table 188).

Gravel Pit Site

The proposed Gravel Pit mitigation site was previously disturbed by gravel mining and remains unvegetated. In 2011, one piezometer was installed at the proposed Gravel Pit wetland mitigation site to a depth of 8.5 feet. Three monthly measurements were collected in 2011 and four monthly measurements were collected in 2012. During the growing season, groundwater levels ranged from 1.6 feet below ground surface in June 2012 to about 8 feet below ground surface in September 2011 (NewFields Companies and Kline Environmental Research 2014). Because the depth to groundwater would require extensive excavation, this mitigation site would be designed for precipitation as the supportive hydrology. Several small depressions would be excavated and lined with low permeability wetland soil to collect and hold precipitation, providing seasonal supportive hydrology. The success of this mitigation site would depend on proper construction and placement of the low permeability soil and adequate annual precipitation. Typically, groundwater-supported mitigation wetlands have a greater chance of success.

The Gravel Pit mitigation site would improve the capacity of the area to perform all 15 functions and three services, in comparison to existing conditions at the gravel pit. In addition, the new wetland site would have similar functions and services as the affected wetlands. Three of the functions (short- and long-term surface water storage; general wildlife habitat; and uniqueness) would have high ratings for the new wetland site, while all of the other functions and services except general fish habitat would have a medium rating (MMC 2014a). Mitigation credit would accrue from creating 3 acres of wetlands at a 2:1 ratio and protecting an upland buffer zone of 2 acres around the new wetland areas at a 5:1 ratio. The agencies estimate total credits would be 1.9 acres (Table 188).

MMC would convey the title or a perpetual conservation easement to the Forest Service for the following lands: lands contiguous with existing wetlands, the isolated wetland mitigation sites and National Forest System lands owned by MMC along Little Cherry.

Table 188. Summary of Isolated Wetland Mitigation and the Agencies' Estimated Credits, Alternative 3.

Mitigation Location	Mitigation Type	Mitigation Areas or Estimated Credit
Wetlands		
Three sites (LCM-1, LCM-2, LCM-3) near Little Cherry Creek	Wetland creation of 4.5 acres	2.25 acres wetlands (2:1 ratio); 0.5 acre upland buffer (5:1 ratio)
Former Gravel Pit near Poorman Creek	Wetland creation of 3.0 acres	1.5 acres wetlands (2:1 ratio); 0.4 acre upland buffer (5:1 ratio)
Total	7.5 acres	4.65 acres

Source: Agencies' analysis.

Mitigation for Other Potential Indirect Effects

The agencies did not require MMC to identify mitigation for three potential indirect effects of the project: affecting the hydrologic support for wetlands north of the Poorman Impoundment Site by the pumpback well system, reducing the flow in Poorman and Little Cherry creeks by the pump-back well system, and affecting the hydrologic support for wetlands and other aquatic resources in the upper watersheds of the East Fork Rock Creek and the East Fork Bull River. The agencies' approach for assessing and monitoring these potential effects and developing appropriate mitigation based on monitoring is described in the following sections.

Indirect Effects of the Pumpback Wells. MMC used a 3D model to predict the effect of the pumpback wells on the impoundment site's hydrology. In Alternative 3, the model predicted that the drawdown from the wells would extend to Little Cherry Creek, potentially affecting wetlands between the Poorman Impoundment Site and Little Cherry Creek. Alternatives 2 and 4 would have similar potential to affect wetlands indirectly (Table 185). Potential effects on streamflow in Libby Creek, Little Cherry Creek, and Poorman Creek from the pumpback wells were discussed in section 3.11.4.4. Streamflow was predicted by the model to be reduced by 0.55 cfs in Libby Creek, 0.04 cfs in Little Cherry Creek, and 0.18 cfs in Poorman Creek.

Section 3.10.4.2 indicates operation of a pumpback well system may not affect groundwater levels, surface resources, or five of the springs south of Little Cherry Creek because of an apparent subsurface bedrock ridge that separates groundwater flow between the watershed of Little Cherry Creek from those of Drainages 5 and 10 in the Poorman Impoundment Site (Chen Northern 1989). Because geologic and hydrologic data from the area between the Little Cherry Creek and Poorman drainages are limited, they are not sufficient to eliminate the possibility of the pumpback well system adversely affecting surface resources, particularly groundwater-supported wetlands. Additional subsurface data, such as aquifer pumping tests, from this area would be collected during the final design process of the Poorman Impoundment (see section 2.5.2.5, *Final Design Process* in Chapter 2 and Appendix C). These data would be used to confirm the geophysical results and the MMC's hydrogeologic interpretation. The 3D model would be rerun to evaluate the site conditions with the new data.

Section C.10 of Appendix C also describes wetland monitoring before operations began. One year before mill operation started, MMC would measure water levels in the piezometers in wetlands LCC-35 and LCC-39 four times over the annual hydrograph. The purpose of the monitoring would be to assess the potential effects of the pumpback well system. Vegetation in these two wetlands also would be monitored, following the methods used for the GDE monitoring. The monitoring would continue through the Closure Phase as long as the pumpback well system operated or until agreed upon by the agencies that it was no longer necessary. Streamflow in Libby Creek, Little Cherry Creek, and Poorman Creek also would be monitored. Should the updated tailings impoundment 3D model indicate streamflow or aquatic resources may be adversely affected by groundwater pumping, MMC would develop appropriate mitigation for the adverse effect. Mitigation would be identified and implemented before the pumpback well system began operation. Monitoring data collected during operations also would be used to assess effect. Conceptual mitigation options include providing hydrology support from groundwater wells or surface water or creating new wetlands on either National Forest System lands or private land north of Little Cherry Creek.

Indirect Effects of Mine Dewatering. Similar to the assessment of the Poorman Impoundment Site's hydrology, the agencies used 2D and 3D models to evaluate the site hydrogeology and analyze potential impacts due to mining. Although the results of the two models were similar, the 3D model provides a more detailed analysis, by incorporating known or suspected fault behavior with respect to hydrology; more recent underground hydraulic testing results; a more comprehensive calibration process, and better simulation of vertical hydraulic characteristics of the geologic formations to be encountered during the mining process. The effect on streamflow was discussed in section 3.11.4, *Surface Water Hydrology*. Section 3.10.4.3.5, *Groundwater Model Uncertainty* discusses model uncertainty. There is uncertainty associated with the hydraulic properties of the bedrock and faults; predictions of mine inflows and impacts on water resources are sensitive to permeability of major fault zones. With the data currently available, the model results provide a potential range of mine dewatering and pumping (in the case of the tailings impoundment model) rates and streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using currently available data in the groundwater models. The mine 3D groundwater model would be refined and rerun after data from the Evaluation Phase were incorporated into the models (see section C.10.4, *Evaluation Phase* in Appendix C). Following additional data collection and modeling, the predicted impacts on surface water resources in the analysis area, including simulation of mitigation measures, may change and the model uncertainty would decrease.

Section C.10 of Appendix C also describes GDE inventory and monitoring and streamflow monitoring of in the mine area. The inventory area may change if the 3D groundwater model used to assess effects was updated and predicted greater or lesser effects. An inventory would help identify and rank GDEs based on their importance in sustaining critical habitats or species. The inventory would be conducted in accordance with the most current version of the Forest Service's *Groundwater Dependent Ecosystems: Level II Inventory Field Guide* (USDA Forest Service 2012b). The inventory, which began in 2009, includes a vegetation survey to describe and document existing vegetation characteristics and establish a prevalence index used by the Corps to determine wetland vegetation (Corps 2008d). The prevalence index would be used to assess changes in vegetation composition and if a loss of wetland species was occurring. The monitoring would continue through the Closure Phase as long as mine dewatering occurred or until agreed upon by the agencies that it was no longer necessary. Should the updated mine area 3D model indicate aquatic resources may be adversely affected by mine dewatering, MMC would develop appropriate mitigation for the adverse effect. Mitigation would be identified and implemented before the mill began operation. Monitoring data collected during operations also would be used to assess effect. Conceptual mitigation options include mitigation on lands acquired for grizzly bear mitigation. Some of the types of activities that would be conducted for mitigation include: remove culverts and restore the floodplain, restore disturbed riparian buffer areas by removing roads and revegetating, add woody debris to the floodplain, remove riprap and bridge abutments below the ordinary high water mark, remove berms and other impervious fill material, and install instream habitat features to increase the value to aquatic life.

3.23.4.10.3 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

The agencies' Wetland Mitigation Plan for Alternative 4 is described in section 2.6.7.1, *Wetlands Mitigation*. Jurisdictional wetlands would be replaced at a ratio determined by the Corps while isolated wetlands would be replaced using the Corps' 2005 ratios. A total of 48.8 acres of off-site mitigation were identified for Alternative 4. If the KNF selected Alternative 4 in the ROD, MMC would develop a mitigation design report for unavoidable effects on jurisdictional waters of the U.S. MMC would implement the wetland rehabilitation and stream restoration at Swamp Creek, the culvert replacement and the bridge replacement on NFS road #278 at Poorman Creek, and culvert removal on lands acquired for grizzly bear mitigation. Other possible wetland mitigation sites may include the North Poorman Creek, South Poorman Creek, Poorman Weather Station and Ramsey Creek sites shown in Table 187 and Figure 33. Insufficient mitigation sites were identified to achieve the Corps' minimum ratios for effects on jurisdictional wetlands, and additional mitigation sites would be necessary if this alternative were permitted. MMC would implement the mitigation described for the Gravel Pit site in Alternative 3 for mitigation for isolated wetlands.

In Alternative 4, the diversion channel for Little Cherry Creek would be a geomorphic-type diversion that would incorporate habitat components. Several mitigation measures would be implemented along the channel to ensure that erosion and sedimentation resulting from heavy rainfall and from high flow events would be minimized. Wetland soil, sod, and shrubs would be excavated from existing wetlands before filling during construction, and placed in the wetland mitigation areas. Use of existing wetland soils in mitigation would improve mitigation success.

As proposed in Alternative 3, 1 year of groundwater monitoring at the mitigation sites would be implemented in Alternative 4. Only sites with adequate existing groundwater available to support wetlands would be used for mitigation.

NMC's 1993 404 permit included more detailed designs for the North Poorman, South Poorman, and Ramsey creek sites (Corps 1993). The Poorman Weather Station mitigation site was not included in NMC's 1993 404 permit and the feasibility of creating 14 acres that replaced the lost functions of the wetlands affected by Alternative 4 is uncertain. According to MMC, the Poorman Weather Station mitigation site (Figure 33) is not within an area of existing wetlands and has no well-defined drainage. Wetlands created at this site may not be jurisdictional if the site does not have a hydrologic connection to a jurisdictional water. The discussion found on page 115 regarding mitigation requirements and on-site and off-site mitigation also applies to Alternative 4. Insufficient mitigation sites were identified to achieve the Corps' minimum ratios, and additional mitigation sites would be necessary if this alternative were permitted.

The agencies' wetland monitoring plan for Alternative 4 is similar to Alternative 3. In Alternative 4, flow from springs SP-02, SP-10, S-12, SP-14, SP-15 and SP-29 (Figure 40) would be measured and sampled for selected water quality parameters. MMC would monitor three wetlands if not filled by project activities: LCC-24, LCC-25, and LCC-39 (Figure 40). MMC would use the procedures established for monitoring of wetland mitigation sites described in Alternative 3 to describe and document existing vegetation characteristics and a prevalence index. A prevalence index would be used to assess changes in vegetation composition. Samples from any standing water in these three wetlands would be collected and analyzed for selected water quality parameters. Sampling would be repeated in mid-summer every 2 years until tailings disposal ceased. The revised monitoring plan would better evaluate the functions and services of the mitigation sites and the effects on downstream springs and wetlands.

3.23.4.11 Cumulative Effects

Past actions in the analysis area, particularly road construction, has resulted in the placement of culverts and other fill material in streams and adjacent wetlands. Past actions after the passage of the Clean Water Act in 1977 were subject to Section 404 permitting and mitigation requirements. Cumulative direct and indirect effects on waters of the U.S. may result from other reasonably foreseeable actions in the analysis area such as other mining operations and road construction. All present and reasonably foreseeable future actions regulated under Section 404 of the Clean Water Act would be subject to Corps' permitting and mitigation requirements. Some activities that may result in future effects on waters of the U.S. are exempt from Corps review under Section 404(f), and other activities with minimal effects do not require notification to the Corps for authorization. With appropriate mitigation, cumulative direct wetland effects would be negligible. Vegetation management projects, such the Flower Creek Vegetation Management project and the Miller-West Fisher Vegetation Management project, would avoid direct effects on waters of the U.S. by maintaining a RHCA buffer around wetlands and other waters. Typically, proposed activities on National Forest Systems lands are designed to meet standards prescribed by INFS. These design features would prohibit timber harvest, including firewood cutting, in RHCAs, thus limiting effects on waters of the U.S. Any activities within the KNF that are not subject to Corps review and that contribute to cumulative effects on waters of the U.S. would be mitigated under

Executive Order 11990. Wetland effects from KNF-approved access projects were not identified, and it would be the responsibility of the landowner to comply with the Clean Water Act. Cumulative indirect effects from reasonably foreseeable future actions in the area may include small amounts of increased sedimentation in wetlands from new roads associated with construction and ground-disturbing activities such as Miller-West Fisher Vegetation Management Project, and projects on private land such as housing development, roads, and logging.

3.23.4.12 Regulatory/Forest Plan Consistency

All of the action alternatives would involve the discharge of fill material or excavation into wetlands or waters of the U.S. MMC would apply for a permit and be required to follow conditions in the Section 404 permit. Plans for avoidance, minimization, and mitigation of effects on wetlands would be required before permit issuance. The agencies prepared a 404(b)(1) analysis that discusses compliance with the 404(b)(1) Guidelines (Appendix L). The lead agencies identified the Poorman Impoundment Site as the least environmentally damaging alternative for surface tailings disposal because it would have the least impacts on wetlands and waters of the U.S., and would not have other significant adverse environmental consequences (40 CFR 230.10(a)). As the permitting authority, the Corps will determine if mine Alternative 3 and transmission line Alternative D-R are the least environmentally damaging practicable alternatives. The Corps also will determine if the proposed project complies with the 404(b)(1) Guidelines. The Corps will discuss compliance with the 404(b)(1) Guidelines in its ROD or Statement of Findings on the Section 404 permit. The Corps' findings regarding the least environmentally damaging practicable alternative and compliance with the 404(b)(1) Guidelines are subject to EPA's review. Any alternative permitted by the Corps would comply with the KFP and Section 404 of the Clean Water Act.

In compliance with Executive Order 11990, the KNF finds that there is no practicable alternative to new construction located in wetlands, and that Alternative 3 would include all practicable measures to minimize harm to wetlands. Section 2.5.2.5.3, *Final Tailings Impoundment Design Process,* describes the agencies' requirements for the impoundment design before construction would begin. One mitigation measure would require MMC to avoid or minimize, to the extent practicable, filling wetlands and streams, such as described in Glasgow Engineering Group, Inc. (2010). This mitigation would ensure adverse effects on National Forest System lands would be minimized before considering compensatory mitigation and would comply with 36 CFR 228 Subpart A.

The Corps' wetland mitigation requirements would fulfill the Executive Order's requirements to minimize harm to jurisdictional wetlands. To minimize harm to isolated wetlands and comply with Executive Order 11990 and with 36 CFR 228 Subpart A regulations for locatable minerals operations on National Forest System lands, the KNF would require MMC to develop compensatory mitigation that would create 7.5 acres of wetlands and 4.5 acres of upland buffers. MMC would submit a final isolated wetland mitigation plan to the KNF for its approval and for incorporation into MMC's amended Plan of Operations.

3.23.4.13 Irreversible and Irretrievable Commitments

All action alternatives would result in an irretrievable commitment of wetlands and streams Successful mitigation would restore lost wetlands and provide similar functions and services to altered wetlands at another location. All action alternatives would affect wetlands and create changes in wetland functions and services. Some biodiversity in wetlands may ultimately be lost from invasion of introduced species and be irreversible under all action alternatives. Any differences in the function and services of the existing Little Cherry Creek channel and the proposed diversion channel in Alternatives 2 and 4 would be an irretrievable commitment.

3.23.4.14 Short-term Uses and Long-term Productivity

Potential short-term effects would result from time delays between the loss of existing wetlands resources and the development of the viable wetlands with similar functions and services. Proposed BMPs would minimize sedimentation. Other potential short-term effects would result from time delays between the loss of existing wetlands resources and the development of the viable wetlands with similar functions and services.

3.23.4.15 Unavoidable Adverse Environmental Effects

A loss of wetland functions and services, biodiversity, and species composition would occur in all action alternatives where wetlands are affected. The agencies anticipate effects on wetlands and streams would be mitigated and wetland functions and services would return to the area in time. The Corps would be responsible for establishing mitigation requirements for jurisdictional wetlands and other waters of the U.S. The KNF would be responsible for establishing and approving any wetland mitigation requirements for non-jurisdictional wetlands associated with the project on National Forest System lands. Any non-jurisdictional wetland affected by the transmission line and access roads may be subject to conditions of the 318 authorization, and, where significant impacts occur, MFSA certification requirements if not covered by other mitigations. The agencies' proposed mitigation would mitigate for direct effects on jurisdictional and isolated wetlands. Created wetlands biodiversity and species composition of forested wetlands would not return to pre-disturbance levels until decades after establishment. The diversity and species composition of herbaceous wetlands would likely be restored within 5 years.

3.24 Wilderness, Roadless Areas and Wild and Scenic Rivers

3.24.1 Cabinet Mountains Wilderness

3.24.1.1 Regulatory Framework

The CMW became a unit of the National Forest Wilderness Preservation System with the passage of the Wilderness Act on September 3, 1964. The Wilderness Act applies to the 94,272 acres of land within the CMW that were designated as part of the wilderness preservation system, not to activities and land outside the CMW boundary. The Wilderness Act directs the Forest Service to protect the natural character of the wilderness and to provide for recreational, scenic, scientific, educational, cultural, and historical uses of wilderness areas. Based on the Wilderness Act's definition of wilderness, the Forest Service uses four qualities to broadly describe all wilderness character in the National Forest System:

- Untrammeled – wilderness is essentially unhindered and free from modern human control or manipulation
- Undeveloped – wilderness is essentially without permanent improvements or modern human occupation
- Natural – wilderness ecological systems are substantially free from the effects of modern civilization
- Outstanding opportunities for solitude or a primitive and unconfined type of recreation – wilderness provides outstanding opportunities for people to experience solitude or primitive and unconfined recreation, including the values of inspiration and physical and mental challenge

More specific descriptions of these wilderness character qualities are described below under *Affected Environment*.

Section 4(d)(3) of the Wilderness Act pertains to mining claims within the wilderness and states that holders of unpatented mining claims validly established as of December 31, 1983 on National Forest System lands designated by the Act as a wilderness area will be accorded rights under the 1872 General Mining Law. The same section states that all patents issued on National Forest System lands designated as a wilderness area will convey only title to the mineral deposits within the claims and the United States reserves all title to the surface and surface resources of the claims. The Secretary of Agriculture may prescribe reasonable stipulations "for the protection of the wilderness character of the land consistent with the use of the land for the purposes for which they are leased, permitted, or licensed." The Secretary of Agriculture also may regulate ingress and egress consistent with the use of the land for mineral location and development. Consequently, mining operations can occur within the wilderness but may be subject to management requirements that are above and beyond those normally imposed on operations outside of a wilderness, provided those requirements do not prevent the operator from exercising due rights under United States mining laws. Forest Service mineral regulations (36 CFR 228, Subpart A) provide direction for administering locatable minerals operations on National Forest System lands. Specifically, 36 CFR 228.15 provides direction for operations within the National Forest Wilderness. Holders of validly existing mining claims within the National Forest

Wilderness are accorded the rights provided by the U.S. mining laws and must comply with the Forest Service mineral regulations (36 CFR 228, Subpart A). Mineral operations in the National Forest Wilderness are to be conducted to protect the surface resources in accordance with the general purpose of maintaining the wilderness unimpaired for future use and enjoyment as wilderness and to preserve the wilderness character consistent with the use of the land for mineral development and production.

The 1987 KFP allocated the CMW to MA 7. The goal of MA 7 is to manage it in accordance with the Wilderness Act, to allow natural processes to continue, maintain the opportunity for solitude and primitive recreation, provide habitat contributing to the recovery of the grizzly bear, and provide natural habitat for viable populations of other species of wildlife which have historically occupied the area. The standard for minerals and geology is that the valid existing rights recognized in the CMW will be managed in accordance with the Wilderness Act and other applicable laws and regulations.

In 2009, the KNF completed the Cabinet Mountains Wilderness Management Plan. The goal statement for the plan directs that the CMW "will be managed according to the Wilderness Act to allow natural processes to operate freely where the evidence of man's activity is substantially unnoticeable" (KNF 2009). Management direction in the plan is derived from the Wilderness Act and subsequent legislation which sought to protect these special areas and preserve wilderness character. The management plan identifies that valid existing rights for the Montanore ore deposit have been established in the CMW

3.24.1.2 Analysis Area and Methods

The analysis area encompasses the CMW south of the ridge separating Big Cherry Creek from Bear Creek (Figure 88). The CMW north of the ridge would not be affected, and, consequently, is outside of the analysis area. Potential effects on the CMW were qualitatively evaluated based on potential effects on wilderness attributes from the proposed project.

3.24.1.3 Affected Environment

The CMW is a 94,272-acre unit of the National Forest Wilderness Preservation System. It is about 34 miles long and varies from 0.5 to 7 miles wide (Figure 88). The wilderness occupies the upper elevations of the Cabinet Mountains, with elevations from 2,500 to 8,700 feet. The Cabinet Mountains are a north/northwest trending, extensively glaciated mountain range. This glaciation produced spectacular features such as high craggy peaks, vertical cliffs, knife-edge ridges, amphitheater-like basins, and filled valley bottoms. These land-building processes also have created many streams and about 85 lakes within the wilderness. MMC's mineral rights in the CMW are discussed in section 1.3.1, *Mineral Rights.*

3.24.1.3.1 Wilderness Character

The Forest Service's national framework for wilderness character was based on Section 2(c) of the Wilderness Act (Landres *et al*. 2008). These qualities of wilderness character provide the basis for the effects analysis.

- Untrammeled – The Wilderness Act states that wilderness is “an area where the earth and its community of life are untrammeled by man,” and “generally appears to have been affected primarily by the forces of nature.” Wilderness is essentially unhindered and free from modern human control or manipulation. This quality is degraded by modern human activities or actions that control or manipulate the components or processes of ecological systems inside the wilderness.
- Natural – The Wilderness Act states that wilderness is “protected and managed so as to preserve its natural conditions.” Wilderness ecological systems are substantially free from the effects of modern civilization. This quality is degraded by intended or unintended effects of modern people on the ecological systems inside the wilderness since the area was designated.
- Undeveloped – The Wilderness Act states that wilderness is “an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation,” “where man himself is a visitor who does not remain” and “with the imprint of man’s work substantially unnoticeable.” This quality is degraded by the presence of structures, installations, habitations, and by the use of motor vehicles, motorized equipment, or mechanical transport that increases people’s ability to occupy or modify the environment.
- Solitude or a primitive and unconfined type of recreation – The Wilderness Act states that wilderness has “outstanding opportunities for solitude or a primitive and unconfined type of recreation.” This quality is about the opportunity for people to experience wilderness; it is not directly about visitor experiences per se. This quality is degraded by settings that reduce these opportunities, such as visitor encounters, signs of modern civilization, recreation facilities, and management restrictions on visitor behavior.

Untrammeled and natural are closely related, emphasizing natural ecological processes and an absence of modern disturbances. Both may be altered by the same activities. Undeveloped focuses on how the wilderness is perceived by the general public, while solitude or a primitive and unconfined type of recreation focuses on how visitors experience wilderness.

The CMW has a high degree of untrammeled, natural, and undeveloped qualities. Vegetation in the CMW is abundant and varied, ranging from delicate harebells growing in rock fissures to the lush, valley bottom stands of old growth cedar and hemlock. Thirteen species of conifer trees, 130 species of wildflowers, and numerous shrub species are known to grow in the wilderness. Many wildlife species inhabit the area within and adjacent to the wilderness. These include the grizzly bear, black bear, elk, bighorn sheep, mountain goats, lynx, mule deer, white-tailed deer, and various small mammals and birds.

Primitive recreation provides opportunities for isolation from the evidence of man. Visitors may enjoy a high degree of challenge and risk, and use of outdoor skills. The CMW offers opportunities for primitive recreational activities in a pristine setting. Hiking is the most popular activity in the wilderness. Fishing, photography, and hunting are the next most common activities pursued by wilderness visitors. The wilderness is split between Sanders and Lincoln counties. Access from the Lincoln County side is provided by 12 trails that are maintained on 1- to 2-year intervals and 19 trails are maintained on 3- to 4-year intervals. Access from the Sanders County side is provided by nine maintained trails and six trails not regularly maintained.

Solitude is isolation from sights, sounds, and the presence of others. The developments and evidence of man do not appear. Features that contribute to solitude include size of area and distance from perimeter to center. Vegetation and topographic screening are also related to solitude. The narrow configuration of the CMW (less than a mile wide at its narrowest point) has caused some pressures to occur at some of the more popular destination sites. The relatively easy access has also resulted in some sites receiving heavy use and visitor impacts.

3.24.1.3.2 Management

Management of the portion of the CMW in the analysis area is shared by two Ranger Districts of the KNF. To determine the type and extent of management actions appropriate for different portions of the wilderness, the Forest Service has identified two distinct opportunity classes for wilderness. The opportunity classes are delineated according to the biological, social, and managerial setting within the wilderness.

Opportunity Class I includes pristine areas without developed trails. The opportunity for solitude is high and one would not expect to see other groups or much evidence of recreation use. Dispersion of visitors is the management intention. Generally, no trails or other structures will be developed within the class. Existing travelways will be left in place and not maintained or marked. Existing facilities will be removed. Requests for research or other mineral development facilities will be evaluated on a case-by-case basis. Fish stocking does not currently occur and is not desirable in this area.

Opportunity Class II includes a delineation of trail corridors and more heavily used lake basins, such as Rock Lake and the trail along the East Fork Bull River to St. Paul Lake. Many lakes in this class are stocked with fish and have relatively easy access. These basins are very scenic, wildlife is often seen, and flowering plants are abundant. The lake basins and the trail corridors accessing them total less than 15 percent of the wilderness acres but account for most of the recreation use. Hiker use is steadily expanding in terms of geographical dispersion. Use has resulted in creation of new sites, expansion of camp areas, vegetation loss, tree damage, and human waste problems. To prevent resource impacts, recreation use should generally be concentrated in these areas.

General use of the CMW will not be promoted. Management activities that maintain or enhance the wilderness character, resource, solitude, or primitive and unconfined forms of recreation will be implemented (KNF 2009).

3.24.1.4 Environmental Consequences

3.24.1.4.1 Alternative 1 – No Mine

The CMW would not be directly affected by additional mine facilities. Sounds associated with existing activities at the Libby Adit Site would be audible within a small portion of the CMW in the upper Libby Creek drainage. Such activities on private land at the Libby Adit Site would remain until reclaimed in accordance with existing permits and approvals. Noise levels in the CMW would return to low, ambient levels when reclamation was completed.

3.24.1.4.2 Alternative 2 – MMC's Mine Proposal

All proposed surface disturbances associated with the mine facilities would occur outside the CMW boundary. None of the mine alternatives would physically disturb any lands within the

CMW directly and none of the four wilderness qualities would be directly affected. None of the alternatives would directly affect wilderness character.

The experience of wilderness visitors may be affected by mining-related activities occurring outside the CMW boundary. Because the wilderness experience is highly personal and individual, the perceived effect would differ among individuals. It is likely that the visual and noise effects of the project outside the CMW would reduce the natural quality of the wilderness experience for some individuals in portions of the wilderness. Visitation in the portions of the CMW exposed to sound and visual effects may decrease. Other qualities such as untrammeled, undeveloped, and outstanding opportunities for solitude or a primitive and unconfined type of recreation may also be diminished at some locations within the CMW for visitors while the project was in operation. These effects would occur throughout the duration of project operations and diminish following mining and reclamation. General indirect effects on wilderness character from Alternative 2 are described below.

Untrammeled

Effects on the untrammeled qualities of the CMW would stem primarily from effects on ecological systems, primarily wildlife and hydrology, within or adjacent to the wilderness. Short-term disturbances to wildlife in and adjacent to the CMW such as grizzly bear, mountain goat, and wolverine would occur from operation of the Ramsey Plant (see section 3.25, *Wildlife*). For all alternatives, blasting during construction of the adit openings would result in very short-term disturbances to wildlife in the CMW. Additional temporary disturbances to wildlife in the CMW would occur for Alternative 2 from helicopters used during construction of the transmission line to the Ramsey Plant Site. These impacts would be short term and would not impact the untrammeled quality of the CMW over the long term.

The CMW is part of a narrow, northwest trending corridor that provides the grizzly bear with a north-south movement corridor. The Cabinet Mountains are a rugged, glaciated mountain range of high relief. The topography of Cabinet Mountains and human development on the east and west sides constrict the width of effective grizzly bear habitat that is critical to grizzly bear movement between the southern Cabinet Mountains and the rest of the CYE (USFWS 2003a). The characteristics and importance of the north-south movement corridor are described in detail in the BA (USDA Forest Service 2013b). Long-term displacement effects from mine activities could inhibit grizzly bear movement in the north-south movement corridor in the Cabinet Mountains. Alternative 2 would have the greatest displacement effects in the north-south movement corridor, affecting 3,597 acres.

Direct effects on wildlife and habitat resources outside of CMW may have indirect effects on ecological processes within the CMW, due to long-term impacts on populations of wide-ranging species such as grizzly bear and wolverine. The extent to which the direct effect on wildlife and habitat outside of wilderness affects ecological processes within the CMW is uncertain; while some species may adapt to mine disturbance, others may avoid areas of mine activity and spend more time in the CMW (see *Wildlife* section 3.25).

Groundwater drawdown during all mine phases may indirectly impact aquatic habitat and associated ecological processes within the CMW. Changes in streamflow in Alternative 2 are discussed in section 3.10.4.2, *Alternative 2 – MMC Proposed Mine* in the *Groundwater Hydrology* section and section 3.11.4.3, *Alternative 2 – MMC Proposed Mine* in the *Surface Water Hydrology* section. The 3D model predicted flow in the East Fork Bull River, the East Fork

Rock Creek, and Libby Creek would be reduced in all mine phases, reaching a maximum reduction of 0.40 cfs in the East Fork Bull River, 0.29 cfs in the East Fork Rock Creek, and 0.07 cfs in Libby Creek at the CMW boundary during the Post-Closure Phase (Table 100). A permanent decrease of 0.01 cfs in the East Fork Bull River and 0.03 in the East Fork Rock Creek is predicted at the CMW boundary. At steady state conditions, streamflow in Libby Creek at the CMW boundary is predicted to return to pre-mine conditions Table 102.

Aquatic habitat for bull trout and other salmonids would be adversely affected. Low flows in the East Fork Bull River at the CMW boundary are estimated to decrease by 4 percent and 11 percent during the Closure Phase and Post-Closure Phases, respectively, without mitigation. Decreases in bull trout habitat availability would be similar for the reach near the Isabella Creek confluence and the reach near the CMW boundary with decreases of 4 to 5 percent predicted in both reaches for adult and juvenile bull trout habitat and 11 percent in spawning habitat (Table 76). Available habitat in the East Fork Bull River would essentially return to pre-mine conditions when the mine void filled and the potentiometric surface reached steady state conditions (Table 113), with a 1 percent or less predicted reduction in low flow. Macroinvertebrate populations are present throughout the reaches potentially affect by mine dewatering, and would be affected by the reduction or elimination of flow that would occur during low flow periods. Headwater streams also perform important ecological functions in terms of transport of organic matter, invertebrates, nutrients, and woody debris to downstream waters (Kline Environmental Research and NewFields 2012). Reductions in flow could adversely impact the ability of these headwater reaches to perform such functions. Effects on aquatic life are discussed in section 3.6.4, *Aquatic Life and Fisheries.*

In Alternative 2, the project would reduce the level and volume of Rock Lake during periods in which bedrock groundwater is the only source of supply to Rock Lake (Table 114). Reductions in lake levels and volume would probably not have a detectable effect on the aquatic biota of Rock Lake. While the lake volume is projected to be decreased by 2 percent post closure with mitigation and up to 5 percent without mitigation, aquatic habitat changes would likely be difficult to separate from those caused by natural variability in lake levels that occur in part due to large influxes of surface water into the lake during snowmelt and storm events (see *Aquatic Life and Fisheries*, section 3.6.4).

These direct and indirect impacts on ecological processes inside and adjacent to the wilderness, as described above, would not affect the untrammeled quality of the wilderness. The untrammeled quality would continue to appear to have been affected primarily by the forces of nature.

Natural

In Alternative 2, maximum modeled nitrogen deposition rates from the mine were greater than the Federal Land Manager (FLM) deposition analysis thresholds at Upper Libby Lake, Lower Libby Lake and Rock Lake; maximum modeled sulfur deposition rates were less than the deposition analysis thresholds at Lower Libby Lake and Rock Lake and greater than the deposition thresholds at Upper Libby Lake (Table 56). Effects of nitrogen and sulfur deposition in Alternative 2 on CMW lakes are discussed in section 3.4.4.2.7, *Cabinet Mountain Wilderness Impact Assessment* in the air quality section.

The lead agencies' analysis concluded that chimney subsidence breaching the surface to form sinkholes is unlikely given the geotechnical setting (thickness of the overlying rock above the mine workings, and the strength of the overlying rock) and the mine plan proposed by MMC (see section 3.14.3.1, *Subsidence* and Agapito Associates, Inc. 2007b). Isolated roof failure and chimney subsidence to some height above the workings is likely, and could lead to increased rock fracturing and higher groundwater hydraulic conductivity within the overlying strata. The evaluation also estimated that chimney subsidence impacts on groundwater may occur up to about 400 feet above the mine workings. The agencies' evaluation concluded that trough subsidence, while not likely, cannot be entirely dismissed at the current level of design. Without the agencies' mitigation described in section 2.5.2.5., *Final Design Process* and the agencies' monitoring described in Appendix C, Alternative 2 would have greater risks associated with subsidence than Alternatives 3 and 4.

Undeveloped

Under Alternative 2, mine construction or operation activities would not affect the undeveloped quality of the CMW because these activities are not proposed within the CMW. The undeveloped quality would not be affected because the wilderness would remain essentially without permanent improvements or modern human occupation.

Solitude or a Primitive and Unconfined Type of Recreation

Solitude within the CMW may be affected by the increased visibility of mine disturbances outside of the wilderness, as well as increased noise from mining facilities. Portions of the Montanore Project would be visible from at least one key viewpoint within the CMW at Elephant Peak. The Libby Adit Site, the Ramsey Plant Site, and the Little Cherry Creek Tailings Impoundment would potentially be visible from the CMW locations west of the facilities. The surface features of proposed Rock Lake Ventilation Adit, located adjacent to Rock Lake on a small parcel of private land outside the CMW would be minimal, but may be visible from some areas within the CMW. Night lighting of the mine facilities would be visible from portions of the CMW west of the facilities. Areas cleared of timber for mine facilities would be visible from some locations within the CMW. The visual effects of mining operations would be noticeable during construction and operations and would diminish following facility reclamation and closure.

Noise from mining facilities would be higher than existing levels in the CMW, potentially reducing solitude. During construction, operations, and reclamation, noise from generators, fans, equipment, traffic, and plant operations would extend westward into the CMW, with noise levels of 55 dBA at the CMW boundary diminishing to 30 dBA along the ridge between Elephant Peak and Bald Eagle Peak. Noise level associated with the Rock Lake Ventilation Adit is unlikely to be audible over ambient noise levels. Following mine closure and reclamation, noise levels and solitude in this portion of the CMW would return to pre-mine levels. Noise levels are discussed in section 3.20.4.

Alternative 2 would not affect opportunities for a primitive and unconfined type of recreation within the CMW. Any trails or access routes that are directly affected by mine facilities would be replaced with new routes and would not affect access to the wilderness. Increased access and familiarity with the area due to mine construction and operations and road improvements may increase recreational use within the wilderness. While increased use may diminish primitive recreation opportunities in some areas (particularly near the CMW boundary), it would not substantially affect the ability of some visitors to find high-quality opportunities for primitive recreation within the wilderness.

3.24.1.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Site

Impacts on the qualities of wilderness character and qualities would be similar to Alternative 2. Some mine facilities and roads would be visible from locations within the CMW. Noise levels in CMW would reach 30 dBA along the ridge between Elephant Peak and Ojibway Peak. Night lighting also would be visible from portions of the CMW. In Alternatives 3 and 4, MMC would shield or baffle night lighting at all facilities, minimizing effects on night sky.

Effects on visual quality and increased levels of noise would diminish wilderness qualities related to solitude from some locations in the CMW under Alternative 3. These effects would occur throughout the duration of project operations and diminish following mining and reclamation.

Untrammeled

Temporary disturbances to wildlife in the CMW would occur for Alternatives 3 and 4 from blasting during construction of the upper Libby Adit. MMC would not conduct any blasting at the entrance to any adit portals during May 15 to June 15 to avoid disturbance to the potential goat kidding area on Shaw Mountain.

Displacement effects on the grizzly bear in the north-south movement corridor would be comparable for the agencies' alternatives, with displacement effects in the north-south movement corridor about 1,700 acres less than Alternative 2. In the agencies' alternatives, long-term displacement effects in the north-south movement corridor would be mitigated through protection of an equal amount of grizzly bear habitat in the north-south movement corridor, where possible. To mitigate for displacement effects due to evaluation adit activities, the first 500 acres acquired or put into conservation easement would be within the north-south corridor in BMUs 2, 5, and 6 (Table 30).

Changes in streamflow in Alternative 3 are discussed in section 3.10.4.3, *Agency Mitigated Poorman Impoundment Site* in the *Groundwater Hydrology* section and section 3.11.4.4, *Agency Mitigated Poorman Impoundment Site* in the *Surface Water Hydrology* section. Effects on flow of CMW streams would be less in Alternative 3 with MMC's modeled mitigation and the agencies' mitigation. In Alternatives 3 and 4, the agencies have required additional mitigation, such as increasing the buffer zones near Rock Lake and the Rock Lake Fault, which was not modeled, and leaving one or more barrier pillars inside the mine. The mitigation is designed to minimize effects on East Fork Rock Creek and East Fork Bull River streamflow and water quality. With MMC's modeled mitigation, the 3D model predicted flow in upper Libby Creek would be slightly reduced in all mine phases and in the East Fork Bull River, the East Fork Rock Creek, and other drainages in the Operations, Closure, and Post-Closure Phases.

With MMC's modeled mitigation, decreases in bull trout habitat availability would be similar to Alternative 2 for the reach near the Isabella Creek confluence and the reach near the CMW boundary with decreases of 4 to 5 percent predicted in both reaches for adult and juvenile bull trout habitat and 11 percent in spawning habitat (Table 76). In Libby Creek at the CMW boundary would be 8 to 10 percent for adult and juvenile bull trout habitat and 20 percent in spawning habitat. Bull trout habitat availability would return to pre-mine conditions at steady state conditions. Mitigation projects planned to offset the risk of the population declines estimated to occur from the project in the Kootenai and Lower Clark Fork Core areas are described in more detail in the BA (USDA Forest Service 2013a) and in section 2.5.7.3, *Bull Trout.*

With MMC's modeled mitigation, the 3D model predicted less of a reduction in the potentiometric surface at Rock Lake. During operations, the effect on Rock Lake would be slightly less with MMC's modeled mitigation than without (Table 114). The agencies' mitigation, leaving barrier pillars with access-opening bulkheads, would be designed, based on hydrologic data collected during mining, to minimize post-mining changes in East Fork Rock Creek and East Fork Bull River streamflow and water quality. The agencies' mitigation of increasing the buffer zones near Rock Lake and the Rock Lake Fault, may eliminate effects on Rock Lake during and after mining. Reductions in lake levels and volume would probably not have a detectable effect on the aquatic biota of Rock Lake.

These direct and indirect impacts on ecological processes inside and adjacent to the wilderness, as described above, would not affect the untrammeled quality of the wilderness. The untrammeled quality would continue to appear to have been affected primarily by the forces of nature.

Natural

Modeled maximum nitrogen deposition rates from the mine were less than the FLM deposition analysis threshold at Upper Libby Lake, Lower Libby Lake and Rock Lake (Table 61). Sulfur deposition rates are expected to be below the sulfur deposition analysis threshold (Klepfer Mining Services 2013a). The agencies' mitigation, such as limiting generator use at the mill after power was available from a transmission line to 16 hours during any rolling 12-month time period and using Tier 4 engines and ultra-low sulfur diesel fuel in underground mobile equipment, would substantially reduce emissions compared to Alternative 2. Nitrogen and sulfur emissions from the mine would substantially decrease when underground mining ceased and would end after the adits were plugged. Effects of nitrogen and sulfur deposition in Alternatives 3 and 4 on CMW lakes are discussed in section 3.4.4.3.3, *Cabinet Mountain Wilderness Impact Assessment*.

In Alternatives 3 and 4, MMC would monitor nitrogen and sulfur emissions at the Libby Adit for a minimum of 2 years. Using the monitoring data, MMC would update the nitrogen and sulfur deposition analysis and compare the updated model results to the current FLM deposition analysis thresholds. MMC would also assess potential effects on lake ANC if appropriate methods were available. If modeled results using the Libby Adit monitoring data were greater than current FLM deposition analysis thresholds, MMC would develop a plan for agencies' review that evaluated all available control technologies to reduce pollutant emissions.

Potential risk of subsidence would be less Alternative 2. The agencies' mitigation for subsidence, described in section 2.5.2.5.4, *Final Underground Mine Design Process*, the agencies' mitigation of increasing the buffer zones near Rock Lake and the Rock Lake Fault, and the agencies' monitoring, described in Appendix C, coupled with final design criteria submitted for the agencies' approval, would minimize the risk of subsidence and associated effects on surface resources in the CMW.

As part of the Alternative 3 grizzly bear mitigation plan, MMC would fund access changes on five roads leading providing access to the CMW in the Bear, Poorman, Ramsey, Libby, and Standard creek drainages. These roads would be barriered and converted into trails. These access changes would improve the manageability and boundaries of the Cabinet Face East IRA, Access on Rock Lake Trail #935, which currently access to Rock Lake and St. Paul Pass in the CMW, would change from being open to snow vehicles December 1 through April 30 to being restricted to all motorized vehicles, including over-snow vehicles. These access changes would improve the wilderness quality of natural. The opportunities for solitude or a primitive and unconfined type of recreation also would improve.

Solitude or a Primitive and Unconfined Type of Recreation

The agencies' proposed access changes would improve opportunities for solitude or a primitive and unconfined type of recreation. The agencies' proposed water resources monitoring would require monitoring of water resources in the East Fork Rock Creek, East Fork Bull River, and Swamp Creek drainages (see Appendix C). Increased use by project personnel conducting the monitoring would decrease opportunities for solitude or a primitive and unconfined type of recreation in the East Fork Rock Creek, East Fork Bull River, and Swamp Creek drainages.

Effectiveness of Agencies' Proposed Mitigation

The agencies mitigation would be effective in minimizing adverse effects on surface resources in the CMW, maintaining the wilderness unimpaired for future use and enjoyment as wilderness a and preserving the wilderness character consistent with the use of the land for mineral development and production in compliance with 36 CFR 228.15. Mitigation measures such as increasing the buffer zones near Rock Lake and the Rock Lake Fault, and the agencies' monitoring coupled with final design criteria submitted for the agencies' approval, would reduce the risk of subsidence and measurable hydrological indirect effects to the surface within the wilderness. In Alternative 3 and 4, potential air quality indirect impacts on wilderness lakes and wilderness character would be minimized by mitigation measures such as limiting generator use, and using tier 4 engines and low sulfur diesel fuel in underground mobile equipment by reducing emissions.

3.24.1.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Site

Impacts on the qualities of wilderness character from the plant and adit sites and from the agencies' proposed mitigations and monitoring would be the same as Alternative 3; the impoundment would have the same effects as Alternative 2. Some mine facilities and roads would be visible from some viewpoints within the CMW. Noise levels would be similar to Alternative 3, and night lighting also would be visible from portions of the CMW. Effects on visual quality and increased levels of noise would diminish wilderness attributes related to solitude from some locations in the CMW under Alternative 4.

3.24.1.4.5 Alternative A – No Transmission Line

In Alternative A, the transmission line, substation, and loop line for the Montanore Project would not be built and CMW would not be affected.

3.24.1.4.6 Effects Common to Alternatives B, C-R, D-R and E-R

The alternative transmission lines alignments, substation, or loop line would not encroach on CMW. Views from within the CMW would be affected by a new transmission line, particularly from high, open vistas such as Elephant Peak within the CMW. None of the transmission line alternatives, substation, or loop line would affect wilderness character.

3.24.2 Roadless Areas

3.24.2.1 Regulatory Framework

The 1987 KFP identified 32 inventoried roadless areas (IRAs) on the KNF. In 1999, the inventory was updated and an additional 11 areas were identified as IRAs. These 43 IRAs on the KNF were included in the 2001 Roadless Area Conservation Rule.

IRAs are areas identified by the Forest Service for consideration of their suitability for inclusion in the National Wilderness Preservation System. IRAs are defined as "areas identified in a set of inventoried roadless area maps, contained in the Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000, and any subsequent update or revision of those maps through the land management planning process" (36 CFR 294.11). Capabilities of IRAs for wilderness suitability include primitive recreation opportunities or opportunities for solitude, natural integrity and appearance, manageability and boundaries, and special features (Land Management Planning Handbook, FSH 1909.12, chapter 70-Wilderness Evaluation). Roadless areas provide opportunities for restoration of ecosystem function and improvement of threatened, endangered, proposed, and sensitive species habitat (Tidwell 2012).

In 2001, the Forest Service promulgated the Roadless Area Conservation Rule (formerly 36 CFR 294, Subpart B), which established prohibitions of road construction and reconstruction and timber harvesting in IRAs on National Forest System lands, with certain exceptions. One of the exceptions was for locatable mining activities, such as the Montanore Project, for which reasonable access and disturbance for mineral entry within an IRA was allowed. The 2001 Roadless Rule was the subject of litigation in multiple jurisdictions. Ultimately, the rule was judicially upheld and it is in effect, with the exceptions of the States of Idaho and Colorado where separate rules apply. See Wyoming v. U.S.D.A., 661 F.3d 1209 (10th Cir. 2011) (upholding 2001 Roadless Rule); Kootenai Tribe of Idaho v. Veneman, 313 F.3d 1094 (9th Cir. 2002) (reinstating Roadless Rule); Jayne v. Sherman, No. 11-35269 (9th Cir. 2013) (upholding Idaho Roadless Rule). In 2012, the Chief of the Forest Service indicated that he would continue to review projects involving road construction or reconstruction and the cutting, sale, or removal of timber in IRAs, except for some projects he delegated to Regional Foresters (Tidwell 2012).

3.24.2.2 Analysis Area and Methods

The analysis area encompasses the Cabinet Face East IRA east of the CMW and south of the ridge between Big Cherry Creek and Bear Creek, the Rock Creek IRA on the west side of the CMW, and that portion of the McKay Creek IRA adjacent to the East Fork Rock Creek (Figure 88). Although other IRAs are shown on Figure 88, they would not be affected by any of the alternatives, and are not discussed further. The analysis of effects on IRAs was quantitatively based on direct effects within an IRA and qualitatively based on indirect effects on IRA capabilities. Data on the IRA capabilities were taken from the KFP Final EIS (USDA Forest Service 1987a).

3.24.2.3 Affected Environment

The Cabinet Face East IRA lies just east of the CMW and extends about 36 miles south from Libby (Figure 88). The entire IRA consists of 50,200 acres of National Forest System lands and 800 acres of private lands. The average width is about 2 miles. This IRA provides attributes and recreational opportunity similar to those found in the CMW. The McKay Creek IRA includes sidehill and ridgetop features and steep-sided stream bottoms. The Rock Creek IRA is a steep and rugged area that is surrounded by the CMW on three sides. Both the McKay and the Rock Creek IRAs are a destination for recreationists accessing the CMW from the Rock Creek drainage (USDA Forest Service 1987a). Under the 2005 roadless rule (36 CFR 294, Subpart B), management requirements for IRAs are guided by KFP. Most of the Cabinet Face East, McKay and Rock Creek IRAs are managed by the KNF under MA 2, Semi-primitive non-motorized recreation. Section 3.15.3.2.2, *Management Area Goals and Standards* discusses applicable KFP goals and standards of MA 2.

3.24.2.3.1 Inventoried Roadless Area Capabilities

The KNF (USDA Forest Service 1987a) identified the following characteristics of the IRAs in the analysis area that could make them suitable for wilderness recommendation.

Natural Integrity and Appearance

The Cabinet Face East IRA excludes most improvements and all roads, leaving it very natural appearing. Man-made features within the IRA include trails and evidence of historical mining activity. The McKay Creek IRA has high natural integrity with trails being the only man-made features. The natural integrity of the Rock Creek IRA is high with no man-made features to detract from the area's natural appearance.

Opportunities for Solitude

The Cabinet Face East IRA opportunity for solitude is low along trail systems and destinations due to the relatively high annual visitation in these areas. The Rock Creek and McKay Creek IRAs have high opportunities for solitude in the Rock Creek areas.

Primitive Recreation Opportunities

Primitive recreation opportunities available in the Cabinet Face East IRA include hiking, hunting, stream fishing, and horseback riding. Challenging experiences are available such as cross-country ski touring. Primitive recreation opportunities in the McKay Creek IRA include hunting, hiking and fishing. Opportunities in the Rock Creek IRA include hiking, viewing, and wildlife observation.

Roadless Area Manageability and Boundaries

Cabinet Face East IRA is a long, linear roadless area with boundaries easily defined in some places and less so in others. Less definable boundaries are due to the exclusion of some narrow drainage corridors in Bear, Cable, Poorman, Ramsey, and Libby Creeks where roads exist. The IRA spans the length of the CMW on its east side and provides a buffer zone to it, making the CMW more manageable for wilderness characteristics. The McKay Creek IRA boundary does not follow topographic features; otherwise the boundary enhances the CMW boundary by providing depth and solitude. The Rock Creek IRA is well-defined by a closed road (150A) and the CMW, making for an easily managed boundary.

Special Features

The Cabinet Face East IRA has many special features including grizzly bear, goat, and moose habitat and views of historical mining activity. Ramsey Lake, a very small lake surrounded by old growth, is also a special scenic feature within the analysis area. The lake receives very little recreational use. Special features within the McKay Creek IRA are wildlife observation and skiing into Rock Creek. The 1987 KFP did not identify any special features in the Rock Creek IRA.

3.24.2.3.2 Other Unroaded Areas

The analysis area contains several areas of unroaded National Forest System lands that are adjacent or contiguous to IRAs. Five tracts of unroaded lands were identified (ERO Resources Corp. 2010b), with two larger areas, adjacent to but separated by roads from an IRA: 1) a 3,500-acre area in the Miller Creek drainage, and 2) a 900-acre area west of the Bear Creek Road in the Upper Little Cherry Creek drainage. The other three areas are smaller (64 to 200 acres) tracts that are contiguous to an IRA between Libby and Poorman Creeks. Unroaded areas analyzed in this document are those with criteria such as proximity to existing Wilderness or IRAs, larger size, overlap with protective Management Area or Recreation Opportunity Spectrum designations, or wildlife habitat. The analysis included unroaded areas that are adjacent to but separated from an IRA by road systems and unroaded areas that are contiguous to an IRA.

3.24.2.4 Environmental Consequences

3.24.2.4.1 Inventoried Roadless Areas

Alternative 1 – No Mine

Alternative 1 would not directly affect the Cabinet Face East IRA. Sounds associated with the activities at the Libby Adit Site would be audible within portions of the Cabinet Face East IRA in the Libby Creek drainage. Noise levels in the IRA would return to low, ambient levels when closure and reclamation was completed at the site. Noise levels are discussed in section 3.20.4.

Alternative 2 – MMC's Mine Proposal

Mine facilities in Alternative 2 would directly affect about 44 acres, or about 0.1 percent, of the Cabinet Face East IRA in the Ramsey Creek drainage. Timber harvest in the IRA would occur at the Ramsey Plant Site and a portion of LAD Area 1, and a road to the Ramsey Adits and LAD Area 1 would be built in the IRA. The Libby Adit Site, the Ramsey Plant Site, and the Little Cherry Creek Tailings Impoundment also would be visible from portions of the IRA. Night lighting at some mine facilities would be visible from the IRA. Roads and clearing areas may be visible from locations with high or open vantage points. Visual effects would be noticeable during construction and operations, and diminish following facility reclamation and closure. The visual effects of Alternative 2 are discussed in section 3.17.4.

Sound levels between 30 and 45 dBAs would be audible for distances up to 1 mile from the eastern boundary of the IRA (Big Sky Acoustics 2006). The Cabinet Face East IRA boundary is segmented on the eastern edge by narrow corridors that exclude the roads in several drainages including Ramsey Creek (Figure 88). These narrow corridors will allow for some non-conforming uses adjacent to the IRA. The project would have no direct effect on Ramsey Lake, but would restrict access to it. The plant site would be located about 1,000 feet northeast of the lake. The noise level at Ramsey Lake would increase to about 55 dBA during construction and would be slightly lower during operations. Noise levels are discussed in section 3.20.4.

Natural Integrity and Appearance

Alternative 2 would not change the overall appearance of the Cabinet Face East IRA, but would affect the appearance of the IRA in locations nearest the direct impact. Changes in natural integrity and apparent naturalness would occur at the edges of the Cabinet Face East IRA in the

Ramsey Creek drainage by the Ramsey Plant site and LAD Area 1. Emissions from the mill and adits would increase concentrations of priority air pollutants in the IRA adjacent to Ramsey Creek; concentrations of all pollutants would be below applicable standards (Table 51). The increased concentrations would reduce the natural integrity of the IRA adjacent to Ramsey Creek. Effects on air quality are discussed in section 3.6.4, *Air Quality.* The indirect effect on baseflow described in section 3.24.1.4.2, *Alternative 2 – MMC's Mine Proposal* in the wilderness section would reduce the natural integrity of the Rock Creek and McKay Creek IRAs.

Opportunities for Solitude

Proposed facilities in Ramsey Creek and Little Cherry Creek drainages also would reduce the opportunity for solitude on the east side of the Cabinet Face East IRA from Libby Creek watershed north to Bear Creek watershed because of the increased sound levels that would be generated by mine operations. Following mine closure and reclamation, noise levels and opportunities for solitude in the IRA would return to pre-mine conditions. Alternative 2 would not affect the opportunities for solitude in the Rock Creek and McKay Creek IRAs.

Primitive Recreation Opportunities

Views of the Libby Adit Site, the Ramsey Plant Site, and the Little Cherry Creek Tailings Impoundment from high or open locations in the IRA may affect some visitors' primitive recreational experience. Alternative 2 would restrict access to portions of the Ramsey Creek drainage beyond LAD Area 1, eliminating recreational opportunities in those portions of the IRA. Access to Poorman Creek also would be restricted under Alternative 2. The access restriction would continue for the life of the project. Due to the restricted access and noise levels, visitors to the area also would likely no longer make Ramsey Lake a destination under this alternative during the project's life. Primitive recreation opportunities would not be affected in the rest of the roadless area. Primitive recreation opportunities would return to pre-mine levels after mine closure and reclamation. Alternative 2 would not affect the primitive recreational opportunities in the Rock Creek and McKay Creek IRAs.

Special Features

Access to Ramsey Lake would be restricted and noise levels would be high enough to deter visitation during the life of the project. Alternative 2 would not affect the special features of the Rock Creek and McKay Creek IRAs. The effects on the special feature of grizzly bear, goat, and moose habitat in the Cabinet Face East IRA are described in the section 3.25, *Wildlife.* None of the mine alternatives would affect views of historical mining activity.

Manageability and Boundaries

The Cabinet East Face IRA would be affected by the Ramsey Plant Site and LAD Area 1 in the Ramsey Creek drainage, which could prevent the expansion or establishment of a future CMW boundary in Ramsey Creek drainage. Manageability and boundaries would return to pre-mine conditions after mine closure and reclamation. Alternative 2 would not affect the manageability and boundaries of the Rock Creek or McKay Creek IRAs.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Cabinet Face East IRA

Alternative 3 would avoid all surface disturbance in the IRA. No road construction or timber harvest would occur in the IRA west of LAD Area 1 or at the Ramsey Plant Site. Increased noise levels from the Libby Plant Site would be audible from within the IRA between Libby and Ramsey creeks. Similar noise levels would be audible from within the IRA adjacent to the Libby Adit Site and Libby Plant Site. Adverse visual impacts from activities occurring outside the IRA would be similar to Alternative 2.

Alternative 3 would not change the overall appearance of the Cabinet Face East IRA, but would affect the appearance of the IRA in locations nearest the direct impact. Changes in natural integrity and apparent naturalness would occur at the edges of the Cabinet Face East IRA in the Libby Creek drainage by the Libby Plant Site and Libby adits. Opportunities for solitude and primitive recreation would be eliminated in the IRA near the Libby Plant Site and Libby adits.

Emissions from the mill and adits would increase concentrations of priority air pollutants in the IRA adjacent to Libby and Ramsey creeks; concentrations of all pollutants would be below applicable standards (Table 57 and Table 58). The increased concentrations would reduce the natural integrity of the IRA adjacent to Libby and Ramsey creeks. The agencies' mitigation, such as limiting generator use at the mill after power was available from a transmission line to 16 hours during any rolling 12-month time period and using Tier 4 engines and ultra-low sulfur diesel fuel in underground mobile equipment, would substantially reduce emissions compared to Alternative 2. Effects on air quality are discussed in section 3.4.4, *Air Quality.* IRA attributes would return to pre-mine conditions after mine closure and reclamation. IRA attributes would return to pre-mine conditions after mine closure and reclamation.

MMC would fund access changes on five roads leading into the Cabinet Face East IRA in the Bear, Poorman, Ramsey, Libby, and Standard creek drainages. These roads would be barriered and converted into trails. These access changes would improve the opportunities for solitude and primitive recreation as well as manageability and boundaries of the Cabinet Face East IRA.

Rock Creek and McKay IRAs

The indirect effect on baseflow described in section 3.24.1.4.2*, Alternative 2 – MMC's Mine Proposal* in the wilderness section and in section 3.10.4, *Groundwater* would reduce the natural integrity of the Rock Creek and McKay Creek IRAs. The agencies' mitigation of increasing the buffer zones near Rock Lake and the Rock Lake Fault which was not modeled, and leaving one or more barrier pillars inside the mine, is designed to minimize effects on East Fork Rock Creek streamflow.

The agencies' proposed water resources monitoring would require monitoring of water resources in the East Fork Rock Creek, East Fork Bull River, and Swamp Creek drainages (see Appendix C). Increased use by project personnel conducting the monitoring would decrease opportunities for solitude or a primitive and unconfined type of recreation in the East Fork Rock Creek, East Fork Bull River, and Swamp Creek drainages.

Access on Rock Lake Trail #935, which currently separates the Rock Creek IRA from the McKay IRA would change from being open to snow vehicles December 1 through April 30 to being restricted to all motorized vehicles, including over-snow vehicles. The change would improve the wintertime opportunities for solitude and primitive recreation. In addition, MMC would secure or protect through conservation easement, including motorized route access changes, or acquisition in fee with conveyance of fee or perpetual conservation easement to the Forest Service or private conservation organization independent of MMC from development (including but not limited to housing, motorized access) and use (timber harvest, grazing, and mining) about 5 acres of replacement habitat near Rock Creek Meadows between the Rock Creek IRA and the McKay IRA. Forest Service acquisition of this parcel, coupled with the access change on Rock Lake Trail #935 would improve the manageability and boundaries of the Rock Creek and McKay IRAs.

Effectiveness of Agencies' Proposed Mitigation

The agencies alternatives would not require road construction and timber harvest within an IRA.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

No road construction or timber harvest would occur in any IRA. Effects on the Cabinet Face East IRA would be similar to Alternative 3 due to similar positioning of the facilities in and near Libby Creek. Predicted changes to the Rock Creek and McKay Creek IRAs would be the same as Alternative 3.

Alternative A – No Transmission Line

In Alternative A, the transmission line, substation, and loop line for the Montanore Project would not be built and the Cabinet Face East IRA would not be affected.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

MMC's proposed North Miller Creek transmission line alignment would physically disturb about 2 acres of the Cabinet Face East IRA in the Ramsey Creek drainage. Timber harvest for line clearing would occur in the IRA. The small area disturbed in the IRA would not directly affect the primitive recreation opportunities and other features, opportunities for solitude, roadless area manageability and boundaries, or special features and special values. The steel monopoles, new roads and associated timber harvest, which would be required under Alternative B, would parallel the IRA boundary along most of Ramsey Creek, and would be visible from some viewpoints within the IRA, particularly high, open vistas. These views also may contribute to a loss of opportunities for solitude for some visitors to the IRA. Noise from transmission line construction would be audible in the IRA adjacent to Ramsey Creek. Noise levels are discussed in section 3.20.4. IRA attributes would return to pre-transmission line conditions after transmission line decommissioning. The substation and loop line would not affect the Cabinet Face East IRA in any alternative.

Effects Common to Alternatives C-R, D-R, and E-R

The other three transmission line alternatives would avoid physical disturbance in the IRAs. No road construction or timber harvest would occur in the IRAs. Transmission line construction to the Libby Plant Site would be audible in the Cabinet Face East IRA between Libby and Ramsey creeks. Views from the IRA would be affected by new H-frame transmission lines, particularly from high, open vistas. Cabinet Face East IRA attributes would return to pre-transmission line conditions after transmission line decommissioning. Attributes of the Rock Creek and McKay Creek IRAs would not be affected.

3.24.2.4.2 Other Unroaded Areas

Mine Alternatives

The mine facilities proposed in Alternatives 2, 3, and 4 would adversely affect an unroaded area, adjacent to but separated by roads from an IRA, in the upper Little Cherry Creek drainage by the various tailings impoundment and road configurations. While the impacts of the alternatives would be similar, Alternative 2 would have the greatest effect on this area by reducing the acres of unroaded area. These impacts would reduce the size of unroaded area (ERO Resources Corp. 2010b).

The impacts of the proposed mine alternatives on the other, smaller unroaded areas, contiguous to an IRA, between Libby Creek and Poorman Creek, would vary. Alternative 2 would have the greatest impact, fragmenting or eliminating two of these three areas while leaving the smallest (north of Libby Creek) intact. Alternatives 3 and 4 would eliminate the smallest area, but would not impact the other two, including the larger area north of Ramsey Creek. Overall, Alternative 2 would have the greatest impacts on unroaded areas, followed by Alternatives 4 and 3.

Transmission Line Alternatives

All of the transmission line alternatives would cross over the outer edge of the unroaded area in the Miller Creek drainage. Alternatives B and C-R would cross the northeastern edge of the unroaded area, Alternative D-R would cross along the southern edge, and Alternative E-R would cross small portions of the southwestern edge. Alternatives B and C-R would have the greatest impact, requiring vegetation clearing of 15,000 feet of centerline, further fragmenting the outer edge of this unroaded area, and reducing its overall size.

Alternative B would construct roads in the unroaded area (Figure 41), while use of helicopter for clearing in Alternative C-R would eliminate the need for road construction (Figure 44). Alternatives B and C-R would not impact the area's overall resource values and character. Alternative D-R would require vegetation clearing of 7,000 feet of centerline and Alternative E-R would require vegetation clearing of 4,000 feet of centerline on the edges of this unroaded area (ERO Resources Corp. 2010b). Alternatives D-R and E-R would not impact this area's overall size, character, or resource value. The Sedlak Park Substation and loop line would not affect unroaded areas.

3.24.3 Wild and Scenic Rivers

3.24.3.1 Regulatory Framework

Section 7 of the 1968 Wild and Scenic Rivers Act provides for the protection of the free-flowing, scenic, and natural values of rivers designated as components or potential components of the National Wild and Scenic Rivers System from the effects of construction of any water resources project. A water resources project under the Wild and Scenic Rivers Act is any activity that may affect the free-flowing characteristics of a designated or study river. The Wild and Scenic Rivers Act affords protection to two types of rivers: designated rivers, or Congressionally-authorized study rivers. The analysis area has no designated rivers or Congressionally-authorized study rivers.

The Forest Service's land management policies require a comprehensive evaluation of the potential for rivers to be eligible for inclusion in the Wild and Scenic River System (USDA Forest Service 2006a). In 1989, the KNF amended the KFP and identified the East Fork Bull River and the entire Bull River as eligible for addition to the National Wild and Scenic Rivers System. The 1989 KFP amendment established management standards to protect river values for eligible segments. Reasonable access for mineral-related purposes is allowed, subject to statutory restrictions such as the Wilderness Act and the Endangered Species Act. A KFP standard is that approval of Plans of Operations include requirements to minimize surface impacts.

River segments eligible for potential inclusion are not afforded protection under the Wild and Scenic Rivers Act. Forest Service policy for eligible river segments directs that "water resources projects proposed on a section 5(d)(1) study river [eligible river] are not subject to section 7(b), but will be analyzed as to their effect on a river's free-flow, water quality, and outstandingly remarkable values, with adverse effects prevented to the extent of existing agency authorities (such as special-use authority)" (USDA Forest Service 2006a).

The Bull River was listed on the Nationwide Rivers Inventory in 1993 (National Park Service 2009). The Nationwide Rivers Inventory is a listing of more than 3,400 free-flowing river segments in the United States that are believed to possess one or more "outstandingly remarkable" natural or cultural values judged to be of more than local or regional significance. A 1979 Presidential Directive requires federal agencies to protect and manage rivers on the Nationwide Rivers Inventory and the surrounding area in a fashion comparable to rivers already included in the Wild and Scenic Rivers System. The U.S. Council on Environmental Quality issued a 1980 Memorandum that stated: "Although the President's directive does not prohibit an agency from taking, supporting or allowing an action which would adversely affect wild and scenic values of a river in the Inventory, each agency is responsible for studying, developing and describing all reasonable alternatives before acting, and for avoiding and mitigating adverse effects on rivers identified in the Inventory."

3.24.3.2 Analysis Area and Methods

The eligible segments of the East Fork Bull River and the Bull River below the confluence with the East Fork Bull River are part of the analysis area for wild and scenic rivers (Figure 88). Other eligible segments of the Bull River system would not be affected. The analysis of effects on wild and scenic rivers was qualitatively based on direct effects on the free-flowing characteristics, water quantity, water quality, and outstandingly remarkable values of the eligible wild and scenic segments.

Data on the outstandingly remarkable values of the eligible wild and scenic segments were taken from the KNF's 2013 process to identify and classify potentially eligible wild and scenic rivers (USDA Forest Service 2013c, Appendix E). None of the transmission line alternatives would affect free-flowing characteristics, water quantity, water quality or outstandingly remarkable values of the eligible wild and scenic segments. Disclosure of effects on eligible segments is limited to the mine alternatives.

3.24.3.3 Affected Environment

Three eligible river segments of the Bull River are eligible for addition to the Wild and Scenic River System. A 3-mile segment of the East Fork Bull River in the CMW was identified as a Wild River. A 4.5-mile segment of the East Fork Bull River outside the CMW and a 9.1-mile eligible segment of the Bull River in the analysis area were identified as Recreational Rivers (Figure 88). The Outstandingly Remarkable Value of the three segments is scenery.

A wild river is a river or section of rivers free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America. A recreation river is a river or section of rivers readily accessible by roads or railroad, which may have some development along their shoreline and which may have undergone some impoundments or diversions in the past. The qualities that contribute to each of the three segments' eligibility are scenic values.

3.24.3.4 Environmental Consequences

3.24.3.4.1 Alternative 1 – No Mine

The three eligible river segments would not be affected by mining activities.

3.24.3.4.2 Alternative 2 – MMC Proposed Mine

Free-Flowing Characteristics

Alternative 2 would not alter the free-flowing character of the East Fork Bull River or Bull River. Flow would remain in natural condition without impoundment, diversion, straightening, rip-rapping, or other modification of the stream.

Water Quantity

Changes in streamflow in Alternative 2 are discussed in section 3.11.4.3, *Alternative 2 – MMC Proposed Mine* in the *Surface Water Hydrology* section. The 3D model predicted flow in the East Fork Bull River and Bull River would be reduced in all mine phases, reaching a maximum reduction of 0.40 cfs in the East Fork Bull River at the CMW boundary and 0.33 cfs at the mouth of the East Fork Bull River and in the Bull River during the Post-Closure Phase. A permanent decrease of 0.01 cfs is predicted in the East Fork Bull River at the CMW boundary, and a flow increase of 0.05 cfs is predicted at the mouth of the East Fork Bull River and in the Bull River.

With the data currently available, the 3D model results provide a potential range of streamflow impacts. They are the best currently available estimates of impacts and associated uncertainty that can be obtained using groundwater models. The 3D groundwater flow model would be refined and rerun after data from the Evaluation Phase were incorporated into the models (see section C.10.4, Evaluation Phase in Appendix C). Following additional data collection and modeling, the predicted impacts on surface water resources in the analysis area, including simulation of mitigation measures, may change and the model uncertainty would decrease. See section 3.10.4.3.5, *Groundwater Model Uncertainty* in the *Groundwater Hydrology* section for more discussion of uncertainty.

Water Quality

Changes in water quality in Alternative 2 are discussed in section 3.13.4.3, *Alternative 2 – MMC Proposed Mine* in the *Water Quality* section. During all phases except post-closure, mine dewatering and the resulting drawdown of bedrock groundwater may reduce the flow of bedrock groundwater to surface water. East Fork Bull River may have lower concentrations of dissolved solids and metals. If such a water quality change occurred, it would be detectable only during low flow periods when bedrock groundwater is the major source of supply to surface water. Even at low flows, the changes in water quality may be difficult to measure.

Post-closure, groundwater levels would begin to recover, but water would continue to flow toward the mine void for hundreds of years. Eventually, water may begin to flow out of the underground mine workings and may mix with groundwater in saturated fractures, react with iron oxide and clay minerals along an estimated 0.5-mile or greater flow path, undergo changes in chemistry, and flow, without mitigation in Alternative 2 at a low rate as baseflow to the East Fork Bull River. The effect cannot be accurately quantified without additional information from the underground setting. It is likely that cadmium, lead, and copper minerals exist within bedrock fractures at low concentrations. To develop a quantitative estimate of the actual effect, MMC would monitor the chemistry within the underground workings, evaluate downgradient groundwater flow and chemistry within bedrock fracture systems, and monitor baseflow in the East Fork Bull River (see Appendix C, *Water Resources Monitoring*).

Outstandingly Remarkable Values

Reductions in streamflow or changes in water quality would have no effect on the scenic values of the East Fork Bull River or Bull River. Historic resources in the three segments, such as trails or the Bull River Guard Station, would not be affected. The scenic quality of the three segments would not be affected by a reduction in baseflow.

3.24.3.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative and Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Free Flowing Characteristics

Alternatives 3 and 4 would not alter the free-flowing character of the East Fork Bull River or Bull River. Flow would remain in natural condition without impoundment, diversion, straightening, rip-rapping, or other modification of the stream.

Water Quantity

Changes in streamflow in Alternative 3 and 4 are discussed in section 3.11.4.4, Alternative 3 – *Agency Mitigated Poorman Impoundment Alternative* and section 3.11.4.5, Alternative 4 – *Agency Mitigated Little Cherry Creek Impoundment Alternative* in the *Surface Water Hydrology* section. The 3D model predicted flow in the East Fork Bull River and Bull River would be reduced in all mine phases, reaching a maximum reduction of 0.39 cfs in the East Fork Bull River at the CMW boundary and 0.32 cfs at the mouth of the East Fork Bull River and in the Bull River during the Post-Closure Phase. A permanent decrease of 0.01 cfs is predicted in all three stream segments. The agencies' mitigation of increasing the buffer zones near Rock Lake and the Rock Lake Fault which was not modeled, and leaving one or more barrier pillars inside the mine, is designed to minimize effects on East Fork Bull River streamflow and water quality.

Water Quality

Changes in water quality in Alternatives 3 and 4 are discussed in section 3.13.4.4, *Alternative 3 – Agency Mitigated Poorman Impoundment Alternati*ve and section 3.13.4.5, *Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative* in the *Water Quality* section. The effects on the three eligible segments in all phases except post-closure would be the same as Alternative 2. With the agencies' mitigation of barrier pillars if required in Alternatives 3 and 4, the flow would be toward East Fork Rock Creek and the post-mining changes in streamflow in the three eligible river segments would be minimized, and the water quality of the three segments would not be affected.

Outstandingly Remarkable Values

Reductions in streamflow or changes in water quality would have no effect on the scenic values of the East Fork Bull River or Bull River. The historic resources in the three eligible river segments, such as trails or the Bull River Guard Station, would not be affected. The scenic quality of the three segments would not be affected by a reduction in baseflow.

Effectiveness of Agencies' Proposed Mitigation

The agencies alternatives would effectively minimize effects on East Fork Bull River streamflow and water quality.

3.24.3.4.4 Transmission Line Alternatives

None of the transmission line alternatives, substation or loop line would affect the free-flowing characteristics, water quantity, water quality, or the outstandingly remarkable values of any of the three eligible segments.

3.24.3.4.5 Cumulative Effects

Past actions have not substantially altered the attributes of the CMW since the passage of the Wilderness Act or the establishment of the Cabinet Face East IRA. The existing Libby Adit is visible from some locations in the CMW and the Cabinet Face East IRA. Development of the reasonably foreseeable Rock Creek Project likely would have similar effects on wilderness and roadless areas as those described for development of the Montanore Project. The Rock Creek Project would not be visible from key viewpoints identified for the Montanore Project scenery analysis, but some components of both projects would be visible from some locations (see section 3.17.4.11, *Cumulative Effects,* in the *Scenery* section. Other viewpoints within the CMW would be affected by the Rock Creek Project. Wilderness visitors at some locations also may be affected by the clearing of timber for any of these future project facilities. The cumulative effects of the Rock Creek Project and the Montanore Project might contribute to a loss of wilderness character desired by some individuals.

The Rock Creek Project would not directly affect the Cabinet Face East IRA, the Rock Creek IRA or the McKay IRA and would not contribute to the cumulative effects on Cabinet Face East IRA. Libby Creek Ventures plans to drill three boring holes in the Libby Creek drainage outside of the Cabinet Face East IRA, which may increase activity and noise in the drainage and in nearby parts of the IRA for up to one week. About 1 acre of land is planned for clearing. This activity in combination with the Montanore Project may have a short-term adverse cumulative effect upon visitors to the IRA and the CMW.

The Montanore and Rock Creek Projects, assuming they occurred concurrently, would cumulatively reduce flow in the East Fork Bull River in the CMW. No other aspects of the two projects would have cumulative effects on surface water resources in the CMW or an IRA. The maximum effects on the East Fork Bull River would occur after both mines ceased operations (assumed to be operating and closing simultaneously). Compared to direct effects, cumulative flow reductions would be 0.08 cfs greater in the East Fork Bull River at the CMW boundary (Table 117). As the mine void filled and groundwater levels above the mines and adits reached steady state conditions, the effects on streamflow would decrease. Cumulative effects at steady state conditions were not quantified.

RCR prepared a 3D numerical hydrogeological model of the Rock Creek mine area to assist in defining potential impacts on groundwater and surface water resources (Hydrometrics 2014). For the Rock Creek Mine SEIS, the predicted cumulative effects were estimated by adding the results from the Montanore and Rock Creek 3D models for the respective periods of greatest groundwater drawdown. RCR's model predicted effects were slightly greater than estimated by MMC's 3D model (Table 117). Cumulative streamflow effects of the Rock Creek and Montanore projects are discussed in section 3.11.4.9, *Cumulative Effects* in the *Surface Water Hydrology* section; cumulative water quality effects are discussed in section 3.13.4.9, *Cumulative Effects* in the *Water Quality* section.

Cumulative reductions in streamflow would have no effect on the scenic values of the East Fork Bull River or Bull River. The historic resources in the three eligible river segments, such as trails or the Bull River Guard Station, would not be affected. The scenic quality of the three segments would not be affected by a reduction in baseflow.

3.24.3.5 Regulatory/Forest Plan Consistency

3.24.3.5.1 Wilderness

Valid existing rights were established to patents were issued to lode mining claims HR 133 and HR 134 in the CMW in 2001. None of the mine and transmission line alternatives would directly physically disturb any lands within the CMW and none of the four wilderness qualities would be directly affected. None of the alternatives would directly affect wilderness character. Under all alternatives, the undeveloped quality would not be affected because the wilderness would remain essentially without permanent improvements or modern human occupation.

The Wilderness Act does not regulate activities outside the wilderness that may affect wilderness character. None of the alternatives would indirectly affect the wilderness quality of undeveloped. The undeveloped quality would not be affected because the wilderness would remain essentially without permanent improvements or modern human occupation.

All mine alternatives have the potential to indirectly affect wilderness qualities of untrammeled, natural, and solitude or a primitive and unconfined type of recreation. Mitigation measures identified in Chapter 2 for Alternatives 3 and 4 and monitoring required for Alternatives 3 and 4 (Appendix C) would be implemented to minimize changes in wilderness character. Mitigation measures such as increasing the buffer zones near Rock Lake and the Rock Lake Fault, and the agencies' monitoring coupled with final design criteria submitted for the agencies' approval, would reduce the risk of subsidence and measurable hydrological indirect effects to the surface within the wilderness. In Alternative 3 and 4, potential air quality indirect impacts on wilderness lakes and wilderness character would be minimized by mitigation measures such as limiting generator use, and using tier 4 engines and low sulfur diesel fuel in underground mobile equipment by reducing emissions as compared to Alternative 2.

Mitigation measures and monitoring requirements in Alternatives 3 and 4 are reasonable stipulations for protection of the wilderness character and are consistent with the use of the land for mineral development. Alternatives 3 and 4 would be conducted to protect the surface resources in accordance with the general purpose of maintaining the wilderness unimpaired for future use and enjoyment as wilderness and preserving the wilderness character consistent with the use of the land for mineral development and production in compliance with 36 CFR 228.15 and the Wilderness Act. All mine and transmission line alternatives would comply with the Wilderness Act, meet the KFP wilderness goals, objectives and standards, and comply with 2009 Cabinet Mountains Wilderness Management Plan. Alternatives 3 and 4 would further minimize adverse environmental impacts on surface resources within the wilderness, and thereby comply with the regulations (36 CFR 228, Subpart A) for locatable mineral operations on National Forest System lands.

3.24.3.5.2 IRA

Mine Alternative 2 and transmission line Alternative B would directly impact 44 acres of the Cabinet Face IRA thru road construction and timber harvest. The roadless characteristics of the 44 acres of surface disturbance would not be preserved in Mine Alternative 2 and Transmission Line Alternative B. MMC has valid existing rights to access the minerals proposed for mining with the Montanore Project, and road construction and timber harvest in the Cabinet Face East IRA could be authorized by the Chief of the Forest Service.

Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R and E-R would not require road construction and timber harvest within an IRA. Effects of these alternatives would be from activities outside of the IRAs. Mine Alternative 3 and 4 and Transmission Line Alternatives C-R, D-R and E-R would comply with the KFP regarding management of affected IRAs. Alternatives 3 and 4 would minimize adverse environmental impacts on surface resources within the IRAs, and thereby comply with the regulations (36 CFR 228, Subpart A) for locatable mineral operations on National Forest System lands.

3.24.3.5.3 Eligible Wild and Scenic River Segments

None of the mine or transmission line alternatives would affect the free-flowing characteristics of the eligible portions of the Wild and Scenic River segments. Flow in the three eligible segments would remain in natural condition without impoundment, diversion, straightening, rip-rapping, or other modification of the stream. Mitigation measures identified in Chapter 2 for Alternatives 3 and 4 and monitoring required for Alternatives 3 and 4 (Appendix C) would be implemented to minimize changes in the water quality of the three eligible segments. Reductions in streamflow or changes in water quality would have no effect on the scenic values of the East Fork Bull River or Bull River. All alternatives would comply with the Wild and Scenic Rivers Act, Forest Service policy, and the KFP regarding eligible Wild and Scenic River segments.

3.24.3.6 Irreversible and Irretrievable Commitments

Any changes to baseflow in the East Fork Rock Creek and East Fork Bull River within the CMW during and after mining would be an irreversible commitment of resources. Wilderness experiences for some visitors may be irretrievably affected from specific viewpoints within the CMW under any of the alternatives. Alternative 2 and MMC's proposed North Miller Creek transmission line alternative would irretrievably devote small portions of the Cabinet Face East IRA to mining uses over the life of the project. Roadless area attributes would be irretrievably affected in the Libby Creek and Ramsey Creek drainages in all alternatives. All alternatives would irreversibly reduce streamflow in the eligible East Fork Bull River and Bull River Wild and Scenic River segments.

3.24.3.7 Short-term Uses and Long-term Productivity

In the short term, development of the project under Alternative 2 would affect the consideration of a small portion of the Cabinet Face East IRA in the Ramsey Creek drainage for permanent designation as wilderness during the project's life due to the project facilities' direct disturbance of the IRA. In the long term, areas that were cleared of timber for facilities would be visible from a number of key viewpoints, both in the CMW and the Cabinet Face East IRA, resulting a long-term impact on the visual quality of some visitor's experience.

3.24.3.8 Unavoidable Adverse Environmental Effects

Under Alternative 2, noise levels would be increased from the Ramsey Plant Site up to the ridge between Elephant Peak and Bald Eagle Peak in the CMW. Under Alternatives 3 and 4, noise levels would increase from the Libby Plant Site up to the ridge between Elephant Peak and Ojibway Peak. Under all alternatives, night lighting would be visible from some locations of the CMW. All mine and transmission line action alternatives would indirectly reduce the opportunities for solitude in both the CMW and the Cabinet Mountains East IRA. The three wilderness qualities of untrammeled, natural, and solitude or a primitive and unconfined type of recreation in certain areas also would be indirectly affected in all action alternatives. Under Alternative 2, primitive recreation opportunities would no longer exist in the Ramsey Creek drainage within the IRA due to the unavoidable physical impacts, presence of facilities, increased noise levels, and night lighting.

3.25 Wildlife

3.25.1 Introduction

The KNF provides habitat for more than 300 different species of wildlife (USDA Forest Service 2003c), many of which occur on the Libby Ranger District (District) and within the Montanore Project analysis area. The presence or absence of wildlife species depends in part on the amount, distribution and quality of habitat used by each species. Successional and structural changes in habitat, as well as natural predation, hunting or trapping can impact species distribution and population numbers.

This section is comprised of six subsections: key habitats, MIS, Forest Service sensitive species, federal threatened and endangered species, migratory birds, and other species of interest, namely moose and Montana Species of Concern. Wildlife resources selected for detailed analysis represent a combination of fine filter (species-specific) and coarse filter (management indicator species) analyses. Management Indicator Species (MIS) are identified in the KFP and represent a particular habitat or habitat complex. Effects on Forest Service sensitive species, which are designated by the Regional Forester, also are disclosed. The evaluation of wildlife effects in the analysis area is concurrent and interdependent with the ESA Section 7 consultation process. The effect of a proposed activity on any wildlife species is largely dependent on the duration of its effects. Three potential categories of effects are: (1) a short-term event whose effects are relaxed almost immediately (pulse effect), (2) a sustained, long-term, or chronic event whose effects are not relaxed (press effect), or (3) a permanent event that sets a new threshold for some feature of a species' environment (threshold effect) (USFWS and National Marine Fisheries Service 1998). For the wildlife subsections, short-term effects were considered to be 2 to 5 years, while long-term effects would last for the life of the mine (30 years) or longer. These definitions are not consistent with those provided in section 3.1.1, Direct, Indirect, and Cumulative Effects (p. 267), but are more appropriate for analysis of wildlife in general due to life history, reproductive cycles and population dynamics specific to each species The evaluation of impacts on Montana Species of Concern is part of the MFSA transmission line certification process.

The analysis area for each species was determined based on viability analysis and concepts described by Ruggiero *et al.* 1994, which considers biological populations and ecological scale. Evaluation of species viability is based on concepts and direction provided in the KNF Conservation Plan (Johnson 2004a), and the Wildlife Habitat Assessment for the Kootenai and Idaho Panhandle Plan Revision Zone (Ecosystems Research Group 2012). The analysis area used for an individual species may vary from other resource sections, or between different species of wildlife, based on biological needs and/or direction provided for T&E species under the ESA.

Depending on the wildlife resource, the analysis area considers all or portions of the six PSUs impacted by the proposed activity: Rock, Treasure, Crazy, Silverfish, McElk, and Riverview PSUs. The size of a PSU is sufficient to cover home ranges of wildlife species considered in this analysis and to determine the effects of the mine and transmission line alternatives.

The majority of the proposed and alternative mine facilities, as well as a portion of the proposed and alternative transmission line alignments would be located within the Crazy PSU while the remaining segments of the transmission line alignments would be located within the Silverfish PSU. Except where noted in the *Analysis Area and Methods* subsection, such as for snags, woody debris, and T&E species, only the Crazy and Silverfish PSUs were evaluated for direct, indirect and cumulative effects to individuals and their habitat on the KNF.

In PSUs other than Crazy and Silverfish, effects would be minor. One acre or less of private land in the Rock PSU would be impacted by the Rock Lake Ventilation Adit. A short segment of the Bear Creek Road, which would be widened for its proposed as the main access road, would pass through the southeast tip of the Treasure PSU on National Forest System lands. Only private land within the McElk and Riverview PSUs would be physically affected (vegetation clearing or road construction) by the eastern segments of the transmission line alternatives. Effects in the Rock, Treasure, McElk, and Riverview PSUs will also be quantified if those effects are important to the species or their habitat.

To evaluate potential direct, indirect and cumulative impacts of the transmission line on private and State lands outside of the Crazy and Silverfish PSUs, the analysis area includes all land within a corridor 1 mile on each side of the alternative transmission line alignments. The 1-mile buffer adjacent to the transmission line alignments was guided by Circular MFSA-2 (DEQ 2004). Potential impacts on wildlife resources on private land are evaluated qualitatively in each subsection and are not included in most habitat calculations conducted to assess compliance with numeric standards, objectives, and guidelines in the KFP. Habitat data on private land were considered in the analysis where available.

Analysis areas for threatened and endangered species are based on management areas defined in recovery plans or other areas, such as those defined by the NRLMD or Grizzly Bear Access Amendment. To provide information about the relative magnitude of anticipated effects of the Montanore Project alternatives, impacts on wildlife habitat were estimated to the nearest acre; uncertainties in the habitat mapping and impact analysis models are beyond this level of precision.

3.25.2 Key Habitats

Key habitats provide aquatic and/or vegetative characteristics, or combinations of characteristics, which may distinguish them from surrounding habitats or may be found as a component within a variety of broader habitat types. The characteristics of these habitats play a role in the survival and success of many wildlife species, although their importance varies by species. This section describes the characteristics and importance of cavity habitat provided by snags and down woody debris and analysis of effects based on the proposed alternatives. Old growth forests, riparian areas, and wetlands, which are also key habitats for some species, are discussed in sections 3.22, *Vegetation,* 3.6, *Aquatic Life and Fisheries,* and 3.23, *Wetlands and Other Waters of the U.S.* Effects to wildlife regarding the availability of cavity habitat and down woody debris are evaluated within the analyses for species associated with these key habitats, such as pileated woodpecker discussed in section 3.25.3*, Management Indicator Species* and flammulated owl, fisher, and western toad discussed in section 3.25.4, *Forest-Sensitive Species.*

3.25.2.1 Regulatory Framework

3.25.2.1.1 Organic Administration Act and Forest Service Locatable Minerals Regulations

The Organic Administration Act authorizes the Forest Service to regulate the occupancy and use of National Forest System lands. The Forest Service's locatable minerals regulations are promulgated at 36 CFR 228, Subpart A. The regulations apply to operations conducted under the U.S. mining laws as they affect surface resources on National Forest System lands under the jurisdiction of the Secretary of Agriculture. One of these regulations (36 CFR 228.8) requires that mining activity be conducted, where feasible, to minimize adverse environmental impacts on National Forest surface resources. 36 CFR 228.8 also requires that mining operators take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations.

3.25.2.1.2 National Forest Management Act/Kootenai Forest Plan

The National Forest Management Act requires the Secretary of Agriculture to promulgate regulations specifying guidelines for land management plans that "provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives…" The "specific land area" (scale) for providing diversity is established in the framework as the area covered by the Forest Plan, or the entire KNF. One of the KFP goals is to "maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species… and in sufficient quality and quantity to maintain habitat diversity representative of existing conditions" (II-1 #7).

KFP direction for maintaining viable populations of cavity-dependent species is derived from Thomas (1979), which describes snag levels necessary to maintain self-sustaining populations of a species. The direction is to maintain habitat capable of providing for at least 40 percent of the potential population level (PPL) of cavity dependent species throughout commercial forest lands and at least 60 percent of the PPL in riparian areas (KFP II-22 and A-16). The PPL is equated with snag level, or the intensity of snag management on a landscape. Snag densities of about 0.9 and 1.35 snags per acre are required to maintain snag levels for 40 and 60 percent of the PPL, respectively (KFP A-16-4). In order to provide a continuous supply of snags over time, there is also a need to designate green trees as snag replacements. Usually two replacements are needed for every snag needed (KFP A-16-11). This results in the general recommendation of one to two snags and two to four snag replacements per acre, or a total of three to six per acre.

The KFP contains minimal direction concerning down woody debris. It directs that sufficient amounts of large down woody debris be retained on site for wildlife habitat needs, nutrient release back into the soil, and site protection for timber stand regeneration. Forest-wide management direction (KFP A 16-6) is to meet Timber/Silviculture Guideline #9, which is to leave logs greater than 12 inches in diameter scattered throughout dozer-piled timber units (a few pieces/acre) to provide cover and feeding sites for birds and small mammals. Five to 15 tons/acre is recommended.

3.25.2.1.3 Major Facility Siting Act

The MFSA directs the DEQ to approve a facility if, in conjunction with other findings, the DEQ finds and determines that the facility would minimize adverse environmental impacts, considering the state of available technology and the nature and economics of the various alternatives. The DNRC and FWP are required to report to DEQ information relating to the impact of the proposed site on FWP's area of expertise. The report may include opinions as to the advisability of granting, denying, or modifying the certificate.

3.25.2.2 Snags and Woody Debris

On the KNF, 42 species of birds, 14 species of mammals, and several species of amphibians are recognized as largely dependent on cavity habitat (KFP, A 16-2). Cavity habitat can be found in snags (standing dead trees), broken topped live trees, live cull trees, and down logs and are used by a variety of wildlife species for nesting, denning, perching, roosting, foraging, and shelter. Snags provide the primary substrate for those species excavating their own cavities as the wood has generally been softened by decay (Bull *et al*. 1997).

Tree mortality is an inevitable outcome within a forested stand. The agent of mortality as well as age, size, distribution, and longevity of the resulting snags are not as predictable. Snags are created by events such as insect and disease, wildfire, physical damage, weather, over-crowding, or simply from old age. They are lost by falling down, through both natural (*e.g.,* decomposition and wind) and human mechanisms (*e.g.*, woodcutting, and timber harvest).

Primary cavity excavators such as pileated woodpeckers and northern flickers excavate new cavities during activities such as feeding, nesting, roosting, and drumming. These in turn are used by secondary cavity users who cannot excavate their own cavities and must depend on those already created. Providing adequate suitable habitat for primary excavators ensures that viable populations of all cavity-dependent species would be supported.

Down woody debris is an important component of forest ecosystems, providing for soil protection and productivity as well as wildlife habitat (*e.g.,* cover, reproduction, and foraging opportunities) for a wide variety of birds, mammals, reptiles, and amphibians. This dead, woody material is derived from trees in various stages of decay and any material larger than 3 inches in diameter is considered coarse woody debris (Graham *et al*. 1994). The most beneficial form of woody debris for wildlife is logs, which to qualify as a log must measure a minimum of 8 feet long with a large-end diameter of 6 inches or more (Bull *et al*. 1997). The larger the log, the greater the longevity and opportunities it provides for wildlife (Thomas 1979, Bull *et al*. 1997, Brown *et al*. 2003) although the retention of small material is better than none (Thomas 1979). The ecological processes and functions of down wood material are discussed in many research papers (*e.g.*, Bull *et al*. 1997; Graham *et al*. 1994; Maser and Trappe 1984; Maser *et al*. 1988).

In summary, the planning subunits (PSUs) in which proposed Montanore Project activities would occur are currently providing high PPLs of 73 to 91 percent for cavity dependent species. These PPLs are well above the 40 and 60 percent standards for upland and riparian habitats, respectively, and there would be negligible to minimal impacts from proposed activities. Snags and down woody debris would be maintained at a sufficient level within the impacted PSUs to provide for viable populations of cavity dependent species in the analysis area. In addition, the agencies' alternatives would retain snags unless required to be removed for safety or operational reasons within the disturbance areas as well as down woody materials beneath the transmission lines at levels recommended for both soil productivity and wildlife habitat as appropriate for the habitat type.

3.25.2.2.1 Analysis Area and Methods

The analysis area for snags includes the four PSUs impacted by proposed activities: the Crazy, McElk, Riverview, and Silverfish PSUs. The majority of the proposed and alternative mine facilities, as well as a portion of the proposed and alternative transmission line alignments would be located within the Crazy PSU while the remaining segments of the transmission line alignments on National Forest System lands would be located within the Silverfish PSU. Therefore, the bulk of the following analysis focuses on these two PSUs. Some segments of the transmission line alignments, substation and loop line would occur within small areas on private land of the McElk and Riverview PSUs. Using the PSU to analyze the potential effects to snag and down wood habitat on private lands provides for both consistency with the scale of analysis used for effects occurring on National Forest System lands as well as context for how many acres of private lands are being impacted compared to what is available within a similar sized analysis area. None of the mine or transmission line alternatives would affect snag and down wood habitats within the Treasure PSU because only road improvement work on an existing open road would occur within it. Therefore, this PSU has been eliminated from further analysis and the proposed road location and existing PPL can be found in the project record. Also eliminated from further analysis was the Rock PSU as less than 1 acre of private land on steep, rocky ground would be affected by the Rock Lake Ventilation Adit.

The analysis area includes National Forest System land as well as private and State lands. Calculations of the PPL and estimates of the impacts to down woody material on National Forest System lands are based on forest vegetation data, past vegetation management treatments (type and date of implementation), the restricted and open road system, and disturbance area boundaries of each of the mine and transmission line alternatives. Information from FACTS, including treatment type and year of completion, and summaries of Vegetation Response Units (USDA Forest Service 1999c) were also used to estimate snag densities. District surveys for old growth and post-harvest units provide additional data sources for cavity and down wood habitat conditions. For the Crazy PSU, data sources for snag and down wood habitat include District surveys for old growth and harvested units that cover about 7,502 acres. Survey methods/procedures for old growth and harvest units are found in section 3.22, *Vegetation*, and the project record, respectively. Quantitative snag and down wood information is not as readily available for private or state-owned lands in the analysis area, much of which has been logged in the past 20 to 30 years. Current snag and down wood availability on private and State land was estimated based on vegetation mapping shown on Figure 85 and likely past and current land use practices.

Thomas (1979) was used to determine the percent PPL of National Forest System lands within the analysis area. This process uses a weighted calculation (percent snag level X percent of the PSU with that snag level) that considers management and other activities as well as natural events (*e.g.*, wildfire, insect and disease outbreaks, etc.) to estimate current PPL and change due to proposed activities as displayed in Table 189. Old growth existing condition acres and acres impacted by proposed activities are not directly comparable to those found within section 3.22.2, *Old Growth Ecosystems*, due to different analysis methods. This analysis includes 100 percent of all identified old growth acres regardless of classification, includes acres above 5,500 feet, and does not include acres within close proximity of open roads to account for snag loss to firewood gathering. Meeting the KFP riparian standards, as amended by INFS (USDA Forest Service 1995), would ensure provision of adequate snags and replacement trees to meet the riparian 60 percent snag level direction. However, all alternatives would result in disturbance to riparian habitats and the analysis considers the impacts to maintaining 60 percent primary cavity excavator PPL on National Forest System lands within this habitat.

The value applied to an activity type is founded on the following assumptions based on Thomas (1979) and KNF snag data analyses. These assumptions are applied as a worst-case scenario and described below and in the footnotes of Table 189. See Table 189 for snag levels applied to activity type and references. Harvest type and period of implementation influence the number of snags left standing in the treated area. Unharvested and old growth stands provide 100-percent snag levels. For the Supplemental Draft EIS and Final EIS, the areas of overlap between mapped old growth and harvest stands were considered old growth habitat. As a result, the area of partial cut stands differs from the Draft EIS. Partial cut stands provide a higher snag level than regeneration harvest methods and regeneration harvests implemented after the KFP retain more snags than those implemented prior (Johnson and Lamb 1998). Firewood cutting within 200 feet of open roads has resulted in some snag loss. However, Tincher (1998) reported this impacted area still provides at least 40 percent snag level compared to unroaded areas of similar habitat type. Similarly, Bate and Wisdom (2004) found there is no difference in snag density adjacent to open versus closed roads although densities were lower in areas closer to a town. Forest-wide, visual observations suggest that snag levels adjacent to roads can be as low as zero. Since firewood cutting is allowed from any open road, retention of snags within 200 feet of the road over time is highly unlikely. Therefore, a worst-case scenario was used where areas within 200 feet of open roads were considered to have total snag loss. Snag loss associated with restricted roads was limited to the roadbed itself.

Impacts on cavity and down wood habitats discussed in the Environmental Consequences section are based on the expected disturbance areas associated with the various project features of the mine and transmission line alternatives. Not all proposed disturbance acres would result in a reduction in the cavity habitat PPL as it depends on the habitat condition in which the clearings would take place. For example, road improvements occurring within existing open road prisms likely would not reduce cavity and down wood habitat and these disturbance acres would not be counted again. Conversely, clearings occurring in old growth or previously untreated stands would have the greatest potential reduction in cavity and down wood habitat changing the snag level from 100 to 0 percent. Those acres determined to affect the PPL are the “disturbance acres” associated with each habitat condition in Table 190; total disturbance acreage is also provided for each alternative. The effect indicators for management level includes the percent of the maximum PPL by PSU relative to the 40 and 60 percent standards for upland and riparian habitats and acres impacted that reduce snag levels.

Since Thomas (1979), new science as summarized in Bull *et al*. (1997) indicate that snag densities need to be increased for variables such as larger woodpecker home ranges, foraging structure, and other secondary uses such as loose bark that Thomas (1979) did not account for. New Forest Inventory and Analysis (FIA) data since implementation of the KFP have been incorporated into a Region One report on snag densities for western Montana (Bollenbacher *et al*. 2009). Bollenbacher *et al*. (2009) used FIA data to estimate snag density based on habitat type groups. Although this report provided snag information to be considered by the Forests, such as providing a guideline for managed snag levels, it does not set forth mandatory or required direction. Based on data for western Montana forests, and specifically to the KNF, snag densities required to achieve 40 and 60 percent snag levels are greater than KFP direction. These snag densities were considered in this analysis.

Data sources for down woody debris consist of District old growth and harvest unit associated surveys and predominant habitat type groups (correlated with VRUs) within the PSUs. Untreated stands would generate down woody material associated with the habitat type. However, in general, current down wood levels are generally considered to exceed historical levels due to longer fire return intervals within stands (Graham *et al*. 1994, Brown *et al*. 2003). Moist VRUs provide productive conditions for tree establishment and growth, which contribute to future down wood materials. This coupled with fire suppression, which has produced an accumulation of both down and standing materials, can result in high level of woody debris within forested stands. Based on the growing conditions and lack of large fires due to fire suppression, and high levels of down wood debris found within survey units it can be inferred that high levels of down wood material is available within the PSUs. Issue indicators are the relative reduction in expected down woody debris based on existing down woody debris available and design features for retaining down wood material within proposed activity areas.

3.25.2.2.2 Affected Environment

Three habitat type groups are found on the KNF and in the impacted PSUs: dry, low to mid elevation moist, and subalpine. The habitat type groups are described in Bollenbacher *et al*. (2009). The dry habitat type has the lowest density of snags, especially in the larger diameter classes due to more frequent, low- to mid-severity fires. Predominant trees are ponderosa pine and Douglas-fir on the drier sites with western larch found within the moister range of this type, all of which are preferred species for primary excavators and secondary cavity nesters. The low and mid moist habitat type is diverse in conifer species and include western larch snags in the early and late seral forest condition, with cedar and grand-fir also providing cavity habitat. This group has the highest density of snags of all size classes. The wet sites increase productivity and periodic mixed severity fires between stand replacing fires encourages the growth of large trees. Finally, the subalpine habitat type has high diversity of species depending on elevation and cold tolerance. Some sites are too cold for western larch and Douglas-fir. Fire frequencies can vary depending on the site composition and location. Snag density is high in the small diameter class and moderate in the larger classes compared to the other habitat types. Snag density, distribution, and longevity can be affected by timber harvest and human access in timber managed areas and possibly climate change and fire suppression in unmanaged areas (*e.g.,* wilderness or roadless) (Bollenbacher *et al*. 2009).

Stands experiencing insect, disease, or severe wildfire could have more than 2.25 snags per acre depending on the severity of the outbreak or fire that the stand receives. Within the analysis area, insect and disease generally appear to be at an endemic level with some slightly larger areas of activity at the southern end of the Silverfish PSU (USDA Forest Service *et al*. 2013) and there are no large areas of snags resulting from these processes. The last large fires occurred between 1885 and 1939, with the 1910 fires affecting large areas of the Crazy and Silverfish PSU leaving limited large tree component and little diversity or heterogeneity across the landscape. Snag levels within the fire perimeter would have been relatively high immediately following the fires, especially in high severity fire areas. However, snag longevity following fires depends on the species, size, and density and most are gone within 20 years (Bull *et al*. 1997, Morrison and Raphael 1993, Harris 1999, Russell *et al*. 2006). Estimating snag densities in these areas is difficult as the fire severity would not be the same throughout the fire perimeter. Some trees would have fallen, others remain, new snags would have been created from remaining trees, and newly established seedlings could reach 10 inches dbh by 60 years (USDA Forest Service 1993b). Harris (1999) included areas where the primary action on the stand is a natural process such as these as "uncut." Also, potentially high levels initially, followed by potentially low levels, would also likely be averaged out across the analysis area depending on the acres impacted. Therefore, fire areas where past timber harvest has not occurred were included in the old growth and unharvested acres in Table 189 and received a managed snag level of 100 percent.

Table 189 summarizes the existing PPL on National Forest System lands in the analysis area PSUs. Snag levels were determined based on the assumptions from the analysis method section above. The existing snag level on National Forest System lands in the analysis area range from about 73 to 91 percent and are well above the current KFP standard and/or guideline of 40 and 60 percent for upland and riparian habitats. Refer to the project record for details.

Table 189. Existing Potential Population Level on Timbered National Forest System Lands in the Analysis Area.

Habitat Condition[1]	Acres	Proportion of National Forest System Lands (%)	Total Snags per Acre[2]	Snag Level (%)	PPL[3] (%)
Crazy					
Old Growth	7,657	12.7	2.25	100[4]	12.7
Untreated Forest	34,548	57.3	2.25	100[4]	57.3
Partial Cut Forest[6]	2,722	4.5	1.35	60[5]	2.7
Past Regeneration Harvest (1990-2013)[7]	786	1.3	0.9	40[5]	0.5
Past Regeneration Harvest (thru 1989)[7]	7,046	11.7	0[5]	0	0
Roads[8]	7,454	12.3	0[9]	0	0
Total PSU	60,213	99.8	—	—	73.2
Silverfish					
Old Growth	7,279	12.0	2.25	100[4]	12.0
Untreated Forest	45,378	74.9	2.25	100[4]	74.9
Partial Cut Forest[6]	3,289	5.4	1.35	60[5]	3.2
Past Regeneration Harvest (1990-2013)[7]	725	1.1	0.9	40[5]	0.4
Past Regeneration Harvest (thru 1989)[7]	1,076	1.7	0[5]	0	0
Roads[8]	2,775	4.5	0[9]	0	0
Total PSU	60,521	99.6	—	—	90.5
McElk					
Old Growth	6,419	22.4	2.25	100[4]	22.4
Untreated Forest	16,698	58.4	2.25	100[4]	58.4
Partial Cut Forest[6]	1,427	4.9	1.35	60[5]	2.9
Past Regeneration Harvest (1990-2013)[7]	492	1.7	0.9	40[5]	0.6
Past Regeneration Harvest (thru 1989)[7]	1,489	5.2	0[5]	0	0
Roads[8]	2,035	7.1	0[9]	0	0
Total PSU	28,560	99.7	—	—	84.3
Riverview					
Old Growth	5,590	17.4	2.25	100[4]	17.4
Untreated Forest	16,897	52.8	2.25	100[4]	52.8
Partial Cut Forest[6]	2,313	7.4	1.35	60[5]	4.4
Past Regeneration Harvest (1990-2013)[7]	1,922	6.2	0.9	40[5]	2.4
Past Regeneration Harvest (thru 1989)[7]	2,004	6.2	0[5]	0	0
Roads[8]	3,269	10.2	0[9]	0	0
Total PSU	31,995	100.2	—	—	77.0

[1] Includes VRUs 1, 2, 3, 4, 5, 6, 7, 9, 10, and 11. Based on timbered lands and does not include the following habitat types: grassland steppe, mountain bottomlands, agricultural lands, rural/urban, rock/scree/ice, and water.
[2] Snag density includes all snags ≥ 10” dbh (Thomas 1979). This density is needed to achieve the corresponding snag level value.
[3] Proportionate PPL equals percent National Forest System lands multiplied by percent snag level. Sum of proportionate PPLs from all habitat conditions equals the PSU PPL (Thomas 1979).
[4] Based on Tincher (2003).
[5] Based on Johnson and Lamb (1998).
[6] Partial cut harvests include, but are not limited to, improvement harvest treatments.
[7] Regeneration harvest includes, but is not limited to, clear cut with reserves, seed tree, and shelterwood harvest treatments.
[8] Roads include an average width of 33 feet; open roads were buffered by 200 feet to account for loss due to firewood gathering.
[9] Based on Tincher (1988), Bate and Wisdom (2004), and KNF forest-wide observations for worst case scenario.

The most recent KFP Monitoring Report addressing cavity habitat (Item C-6) is from fiscal year 2007 (USDA Forest Service 2008c). This report shows that over the last 5 years, 72.6 percent of the individual harvest units met KFP standards and 100 percent of the 33 compartments analyzed met or exceeded KFP standards for cavity habitat. The fiscal year 2005 monitoring report provided estimates of snag density on the KNF and looked at two size categories of snags: 10.0 to 19.9 inches dbh and those 20 inches or greater. Snags ranging between 10.0 and 19.9 inches are estimated to occur at a density of 10 snags per acre (8.3 to 11.7 snags per acre with a 90 percent confidence interval). Snags at least 20 inches in diameter are estimated to occur at a density of 1 snag per acre (0.8 to 1.2 snags per acre with a 90 percent confidence interval). Overall, monitoring indicates that the KNF is providing cavity habitat at a level sufficient to maintain viable populations of cavity-dependent species (40 percent or more of the PPL). Meeting Forest riparian standards, as amended by INFS, would assure the 60 percent level is being met in those areas.

The major VRU found in the vegetation analysis area is VRU5 (both VRS5S and VRU5N), which are moderately cool and moist ecosystems (see section 3.22, *Vegetation*). This VRU contains productive land types and moderate to high precipitation, providing environmental conditions favorable to vegetative growth (Gautreaux 1999) and, therefore, potential volumes of down woody debris. Both wildfire and vegetation management influence the levels of down wood debris within treated stands.

Historically, wildfires have played a large role in the amount of down wood in the forests (Graham *et al.* 1994). Depending on the frequency, intensity, and magnitude of fires, ponderosa pine forests could have more than 45 tons per acre of down wood while western white pine forests could have more than 268 tons per acre of down wood. The longer period of time between fires, the longer the down wood would remain. During the last 100 years, the frequency of fires in the northern Rocky Mountains has been greatly reduced, potentially resulting in larger amounts of down wood. Vegetation management treatments, primarily timber harvest, before the KFP would have reduced the amount of down woody debris available within the treated stands whereas vegetation management occurring post-implementation of the KFP would have been designed to maintain the recommended tons per acre. Results of down wood surveys in the Crazy and Silverfish PSUs suggest that the KFP guidelines of 5 to 15 tons of down wood per acre are being met in old growth and past harvest areas. Surveyed old growth stands average over 23 tons per acre and past harvest units averaged 41 tons per acre in the Crazy PSU. These estimates only included materials greater than 10 inches dbh, which identified the larger material more beneficial for wildlife use. It is likely that smaller materials were also present, contributing to a higher level of down wood available across the landscape than what was estimated. Therefore, the National Forest System lands within the analysis area currently provide for a variety of species that utilize down woody habitat, including the pileated woodpecker (see pileated woodpecker discussed in section 3.25.3*, Management Indicator Species*), and the existing down wood habitat level in the analysis area is expected to provide adequate suitable habitat for other dependent species.

The majority of the private and State lands impacted by the proposed transmission line, substation and loop line is heavily roaded and has been logged in the past 20 to 30 years (Figure 85 and project record). Also, the protection of riparian habitats on these lands is likely less stringent or may not occur compared to vegetation management activities on National Forest System lands and the retention of snags and down wood material is not expected to occur to the same level. As a result, existing levels of cavity and down wood habitat is likely to be less available on private and State lands.

3.25.2.2.3 Environmental Consequences

The Montanore Project's mine and transmission action alternatives would generally result in the clearing of vegetation to allow for the construction of proposed infrastructure. The acres reduced and resultant level of impact on the cavity habitat PPL and amount of down wood debris depends on where the activities would occur and what the existing habitat condition is there. Overall, proposed activities that result in the reduction of forested stands are expected to slightly reduce both snag and down wood debris levels within the impacted PSUs. As a worst case scenario, it was assumed that the clearings would result in a snag level of 0 percent and that all down wood debris would be removed. Mitigation for the agencies' alternatives would maintain some level of existing cavity and down wood habitat within clearings (see section 2.5.7.4.4, *Key Habitats* and section 2.9.6.1, *Down Wood Habitat*).

Clearing of all snags within the disturbance area would result in the loss of cavity habitat for the life of the mine and for some time following reclamation. For wildlife species that utilize large diameter snags and heavier canopy cover, it would take an estimated 125 to 150 years for the cavity habitat to recover to a condition where it may be used. For other species that will use smaller trees and a more open canopy condition, recovery and use would likely occur within 60 years. Similarly, for those species that require large amounts of down wood, especially large diameter wood structure, it would take many years for disturbed sites to grow and accumulate this material on the forest floor. For effects to wildlife associated with these habitat types, please see the following species' analyses.

The effects to cavity habitat and the change to the PPL on National Forest System lands within the Crazy and Silverfish PSUs are displayed in Table 190 and Table 192 for the mine and transmission line alternatives, respectively, and are further described in the following subsections. No activities would occur on National Forest System lands within the McElk and Riverview PSUs (see project record). Within the Crazy, Silverfish, McElk, and Riverview PSUs, private and State lands impacted by the transmission line, substation and loop line are discussed separately.

Alternative 1 – No Mine

No direct effects from federal actions would occur. The No Mine Alternative would maintain the existing vegetative condition on the landscape and wildlife use of cavity and down wood habitat would continue at current levels. Although past timber harvests and other vegetation management treatments resulted in a decrease in the amount of both habitats available, especially in some existing regeneration harvest units, both District and Forest level monitoring indicates that current levels meet KFP standards. Also, current down wood levels are generally considered to exceed historical levels due to longer fire return intervals within stands (Graham *et al*. 1994, Brown *et al*. 2003). The addition or loss of snags would depend on other factors, such as firewood cutting, wind events, natural attrition, or wildfire. The level of impact from these factors cannot be calculated due to the high uncertainty in predicting occurrence and intensity levels. Similarly, this alternative would not change the current condition or availability of down woody debris within the PSUs.

Table 190. Impacts on Cavity Habitat and Potential Population Level on Timbered National Forest System Lands in the Crazy PSU by Mine Alternative.

Habitat Condition[1]	Existing Acres	Disturbance Acres	Post Activity Acres	Proportion of NFS Lands (%)	Total Snags per Acre[2]	Snag Level (%)	PPL[3] (%)
Alternative 2							
Old Growth	7,657	303	7,354	12.2	2.25	100[4]	12.2 (-0.5)
Untreated Forest	34,548	341	34,207	56.8	2.25	100[4]	56.8 (-0.5)
Partial Cut Forest[6]	2,722	192	2,530	4.2	1.35	60[5]	2.5 (-0.2)
Past Regeneration Harvest (1990-2013)[7]	786	0	786	1.3	0.9	40[5]	0.5 (0)
Past Regeneration Harvest (thru 1989)[7]	7,046	1,016	6,030	10.0	0[5]	0	0
Roads[8]	7,454	430	7,024[10]	11.6	0[9]	0	0
Total Alternative 2 Acres	—	2,282	2,282	3.7	0[11]	0	0
Total PSU	60,213		60,213	99.8	—	—	72.0 (-1.2)
Alternative 3							
Old Growth	7,657	138	7,519	12.4	2.25	100[4]	12.4 (-0.3)
Untreated Forest	34,548	306	34,242	56.8	2.25	100[4]	56.8 (-0.5)
Partial Cut Forest[6]	2,722	184	2,538	4.2	1.35	60[5]	2.5 (-0.2)
Past Regeneration Harvest (1990-2013)[7]	786	0	786	1.3	0.9	40[5]	0.5 (0)
Past Regeneration Harvest (thru 1989)[7]	7,046	513	6,533	10.8	0[5]	0	0
Roads[8]	7,454	394	7,060[10]	11.7	0[9]	0	0
Alternative 3 Acres	—	1,535	1,535	2.5	0[11]	0	0
Total PSU	60,213		60,213	99.7	—	—	72.2 (-1.0)
Alternative 4							
Old Growth	7,657	159	7,498	12.4	2.25	100[4]	12.4 (-0.3)
Untreated Forest	34,548	281	34,267	56.9	2.25	100[4]	56.9 (-0.4)
Partial Cut Forest[6]	2,722	101	2,621	4.3	1.35	60[5]	2.5 (-0.2)
Past Regeneration Harvest (1990-2013)[7]	786	0	786	1.3	0.9	40[5]	0.5 (0)
Past Regeneration Harvest (thru 1989)[7]	7,046	656	6,390	10.6	0[5]	0	0
Roads[8]	7,454	437	7,017[10]	11.6	0[9]	0	0
Alternative 3 Acres	--	1,634	1,634	2.7	0[11]	0	0
Total PSU	60,213		60,213	99.8	—	—	72.3 (-0.9)

[1] Includes VRUs 1, 2, 3, 4, 5, 6, 7, 9, 10, and 11 and does not include the following habitat types: grassland steppe, mountain bottomlands, agricultural lands, rural/urban, rock/scree/ice, and water.
[2] Snag density includes all snags ≥ 10” dbh (Thomas 1979). This density is needed to achieve the corresponding snag level value.
[3] Proportionate PPL equals percent National Forest System lands multiplied by percent snag level. Sum of proportionate PPLs from all habitat conditions equals the PSU PPL (Thomas 1979).
[4] Based on Tincher (2003); [5] Based on Johnson and Lamb (1998).
[6] Partial cut harvests include, but are not limited to, improvement harvest treatments.
[7] Regeneration harvest includes, but is not limited to, clear cut with reserves, seed tree, and shelterwood harvest treatments.
[8] Roads include an average width of 33 feet and were buffered by 200 feet to account for loss due to firewood gathering.
[9] Based on Tincher (1988), Bate and Wisdom (2004), and KNF forest-wide observations for worst case scenario.
[10] Existing restricted and open roads would generally still be located on the landscape; the displayed reduction in acres is to reflect the overlap in disturbance area and reallocation to the alternative’s disturbance acres.
[11] Worst-case scenario that assumes all snags would be removed with the vegetation clearing, although mitigation plans would be implemented under the agencies’ alternatives to maintain snags, unless required to be removed for safety reasons.

Alternative 2 – MMC Proposed Mine

All proposed mine activities that would impact snag and down wood debris would occur within the Crazy PSU. Disturbance for Alternative 2 would include facility (tailings impoundment, plant site, and other) and road construction. Most of the disturbance would occur on National Forest System lands, although some private land owned by the mine would be disturbed (Figure 78). Approximately 2,282 acres of the total 2,582 acres would occur within the habitat conditions identified in Table 190. Snags would be cleared within the disturbance boundaries for Alternative 2 and result in a snag level of 0 percent; however, not all proposed clearing acres would affect the cavity habitat PPL due to their location within a previously managed area.

The effect of the vegetative clearing in Alternative 2 within the Crazy PSU would be a reduction in the PPL of 1.2 percent from 73.2 to 72.0 percent. Approximately 644 acres of disturbance would occur within old growth and untreated stands, resulting in a change in the snag level from 100 to 0 percent on these acres. These two habitat conditions would continue to comprise 69.0 percent of the PSU and these moist habitats provide snag levels on the KNF in the range of 6.3 to 17.1 per acre (Bollenbacher *et al*. 2009). Therefore, the cavity habitat PPL would remain well above the 40 percent level recommended in the KFP for upland habitats. Alternative 2 would impact 249 acres of riparian habitat on National Forest System lands and is a reduction of 3.0 percent of riparian habitat available within the Crazy PSU and is minor at the PSU scale (Table 191). Also, Alternative 2 would not comply with a number of riparian area standards, which are discussed in section 3.6.4.11.4, *National Forest Management Act/Kootenai Forest Plan* (RF-2 through RF-5), beginning on p. 453. The feasibility of MMC's proposed Wetland Mitigation Plan to replace the lost functions of all potentially affected wetlands is uncertain. MMC's plan is conceptual and would be refined during the 404 permitting process. MMC did not update its mitigation plan for Alternative 2 to reflect new wetland and stream mitigation regulations and procedures. Section 3.23, *Wetlands and other Waters of the U.S.*, discusses proposed wetland mitigation in more detail. Therefore, Alternative 2 may not meet the riparian standard for snag levels (60 percent) within the immediate area of the disturbance. However, riparian habitats throughout the remainder of the PSU that are not impacted by Alternative 2 is expected to continue to meet the 60 percent standard through adherence to KFP riparian standards and the effect would be minimal at the PSU scale. Alternative 2 would result in the loss of all down wood on 2,282 acres on National Forest System land in the Crazy PSU. This estimated reduction of down woody material would be minor as it would occur on 3.7 percent of the timbered lands within the PSU (Table 190). Down wood levels, on average, is expected to exceed KFP standards within the Crazy PSU for dependent wildlife species based on: 1) the predominant habitat type within the disturbance area, 2) the amount of old growth and untreated stands within the PSU, 3) the existing level of down wood as supported by District surveys, and 4) because current down woody debris levels are generally considered to exceed historical levels due longer fire return intervals within stands (Graham *et al*. 1994, Brown *et al*. 2003).

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Table 191. Riparian Habitat on National Forest System Lands Impacted by Proposed Mine Activities within the Crazy PSU.

PSU	Alternative 1/ No Mine	Alternative 2 (Acres	%)	Alternative 3 (Acres	%)	Alternative 4 (Acres	%)
Crazy	0	249	(3.0%)	195	(2.4%)	206	(2.5%)

Percents shown represent percent of available riparian habitat in entire PSU

The types of activities proposed under this alternative are similar to Alternative 2. Similar facility and road construction activities would occur, but there would be no LAD Areas associated with Alternative 3 and the tailings impoundment would be located slightly to the south and found entirely on National Forest System lands. The disturbance area surrounding the Poorman tailings impoundment would be smaller than the Little Cherry Creek impoundment disturbance area proposed in Alternative 2 by 656 acres.

Within the Crazy PSU, 1,535 acres within the disturbance boundary would occur within the habitat conditions identified in Table 190 for Alternative 3. Not all proposed clearing acres affect the cavity habitat PPL due to their location within a previously managed area. The effect of the vegetative clearing to the PPL in Alternative 3 is similar to Alternative 2 with a 1.0 percent reduction from 73.2 to 72.2 percent. Also, old growth and untreated stands would continue to be found within a majority of the PSU (69.2 percent) and provide a 100 percent snag level. Therefore, the cavity habitat PPL would remain well above the 40 percent level recommended in the KFP for upland habitats. Alternative 3 would impact 195 acres of riparian habitat on National Forest System lands. This is a reduction of 2.4 percent of riparian habitat available within the Crazy PSU and is minor at the PSU scale. Also, implementation of the agencies' Wetland and Mitigation Plan and the KFP's riparian standards and guidelines, as amended by the INFS, would minimize impacts on snag habitat in riparian areas on National Forest System lands. It is expected that this would result in meeting the riparian standard for snag levels (60 percent) within the PSU.

In comparison to Alternative 2, Alternative 3 would result in fewer acres that would be disturbed by clearing activities. This includes fewer acres being disturbed within riparian habitat and old growth and untreated stands. This includes 200 more acres of old growth and untreated stands that would be maintained with a 100 percent snag level in the vicinity of the mine for wildlife use. In addition, implementation of project design features would help to maintain or improve cavity habitat within the disturbance area. Also, mitigation plans, including the Vegetation Removal and Disposition Plan (discussed in section 2.5.2.5.2), call for the designation of 797 acres of effective or replacement old growth on National Forest System lands and that snags would be left in disturbance areas unless required to be removed for safety reasons. Therefore, the snag level would not be 0 percent on all cleared acres and at least portions of the disturbance areas may provide for some use by wildlife species both during mining operations and following reclamation. Effects of reduced cavity habitat with the Crazy PSU would be less in Alternative 3 compared to Alternative 2.

Alternative 3 would result in the loss of all down wood on 1,535 acres on National Forest System land in the Crazy PSU. This estimated reduction of down woody material would be minor as it would occur on 2.5 percent of the timbered lands within the PSU (Table 190). The effect to the availability of down wood from proposed vegetation clearing would be less than Alternative 2 by 1.2 percent. Also, estimated effects to down wood would be minimized in Alternative 3 through implementation of the Vegetation Removal and Disposition Plan developed for agencies' alternatives discussed in section 2.5.2.5.2. Down wood levels, on average, is expected to exceed KFP standards within the Crazy PSU for dependent wildlife species.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

The types of activities proposed under this alternative are similar to Alternatives 2 and 3. Similar facility and road construction activities would occur, but there are no LAD sites associated with Alternative 4 and the tailings impoundment has been modified from Alternative 2 to avoid RHCAs and old growth habitat. The disturbance area around the Little Cherry Creek Tailings

Impoundment Site would be 310 acres smaller than the Little Cherry Creek impoundment disturbance area proposed in Alternative 2.

Within the Crazy PSU, 1,634 acres within the disturbance boundary would occur within the habitat conditions identified in Table 190 in Alternative 4. Not all proposed clearing acres affect the cavity habitat PPL due to their location within a previously managed area. The effect of the vegetative clearing to the PPL in Alternative 4 would be similar to Alternatives 2 and 3 with a 0.9 percent reduction from 73.2 to 72.3 percent. Also, old growth and untreated stands would continue to be found within a majority of the PSU (69.3 percent) and provide a 100 percent snag level. Therefore, the cavity habitat PPL would remain well above the 40 percent level recommended in the KFP for upland habitats. Alternative 4 would impact 206 acres of riparian habitat on National Forest System lands. This is a reduction of 2.5 percent of riparian habitat available within the Crazy PSU and is minor at the PSU scale. Also, implementation of the agencies' Wetland and Mitigation Plan and the KNF's riparian standards and guidelines, as amended by the INFS, would minimize impacts on snag habitat in riparian areas on National Forest System lands. It is expected that this would result in meeting the riparian standard for snag levels (60 percent) within the PSU.

In comparison to Alternatives 2 and 3, Alternative 4 would result in a moderate reduction in cavity habitat acres due to proposed clearing activities. This includes fewer acres being disturbed within riparian habitat and old growth and untreated stands than Alternative 2 and is similar to Alternative 3. Approximately 204 acres of old growth and untreated stands would be maintained with a 100 percent snag level in the vicinity of the mine for wildlife use. In addition, implementation of project design features would help to maintain or improve cavity habitat within the disturbance area. Also, mitigation plans, including the Vegetation Removal and Disposition Plan (discussed in section 2.5.2.5.2), call for the designation of 828 acres of effective or replacement old growth on National Forest System lands and that snags would be left in disturbance areas, unless required to be removed for safety reasons (see section 2.5.7.4.4, *Key Habitats*). Therefore, the snag level would not be 0 percent on all cleared acres and at least portions of the disturbance areas could provide for some use by wildlife species both during mining operations and following reclamation. Effects of reduced cavity habitat with the Crazy PSU are reduced in Alternative 4 compared to Alternative 2 and would result in a greater designation of old growth habitat than Alternative 3.

Alternative 4 would result in the loss of all down wood on 1,634 acres on National Forest System land in the Crazy PSU. This estimated reduction of down woody debris would be minor as it would occur on 2.7 percent of the timbered lands within the PSU (Table 190). The effect to the availability of down wood from proposed vegetation clearing would be less than Alternative 2 by 1.0 percent and similar to Alternative 3. Also, estimated effects to down wood would be minimized in Alternative 4 through implementation of the Vegetation Removal and Disposition Plan developed for agencies' alternatives discussed in section 2.5.2.5.2. Down wood levels, on average, is expected to exceed KFP standards within the Crazy PSU for dependent wildlife species.

Alternative A – No Transmission Line

No direct effects from federal actions would occur. The No Transmission Line Alternative would maintain existing vegetative condition on the landscape and wildlife use of cavity and down wood habitat would continue at current levels. Although past timber harvests and other vegetation management treatments often resulted in a decrease in the amount of both habitats available, especially in some existing regeneration harvest units, both District and Forest level monitoring indicates that current levels meet KFP standards. Current down wood levels are generally considered to exceed historical levels due to longer fire return intervals within stands (Graham *et al*. 1994, Brown *et al*. 2003). The addition or loss of snags would depend on other factors, such as firewood cutting, wind events, natural attrition, or wildfire. The level of impact from these factors cannot be calculated due to the high uncertainty in predicting occurrence and intensity levels. Similarly, this alternative would not change the current condition or availability of down wood within the PSUs.

Effects Common to All Transmission Line Action Alternatives

The Montanore Project has four transmission line action alternatives: MMC's Proposed Transmission Line (Alternative B), Modified North Miller Creek (Alternative C-R), Miller Creek (Alternative D-R), and West Fisher Creek (Alternative E-R). In general, vegetation would be cleared from access roads, pulling and tensioning sites, substation and loop line, and within the transmission line clearing area for all action alternatives. For all but Alternative B, alternative design and topography would help maintain some snags within the identified disturbance areas. For example, snags located outside of the transmission lines right-of-way would only be removed if deemed a safety hazard. Harvest would not occur and trees would be maintained in portions of the clearing area, such as within high spans across valleys. New roads would not be open to the public; therefore, areas adjacent to new transmission line access roads would not likely have reduced snag levels from firewood gathering. Also, impacts on cavity habitat in riparian areas in the agencies' alternatives would be minimized through implementation of KFP riparian standards and guidelines, as amended by the INFS (USDA Forest Service 1995) on National Forest System lands as well as the Environmental Specifications (Appendix D) on all lands impacted by the transmission lines in the agencies' alternatives. It is expected that this would result in meeting the riparian standard for snag levels (60 percent) on National Forest System lands within the PSUs.

Transmission line clearing activities on National Forest System lands would occur within the Crazy and Silverfish PSUs. Clearing within old growth and untreated stands would have the most potential impact on the existing cavity habitat PPL and down wood debris levels. Disturbance would also occur within riparian habitat (Table 194). However, due to the relatively few acres that would be cleared at the PSU scale within these habitat conditions and that a portion of the acres occur within stands that already have a reduced snag level, the effect of this clearing activity to the cavity habitat PPL and down wood levels would be negligible. Also, both old growth and untreated forest conditions would continue to comprise the majority of the PSUs (Table 192) and these moist habitats provide snag levels on the KNF in the range of 6.3 to 17.1 per acre (Bollenbacher *et al*. 2009). Therefore, the cavity habitat PPL would remain well above the 40 percent level recommended in the KFP for upland habitats under all of the transmission line action alternatives. Down woody debris would be maintained in portions of the clearing area, such as within high spans across valleys. Also, impacts on down wood habitat in riparian areas in the agencies' alternatives would be minimized through implementation of KFP riparian standards and guidelines, as amended by the INFS (USDA Forest Service 1995) on National Forest System lands as well as the Environmental Specifications (Appendix D) on all lands impacted by the agencies' transmission line alternatives. Down wood levels, on average, is expected to exceed KFP standards within the Crazy and Silverfish PSUs for dependent wildlife species based on: 1) the predominant habitat type within the disturbance area, 2) the amount of old growth and untreated stands within the PSU, 3) the existing level of down wood as supported by District surveys, and 4) because current down woody debris levels are generally considered to exceed historical levels due longer fire return intervals within stands (Graham *et al*. 1994, Brown *et al*. 2003).

Clearing activities would also occur on private and State lands within the Silverfish PSU as well as the McElk and Riverview PSUs to the east. The majority of the private land that would be disturbed by the action alternatives, including the Sedlak Park Substation and loop line, is heavily roaded and has been logged in the past 20 to 30 years, and likely provides less cavity habitat than National Forest System lands. The amount of land on which these clearing acres would occur are negligible compared to the amount of private and State lands within the PSUs, for both upland and riparian habitats. Also, because of the low snag and down wood debris levels expected to currently exist on these lands, this reduction in cavity and down wood habitats on private and State lands, including the Sedlak Park Substation and loop line, would be negligible compared to the existing condition.

The subsections below describe the differences between the proposed action alternatives. The differences include total acres impacted, division of acres on National Forest System versus private and State lands, the types of habitat condition the clearing would occur in, and additional design features and/or mitigation plan measures that would be implemented. Table 192 summarizes the impacts of the transmission line alternatives on National Forest System lands and the change to the cavity habitat PPL within the Crazy and Silverfish PSUs. Impacts from all alternatives to habitat condition acres, proportion of National Forest System lands, and PPL have been calculated and are available in the project record. Table 193 displays the impacts of the alternatives on private and State lands within the Crazy, Silverfish, McElk, and Riverview PSUs. The impacts considered on private and State lands include the clearing areas associated with the transmission lines, and consider this impact in context with the amount of private and State lands available within the PSU.

Table 192. Impacts on Snag Habitat and Potential Population Level on National Forest System Lands in the Crazy and Silverfish PSUs by Transmission Line Alternative.

Activity	PSU	[A] No Transmission Line/Existing Conditions	[B] MMC's Proposed North Miller Creek Alternative	[C-R] Modified North Miller Creek Alternative	[D-R] Miller Creek Alternative	[E-R] West Fisher Creek Alternative
Total Clearing Acres	Crazy	0	114	73	73	73
	Silverfish	0	69	138	125	140
Acres Within Old Growth (% PPL)[1]	Crazy	0	24 (-0.1)	0 (0)	0 (0)	0 (0)
	Silverfish	0	8 (0)	18 (-0.1)	4 (0)	0 (0)
Acres Within Untreated Forest (% PPL)[1]	Crazy	0	39 (0)	36 (0)	26 (0)	26 (0)
	Silverfish	0	33 (0)	68 (-0.1)	37 (0)	9 (0)
Acres Within Past Harvest/ Road (% PPL)[1]	Crazy	0	51 (0)	37 (0)	47 (0)	47 (0)
	Silverfish	0	28 (0)	52 (0)	84 (0)	131 (-0.1)[2]
PPL (% Change)	Crazy	73.2	73.1 (-0.1)	73.2 (0)	73.2 (0)	73.2 (0)
	Silverfish	90.5	90.5 (0)	90.3 (-0.2)	90.5 (0)	90.4 (-0.1)

[1] % PPL: represents the percent change in the PPL from the existing condition.
[2] The one-tenth percent change due to clearing acres occurred within past partial cut forest condition.

Table 193. Private and State Lands within the PSU Impacted by the Transmission Line Alternative's Clearing Areas.

PSU	[B] MMC's Proposed North Miller Creek Alternative (Acres %)	[C-R] Modified North Miller Creek Alternative (Acres %)	[D-R] Miller Creek Alternative (Acres %)	[E-R] West Fisher Creek Alternative (Acres %)
Crazy	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Silverfish	39 (0.4%)	35 (0.4%)	35 (0.4%)	86 (0.9%)
McElk	55 (0.1%)	72 (0.2%)	72 (0.2%)	72 (0.2%)
Riverview	39 (0%)	6 (0%)	6 (0%)	6 (0%)

Table 194. Riparian Habitat on National Forest System and Private and State Lands Impacted by Transmission Line Alternative.

PSU	Land Ownership	[B] MMC's Proposed North Miller Creek Alternative (Acres %)	[C-R] Modified North Miller Creek Alternative (Acres %)	[D-R] Miller Creek Alternative (Acres %)	[E-R] West Fisher Creek Alternative (Acres %)
Crazy	NFS	20 (0.2%)	8 (0.1%)	26 (0.3%)	26 (0.3%)
	Private/State	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Silverfish	NFS	9 (0.1%)	16 (0.2%)	9 (0.1%)	6 (0.1%)
	Private/State	15 (0.8%)	6 (0.3%)	6 (0.3%)	21 (1.2%)
McElk	NFS	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	Private/State	2 (0%)	5 (0.1%)	5 (0.1%)	5 (0.1%)
Riverview	NFS	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	Private/State	18 (0.2%)	2 (0%)	2 (0%)	2 (0%)

NFS = National Forest System.
Percents shown represent percent of available riparian habitat in entire PSU.

Alternative B – MMC Proposed Transmission Line

This transmission line alternative would be 16.4 miles long with an associated clearing area of 150 feet. Alternative B would clear 153 acres on National Forest System lands, including 114 and 69 acres in the Crazy and Silverfish PSUs, respectively (Table 192). This includes impacts to 32 acres of old growth and 72 acres of untreated stands and these two habitat conditions would continue to comprise the majority of the PSUs (Table 189). This also includes disturbance to riparian habitat, including 20 acres within the Crazy PSU and 9 acres within the Silverfish PSU. This would amount to 0.1 to 0.2 percent of total riparian habitat available within the PSU and would be negligible at this scale. Also, there would be no effect to the cavity habitat PPLs. Down wood habitat would be reduced on these 153 acres of National Forest System lands as well. Effects to the down wood habitat level within the Crazy and Silverfish PSUs would be negligible based on the existing high levels and the availability of old growth and untreated forest habitats.

An additional 133 acres of clearing would occur on private and State lands (Figure 78) within the impacted PSUs. As described above, the existing snag level is already reduced on much of these lands and the proposed clearing acres would small compared the amount of land available within the PSU; effects would be negligible. Disturbance to riparian habitats would occur on 2, 18, and 15 acres within the McElk, Riverview, and Silverfish PSUs, which account for ≤0.8 percent of the private and State lands. Similarly, removal of down woody debris would occur on ≤0.4 percent of the private and State lands within the PSUs. In addition, the proposed clearings would not be expected to reduce the available wood debris level to an extent different from the existing low level condition found within these areas. Effects would be negligible on private and State lands at the PSU scale.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

The location of this transmission line alignment was intended to increase the acreage located on National Forest System lands versus private and State lands. This transmission line is the shortest of all alternatives and would be 13.1 miles long with an associated clearing area of 200 feet due to the use of wooden H-frame structures that are wider than the steel monopoles used in Alternative B. Alternative C-R would clear 211 acres on National Forest System lands, including 73 and 138 acres in the Crazy and Silverfish PSUs, respectively (Table 192). This would amount to 0 and 0.2 percent of the PSUs, respectively, with negligible effects to the cavity habitat PPLs. Clearing would impact fewer acres of old growth, totaling only 18 acres of old growth found within the Silverfish PSU, but more acres of untreated stands at about 104 acres between the two PSUs. Additionally, the goal of the Vegetation Removal and Disposition Plan would be to reduce the amount of vegetation clearing associated with the lines. Alternative C-R would disturb 8 and 16 acres (0.1 to 0.2 percent) of riparian habitat of National Forest System lands in the Crazy and Silverfish PSU, respectively, and would be negligible at the PSU scale.

Alternative design and topography would help maintain some snags within the clearing and disturbance areas. In addition, the mitigation plan for this alternative calls for the designation of 29 acres of effective or replacement old growth on National Forest System lands and that snags would be left in clearing area unless required to be removed for safety reasons. Although slightly more acres of clearing would occur on National Forest System lands with this alternative compared to Alternative B, the amount of acres would still be very small compared to cavity habitat available within the PSU and Alternative C-R would maintain the cavity habitat PPL well above the 40 percent level recommended in the KFP for upland habitats. Also, this alternative would reduce the impact on habitat conditions that provide 100 percent snag level through a reduction in the amount of clearing occurring within old growth habitat and the designation of additional old growth acres as well as the retention of snags that do not pose a safety hazard within the clearing acres. Fewer acres would be cleared in riparian habitats with this alternative than Alternative B. Therefore, the effects of the vegetation clearing with the Crazy and Silverfish PSUs would be reduced in Alternative C-R compared to Alternative B.

Approximately 113 acres of clearings would occur on State and private lands (Figure 78) within the impacted PSUs. This is a reduction of 20 acres that would occur on State and private lands than in Alternative B. Fewer acres would also be cleared within riparian habitats (13 compared to 35 acres). Overall, the effects would be the same to Alternative B and negligible as these lands already have reduced cavity habitat levels and activity would occur on ≤0.4 percent of private and State lands within each PSU.

Alternative C-R could impact the amount of down wood on 211 acres on National Forest System land in the Crazy and Silverfish PSUs. However, in contrast to Alternative B, alternative design and topography would help maintain some down wood debris within the identified clearing areas. In addition, the mitigation plan for this alternative calls for leaving up to 30 tons per acre of coarse woody debris within clearing area (Table 37). Therefore, potential effects to down wood debris under this alternative are negligible, reduced compared to Alternative B, and would maintain levels appropriate for the site for wildlife use.

As described for cavity habitat, potential impacts to down woody debris would occur on ≤0.4 percent of the private and State lands within the PSUs where it is expected that reduced levels of down wood material already exist. The mitigation plan would retain up to 30 tons per acres of coarse woody debris within these disturbance areas that could be acquired upon removal of the trees. Therefore, there is the potential for improvement in the down woody debris levels on State and private lands under this alternative and is an improvement compared to Alternative B.

Alternative D-R – Miller Creek Transmission Line Alternative

Similar to Alternative C-R, the location of this transmission line would increase the acreage located on National Forest System lands versus private and State lands but reduce the amount of vegetation clearing associated with the line through implementation of the Vegetation Removal and Disposition Plan. This transmission line alternative would have the same clearing area of 200 feet as Alternative C-R, but would be slightly longer at 13.7 miles. Alternative D-R would clear 198 acres on National Forest System lands, including 73 and 125 acres in the Crazy and Silverfish PSUs, respectively (Table 192). There would be no effect to the PPL. Clearing would impact fewer acres of old growth and untreated forest than either Alternatives B or C-R, totaling only 4 acres of old growth within the Silverfish PSU, and 63 acres of untreated stands split between the two PSUs. Within the Crazy PSU, more riparian habitat would be impacted with this alternative than either Alternatives B or C-R with 26 acres proposed for clearing. This alternative proposes the clearing of 9 acres of riparian habitat in the Silverfish PSU. This is the same as Alternative B and slightly less than Alternative C-R and the effects would be negligible.

Similar to Alternative C-R, alternative design and topography would help maintain some snags within the clearing and other disturbance areas. In addition, the mitigation plan for this alternative calls for the designation of 12 acres of effective or replacement old growth on National Forest System lands and that snags would be left in clearing area unless required to be removed for safety reasons (Table 37). Although slightly more acres of clearing would occur on National Forest System lands with this alternative compared to Alternative B, the amount of acres is still very small compared to cavity habitat available within the PSU and Alternative D-R would maintain the cavity habitat PPL well above the 40 percent level recommended in the KFP for upland habitats and continue to meet the 60 percent level within the riparian habitats. Also, this alternative reduces the impact on habitat conditions that provide 100 percent snag level through a reduction in the amount of clearing occurring within old growth habitat and the designation of additional old growth acres as well as the retention of snags that do not pose a safety hazard within the clearing acres. Therefore, the effects of the vegetation clearing with the Crazy and Silverfish PSUs are reduced in Alternative D-R compared to Alternatives B and C-R.

Approximately 113 acres of clearings would occur on State and private lands (Figure 78) within the impacted PSUs. This is a reduction of 20 acres that would occur on State and private lands than in Alternative B and is the same as Alternative C-R. Impacts to riparian habitat would be the same as Alternative C-R (13 acres) and less than Alternative B. Overall, the effects would be the same as Alternative C-R and negligible as these lands already have reduced cavity habitat levels and activity would occur on ≤0.4 percent of each PSU.

Alternative D-R would impact the amount of down wood on 198 acres on National Forest System land in the Crazy and Silverfish PSUs. However, similar to Alternative C-R, alternative design and topography would help maintain some down wood debris within the identified clearing areas. In addition, as for Alternative C-R the mitigation plan for this alternative calls for leaving up to 30 tons per acre of coarse woody debris within clearing area (Table 37). Therefore, potential effects to down wood debris under this alternative are reduced compared to Alternative B and similar to Alternative C-R, and would maintain levels appropriate for the site for wildlife use.

As described for cavity habitat, potential impacts to down woody debris would occur on ≤0.4 percent of the private and State lands within the PSUs where it is expected that reduced levels of down wood material already exist. The mitigation plan would retain up to 30 tons per acres of coarse woody debris within these clearing areas, assuming this level of debris is available for retention. Therefore, there is the potential for improvement in the down woody debris levels on State and private lands under this alternative and is an improvement compared to Alternative B and the same as Alternative C-R.

Alternative E-R – West Fisher Creek Transmission Line Alternative

Similar to Alternatives C-R and D-R, the clearing for this transmission line would reduce the amount of vegetation cleared through implementation of the Vegetation Removal and Disposition Plan. However, the location of the transmission line would result in the most acres being impacted by clearing activities, both on National Forest System and private and State lands. This transmission line would have a mixed-width disturbance area depending on whether the section of line consisted of wooden H-frame structures (200-foot clearing area and majority of the line) or wooden monopoles (150-foot clearing area). The total length is 15.1 miles which is intermediate between Alternatives B and C-R. Alternative E-R would clear about 213 acres on National Forest System lands, including 73 and 140 acres in the Crazy and Silverfish PSUs, respectively. This would amount to 0 and 0.1 percent and would be negligible at the PSU scale (Table 192). Clearing would not impact old growth with this alternative as compared to all other alternatives. This alternative would also impact the fewest acres of untreated forest compared to the other three action alternatives, totaling 35 acres between the two PSUs. This alternative would clear 26 acres within riparian habitats in the Crazy PSU, similar to Alternative D-R, but the fewest acres (6 acres) within the Silverfish PSU compared to all other alternatives and effects would be negligible.

Similar to Alternative C-R, alternative design and topography would help maintain some snags within the identified disturbance areas. In addition, the mitigation plan for this alternative calls for the designation of 6 acres of effective or replacement old growth on National Forest System lands and that snags would be left in clearing area unless required to be removed for safety reasons (Table 37). Although slightly more acres of clearing would occur on National Forest System lands with this alternative compared to the other action alternatives, the amount of acres would be still very small compared to cavity habitat available within the PSU and Alternative E-R would maintain the cavity habitat PPL well above the 40 percent level recommended in the KFP for upland habitats and continue to meet the 60 percent level within the riparian habitats. Also, this alternative would reduce the impact on habitat conditions that provide 100 percent snag level through the elimination of clearing within old growth habitat and the reduction of clearing within untreated forest, the designation of additional old growth acres, and the retention of snags that do not pose a safety hazard within the clearing acres. Therefore, the effects of the vegetation clearing under this alternative would be similar to Alternative C-R with respect to the amount of clearing that would occur but reduced effects within old growth and untreated forest that provide the highest snag levels compared all of the other action alternatives. More total acre would be cleared with this alternative than Alternative D-R, but more would occur within previously disturbed with similar or slightly less effects to old growth and untreated stands.

Approximately 164 acres of clearings would occur on State and private lands (Figure 78) within the impacted PSUs. This is an increase of 31 and 51 acres than would occur on State and private lands with Alternative B and Alternatives C-R and D-R, respectively. Impacts to riparian habitat ranges between 2 and 21 acres with this alternative, totaling 29 acres on private and State lands. This is more acres than Alternatives C-R and D-R but less than Alternative B. Overall, the effects would be similar to the other action alternatives and negligible as these lands already have reduced cavity habitat levels and activity would occur on ≤0.9 percent of each PSU.

Alternative E-R could impact the amount of down wood on about 213 acres on National Forest System land in the Crazy and Silverfish PSUs. However, similar to Alternative B, alternative design and topography would help maintain some down wood debris within the identified clearing areas. In addition, as for Alternatives C-R and D-R the mitigation plan for this alternative calls for leaving up to 30 tons per acre of coarse woody debris within clearing area (Table 37). Therefore, potential effects to down wood debris under this alternative are negligible, reduced compared to Alternative B and similar to Alternatives C-R and D-R, and would maintain levels appropriate for the site for wildlife use.

As described for cavity habitat, potential impacts to down woody debris would occur on ≤0.1 percent of the private and State lands within the PSUs where it is expected that reduced levels of down wood material already exist. The mitigation plan would retain up to 30 tons per acres of coarse woody debris within these clearing areas, assuming this level of debris is available for retention. Therefore, there would be no effect to down wood habitat on State and private lands under this alternative and is an improvement compared to Alternative B and the same as Alternatives C-R and D-R.

Combined Mine-Transmission Line Effects

When considering the mine and transmission lines in combination, only the Crazy PSU could have increased impacts as it is the only PSU where both mine facilities and the transmission line would be located. Some overlap of impact acres would occur where the transmission lines terminated at the plant site. These overlapping acreages are small, but were not double counted when assessing the combined acres in Table 195. Within the Crazy PSU, transmission lines D-R and E-R alignments would be the same and combined effects with the mine alternatives would be the same; therefore, these transmission line alternatives are shown in the same column in Table 195. For the other PSUs, the “combined effects” would be the same as those described above under the transmission line alternatives.

Table 195. Impacts of Combined Mine and Transmission Line Alternative on Cavity Habitat Population Level and Riparian Habitat on National Forest System Land in the Crazy PSU.

Activity	[1A] Existing Condition	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative		[4] Agency Mitigated Little Cherry Creek Impoundment Alternative	
		[B]	[C-R]	[D-R] and [E-R]	[C-R]	[D-R] and [E-R]
Cavity Habitat Population Level						
Total Clearing Acres	0	2,378	1,605	1,605	1,704	1,704
Acres Within Old Growth (% PPL)[1]	0	319 (-0.5)	138 (-0.3)	138 (-0.3)	159 (-0.3)	159 (-0.3)
Acres Within Untreated Forest (% PPL)[1]	0	380 (-0.6)	342 (-0.5)	332 (-0.5)	317 (-0.5)	307 (-0.5)
Acres Within Partial Cut Forest (% PPL)[1]	0	199 (-0.3)	193 (-0.2)	191 (-0.2)	110 (-0.2)	108 (-0.2)
Acres Within Past Regeneration Harvest/Roads (% PPL)[1]	0	1,480 (0)	932 (0)	944 (0)	1,118 (0)	1,130 (0)
PPL (% Change)	73.2	71.8 (-1.4)	72.2 (-1.0)	72.2 (-1.0)	72.2 (-1.0)	72.2 (-1.0)
Riparian Habitat						
Riparian Habitat Acres (% PSU)	0	252 (3.1)	203 (2.5)	221 (2.7)	214 (2.6)	232 (2.8)

[1] % PPL: represents the percent change to the PPL from the existing condition.

Relative to other action alternatives, combined Alternative 2B would result in the greatest impacts on the availability of snags. This alternative would result in the disturbance/clearing of the most total acres, 2,378 acres, as well as impacting the most old growth and untreated forest (319 and 380 acres, respectively). Also, this alternative results in the disturbance of 252 acres (3.1 percent) of riparian habitat, which is more than any of the other alternatives. However, this combined reduction in acres only results in a negligible decrease in the cavity habitat PPL compared to the mine alternative alone and the PPL would be 71.8 percent in the Crazy PSU. As the numbers in Table 195 indicate, there is very little difference between Alternatives C-R and D-R/E-R when in combination within the respective mine alternative and only considering National Forest System lands. Alternative 3 combinations would have the least potential impact on cavity habitat (1,605 acres), acres occurring within an old growth condition (138 acres), and range of acres occurring in riparian habitat (203 to 221 acres). Alternative 4 combinations would result in intermediate impacts, although more similar to Alternative 3. This combination of alternatives would impact 1,704 acres in total with 159 occurring in old growth and 214 to 232 acres within riparian habitat. These alternatives have additional mitigation plans in place that would retain snags in the disturbance/clearing areas that would not occur under combined Alternative 2B. Similar to combined Alternative 2B, the proposed combined reductions in the PPL are negligible compared to the mine Alternatives 3 and 4 alone and would remain at 72.2 percent. In all combined action alternatives, the PPL would remain well above the 40 percent recommended in the KFP for upland habitat and continue to meet the 60 percent standard for riparian habitat across the PSU.

Combined effects for the potential reduction of down wood debris would be similar to cavity habitat. The Alternative 3 combinations would have the least impact on down wood habitat as it proposes the fewest disturbance/clearing acres, followed by Alternative 4 combinations. In addition, the mitigation plan for the agencies' alternatives propose to leave up to 30 tons per acre of coarse woody debris under the transmission lines to maintain down wood habitat.

Cumulative Effects

The Affected Environment/Existing Condition section describes the past and present factors contributing to the existing cavity and down wood habitat conditions within the analysis area. This cumulative effects section summarizes the past actions as well as further describes ongoing and other reasonably foreseeable contributions potentially impacting cavity and down wood habitats. As described under the section "Analysis Areas and Methods," the PSU was chosen as the appropriate scale for cavity and down wood habitat cumulative effects analysis as this size is sufficient to cover home range sizes of species associated with cavity and down wood habitat as well as to be able to determine the effects of proposed management activities.

Past Actions

Past actions, including detailed descriptions of previous vegetation and road management activities, are described in section 3.2, *Past and Current Actions*, shown on Figure 50, and listed in Appendix E. Cavity and down wood habitats are affected by various activities both directly and indirectly. Therefore, changes in the availability of cavity habitat, as compared to the 40 and 60 percent standards, and down wood habitat are the measure of effects. The Affected Environment section of this analysis summarizes the existing condition and Table 190 and Table 192 reflect the changes to the upland snag level and PPL under the mine and transmission line alternatives, respectively. Table 191 displays the impacts to riparian habitats. Effects to down wood habitat were more qualitative in nature. Harvest and other vegetation management have occurred in the analysis area since the 1950s. Before the 1990s, these activities resulted directly in the loss of snags as well as indirectly through reductions in trees that would have become snags in the future. Similarly, past vegetation management often resulted in the direct loss of down woody debris as well as indirectly through reductions in trees and snags that would have become down woody materials in the future. Road construction and the amount of road open to public motorized use also reduced the availability of snags and down wood due to firewood collection. In unmanaged areas, natural disturbances such as wildfire would have resulted in the development of clusters of snags. Fires would have both reduced down woody debris as well as the development of snags that would come down in the future. In contrast, fire suppression since the early 1900s has altered stand structure resulting in reduced creation of snags and development of future snags. It has also resulted in the large accumulations of small down wood debris that does not persist on the landscape nor are as beneficial to wildlife. Since the 1990s, application of KFP standards has resulted in the better retention of snags, snag replacement trees, and existing and future down wood materials. There has been more reliance on intermediate harvest that leaves more trees that would become snags and down wood in the future. Also, there has been a reduction in roads available for public motorized use, which has affected the location and amount of snag habitat available for firewood gathering. Application of these standards and management trends has since provided better protection and maintenance of cavity and down wood habitat.

The No Action Alternatives (Alternatives 1 and A)

No direct effects from federal actions would occur; therefore, these alternatives would not contribute to cumulative losses of snags and down wood, and would not contribute to cumulative effects on cavity and down wood habitats. Implementation of these alternatives would maintain existing vegetative condition on the landscape and wildlife use of cavity and down wood habitat would continue at current levels. Although past timber harvests and other vegetation management treatments resulted in a decrease in the amount of both habitats available in some existing regeneration harvest units, both District and Forest level monitoring indicates that current levels meet KFP standards. Also, current down wood levels are generally considered to exceed historical levels due to longer fire return intervals within stands (Graham *et al*. 1994, Brown *et al*. 2003). The addition or loss of snags would depend on other factors, such as firewood cutting, wind events, natural attrition, or wildfire.

Mine Alternatives (2, 3, 4), Transmission Line Alternatives (B, C-R, D-R, E-R), and Combined Mine-Transmission Line Alternatives

Ongoing and Reasonably Foreseeable Actions

Reasonably foreseeable actions include those federal, state, or private activities that are ongoing or scheduled to occur within the next five years, independent of this federal action. Section 3.2, *Past and Current Actions*, and Appendix E identify those current and foreseeable actions in the analysis area that were determined to be appropriate for inclusion in the analysis of environmental effects. As described above, cavity and down wood habitat has been reduced due to past actions that have occurred within the analysis area. However, abundant snags and down wood debris occur throughout the analysis area due the habitat types and moist environments found here. Changes in harvest methods and retention and protection of snags and down wood materials in recent years have maintained/created higher quality cavity and down wood habitat throughout the analysis area PSUs.

One active timber sale, Miller-West Fisher, occurs within the Silverfish PSU. The project includes commercial timber harvest, which was included in the existing condition PPL. Only the transmission line alternatives would occur within this PSU and the cumulative impact on the cavity habitat PPL would be a 0 to 0.2 percent reduction. This reduction would be negligible at the PSU scale and would maintain the cavity habitat PPL well above the 40 percent standard. Miller-West Fisher would adhere to riparian standards and there would be no cumulative effect to the 60 percent riparian standard. Prescribed fire units and post-harvest burning could kill or injure some of the live trees within the units, especially those harvest units with more western redcedar left, and create more snags. Cumulatively, the impacts of the two projects to snag level in the PSU would be negligible as only relatively few acres would be cleared under the transmission line alternatives, the agencies' alternatives would retain existing snags where possible to meet KFP recommendations, and the reduction to the high snag PPL within the PSU would be negligible. Project design would require that the down wood materials be left as appropriate for the habitat type; therefore, there would be no cumulative reduction in down wood on National Forest System lands.

The Coyote Improvement vegetation management project is in the planning stages and would take place within the Crazy PSU. The project would harvest 240 acres to increase stand resiliency to mountain pine beetles. If this harvest occurs within currently untreated forest stands, at most the PPL would be reduced by 0.4 percent within the PSU. In addition to the proposed activities, this would still result in a minor reduction in the PPL in the Crazy PSU and maintain a very high PPL above 71 percent. Also, the project would meet riparian standards. Project design would require that the down wood materials be left as appropriate for the habitat type; therefore, there would be no cumulative reduction in down wood on National Forest System lands.

Increased use of public lands is likely with population growth and development, but use is expected to be gradual and focused on areas along or near roads open to motorized traffic. Activities include firewood cutting which removes snags and down wood. Loss would be limited to individual trees and logs and to areas within about 150 to 200 feet of open roads and has been accounted for in available snag habitat. Also, the Montanore Project proposes no increase in the amount of roads open for public motorized use. However, new clearings within viewing distance of the open roads may make existing snags more visible for cutting. Therefore, cumulatively there would be a negligible increase in the expected loss of snags and down wood due to proposed activities and firewood gathering within the analysis area.

Development of private land within the analysis area likely resulted in the loss of both existing and future snags, including in riparian areas such as along the Fisher River. Also, as discussed above under "Environmental Consequences" much of the State and private lands within the project PSUs have been harvested within the past 20 to 30 years and already have a reduced cavity habitat PPL and down wood level. Further development would not be expected to reduce these habitats compared to the existing condition. In addition, high levels of both habitats currently exist on adjacent National Forest System lands that would continue to provide habitat for cavity and down wood dependent species.

Following implementation of any of the action alternatives and reasonably foreseeable Forest Service projects, the primary cavity excavator PPL on National Forest System lands would remain at ≥ 71 percent. Only the Crazy PSU would experience a 1 percent decrease in the PPL due to proposed mine and transmission line alternatives. The remaining PSUs would experience negligible to no effects to the PPL on National Forest System lands. This level of snag habitat is expected to provide for cavity habitat associated species PPL well above 40 percent, which is thought to be the minimum needed to maintain self-sustaining populations of snag-dependent wildlife (Thomas 1979). Additionally, due to the ongoing and future predicted bark beetle epidemics and fire, it is anticipated that the density of snags is increasing in all diameter classes over time (Bollenbacher *et al*. 2009). Impacts to riparian habitats would be negligible and expected to maintain cavity habitat PPL above 60 percent across the PSUs. Productive growing conditions on impacted National Forest System lands have resulted in high existing levels of down wood materials. Proposed clearings would result in negligible reductions at the PSU scale. Also, mitigation plans under the agencies' proposed alternatives would reduce this potential reduction level. Cumulatively, when proposed activities and all past, present, and reasonably foreseeable activities are considered, habitat on federal lands is considered sufficient to provide cavity and down wood habitat to cavity and down wood dependent species within the impacted PSUs. Proposed activities on State and private lands are expected to have negligible cumulative effects due to the reduced availability of these habitat types currently existing on these lands, the small amount of acres that would be cleared for the transmission line alternatives, and coarse woody would be retained up to 30 tons per acre under the agencies' alternatives.

Regulatory/Forest Plan Consistency

Organic Administration Act and Forest Service Locatable Minerals Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources and to take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations. Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8. In the proposed action, MMC did not propose to implement feasible measures to minimize effects on key habitats

or all practicable measures to maintain and protect wildlife habitat. The agencies' alternatives (Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R) would comply with 36 CFR 228.8. The agencies' alternatives would incorporate additional feasible and practicable measures to minimize adverse environmental impacts on wildlife habitat that benefit key habitats, including leaving snags in disturbance and clearing areas unless required to be removed for safety reasons, leaving down wood on National Forest System and State lands minimizing effects on riparian areas and complying with all KFP riparian standards, and having a wetland mitigation plan more likely to replace lost wetland functions.

National Forest Management Act/Kootenai Forest Plan

The combined mine and transmission line action alternatives meet KFP guidelines and standards as they apply to cavity and down wood habitat on National Forest System land and include:

1. Forestwide Management Direction, KFP II-1 #8 – *Manage for sufficient snags and snag replacement trees to maintain viable populations of snag-dependent species.* Within the Crazy PSU, the combined mine and transmission line alternatives would reduce PPL by about 1 percent to 72 percent. The transmission line alternatives within the Silverfish PSU would have a negligible effect to the PPL, a maximum of a 0.2 percent decrease, and would maintain a PPL of 90 percent. Both PSUs would continue to provide a snag level higher than 40 percent within the analysis area. The transmission line clearings would not impact National Forest System lands within the McElk and Riverview PSUs. Impacts to riparian habitat are negligible at the PSU scale and these habitats would continue to meet the 60 percent standard within the PSUs.

2. Cavity Habitat standard in MAs 10, 11, 12, 15, 16, 17, and 18

    a. a. MA 10 – KFP III-39: *Existing cavity habitat will be retained.* The requirement to retain habitat in MA 10 would continue to be met because none of the disturbance associated with the action alternatives would occur in MA 10.

    b. MAs 11, 12, 15, 16, 17, and 18 – KFP III-44, 49, 65, 69, 75, and 80, respectively: *Cavity habitat will be maintained at 40 percent of maximum as described in Appendix 16, "Cavity Habitat Management Guidelines."* In all alternatives, the KFP cavity habitat standard (40 percent PPL) in MAs 11, 12, and 15 through 18 would be met. The total acres proposed for reduction are small compared to the high levels of old growth and untreated habitats that would continue to provide a 100 percent snag level within the Crazy and Silverfish PSUs and National Forest System lands would not be impacted within the McElk and Riverview PSUs. In addition, under the agencies' alternatives (Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R) snags would be left within the disturbance and/or clearing acres unless required to be removed for safety reasons and would newly designate old growth acres that would maintain the old growth characteristics.

3. Appendix 16 – *A 16-4: Minimum levels for cavity habitat retention should be applied on a drainage or compartment area basis at the following recommended levels: At least 40 percent of the potential capacity will be maintained throughout commercial forest lands and at least 60 percent of the potential will be maintained in riparian areas.* Within the Crazy and Silverfish PSUs, upland areas of National Forest System lands unaffected by the proposed combined mine and transmission line alternatives would exceed 40 percent

snag level as described in 2b above. In the agencies' alternatives, implementation of KNF riparian standards and guidelines, as amended by the INFS (USDA Forest Service 1995), and the Environmental Specifications would help minimize impacts on snag habitat in riparian areas within the proposed clearing and disturbance areas and would ensure the 60 percent level is being met in the PSUs.

The KFP has no standards for down wood habitat. It does contain the goal to maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species (II-1). Also, it provides guidelines in Appendix 16, Cavity Habitat Management (A-16-6) to leave logs greater than 12 inches in diameter (a few pieces or about 5-15 tons/acre) to provide cover and feeding sites for birds and small mammals. Given the wide range of habitats and different successional stages and associated amounts of downed wood that would continue to be available within the impacted PSUs, all combined mine and transmission line alternatives would be consistent with the KFP.

Statement of Findings

Based on the analysis for cavity habitat, analyzing snags as the primary substrate, habitat for cavity dependent species would be maintained at a minimum PPL of about 72 percent in the impacted PSUs. Although up to 2,378 acres would be impacted under combined Alternative 2B in the Crazy PSU, the majority would occur within stands that already have a reduced snag level due to prior treatment or use as a road. Also, the overall acres proposed for reduction are small compared to the high levels of old growth and untreated habitats that would continue to provide a 100 percent snag level within the PSU; fewer acres would be disturbed and cleared under the combined Alternatives 3 and 4. The transmission line alternatives in the other PSUs would remove very few acres associated within the clearings relative to total acres available within the PSUs. In addition, under the agencies' alternatives (Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R), snags would be left within the disturbance acres where they do not pose a safety hazard and would newly designate old growth acres that would maintain the old growth characteristics. The analysis area PSUs would continue to provide sufficient quality and quantity of snags and replacement snags for viable populations of cavity habitat dependent wildlife species well above minimum standard 40 percent on National Forest System lands. Impacts to riparian habitat are negligible compared to the amount available with the PSUs and the 60 percent level would be maintained throughout the PSUs. Where clearings would occur on private and State lands under the transmission line alternatives, the proposed clearings are expected to have negligible effects compared to the existing snag level conditions.

Maintenance of down wood habitat is beneficial to both forest health and various wildlife species that are dependent on down woody material to fulfill life requirements. Based on the predominant habitat types and district surveys within old growth and past harvest units, the analysis area PSUs currently have high levels of down woody debris. Removal associated with the disturbance areas is expected to remove very little compared to what would remain available within the surrounding forested habitats under all alternatives. In addition, the retention of recommended levels of down wood materials would occur through retention of existing logs and felled snags under the agencies' transmission line alternatives, which would occur on both National Forest System and private and State lands. Proposed activities and implementation of design features would maintain the availability and distribution of down wood materials within the impacted PSUs at levels beneficial to wildlife.

State Requirements

Alternatives 3 and 4 would comply with the MMRA regarding disturbed lands being reclaimed to a post-mining land use with stability and utility comparable to that of the pre-mining landscape. Draft findings regarding compliance with MFSA requirements are discussed in the Summary, beginning on p. S-53.

3.25.3 Management Indicator Species

The KNF identified MIS species in the 1987 KFP because they were believed to act as barometers of change for a particular habitat. The species identified fall into different categories that include: 1) the species was identified by the USFWS as a threatened or endangered species and present on the KNF; 2) it is a species that is commonly hunted, fished, or trapped; or 4) they are a species believed to have special habitat needs that could be affected by management activities. As specified in the KFP, the KNF uses MIS, which act as representatives for an array of other species that use the same habitat, or with similar breeding and foraging habitat requirements, providing a tool for more accurately monitoring more than 300 different species of wildlife (USDA Forest Service 2003b) that occupy the KNF. Management Indicator Species (MIS) were chosen based on the following criteria: (1) the species can be easily monitored and (2) the species is susceptible to changes resulting from management activities. It is assumed that effects on MIS can be correlated to effects on other species with similar habitat requirements.

3.25.3.1 Regulatory Framework

3.25.3.1.1 Federal Requirements

The Organic Administration Act authorizes the Forest Service to regulate the occupancy and use of National Forest System lands. The Forest Service’s locatable minerals regulations are promulgated at 36 CFR 228, Subpart A. The regulations apply to operations conducted under the U.S. mining laws as they affect surface resources on National Forest System lands under the jurisdiction of the Secretary of Agriculture. One of these regulations (36 CFR 228.8) requires that mining activity be conducted, where feasible, to minimize adverse environmental impacts on National Forest surface resources. 36 CFR 228.8 also requires that mining operators take all practicable measures to maintain and protect fisheries and wildlife habitat which may be affected by the operations; and construct and maintain all roads so as to assure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water, and other resource values.

The National Forest Management Act requires the Secretary of Agriculture to promulgate regulations specifying guidelines for land management plans that “provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives…” The “specific land area” (scale) for providing diversity is established in the framework as the area covered by the Forest Plan, or the entire KNF. One of the KFP goals is to “maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species… and in sufficient quality and quantity to maintain habitat diversity representative of existing conditions” (II-1 #7). In addition, the KFP includes a wildlife standard relevant to MIS that states that “the maintenance of viable populations of existing native and desirable non-native vertebrate species, as monitored through indicator species, will be attained through the maintenance of a diversity of plan communities and habitats” (II-22). The MIS designated for the KNF and the habitat they are intended to represent are identified in the KFP (KFP Vol. 2, Appendix 12), and shown in Table 196.

Table 196. KNF Management Indicator Species.

Species	Habitat Represented	Comments
Grizzly Bear (*Ursus arctos*)	General Forest	See section 3.25.5, *Threatened, Endangered, and Proposed Species*
Gray Wolf (*Canis lupus*)	General Forest	See section 3.25.4, *Sensitive Species*
Bald Eagle (*Haliaeetus leucocephalus)*	Rivers and Lakes	See section 3.25.4, *Sensitive Species*
Peregrine Falcon (*Falco peregrinus*)	Cliffs	See section 3.25.4, *Sensitive Species*
Elk (*Cervus elaphus*)	General Forest	
White-tailed Deer (*Odocoileus virginianus*)	General Forest	
Mountain Goat (*Oreamnos americanus*)	Alpine	
Pileated Woodpecker (*Dryocopus pileatus*)	Snag Habitat, Old Growth	See section 3.25.2, *Key Habitats*

The MIS described in this section are elk, white-tailed deer, mountain goat, and pileated woodpecker. Impacts on the grizzly bear are addressed in section 3.25.5*, Threatened, Endangered, and Proposed Species* and impacts on the bald eagle, gray wolf, and peregrine falcon are described in section 3.25.4, *Sensitive Species.*

3.25.3.1.2 State Requirements

The MFSA directs the DEQ to approve a transmission line if, in conjunction with other findings, the DEQ finds and determines that the facility would minimize adverse environmental impact, considering the state of available technology and the nature and economics of the various alternatives. An assessment of effects on big game species is part of the transmission line certification process. FWP is required to report DEQ information relating to the impact of the proposed site on FWP's area of expertise. The report may include opinions as to the advisability of granting, denying, or modifying the certificate.

3.25.3.2 Elk

Elk and white-tailed deer are two MIS that were selected to indicate change in general forest habitat. Summerfield (1991) recommends selecting one big game species as the focus of analysis in a particular area, because species winter requirements differ. The KNF and the FWP have developed management emphasis designations for elk by PSU (Johnson 2004a). In PSUs where elk is designated as high emphasis, elk will be the indicator for general forest habitat. For PSUs where elk is designated as low emphasis, whitetail deer will be the indicator for general forest habitat. For PSUs where elk is designated as moderate emphasis, the project biologist will designate the general forest indicator, based on site-specific information about elk and deer use in the PSU. Management emphasis ratings for elk are high in PSUs where maintaining elk security is a high priority, medium where elk are one of the primary resource considerations, and low where elk management is not a priority. The PSUs potentially affected by the Montanore Project are the Crazy and Silverfish PSUs. The Crazy PSU is assigned a medium elk emphasis rating, while the Silverfish PSU is assigned a high elk emphasis rating. Based on these management emphasis ratings, KFP direction, the biological potential of the area, state wildlife management objectives, public comments during scoping, information contained within the KNF Conservation Plan (Johnson 2004a), and site-specific knowledge of deer and elk use in the Crazy and Silverfish PSUs, the elk was selected as the general forest indicator for the Silverfish PSU and the white-tailed deer was selected as the general forest indicator for the Crazy PSU.

3.25.3.2.1 Analysis Area and Methods

Elk population ecology, biology, habitat description, and relationships identified by research are described in Thomas (1979), Lyon *et al*. (1985), Hillis *et al*. (1991), and Toweill and Thomas (2002). This literature helped inform the analysis of effects to elk and its habitat based on direction provided in the KFP (as amended) and is incorporated by reference. Elk population and harvest data come primarily from FWP. Additional information is provided by recent District wildlife observation records and KNF historical data (NRIS Wildlife).

The analysis area for evaluating direct, indirect and cumulative effects on individuals and their habitat on National Forest System lands is the Silverfish PSU, because activities in these areas could result in disturbance and displacement effects to elk (Figure 89). Elk emphasis areas were defined by the PSU, although adjacent planning areas were also considered for effects. Elk have home ranges that include both winter and summer use areas, which could extend beyond the Silverfish PSU. The PSU is large enough to account for effects on these various components of elk habitat and use in this area. Connectivity and movement within home ranges could be impacted by the proposed activities as well as activities in adjacent PSUs. To evaluate potential direct, indirect and cumulative impacts of the transmission line on elk on private and State land, the analysis area includes all land within a corridor 1 mile on each side of the alternative transmission line alignments. The boundaries for determination of population trend and contribution toward population viability are the FWP hunting districts (HD) 103 and 104 and the KNF, respectively. The analysis for elk was limited to the transmission line alternatives because the mine alternatives would not affect the Silverfish PSU.

Data sources used in this analysis include FWP hunting and population data, research, and plans; District vegetation layers; INFRA roads layers; TSMRS data; Summerfield (1991); and field surveys by District biologists and data collection crews. Potential effects to elk in the KNF are evaluated according to five effects indicators: cover/forage ratio, forage openings, habitat effectiveness (HE), security, and key habitat features. These indicators are described below. Potential effects to forage quality are also evaluated.

Cover/Forage Ratios

An important consideration when evaluating big game habitat is the distribution of cover and forage within a given area. Cover can be described as vegetation that provides protection from weather, predators, and humans. Two types of cover are considered for this analysis: hiding and thermal cover, based on Thomas (1979). Hiding cover is defined as vegetation capable of hiding 90 percent of an elk from human view at 200 feet. Thermal cover is defined as stands of conifers at least 40 feet tall with 70 percent crown closure. Forage areas are natural or man-made areas that do not qualify as either hiding or thermal cover. Re-examination of elk use of thermal cover and foraging areas indicates that providing thermal cover does not compensate for inadequate forage conditions (Cook *et al.* 1998). The ratio of cover to forage represents the percentage of the PSU that meets elk requirements for both cover and forage.

Effects of the alternatives on cover and forage are evaluated based on cover/forage ratios for summer and winter range, percent cover for combined MAs 15, 16, 17, and percent thermal cover on winter range in the Silverfish PSU. MA designations, goals, and standards are described in detail in section 3.15, *Land Use*. The KFP recommends a cover/forage ratio of 30/70 percent for elk winter range (for MA 10 and 11 combined). MAs 10 and 11 were delineated for the KFP and do not entirely overlap with elk winter range mapped by FWP (Figure 89). To avoid confusion with FWP winter range, for impacts evaluated on National Forest System land, winter range is referred to as MAs 10 and 11. Summerfield (1991) recommends 60 percent cover on winter range and summer range combined (for all MAs). On elk winter range, the cover should be at least 40 percent thermal cover. Summer range cover may include any combination of hiding and thermal cover (Ibid.). The KFP guideline for hiding and thermal cover on MAs 15, 16, and 17 for elk is greater than 15 percent. MAs 15, 16, and 17 are managed for timber production and do not necessarily correspond to areas of seasonal elk use.

Forage Openings

In general, use of foraging areas decreases when big game is required to venture more than 600 feet from cover (Thomas 1979). According to KFP guidelines, maximum opening size on National Forest System lands should generally be less than 40 acres. Forage openings are identified through TSMRS database queries to determine type and age of past harvest. For this analysis, effects of forest openings on elk are evaluated based on the regeneration harvest greater than 40 acres occurring after 1986. This analysis was based on a worst-case scenario for transmission line clearing effects and assumes that the entire transmission line clearing area would be cleared.

Habitat Effectiveness

The habitat effectiveness (HE) of an area refers to the percentage of habitat without open roads that is usable by elk outside of the hunting season. Numerous studies have shown a strong negative correlation between elk use of an area and the density of open roads even if those roads are only lightly traveled (Frederick 1991).

Lyon (1983) describes the underutilization of habitat along open roads by elk and developed a road density model that showed that an increase in open road density (ORD) results in a non-linear decrease in HE. The road density model from Lyon (1983) was used to derive the approximate HE level for the PSU and MAs within the PSU.

The KFP includes ORD standards for four MAs. ORD is measured as miles of open roads per square mile (mi/mi^2). The KFP standard for ORD in MA 12 (managed for big game summer range and timber production) is no more than 0.75 mi/mi^2, which equates to 68 percent HE (Lyon 1984). Meeting the ORD standard means that lands within this MA are providing important habitat for elk. On MAs 15, 16, 17, and 18, the KFP ORD standard is no more than 3.0 mi/mi^2, which equates to 38 percent HE. The KFP does not provide ORD standards for winter range (MAs 10 and 11); road use and timber harvest activities would normally be restricted during the winter in these MAs (December 1 to April 30).

All lands within the Silverfish PSU could provide elk habitat, including other MAs such as MA 2 (semi-primitive non-motorized recreation), MA 13 (old growth), and MA 14 (grizzly bear habitat). Determining HE levels only for those MA's with an ORD standard does not always reflect the amount of land useable by elk within the analysis area; therefore ORD, and the corresponding HE, were calculated for all National Forest system lands in the Silverfish PSU.

Christensen *et al*. (1993) defined levels of HE for elk management depending on the desired condition for elk in the management area. Where elk are a primary consideration for management, HE should be ≥ 50 percent (corresponding ORD of >1.85 mi/mi^2), while areas with HE levels ≥ 70 percent (corresponding ORD of 0.65 mi/mi^2) is expected to retain high elk use.

Effects of the alternatives on HE were evaluated based on ORD for National Forest System lands in MA 12, for the combined MAs 15, 16, 17 and percent HE on National Forest System lands in the Silverfish PSU. In all transmission line alternatives, the KNF would designate lands within a 500-foot corridor of the selected 230-kV transmission line on National Forest System lands as MA 23. This MA change would apply only to National Forest System lands currently not MA 23 but included in the right of way by any transmission line alternative, and would not apply to private lands crossed by the transmission line alternatives. ORD in MA 12 was calculated assuming all MA 12 within a 500-foot corridor of all transmission line alternatives would be changed to MA 23.

Security Habitat

Security areas are defined as areas that are larger than 250 contiguous acres in size and more than 0.5 mile from an open road (Hillis *et al*. 1991). Security habitat offers elk refuge and reduces their vulnerability during the hunting season. The size and availability of secure habitat can influence the age structure and composition of a herd (Leptich and Zager 1991; Unsworth and Kuck 1991; Lyon *et al*. 1997; Servheen *et al*. 1997; Jellison 1998; Canfield *et al*. 1999; FWP 2004a).

The KFP has no standard for security areas. A panel of state and federal wildlife biologists convened in 1996 to produce the document entitled "Integrating Kootenai National Forest Plan and Fish, Wildlife & Parks Elk Management Plan Final Task Force Report" (KNF and FWP 1997) which identifies security as an important component of elk habitat and indicated that it should be quantified based on methods used by Hillis *et al.* (1991). Hillis *et al*. (1991) recommends maintaining at least 30 percent of an elk's fall use area as security habitat. Because elk fall use areas could be anywhere within a PSU, the 30 percent minimum elk security standard is applied to all lands within a PSU. Security levels are defined in Appendix H-B of Johnson (2004a). Effects of the alternatives on elk security were evaluated based on the percent security in the Silverfish PSU.

Key Habitat Features

Moist environments are important to elk, providing high-quality forage, allowing regulation of body temperature, and providing wallowing areas used primarily by bull elk during the breeding season (Lyon *et al.* 1985; Toweill and Thomas 2002). Effects of the alternatives on key habitat features are evaluated based on the acres of wetlands potentially impacted. KFP standards for MAs 11 and 12 include avoidance of wallows, wet meadows and bogs when constructing roads. INFS standards for RHCAs, discussed in detail in section 3.6, *Aquatic Life and Fisheries*, provide additional protection of wallows, wet meadows, and bogs that occur in riparian areas.

Movement Areas

According to KFP direction, activities such as timber harvest should not interfere with wildlife movement patterns, and forested cover should be provided in harvest and thinning areas as movement corridors for wildlife in summer and winter range. In the KNF, movement corridors along ridgetops are especially important for elk. The analysis of impacts on movement corridors was based on District GIS mapping of topographical contours and is available in the Project record.

Alternative Mitigation Measures

The agencies' alternatives would include additional yearlong access changes through the installation of barriers or gates in several roads to mitigate for the loss of big game security and impacts (Figure 35). These road access changes are taken into account in elk HE, elk security, and road density calculations.

Additional road access changes may also occur on land acquired as part of the grizzly bear mitigation proposed by MMC or the agencies (see mitigation plan descriptions in sections 2.4, *Alternative 2- MMC's Proposed Mine*, and section 2.5, *Alternative 3—Agency Mitigated Poorman Impoundment Alternative*). Elk HE, elk security, and road density calculations do not take into account the effect of land acquisition requirement for grizzly bear mitigation.

Other mitigation measures incorporated into MMC's or the agencies' alternatives that could benefit elk include winter construction timing restrictions in elk winter range, prohibiting employees from carrying firearms, and monitoring road-killed animals along mine access roads to determine if improved access resulted in increased wildlife mortality. Impacts on elk on private and State land from the transmission line corridor were evaluated based on FWP winter habitat mapping (Figure 89); elk security generated from KNF roads data; FWP hunting and population data, research, and plans; KNF and FWP information on wildlife linkage and approach areas; and mapping of broad vegetation types shown on Figure 85.

3.25.3.2.2 Affected Environment

The Silverfish PSU is located in elk HD 104, which is one of six hunting districts in the Lower Clark Fork Elk Management Unit (EMU), described in the Statewide Elk Management Plan (FWP 2004a). The FWP evaluates elk population composition and trends based on total elk, calf/cow ratios, and bull/cow ratios observed during sampling surveys of a portion of the HD referred to as trend areas, harvest data, and hunter effort data (Brown, pers. comm. 2008). The area near the proposed mine facilities is not surveyed during trend surveys, and the most recent trend area survey for HD 104 was conducted in 2008 (FWP 2013a). No surveys were conducted for HD 104 between 2004 and 2007 (FWP 2013a). The average number of elk observed in the trend area for HD 104 from 1999 to 2008 was 182 elk, including an average of 17 bulls (FWP 2013a). Trend area survey goals established by the Statewide Elk Management Plan for HD 104 are between 180 and 270 elk (FWP 2004b). Heavy snowfall during the winter of 1996 to 1997 in northwest Montana resulted in higher than average winter mortality and poor calf production the following spring.

The elk population in northwest Montana has increased since the winter of 1996 to 1997 and remains stable (FWP 2004a; USDA Forest Service 2008c; FWP 2013b). Overall, the elk population in HD 104 has stabilized. Although high snowfall during the winter of 2007 to 2008 resulted in relatively high elk mortality and low calf production, impacts were significantly less than from the winter of 1996 to 1997 (Brown, pers. comm. 2008). During 2013, elk numbers in the lower Clark Fork EMU were stable with good calf and bull numbers seen during spring surveys (FWP 2013b).

The eastern segments of the transmission line alternatives would occur in HD 103, which is in the Salish EMU. An annual average of 164 elk, including 13 bulls, was observed during trend area surveys in HD 103 from 1977 to 2003 (FWP 2007a). Trend area survey goals for HD 103 are 260 elk (FWP 2007a). Some of the larger concentrations of elk in HD 103 occur in the Fisher and Thompson River valleys.

The KNF's 2007 Monitoring and Evaluation Report (USDA Forest Service 2008c), concluded that the elk population on the KNF appears to be increasing in the last few years based on FWP data. Observations made during FWP surveys counted a minimum of 1,951 elk in 2007, an increase of at least 173 individuals since the last reporting period in 2002. Since 1998, hunting season regulations changed allowing harvest of branch antlered bulls and cows by permit. This increase in population has reduced the average number of days needed to harvest an elk and has allowed FWP to increase the number of permitted cow/calf tags each season. Increased road restrictions and decommissioning in the last 20 years has improved elk security on the KNF, likely contributing to the population increase and steady numbers of large bulls observed since 2002.

Cover/Forage

As of the end of 2007, elk summer range in the Silverfish PSU is comprised of 99 percent cover and 1 percent forage habitat, while MAs 10 and 11 are comprised of 97 percent cover and 3 percent forage habitat. Cover to forage ratios in the Silverfish PSU indicate that the proportion of forage habitat is well below recommended levels. As noted in the Statewide Elk Management Plan (FWP 2004b), the quality of winter elk forage productivity is declining in the Lower Clark Fork EMU due to conifer encroachment, noxious weed infestations, and aging shrubs. The proportion of thermal cover in winter range (MAs 10 and 11) is 21 percent, which is below the 40 percent minimum recommended by Summerfield (1991). Research conducted by Cook *et al.* (1998) suggests that thermal cover may not enhance elk condition. MAs 15, 16, and 17 in the Silverfish PSU consist of 86 percent thermal and hiding cover combined, which is greater than the KFP recommended 15 percent minimum.

Most past harvest areas have recovered to the point they are no longer considered openings and contribute to the high cover to forage ratio in the PSU; there are 15 existing openings greater than 40 acres within proposed activity areas. Covered movement areas are found throughout the Silverfish PSU. Historically, wildfire would create a mosaic of successional stages and result in vegetative diversity in this area. In contrast, fire suppression and past timber management has resulted in a trend toward homogenous stand composition and structure consisting of high density stands of shade-tolerant species (see section 3.22, *Vegetation*) that reduce the presence and productivity of understory forage species. In summary, the PSU is currently outside the desired conditions for elk and other big game species with high cover and limited forage availability.

Habitat Effectiveness, Security Habitat, and Open Road Density

The existing MA 12 ORD of 1.29 mi/mi^2 equates to a HE of 57 percent, which does not meet the KNF ORD standard and has less effective habitat. The current ORD of 0.9 mi/mi^2 in MAs 15, 16, 17, and 18 with a corresponding HE of 66 percent meets (is less than the maximum allowed) KFP ORD standard and consequently has more effective habitat.

The high elk emphases rating for the Silverfish PSU is reflected by existing elk security habitat (57 percent) and HE (72 percent) that are greater than minimum levels recommended by Hillis *et al*. (1991) and Christensen *et al*. (1993).

Forage Openings

The Silverfish PSU contains 15 openings greater than 40 acres. The distance to cover may discourage elk from foraging in portions of these openings.

Key Habitat Features

Wetland that may provide potential wallowing areas for elk are described in section 3.23, *Wetlands and Other Waters of the U.S.*

Movement Areas

Movement corridors along ridgetops are especially important for elk, and most of these areas or travel ways are intact and providing hiding cover. Following a process developed by Servheen *et al.* (2003) and the Interagency Grizzly Bear Committee (IGBC) (2004), the KNF identified a wildlife approach area in the Fisher River valley between the Barren Peak and Teeters Peak areas to the west of US 2, and the Kenelty Mountain and Fritz Mountain areas to the east of US 2 (Brundin and Johnson 2008). An approach area is a zone of habitat where wildlife can safely and securely cross and move away from highways, railways, rivers, or other features that fragment habitat, impede movements, and elevate mortality risk. US 2 in the Fisher River valley between Raven and Brulee creeks (Figure 89) is a crossing area for many species of wildlife, including elk, white-tailed deer, grizzly bear, and moose migrating between summer ranges in the Cabinet Mountains and winter ranges in the Salish Mountains (Brown, pers. comm. 2008).

Impacts on Elk on State or Private Lands

Elk winter range is shown on Figure 89. The Montanore Project potentially affects elk winter range in the Fisher River and West Fisher Creek corridors and the southern exposures of Miller Creek. The majority of state and private land is heavily roaded and does not provide security habitat for elk (Figure 89).

Private land occupies the areas adjacent to US 2 in the wildlife approach area described above, most of which is heavily roaded and has been logged in the past 20 to 30 years. Regeneration has occurred on some of the logged stands, providing potential hiding cover.

3.25.3.2.3 Environmental Consequences

Impacts on elk habitat and percent elk security, habitat effectiveness, and open road densities in the Silverfish PSU and private and State lands in the analysis area from the various project features of the transmission line alternatives are shown in Table 197 and Table 198, and described in the following subsections. Elk is the MIS for the Silverfish PSU. Impacts associated with the mine alternatives would be limited to the Crazy PSU, where the white-tailed deer is the MIS for general forest species. Impacts on white-tailed deer in the Crazy PSU are described in the *White-tailed Deer* subsection.

Alternative A – No Transmission Line

No direct effects from alternative A would occur. Alternative A would not impact elk habitat and would maintain the existing vegetation condition on the landscape, including cover forage ratios, security habitat, and HE within the Silverfish PSU. Over time, with continued fire suppression and lack of active forest management, indirect effects of this alternative would include a continued trend toward later successional habitats. Forage habitat would decrease over time unless harvest or other stochastic events, such as a wildfire or windstorm, created additional forage. If these events resulted in large openings being created, new forage habitat may not be available to elk due to lack of cover within 600 feet. Until hiding cover develops (about 15 to 20 years, depending on site conditions), individual animals may be more vulnerable to predation and hunting mortality in areas where large openings develop following wildfire.

Table 197. Impacts on Elk Habitat by Transmission Line Alternative.

Habitat Component	[A] No Transmission Line	[B] North Miller Creek	[C-R] Modified North Miller Creek	[D-R] Miller Creek	[E-R] West Fisher Creek
Silverfish PSU					
Percent Cover/Forage Summer Range[1] Guide is 60/40	99/1	99/1	99/1	99/1	99/1
Percent Cover/Forage in MAs 10 and 11[2] Guide is 60/40	97/3	96/4	96/4	96/4	95/5
Percent Thermal Cover in MAs 10 and 11[2] Standard is 30/70 Guide is >40%	21	20	21	21	21
Percent Cover in MAs 15, 16, and 17 Standard is ≥ 15%	92 (>15)	92	90	88	92
# Openings >40 acres[3]	15	16	16	16	16
Key Habitat Features Potentially Affected (acres)[4]	NA	4	2	2	2
# Movement Areas Affected[5]	NA	2	4	3	2
All Lands in Analysis Area					
Elk Winter Range Impacted (acres)[6]	NA	124	161	128	103
State and Private Lands					
Elk Winter Range Impacted (acres)[6]	NA	97	108	108	97

NA = Does not apply.
[1] Elk summer range includes all MAs except MAs 10 and 11.
[2] MAs 10 and 11 are managed for big game winter range; all MA 10 and 11 within a 500-foot corridor of the transmission line centerline would be reallocated to MA 23.
[3] The transmission line corridor is counted as one opening. No portion of the corridor would be greater than 600 feet to cover.
[4] Key habitat features such as bogs, wallows, and wet meadows are represented by wetlands, as described in section 3.23, *Wetlands and Other Waters of the U.S.* Values shown are wetlands and streams within clearing area of the transmission line alternatives from Table 186.
[5] Movement areas are represented by ridgelines of third order or larger drainages.
[6] Based on 2008 FWP mapping.
Source: GIS analysis by ERO Resources Corp. using KNF data and 2008 FWP mapping.

Table 198. Effects to Elk Habitat Components on National Forest System Land in the Silverfish PSU by Transmission Line Alternative.

Habitat Component	[A] No Transmission Line	[B] North Miller Creek		[C-R] Modified North Miller Creek		[D-R] Miller Creek		[E-R] West Fisher Creek	
		Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]
Percent Security Habitat[3] Guide is >30	57	55	57	54	57	56	57	56	57
Percent Habitat Effectiveness Guide is ≥ 50 percent	72	69	72	69	72	69	72	69	72
Percent Habitat Effectiveness in MA 12[4] Guide is >68 percent	57	56	57	57	57	57	57	53	57
Percent Habitat Effectiveness in MAs 15, 16, 17,and 18[4] Guide is >38 percent	62	62	62	58	62	59	69	62	62
ORD in Silverfish PSU (mi/mi^2) Guide is <1.9 mi/mi^2	0.62	0.69	0.62	0.71	0.62	0.69	0.62	0.68	0.62
ORD in MA 12 (mi/mi^2)[5] Standard is ≤0.75	1.29	1.35	1.30	1.31	1.30	1.30	1.29	1.64	1.30
ORD in MAs 15, 16, 17, and 18 (mi/mi^2) Standard is <3.0	0.9	1.0	0.9	1.4	0.9	1.5	0.9	0.9	0.9

[1] Const = during transmission line construction.
[2] Ops = during transmission line operations.
[3] Security habitat is calculated by buffering all roads open during the fall (October 15 to November 30) by 0.5 mile. The remaining total area, which may consist of one or more habitat blocks greater than 250 acres, equals security habitat. Security habitat may include State and private lands, but no elk security habitat occurs on private or State land in the analysis area.
[4] Habitat Effectiveness is based on the relationship between open road density and habitat effectiveness, as described in Appendix H of Johnson (2004a).
[5] All MA 12 within a 500-foot corridor of the transmission line centerline would be reallocated to MA 23. Alternative A reflects the existing MA and ORD prior to reallocation. MA reallocation was taken into account in the action alternative road density calculations.
ORD = open road density.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Introduced species that are often unpalatable to elk would continue to spread in the analysis area, displacing native forage species. Current Forest Service, state, and county-wide noxious weed management practices would continue to reduce noxious weed infestations. Overall, elk populations are expected to be maintained at a level commensurate with the available suitable habitat.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Cover/Forage

In Alternative B, cover relative to forage habitat on Forest System land would decrease by 1 percent to 96 percent in MAs 10 and 11 and percent thermal cover relative to forage in MAs 10 and 11 would decrease by 1 percent to 20 percent in the Silverfish PSU (Table 197). Percent cover relative to forage habitat in summer range and percent cover in MAs 15, 16, and 17 in the Silverfish PSU would not change as a result of Alternative B. Alternative B would include the reallocation of MAs 10 and 11 in a 500-foot corridor along the transmission line to MA 23, which does not have a cover/forage standard. All disturbed areas, such as access roads, pulling and tensioning sites, and transmission line clearing areas, would be seeded with grass and shrub species after transmission line construction. Areas where trees were trimmed, but otherwise not disturbed, would be allowed to establish naturally as grassland or shrubland. Once vegetation is re-established, disturbed areas of winter range would provide additional forage habitat as forage species become established, thereby moving elk habitat conditions in the Silverfish PSU toward KFP objectives. Roads built for the installation of the transmission line would be redisturbed during line decommissioning. After the transmission line was removed, all newly constructed roads would be bladed, contoured, and seeded. Once vegetation re-established, redisturbed areas would provide forage habitat. Alternative B would increase the spread and establishment of noxious weeds and other introduced species associated with surface disturbance. Alternative B would have the largest area of surface disturbance associated with new or upgraded road construction and timber clearing of all transmission line alternatives, but would have the least area of vegetation clearing. Surface disturbances and continued road use would increase the risk of spread of noxious weed and other introduced species that are unpalatable to elk. New roads would be reseeded as an interim measure, but used for maintenance activities, as necessary. MMC's weed control and other BMPs would be implemented. Current populations of elk would likely be maintained in Alternative B because changes to cover to forage ratios would be 1 percent or less, and because while cover would decrease relative to forage, the Silverfish PSU provides an abundance of cover.

Open Road Density, Security Habitat, and Habitat Effectiveness

Alternative B includes an access change in NFS road #4724 from April 1 to June 30 to mitigate for impacts on grizzly bears. The seasonal access change in NFS road #4724 is taken into account in ORD calculations but would not affect percent elk security habitat as motorized access could occur during the fall hunting season.

Within the Silverfish PSU MA 12 ORD at 1.29 mi/mi^2 currently does not meet the KFP standard (Table 198). Alternative B would include the reallocation of MA 12 in a 500-foot corridor along the transmission line to MA 23. During Alternative B line construction, MA 12 ORD in the Silverfish PSU would increase to 1.35 mi/mi^2 due to new or opened roads located on MA 12 lands outside the 500 –foot transmission line corridor and would require a site-specific KFP amendment to exceed the MA 12 standard for ORD. Specifically, the site specific amendment for temporary increases in ORD would apply to MA 12 in the northwest quarter of section 16 T2N, R30W. During operations MA 12 ORD would lower to (1.30 mi/mi^2), slightly higher than existing conditions. The alternative also increases ORD to 1.0 mi/mi^2 in MAs 15, 16, 17, and 18, where the KFP standard would be met (Table

198). ORD would return to existing conditions in MAs 15, 16, 17, and 18 during transmission line operations.

During Alternative B line construction, ORD in the Silverfish PSU would increase to 1.35 mi/mi^2 in MA 12, where ORD is currently worse than the KFP standard and would require a site-specific KFP amendment to exceed the MA 12 standard for ORD. The alternative also increases ORD to 1.0 mi/mi^2 in MAs 15, 16, 17, and 18, where the KFP standard would be met (Table 198). Alternative B would include the reallocation of MA 12 in a 500-foot corridor along the transmission line to MA 23. Where new or opened roads associated with Alternative B would be outside the 500-foot transmission line corridor. Specifically, the site-specific amendment for temporary increases in ORD would apply to MA 12 in the northwest quarter of section 16 T2N, R30W.

Alternative B would decrease both percent elk security habitat and HE in the Silverfish PSU by 2 percent during construction; both measurement criteria would remain better than recommended guideline minimum levels. During construction, HE would decrease by one percent in MA 12, but would remain at existing levels in MAs 15, 16, 17, and 18. During transmission line operations, security habitat and HE would return to existing levels.

The transmission line corridor would cross a 2,108-acre block of elk security habitat in the Miller Creek drainage in the Silverfish PSU (Figure 89). The transmission line clearing area in the Miller Creek drainage would include 35 acres of elk security habitat. Some of this area would not be cleared because it would be in a valley that would be spanned by the transmission line, or is currently fairly open habitat due to past regeneration harvest. Clearing of about 0.5 mile (9 acres) of elk security habitat would provide improved access for forest users along the ridgeline between the Miller Creek and Midas Creek drainages, reducing the effectiveness of security habitat for elk during the big game hunting season for the duration of the project. After the transmission line was decommissioned, forest cover would return slowly to the clearing area and elk security habitat would return to pre-mine conditions.

Although the new road prism in Alternative B would remain during transmission line operations, roads opened or constructed for transmission line access would be gated or barriered on National Forest System lands after transmission line construction. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction. During the final Closure Phase following mine closure, the transmission line would be removed, roads and other areas of surface disturbance reclaimed on National Forest System land, and trees along the line allowed to grow. The increase in ORD and the decrease in security habitat and habitat effectiveness could displace individual elk to less disturbed areas in the short term, until transmission line construction was complete. In Alternative B, no construction would occur during winter (assumed to be December 1 to April 30) on winter range, and no motorized activity would occur from April 1 to June 15 in bear habitat in the Miller Creek and Midas Creek drainages. The winter and spring construction timing restrictions would reduce displacement effects. Because percent security habitat and habitat effectiveness would remain above recommended levels during Construction and Operations Phases (Table 198), and because transmission line disturbance would be short-term, overall populations would not likely be affected.

Habitat effectiveness and percent security do not take into account the potential effects of disturbance from helicopter use during line stringing. Helicopter use could contribute to short-term displacement of individual elk from the transmission line corridor. Helicopter use for line stringing would occur during a relatively short period (about 10 days). Except for annual inspection and infrequent maintenance operations, helicopter use and other construction activities would cease after transmission line construction until decommissioning. Helicopter use and other activities could result in short-term disturbance of elk during line decommissioning. Overall elk populations would not likely be affected by helicopter activity because sufficient security habitat would be available for any elk displaced due to short-term disturbance, and because construction timing restrictions would reduce the extent of potential displacement effects.

Forage Openings

One opening in forest cover greater than 40 acres would be created by Alternative B. No point in the transmission line clearing area would be greater than 600 feet from cover.

Key Habitat Features

The clearing area for Alternative B would include about 4 acres of wetland habitat providing potential wallowing areas for elk. Direct effects to wetlands are expected to be mostly avoided by placement and location of transmission line facilities and roads outside of wetlands and streams. Less than 0.1 acre of wetlands and streams would be affected by new or upgraded road construction.

Movement Areas

Alternative B could interfere with elk movement in the Silverfish PSU where it followed the ridges between Midas Creek and Howard Creek, and Midas Creek and the unnamed tributary to Miller Creek. Elk could be discouraged from using these areas during transmission line construction due to increased noise from helicopters and machinery and the presence of humans, but these effects would be short-term. The width of clearing area would not likely be great enough to affect elk movement in this area after the Construction Phase because sufficient cover would be present.

The eastern segment of the Alternative B transmission line alignment would occur within the wildlife approach area in the Fisher River valley in the description of the affected environment above. The proximity of this alignment to US 2 would result in a widening of disturbed area and could potentially discourage elk movement within the approach area by decreasing cover. Transmission line construction activities could cause elk to change their traditional movement patterns within this approach area, but these effects would be short-term because human-caused disturbance directly related to the project would cease when the transmission line construction were completed. Once revegetated, cleared areas could provide additional forage habitat. Some shrub and tree cover would be maintained in the transmission line right-of-way because only the largest trees would be removed, and would continue to provide cover. Given that most of the approach area potentially affected by Alternative B is generally heavily roaded and has been logged in the past 20 to 30 years, and because of the short-term nature of human-caused disturbance, it is not likely that elk movement within the approach area would be greatly affected by Alternative B.

Impacts on Elk on State and Private Lands

Alternative B would not affect State lands. Alternative B would affect about 124 acres of elk winter range on all lands in the analysis area, including 97 acres on private lands, primarily in the Miller Creek drainage and along the Fisher River valley (Table 197 and Figure 89). Direct impacts on winter range would include a reduction in thermal and hiding cover and, once the transmission line corridor was revegetated, an increase in forage habitat. Short-term disturbance impacts in elk winter range from transmission line construction would be minimized by restricting construction in elk winter range. Alternative B would result in increases in road densities on private lands. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction, but could result in a reduction of elk security habitat and increased elk mortality if hunting access were allowed. Short-term habitat displacement could occur in the analysis area during transmission line construction as a result of increased road use during construction and helicopter use during line stringing. Helicopter use could contribute to short-term displacement of individual elk from the transmission line corridor. Helicopter use for line stringing would occur during a relatively short period (about 10 days), Except for annual inspection and infrequent maintenance operations, helicopter use and other construction activities would cease after transmission line construction until decommissioning. Helicopter use and other activities could result in short-term disturbance of elk during line decommissioning. Because private lands generally have high road densities and have been logged in the past 20 to 30 years, and because of the short-term nature of human-caused disturbance, overall, elk populations on private land, including the Sedlak Park Substation and loop line, would not likely be affected by Alternative B.

Private land in the eastern segment of the Alternative B transmission line alignment would occur within the wildlife approach area in the Fisher River valley described above for the affected environment. Potential effects of Alternative B, including construction of the Sedlak Park Substation and loop line, on elk use of the wildlife approach area would be the same as described above for National Forest System lands.

The risk of replacement of native forage species with unpalatable species would be the same as described above for National Forest Systems lands, except that new roads on private land would not be reseeded, potentially increasing the spread of noxious weeds and reducing available forage.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

Cover/Forage

The effects of Alternative C-R on cover-to-forage ratios in the Silverfish PSU would be the same as Alternative B, except that Alternative C-R would not reduce the percent thermal cover in MAs 10 and 11, but would reduce percent cover in MAs 15, 16, and 17 by 2 percent in the Silverfish PSU. Current populations of elk would likely be maintained in Alternative C-R because changes to cover to forage ratios would be 2 percent or less, and because while cover would decrease relative to forage, the Silverfish PSU provides an abundance of cover.

The effects of Alternative C-R on the risk of replacement of native forage species with unpalatable introduced species would be less than those described for Alternative B. The agencies' noxious weed mitigation measures would be implemented in the agencies' transmission line alternatives. To the extent possible, MMC would survey all proposed ground disturbance areas for noxious weeds before initiating disturbance. Where noxious weeds were found, MMC would treat infestations the season before the activity was planned. For example, if timber clearing were planned to be in the spring or early summer, the survey and control would be implemented the previous fall. Areas surveyed would include all areas designated for timber removal. MMC would describe in final design plans the extent of which surveys and pretreatment would not be feasible. The proposed survey and treatment approach would be a part of the final Weed Control Plan, to be reviewed and approved by the lead agencies. Helicopter use for vegetation clearing in some areas would minimize the potential for exotic species introduction associated with road construction or improvement and the extent of vegetation clearing would be greater. The agencies' modifications to MMC's proposed weed control plan for Alternative B would more effectively control the spread of weeds, minimizing the replacement of forage species.

Open Road Density, Security Habitat, and Habitat Effectiveness

Alternative C-R would include access changes (installation of barriers or gates and public access restrictions) in several roads to mitigate for the loss of big game security and impacts on grizzly bear (Figure 35). These access changes are taken into account in security, HE, and ORD calculations.

Within the Silverfish PSU MA12 ORD at 1.29 mi/mi^2 currently does not meet the KFP standard (Table 198). Alternative C-R would include the reallocation of MA 12 in a 500-foot corridor along the transmission line to MA 23 prior to activity. During Alternative C-R line construction, MA 12 ORD in the Silverfish PSU would increase to 1.31 mi/mi^2 due to new or opened roads located outside the 500-foot transmission line corridor. During operations MA 12 ORD would lower to 1.30 mi/mi^2. Alternative C-R would require a site specific KFP amendment for exceeding ORD in MA 12 during construction and operations in the northwest quarter of section 16 T27N, R30W. During construction, Alternative C-R would increase ORD to 1.4 mi/mi^2 in MAs 15, 16, 17, and 18, where the KFP standard is met (Table 198). During operations, ORD would return to existing conditions in MAs 15, 16, 17, and 18.

Alternative C-R would decrease percent elk security habitat and HE in the Silverfish PSU by 3 percent, respectively, during construction; both measurement criteria would remain better than the KFP-recommended minimum levels and would return to existing conditions during operations.

The transmission line corridor in Alternative C-R would cross a 2,108-acre block of existing elk security habitat in the Miller Creek drainage and a 1,597-acre block of existing elk security habitat in the West Fisher Creek drainage (Figure 89).). Although the transmission line clearing area in these segments of Alternative C-R would include more elk security habitat than Alternative B (about 59 acres for Alternative C-R), the general effects on forest user access of the clearing area would be the same as Alternative B.

The status of new or opened roads associated with Alternative C-R would be the same as Alternative B, except that on National Forest System lands, the status of roads opened or constructed for transmission line access would be changed to intermittent stored service after line installation was completed. Like Alternative B, in Alternative C-R the road prism would remain and new roads would be gated or barriered on National Forest System land after transmission line construction. In Alternative C-R, new transmission line roads on National Forest System lands would be decommissioned and revegetated after closure of the mine and removal of transmission line. The increase in ORD and the decrease in security habitat could displace individual elk to less disturbed areas in the short term, until transmission line construction was complete. In Alternative C-R, all construction and decommissioning activities on National Forest System and State lands would occur between June 16 and October 14, eliminating construction disturbance during winter and spring. Because percent security habitat and HE would remain above recommended levels during Construction and Operations Phases (Table 198), and because transmission line disturbance would be short-term, overall populations would not likely be affected.

HE and percent security do not take into account the potential effects of helicopter use during construction. Helicopter use could contribute to short-term displacement of individual elk from the transmission line corridor. In Alternatives C-R, D-R, and E-R, two seasons of helicopter construction would occur and the total duration of helicopter use each season would be about 2 months because helicopters would be used for vegetation clearing and structure construction. The type and duration of impacts from helicopter use for line stringing would be the same as Alternative B (about 10 days). Except for annual inspection and infrequent maintenance operations, helicopter use and other construction activities would cease after transmission line construction until decommissioning. Helicopters use and other activities could result in short-term disturbance of elk during line decommissioning. Overall elk populations would not likely be affected by helicopter activity because sufficient security habitat would be available for any elk displaced due to short-term disturbance.

Forage Openings

New forage openings would be the same for Alternative C-R as Alternative B.

Key Habitat Features

The clearing area for Alternative C-R would include about 2 acres of wetland habitat providing potential wallowing areas for elk. Direct effects to wetlands are expected to be mostly avoided by placement and location of transmission line facilities and roads outside of wetlands and streams.

Movement Areas

Alternative C-R may interfere with elk movement where it would follow the ridges between Midas Creek and Howard Creek, Midas Creek and the unnamed tributary to Miller Creek, and Miller Creek and West Fisher Creek and the east-facing ridge north of the Sedlak Park Substation. Elk could be discouraged from using these areas during transmission line construction due to increased noise from helicopters and machinery and the presence of humans, but these effects would be short-term. The width of clearing area would not likely be great enough to affect elk movement in this area after the Construction Phase because sufficient cover would be present.

A relatively small segment of the Alternative C-R transmission line would cross the Fisher River valley in the wildlife approach area, potentially discouraging elk movement in a localized area due to transmission line construction activities. These effects would be short-term because human-caused disturbance directly related to Alternative C-R would cease when the transmission line construction was completed. Given that the area of the approach area potentially affected by Alternative C-R is generally heavily roaded and has been logged in the past 20 to 30 years, and because of the short-term nature of human-caused disturbance, it is not likely that this alternative would greatly affect elk movement within the approach area.

Impacts on Elk on State and Private Lands

Alternative C-R would affect about 161 acres of elk winter range on all lands in the analysis area, including 108 acres on state and private lands, primarily in the Miller Creek, West Fisher Creek, and Fisher River drainages (Table 197 and Table 198). Direct impacts on winter range would include a reduction in thermal and hiding cover and, once the transmission line corridor was revegetated, an increase in forage habitat. Short-term disturbance impacts in elk winter range from transmission line construction would be minimized by restricting construction during the winter. Alternative C-R would result in increases in road densities on state and private lands. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction, and could result in a reduction of elk security habitat and increased elk mortality if hunting access were allowed. Short-term habitat displacement could occur in the analysis area during transmission line construction as a result of increased road use and helicopter use during line stringing. Short-term impacts on private land from road and helicopter use would be the similar to Alternative B, but less extensive for Alternative C-R. Within the Silverfish PSU, short-term impacts on State trust lands from road and helicopter use would be similar to impacts on National Forest System lands. This is because mitigations applied to State trust land would be consistent with mitigations applied to affected National Forest System lands. Private land in the analysis area currently has high road densities and overall elk populations would not likely be affected. Because State and private lands generally have high road densities and have been logged in the past 20 to 30 years, and because of the short-term nature of human-caused disturbance, overall, elk populations on private and State land, including the Sedlak Park Substation and loop line, would not likely be affected by Alternative C-R.

Private and State land in the eastern segment of the Alternative C-R transmission line alignment would occur within the wildlife approach area. The segment of Alternative C-R that would parallel US 2 would be primarily on private land, would be located upslope and out of the Fisher River valley, and would not likely affect elk movement in the approach area. Other potential effects of Alternative C-R on elk use of the wildlife approach area would be the same as described above for National Forest System lands.

Alternative D-R – Miller Creek Transmission Line Alternative

Cover/Forage

Alternative D-R would have the same effect on the proportion of cover relative to forage habitat as Alternative C-R, except that Alternative D-R would reduce percent cover/forage in MAs 15, 16, and 17 in the Silverfish PSU by 4 percent.

The effects of Alternative D-R on the quality of forage due to the introduction of unpalatable species are similar to those described for Alternative C-R, except that the risk of replacing forage species with introduced species would be greater due to a longer clearing area.

Open Road Density, Security Habitat, and Habitat Effectiveness

Alternative D-R would include the same road access changes described for Alternative C-R, except that in Alternative D-R the entire length of NFS road #4725 would be closed before transmission line construction (Figure 35). Other than the differences in access to NFS road #4725, the status, use, and reclamation of new or opened roads associated with the transmission line would be the same for Alternative D-R as Alternative C-R.

The current ORD for MA 12 lands of 1.29 mi/mi^2 within Silverfish PSU exceeds the KFP standard (Table 198). Alternative D-R would include the reallocation of MA 12 in a 500-foot corridor along the transmission line to MA 23. During Alternative D-R line construction, ORD in MA 12 would increase to 1.30 mi/mi^2 due to new or opened roads located outside the 500-foot transmission line corridor. During operations, MA 12 ORD would return to the existing condition. During both construction and operations, Alternative D-R would require a site specific KFP amendment for MA 12 for temporary increases in ORD, and exceeding current KFP standards respectively. These MA changes would occur in the southeast quarter of section 19 T27N, R30W.

Within the Silverfish PSU, existing ORD for lands in MAs 15, 16, 17, and 18 is at 0.9 mi/ mi^2 and meets the KFP standard, (Table 198). ORD for these MAs would increase to 1.5 mi/ mi^2 during construction and would return to existing conditions during operations.

During construction, Alternative D-R would decrease percent elk security habitat and HE in the Silverfish PSU by 1 and 3 percent, respectively; both measurement criteria would remain better than the KFP-recommended minimum levels. Percent elk security and HE in the Silverfish PSU would return to existing conditions during operations.

Alternative D-R would include the reallocation of MA 12 in a 500-foot corridor along the transmission line to MA 23. Where new or opened roads associated with Alternative D-R would be outside the 500-foot transmission line corridor, a site specific KFP amendment would be required to allow for exceedance of the ORD standard in MA 12 during transmission line construction and operations. Specifically, the KFP amendment for temporary increases in ORD would apply to MA 12 in the southeast quarter of section 19 T27N, R30W.

Like Alternative C-R, the transmission line corridor in Alternative D-R would cross the edge of a 1,597-acre block of existing elk security habitat in the West Fisher Creek drainage (Figure 89). The transmission line clearing area in this segment of Alternative D-R would include about 11 acres of elk security habitat. The effects on forest user access of clearing would be the same as Alternative B. After the transmission line was decommissioned, forest cover in the clearing area would slowly return to pre-mine conditions.

The increase in ORD and the decrease in security habitat could displace individual elk to less disturbed areas in the short term, until transmission line construction was complete. In Alternative D-R, short-term elk displacement due to helicopter construction and stringing the transmission line would be similar to Alternative C-R, except that the extent of helicopter use would be less. In Alternative D-R, all construction and decommissioning activities on National Forest System and State lands would occur between June 16 and October 14, eliminating construction disturbance during winter and spring. Because percent security habitat and HE would remain above recommended levels during operations (Table 198), and because transmission line disturbance would be short-term, overall populations would not likely be affected.

Forage Openings

New forage openings would be the same for Alternative D-R as Alternative B.

Key Habitat Features

The effect on key habitat features would be the same for Alternative D-R as Alternative C-R.

Movement Areas

Like Alternative C-R, Alternative D-R could interfere with elk movement where it followed the east-facing ridge north of the Sedlak Park Substation and crosses the ridges between Miller Creek and West Fisher Creek, and Miller Creek and Howard Creek. Elk could be discouraged from using these areas during transmission line construction due to increased noise from helicopters and machinery and the presence of humans, but these effects would be short-term. The width of clearing area would not likely be great enough to affect elk movement in this area after the Construction Phase because sufficient cover would be present.

Potential effects of Alternative D-R on elk movement in the wildlife approach area would be the same as Alternative C-R.

Impacts on Elk on State and Private Lands

Impacts of Alternative D-R on elk would be the same as Alternative C-R (Table 197 and Figure 89).

Alternative E-R – West Fisher Creek Transmission Line Alternative

Cover/Forage

The effects of Alternative E-R on cover-to-forage ratios in the Silverfish PSU would be the same as Alternatives C-R and D-R except that Alternative E-R would decrease cover relative to forage habitat in MAs 10 and 11 by 2 percent to 95 percent in the Silverfish PSU and would not change the cover-to-forage ratio in MAs 15, 16, and 17. The effects of Alternative E-R on the quality of forage due to the introduction of unpalatable species are similar to those described for Alternatives C-R and D-R, except that the risk of replacing forage species with introduced species would be greater due to a longer clearing area.

Open Road Density, Security Habitat, and Habitat Effectiveness

Alternative E-R would include the same changes in road access for mitigation as described for Alternative D-R. The status, use, and reclamation of new or opened roads associated with the transmission line would be the same for Alternative E-R as Alternative D-R where the transmission line would follow the same alignment. Use and reclamation of new or opened roads in Alternative E-R would differ from Alternative D-R where the two alignments diverged.

Alternative E-R impacts on ORD would be the same as Alternatives C-R and D-R except that during construction, ORD in MA 12 in the Silverfish PSU would increase to 1.64 mi/mi^2 and ORD in MAs 15, 16, 17, and 18 would not change (Table 198). Alternative E-R impacts on percent security habitat and habitat effectiveness would be the same as Alternative D-R. Also, the site specific KFP amendment for exceeding the MA 12 ORD standard outside of the 500-foot transmission line corridor would apply to transmission line construction and operations in the eastern half of section 30, the western half of section 29, the northeastern quarter of section 31, the northwestern quarter of section 32, and the southeast quarter of section 19 T27N, R30W. Unlike Alternatives B, C-R, and D-R, Alternative E-R would not affect ORD in MAs 15, 16, 17, and 18. Short-term elk displacement due to helicopter construction and stringing the transmission line in areas other than elk security habitat would be similar to Alternatives C-R and D-R, except that the linear extent of helicopter activity would be greater.

The increase in ORD and the decrease in security habitat could displace individual elk to less disturbed areas in the short term, until transmission line construction was complete. In Alternative E-R, short-term elk displacement due to helicopter construction and stringing the transmission line would be similar to Alternatives C-R and D-R, except that the extent of helicopter use would be greater. In Alternative E-R, all construction and decommissioning activities on National Forest System and State trust lands would occur between June 16 and October 14, eliminating construction disturbance during winter and spring. Because percent security habitat and HE would remain above recommended levels during operations (Table 198), and because transmission line disturbance would be short-term, overall populations would not likely be affected.

Forage Openings

New forage openings would be the same for Alternative E-R as Alternative B.

Key Habitat Features

The effect on key habitat features would be the same for Alternative E-R as Alternative C-R.

Movement Areas

Alternative E-R could interfere with elk movement where it followed the east-facing ridge north of the Sedlak Park Substation and crossed the ridge between West Fisher and Howard creeks. Elk could be discouraged from using these areas during transmission line construction due to increased noise from helicopters and machinery and the presence of humans, but these effects would be short-term. The width of clearing area would not likely be great enough to affect elk movement in this area after the Construction Phase because sufficient cover would be present.

Potential effects of Alternative E-R on elk movement in the wildlife approach area would be the same as Alternatives C-R and D-R.

Impacts on Elk on State and Private Lands

Alternative E-R would affect the least amount of elk winter range (about 103 acres) on all lands in the analysis area. About 97 acres of elk winter range on state and private land would be affected by Alternative E-R, primarily in the Fisher River and West Fisher Creek drainages (Table 197 and Figure 89). Otherwise, impacts of Alternative E-R on elk on private and State lands would be the same as Alternatives C-R and D-R, except that in Alternative E-R the effects of helicopter use and the risk of replacing forage species with introduced species would be more extensive due to a longer clearing area.

Combined Mine-Transmission Line Effects

Impacts on elk habitat in the analysis area from combined mine-transmission line alternatives are described below and shown in Table 199.

Cover/Forage

The combined mine-transmission line alternatives would not change the percent cover to forage in summer range or the percent of thermal cover in MAs 10 and 11. All alternatives would result in a 1 to 2 percent decrease decreases in cover relative to forage habitat in MAs 10 and 11, with Alternatives 3E-R and 4E-R decreasing cover the most. All transmission line alternatives would include the reallocation of MAs 10 and 11 in a 500-foot corridor along the transmission line to MA 23, which does not have a cover/forage standard. Alternatives 2B, 3E-R, and 4E-R would not affect cover in MAs 15, 16, and 17, while Alternatives 3C-R, 3D-R, 4C-R, and 4D-R would reduce cover in MAs 15, 16, and 17 by 2 to 4 percent. Alternatives 3D-R and 4D-R would have the least impact on cover-to-forage ratios, but would reduce percent cover in MAs 15, 16, and 17 the most (by 4 percent). Cover to forage ratios in the Silverfish PSU indicate that the proportion of forage habitat is well below recommended levels. Current populations of elk would likely be maintained in all combined mine-transmission line alternatives because changes to cover to forage ratios would be 4 percent or less, and because while cover would decrease relative to forage, the Silverfish PSU provides an abundance of cover.

Open Road Density, Security Habitat, and Habitat Effectiveness

Alternative 2B includes an access change in NFS road #4724 from April 1 to June 30 to mitigate for impacts on grizzly bears and the agencies' alternatives would include access changes (installation of barriers or gates and public access restrictions) in numerous roads to mitigate for the loss of big game security and impacts on grizzly bear (Figure 35). These access changes are taken into account in security, habitat effectiveness, and ORD calculations.

Table 199. Impacts on Elk Habitat by Combined Mine-Transmission Line Alternative.

Measurement Criteria	[1] No Mine/ Existing Conditions	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Little Cherry Creek Impoundment Alternative		
	TL-A	TL-B	TL-C-R	TL-D-R	TL-E-R	TL-C-R	TL-D-R	TL-E-R
Silverfish PSU								
Percent Cover/forage Summer Range[1] Guide is 60/40	99/1	99/1	99/1	99/1	99/1	99/1	99/1	99/1
Percent Cover/forage in MAs 10 and 11[2] Guide is 60/40	97/3	96/4	96/4	97/3	95/5	96/4	97/3	95/5
Percent Thermal Cover in MAs 10 and 11[2] Standard is 30/70 Guide for elk >40 %	21	21	21	21	21	21	21	21
Percent Cover in MAs 15, 16, and 17 Standard is >15%	92	92	90	88	92	90	88	92
# Openings >40 acres[3]	15	16	16	16	16	16	16	16
Key Habitat Features Potentially Affected (acres)[4]	NA	4	2	2	2	2	2	2
Movement Areas Affected[5]	NA	2	4	3	2	4	3	2
All Lands in Analysis Area								
Elk Winter Range Impacted (acres)[6]	0	124	161	128	103	161	128	103

NA = Does not apply.
Impacts shown are for the transmission line Construction Phase, which represents maximum estimated impacts.
[1] Elk summer range includes all MAs except MAs 10 and 11.
[2] MAs 10 and 11 are managed for big game winter range; all MAs 10 and 11 within a 500-foot corridor of the transmission line centerline would be reallocated to MA 23.
[3] Transmission line corridor is counted as one opening. Other than the corridor length, no portion of the corridor would be greater than 600 feet to cover.
[4] Key habitat features such as bogs, wallows, and wet meadows are represented by wetlands, as described in section 3.23, *Wetlands and Other Waters of the U.S.* Values shown are wetlands and streams within clearing area of the transmission line alternatives from Table 186.
[5] Movement areas are represented by ridgelines of third order or larger drainages.
[6] Based on 2008 FWP mapping.
Source: GIS analysis by ERO Resources Corp. using KNF data and 2008 FWP mapping.

In all combined mine-transmission line, new road prisms would remain during transmission line operations. Roads opened or constructed for transmission line access would be gated or barriered on National Forest System land after transmission line construction. In the agencies' alternatives, roads on National Forest System lands would be placed into intermittent stored service after line installation was completed. Intermittent stored service roads would be closed to traffic and would be treated so they would cause little resource risk if maintenance were not performed during the operation period of the mine and before their future need. The service roads would not be used for routine maintenance of the transmission line, but could be used for emergency repairs, such as a damaged insulator. During the final Closure Phase following mine closure, the transmission line would be removed, roads reclaimed, and all disturbed areas revegetated. In the agencies' alternatives, roads on National Forest System lands would be decommissioned at mine closure and transmission line decommissioning. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction. Management of newly constructed roads on Plum Creek land after the transmission line was removed would depend on the easement agreement between Plum Creek and MMC.

Habitat effectiveness and percent security do not take into account the potential effects of disturbance from helicopters. Disturbance from helicopter use and other transmission line construction activities are described for Alternatives B, C-R, D-R, and E-R above.

Alternatives 3C-R, 3D-R, 4C-R and 4D-R would increase ORD in MAs 15, 16, 17, and 18 from between 0.2 mi/mi^2 and 0.3 mi/mi^2 during transmission line construction (Table 200). Alternatives 2B and 3E-R and 4E-R would not affect ORD in MAs 15, 16, 17, and 18 during transmission line construction. None of the combined mine-transmission line alternatives would increase ORD in MAs 15, 16, 17, and 18 during operations, and they would decrease by 0.2 mi/mi^2 in Alternatives 3D-R and 4D-R.

During transmission line construction, increases in ORD in MA 12 would range from 0.01 mi/mi^2 for Alternatives 3D-R and 4D-R to 0.35 mi/mi^2 for Alternatives 3E-R and 4E-R. During transmission line operations, ORD in MA 12 would return to existing conditions in Alternatives 3D-R and 3E-R, but would increase by 0.01 mi/mi^2 in Alternatives 2B, 3C-R, 4C-R, 3E-R and 4E-R.

All combined mine-transmission line alternatives would include the reallocation of MA 12 in a 500-foot corridor along the transmission line to MA 23. Where new or opened roads associated with the combined mine-transmission line alternatives would be outside the 500-foot transmission line corridor, a site specific KFP amendment to allow for increased ORD in MA 12 would be necessary. Site specific KFP amendments for increases in ORD in MA 12 would be needed for Alternatives 2B, 3C-R and 4C-R, 3E-R, and 4E-R during transmission line construction and operations, and for Alternatives 3D-R and 4D-R during transmission line construction.

All combined mine-transmission line alternatives would result in 1 to 3 percent less elk security habitat in the Silverfish PSU during transmission line construction. Percent elk security habitat would return to existing levels following transmission line construction.

All combined mine-transmission line alternatives would result in 3 percent less habitat effectiveness in the Silverfish PSU during construction. Following transmission line construction, habitat effectiveness would return to existing levels.

Increases in ORD and the decrease in security habitat and habitat effectiveness could displace individual elk to less disturbed areas in the short term, until transmission line construction was complete. Overall populations would not likely be affected.

Table 200. Effects to Elk Habitat Components on National Forest System Land in the Silverfish PSU by Combined Mine and Transmission Line Alternative.

Measurement Criteria	[1] No Mine/ Existing Conditions	[2] MMC's Proposed Mine		[3] Agency Mitigated Poorman Impoundment Alternative						[4] Agency Mitigated Little Cherry Creek Impoundment Alternative					
		TL-B		TL-C-R		TL-D-R		TL-E-R		TL-C-R		TL-D-R		TL-E-R	
		Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]
Percent Security Habitat[3] Guide is >30 percent	57	55	57	54	57	56	57	56	57	54	57	56	57	56	57
Percent Habitat Effectiveness Guide is ≥ 50 percent	72	69	72	69	72	69	72	69	72	69	72	69	72	69	72
Percent Habitat Effectiveness MA 12[4] Guide is >68 percent	57	56	57	57	57	57	57	53	57	57	57	57	57	53	57
Percent Habitat Effectiveness MAs 15,16, 17, and 18[4] Guide is >38 percent	62	62	62	58	62	59	69	62	62	58	62	59	69	62	62
ORD in Silverfish PSU (mi/mi^2) Guide is <1.9 mi/mi^2	0.62	0.69	0.62	0.71	0.62	0.69	0.62	0.68	0.62	0.71	0.62	0.69	0.62	0.68	0.62
ORD in MA 12 (mi/mi^2)[5] Standard is ≤0.75	1.29	1.35	1.30	1.31	1.30	1.30	1.29	1.64	1.30	1.31	1.30	1.30	1.29	1.64	1.30
ORD in MAs 15, 16, 17, and 18 (mi/mi^2) Standard is,3.0	0.9	0.9	0.9	1.2	0.9	1.1	0.7	0.9	0.9	1.2	0.9	1.1	0.7	0.9	0.9

[1] Const = during mine construction.
[2] Ops = during transmission line operations.
[3] Security habitat is calculated by buffering all roads open during the fall (October 15 to November 30) by 0.5 mile. The remaining total area, which may consist of one or more habitat blocks greater than 250 acres, equals security habitat. Security habitat may include State and private lands, but no elk security habitat occurs on private or State land in the analysis area.
[4] Habitat Effectiveness is based on the relationship between open road density and habitat effectiveness, as described in Appendix H of Johnson (2004a).
[5] All MA 12 within a 500-foot corridor of the transmission line centerline would be reallocated to MA 23.
ORD = open road density.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Overall, road densities, percent security habitat, and habitat effectiveness would likely improve through the grizzly bear land acquisition requirement. Acquired parcels would be managed for grizzly bear use in perpetuity, and could improve road densities, percent security habitat, and habitat effectiveness where roads could be closed. The agencies' land acquisition requirement would likely be more effective at reducing road densities than MMC's proposed land acquisition because more land would be protected.

Forage Openings

In all combined mine-transmission line alternatives, one opening greater than 40 acres would be created. No point in this opening created by the transmission line clearing area would be greater than 600 feet from cover.

Key Habitat Features

The agencies' alternatives would potentially affect 2 acres of wetland habitat providing potential wallowing areas for elk in the Silverfish PSU, while Alternative 2B would potentially impact 4 acres. Direct effects to wetlands are expected to be mostly avoided by placement and location of transmission line facilities and roads outside of wetlands and streams.

Movement Areas

The agencies' alternatives may interfere with elk movement where it followed the east-facing ridge north of the Sedlak Park Substation. Alternative 2B would be located at a lower elevation in the Fisher River valley and would not impact this area. Alternatives 2B, 3C-R, and 4C-R may interfere with elk movement where the transmission lines followed the ridge between Midas Creek and Howard Creek. Potential elk movement along the ridge between Miller Creek and Howard Creek could be affected by Alternatives 4D-R and 4E-R. Elk could be discouraged from using these areas during transmission line construction due to increased noise from helicopters and machinery and the presence of humans, but these effects would be short-term. The width of clearing area would not likely be great enough to affect elk movement in this area after the Construction Phase because sufficient cover would be present.

Wildlife Approach Area

The eastern segment of the Alternative 2B transmission line corridor would occur within the wildlife approach area in the Fisher River valley and relatively small segments of all combined mine-transmission line action alternatives would cross the Fisher River valley in the wildlife approach area. The portions of the combined agencies' alternative transmission lines that would parallel US 2 would be located upslope and out of the Fisher River valley, and would not likely affect elk movement in the approach area. Impacts of the combined mine-transmission line action alternatives on elk in the Fisher River valley wildlife approach area are the same as described for transmission line Alternatives B, C-R, D-R, and E-R above.

Elk Winter Range on All Lands

Impacts on elk winter range from the combined mine-transmission line action alternatives on all lands in the analysis area, including private and State lands, would range between 103 acres and 161 acres. Alternatives 3C-R and 4C-R would have the greatest impacts on winter range, while Alternatives 3E-R and 4E-R would have the fewest impacts on winter range. In all combined mine-transmission line action alternatives, direct impacts on winter range would include a reduction in thermal and hiding cover and, once the transmission line corridor was revegetated, an increase in forage habitat. Short-term disturbance impacts in elk winter range from transmission line construction would be minimized by restricting construction during the winter. All combined action alternatives would result in increased road densities on state and private lands. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction, and could result in a reduction of elk security habitat and increased elk mortality if hunting access were allowed. Short-term habitat displacement could occur in the analysis area during transmission line construction as a result of increased road use and helicopter use. State and private lands including the Sedlak Park Substation and loop line, currently have high road densities and overall elk populations would not likely be affected.

Cumulative Effects

Past Actions and the Existing Condition

Past actions are described in section 3.2, *Past and Current Actions,* shown on Figure 50, and listed in Appendix E.

Forest management practices and other human activities (*e.g.,* hunting, wood consumption, and motorized recreation) have had influential cumulative impacts on elk and other big-game security, as well as measurable fluctuations in cover to forage ratios. While natural events, such as wildfires, can result in dramatic and immediate changes to big-game cover, and will continue to do so, it is the indirect effects of forest management that has likely had the greatest impact on big-game habitat in the form of road construction and associated uses. Use of these roads decrease elk and other big-game security (increasing vulnerability or risk of mortality), decrease habitat availability via temporary displacement, and can increase stress levels of resident species. The formulation and adherence to KFP standards for open and total road densities has been and will continue to be an important tool to mitigate the associated cumulative impacts to elk and other big-game. The current conditions of various elk habitat components are displayed in Table 197 and Table 198.

Past forest management has also contributed positively to elk and big-game habitat. Logging and prescribed burning have worked successfully to cycle forest cover through the many periods of succession. Harvest has occurred in the analysis area since the 1950s and resulted in a diversity of age classes and successional stages that provide forage and cover for elk and other big game species. Roads built associated with this harvest activity increased open roads while reducing habitat effectiveness, as well as improving human access and decreasing security. Detailed descriptions of previous vegetation and road management activities are found in section 3.2, *Past and Current Actions*. In unharvested areas, natural disturbances such as wildfire would have resulted in a mosaic of vegetation successional stages providing a diversity of forage or cover habitat. Fire suppression since the early 1900s in some areas has allowed relatively uninterrupted succession to occur resulting in more homogenous stands with greater canopy closure and reduced potential for forage production.

Activities affecting elk habitat have changed in recent years, with a trend toward reduced motorized access as a result of decisions intended to facilitate grizzly bear recovery. This in turn has benefited elk with the resulting increase in habitat effectiveness and secure habitat available for elk. Since the mid-1990s, there has also been a greater use of intermediate harvest methods, which results in both hiding cover and foraging opportunities occurring in close proximity. Prescribed burning has worked successfully to cycle forest cover through the many periods of succession.

Roads constructed in association with timber harvest, mining, and other development have cumulatively reduced elk security habitat and habitat effectiveness in the analysis area. Development of private lands within the analysis area, including commercial timber harvest, land clearing, home construction, and road construction has contributed to increased disturbance of elk and a loss or reduction in quality of foraging and winter habitat, and is expected to continue. Fire suppression has resulted in the encroachment of conifers into foraging habitat and aging of shrub habitat.

Areas previously impacted by special use permits such as mineral material sites (pits quarries, borrow, roadsides), water developments, utility corridors, private land access routes, and outfitter/guide trails/camps, would continue to be present and utilized. The ground disturbance on resources such as elk winter range, habitat effectiveness and cover is described previously for the affected environment and would have no additional impacts. Other public uses such as wildlife viewing, berry picking, firewood gathering, camping, snowmobiling, etc. have negligible impacts on elk given their limited scope (time and space). Infra-structure, such as roads and campgrounds, that facilitate these activities have already been accounted in the description of the affected environment.

Effects of Current and Reasonably Foreseeable Actions

Reasonably foreseeable actions are described in section 3.3, *Reasonably Foreseeable Future Action or Conditions*. Current actions are described in section 3.2, *Past and Current Actions* and shown on Figure 50.

The Miller-West Fisher Vegetation Management Project will occur entirely in the Silverfish PSU and will include intermediate harvest of 1,206 acres, regeneration harvest of about 692 acres, precommercial thinning of 351 acres, and prescribed burning of 2,830 acres of National Forest System lands in the Silverfish PSU. Because of the availability of harvest data, the effects of the Miller-West Fisher Vegetation Management Project can be evaluated quantitatively for cover and forage. Surface impacts from other reasonably foreseeable actions in the Silverfish PSU would be minimal, and would not result in any measurable changes in cover or forage habitat. Cumulative impacts of the Miller-West Fisher Vegetation Management Project on cover-to-forage ratios in MAs 10 and 11 and on percent cover in MAs 15, 16, and 17 are shown in Table 201. Because the mine alternatives would not affect elk habitat in the Silverfish PSU and because the transmission line action alternatives would not change the percent cover to forage in summer range or the percent of thermal cover in winter range, effects on these habitat components are not shown in Table 201.

New roads and access changes for mitigation associated with reasonably foreseeable actions, including the Wayup Mine/Fourth of July Road Access Project, and the Miller-West Fisher Vegetation Management Project, would contribute to cumulative effects on ORD (Table 201). Access changes resulting from Wayup Mine/Fourth of July Road Access Project, Plum Creek activities, the Miller-West Fisher Vegetation Management Project, and other reasonably foreseeable actions would increase ORD to 1.76 mi/mi^2 in MA 12 and 1.1 mi/mi^2 in MAs 15, 16, 17, and 18. ORD in the Silverfish PSU would increase to 0.82 mi/mi^2 as a result of reasonably foreseeable activities. Habitat effectiveness in MA 12 would decrease to 64 percent, habitat effectiveness in MAs 15, 16, 17, 18 would decrease to 59 percent, and habitat effectiveness in the Silverfish PSU would decrease to 66 percent as a result of reasonably foreseeable actions. Habitat Security on the Silverfish PSU would decrease 10 percent to 47 percent.

Road management actions such as road maintenance and administrative use associated with permit administration, data collection and monitoring of National Forest System lands are not likely to affect elk habitat because they generally do not result in vegetation removal. Elk and other large ungulates will typically simply avoid the disturbance area until human activities terminate, which usually comprises of a few hours. These activities include work on existing roads for the Miller-West Fisher Project. This action would not result in a loss of cover because the roads that will be used already exist. Although water restoration projects may temporarily displace elk and other wildlife from a localized area, they typically benefit wildlife in the long-term by increasing security, providing pulses of foraging when seeded, or by stabilizing soils where certain habitat components can remain available.

The Coyote Improvement vegetation management project is in the planning stages and would take place within the Crazy PSU. The project would harvest 240 acres to increase stand resiliency to mountain pine beetles. This project would contribute to open canopy habitat/openings within the analysis area. This habitat component is generally lacking on the landscape and Coyote Improvement project would contribute toward improving its availability within these planning subunits. The transmission line alternatives would contribute openings as well, although they are expected to be maintained longer before natural succession is allowed to occur compared to Coyote Improvement.

Silverbutte Bugs timber sale is in the Silverfish PSU and would be a small project like Coyote. Similar to the timber sales mentioned above, it would contribute some openings/open-canopied habitat within this PSU. If Silverbutte Bugs mainly treats stands already impacted by insects/disease, those stands may already be in an open-canopied condition.

Flower Creek timber sale is in the Treasure PSU and only has minimal overlap with the project with a small amount of the access road for Montanore located within this PSU. Flower Creek timber sale, like the timber sales mentioned above, would contribute openings or open-canopied habitat as well. Approximately 900 acres are proposed for treatment. Due to the minimal overlap, cumulative effects would be minimal.

Actions such as road, trail, campground maintenance and administrative use associated with permit administration, data collection and monitoring of National Forest System lands are not likely to measurably affect elk and other big game species. These species will typically simply avoid the disturbance area until human activities terminate, which usually comprises of a few hours. With population growth and development, it is reasonable to assume that some corresponding increase in human use of National Forest System lands is likely to occur. Recreational activities such as sightseeing, hiking, cross-country skiing, camping, snowmobiling, fishing, and firewood cutting are ongoing and expected to increase over the next 10 years. This increase is likely to be gradual and incremental and tend to be focused on areas along or near roads open to motorized traffic. Elk may, over time, experience more frequent disruption of their daily activities if they are in proximity to roads, although as discussed previously, these areas receive proportionately less use by elk than more secure habitats. Also, any increase in recreation activities are not likely to occur around private lands where most of the activities are located and would not appreciably change the existing condition as elk already tend to avoid open roads.

Activities on private land, such as timber harvest, land clearing, home construction, road construction, and livestock grazing, are likely to continue on private lands within the Silverfish PSU and would likely slightly impact on elk cover and security. Potential effects depend on the magnitude, type and location of developments and include the loss of secure habitat and localized disturbance on elk and other big game species. Private lands occupy 12 percent of the Silverfish PSU and are intermixed with public and corporate/State land. Most recommended guidelines are met on National Forest System Lands within the Silverfish PSU, and development of private lands is expected to have minor cumulative impacts on elk and other big game species within the analysis area over the next 10 years.

No Action Alternative

The Montanore Project No Action alternatives (Alternative 1 and Alternative A) would not contribute to cumulative impacts on elk.

Combined Mine-Transmission Line Action Alternatives

Cumulative impacts of the combined mine-transmission line alternatives, in combination with other reasonably foreseeable actions, on percent elk security habitat, habitat effectiveness, and ORD are shown in Table 201. The mine alternatives would not have any effects on elk in the Silverfish PSU, and would not contribute to cumulative effects.

Cover/Forage

The transmission line action alternatives would not change the percent cover to forage in summer range or the percent of thermal cover in winter range and would not contribute to cumulative changes in these parameters.

All combined mine-transmission line action alternatives, in combination with the Miller-West Fisher Vegetation Management Project, would decrease cover in MAs 10 and 11 by 2 to 4 percent. All transmission line alternatives would include the reallocation of MAs 10 and 11 in a 500-foot corridor along the transmission line to MA 23, which does not have a cover/forage standard. Alternatives 2B, 3E-R, and 4E-R, in combination with the Miller-West Fisher Vegetation Management Project, would not affect cover in MAs 15, 16, and 17, while Alternatives 3C-R, 3D-R, 4C-R, and 4D-R would reduce cover in MAs 15, 16, and 17 by 2 to 3 percent.

Habitat clearing and forest treatments associated with the Montanore Project combined mine-transmission line action alternatives and the Miller-West Fisher Vegetation Management Project provide more forage habitat, which would improve overall habitat conditions in FWP elk HD 104 and the KNF. Given the existing abundant cover, cumulative effects on cover are not likely to adversely affect elk populations in elk HD number 104 or the KNF.

Open Road Density, Security Habitat, and Habitat Effectiveness

As described above, access changes resulting from the Wayup Mine/Fourth of July Road Access Project, Plum Creek activities, the Miller-West Fisher Vegetation Management Project, and other reasonably foreseeable actions would increase ORDs in MA 12 and MAs 15, 16, 17, and 18. During construction, Alternatives 2B, 3C-R, 3D-R, 4C-R, and 4D-R would increase ORD in MAs 15, 16, 17, and 18 to 1.0 mi/mi^2 to 1.2 mi/mi^2. During construction in MA 12, Alternatives 2B, 3C-R, D-R, 4C-R, and 4D-R would increase ORD to 1.45 mi/mi^2 to 1.49 mi/mi^2, while Alternatives 3E-R and 4E-R would increase ORD to 1.80 mi/mi^2. In all combined mine-transmission line action alternatives, ORD in MAs 15, 16, 17, and 18 during transmission line construction would be the same or slightly less than Alternative 1, which includes the effects of other actions only, and would be less than the standard.

During operations, cumulative ORD in MAs 15, 16, 17, and 18 would increase, relative to existing conditions, during operations to 1.0 mi/mi^2 to 1.2 mi/mi^2 for Alternatives 2B, 3C-R, 3E-R, 4C-R, and 4E-R and it would remain the same in Alternatives 3D-R and 4D-R. In all combined mine-transmission line action alternatives, ORD in MAs 15, 16, 17, and 18 during transmission line operations would be the less than the standard. Cumulative ORD in MA 12 during operations would continue to be greater than existing conditions and the standard, ranging from 1.43 mi/mi^2 to 1.44 mi/mi^2.

All combined mine-transmission line action alternatives, in combination with the Wayup Mine/Fourth of July Road Access Project, Plum Creek activities, the Miller-West Fisher Vegetation Management Project, and other reasonably foreseeable actions, would reduce security habitat by 9 to 10 percent during transmission line construction. During construction, habitat effectiveness would be reduced by 8 to 10 percent as a result of cumulative impacts of the combined mine-transmission line action alternatives in combination with the Wayup Mine/Fourth of July Road Access Project, Plum Creek activities, the Miller-West Fisher Vegetation Management Project, and other reasonably foreseeable actions (Table 201). For all combined mine-transmission line action alternatives, percent security habitat during operations would improve relative to the No Mine Alternative, which includes the effects of other reasonably foreseeable actions. As shown in Table 201), the contribution of the Montanore combined mine-transmission line action alternatives to changes in percent habitat effectiveness would not be measurable during operations.

Forage Openings

The combined mine-transmission line alternatives would not create any new openings greater than 40 acres with points greater than 600 feet from cover in the Silverfish PSU, and would not contribute to cumulative increases in forest openings that elk might avoid.

Key Habitat Features

All combined mine-transmission line action alternatives would result in the disturbance of wetlands providing potential wallowing habitat for elk in the Silverfish PSU. The clearing area for the combined mine-transmission line action alternatives would include between 2 and 4 acres of wetlands. Other reasonably foreseeable actions would contribute to losses of wetland habitat; unavoidable impacts on wetlands in all reasonably foreseeable actions would require compensatory mitigation under the Clean Water Act or Executive Order 11990.

Movement Areas

All combined mine-transmission line action alternatives may interfere with elk movement where ridges and drainages were crossed. Disturbance-related impacts would be short-term, and the width of clearing area would not likely be great enough to affect elk movement after the Construction Phase because sufficient cover would be present. Other reasonably foreseeable actions could impede elk movement in specific areas, but KNF riparian standards would minimize activities in riparian areas, and activities on ridgelines would generally be avoided due to steep terrain. While some cumulative effects to elk movement could occur, they would likely to be minimal.

Table 201. Cumulative Effects to Elk Habitat Components on National Forest System Land in the Silverfish PSU by Combined Mine-Transmission Line Alternative.

Measurement Criteria	Existing Con-ditions	[1] No Mine[1]	[2] MMC's Proposed Mine		[3] Agency Mitigated Poorman Impoundment Alternative						[4] Agency Mitigated Little Cherry Creek Impoundment Alternative					
			TL-B		TL-C-R		TL-D-R		TL-E-R		TL-C-R		TL-D-R		TL-E-R	
			Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]
Percent Cover/forage in MAs 10 and 11[4] Guide is 60/40	97/3	97/3	94/6	94/6	94/6	94/6	95/5	95/5	93/7	93/7	94/6	94/6	95/5	95/5	93/7	93/7
Percent Cover in MAs 15, 16, 17, and 18 Guide for elk is >15%	92	84	84	84	82	82	81	81	84	84	82	82	81	81	84	84
Percent Security Habitat[5] Guide is >30	57	47	47	48	46	49	46	49	47	49	46	49	46	49	47	49
Percent Habitat Effectiveness Guide is ≥ 50 percent	72	66	62	66	66	68	62	66	66	66	66	66	62	66	66	66
Habitat Effective-ness in MA 12[6] Guide is >68 percent	57	64	54	56	54	56	56	56	51	56	54	56	56	56	51	56
Habitat Effective-ness in MAs 15, 16, 17, and 18[6] Guide is >38 percent	62	59	58	56	58	60	60	62	60	60	58	60	60	62	60	60
ORD in Silverfish PSU (mi/mi^2) Guide is <1.9 mi/mi^2	0.62	0.82	0.85	0.78	0.84	0.77	0.86	0.77	0.82	0.77	0.84	0.77	0.86	0.77	0.82	0.77
ORD in MA 12 (mi/mi^2)[7] Standard is ≤0.75	1.29	1.76	1.49	1.44	1.45	1.44	1.45	1.43	1.78	1.44	1.45	1.44	1.45	1.43	1.78	1.44

Measurement Criteria	Existing Con-ditions	[1] No Mine[1]	[2] MMC's Proposed Mine		[3] Agency Mitigated Poorman Impoundment Alternative						[4] Agency Mitigated Little Cherry Creek Impoundment Alternative					
			TL-B		TL-C-R		TL-D-R		TL-E-R		TL-C-R		TL-D-R		TL-E-R	
			Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]
ORD in MAs 15, 16, 17, and 18 (mi/mi^2) Standard is <3.0	0.9	1.1	1.2	1.2	1.2	1.0	1.0	0.9	1.0	1.0	1.2	1.0	1.0	.9	1.0	1.0

[1] Effects shown include effects of the Wayup Mine/Fourth of July Road Access Project, Plum Creek activities, the Rock Creek Project, and the Miller-West Fisher Vegetation Management Project. Alternative 1 (No Transmission Line) would not contribute to cumulative effects on ORD.
[2] Const = during mine construction.
[3] Ops = during transmission line operations.
[4] MAs 10 and 11 are managed for big game winter range; all MA 10 and 11 within a 500-foot corridor of the transmission line centerline would be reallocated to MA 23.
[5] Security habitat is calculated by buffering all roads open during the fall (October 15 to November 30) by 0.5 mile. The remaining total area, which may consist of one or more habitat blocks greater than 250 acres, equals security habitat. Security habitat may include State and private lands, but no elk security habitat occurs on private or State land in the analysis area.
[6] Habitat Effectiveness is based on the relationship between open road density and habitat effectiveness, as described in Appendix H of Johnson (2004a).
[7] All MA 12 within a 500-foot corridor of the transmission line centerline would be reallocated to MA 23.
ORD = open road density.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Wildlife Approach Area

The eastern segment of the Alternative 2B transmission line corridor would occur within the wildlife approach area in the Fisher River valley and relatively small segments of all combined mine-transmission line action alternatives would cross the Fisher River valley in the wildlife approach area. The proximity of the Alternative 2B alignment to US 2 would result in a widening of disturbed area and could potentially discourage elk movement within the approach area by decreasing cover. The Miller-West Fisher Vegetation Management Project could also perturb elk movement within the approach area by decreasing cover and contributing to human disturbance. Given that most of the approach area potentially affected by Alternative B and the Miller-West Fisher vegetation Project is generally heavily roaded and has been logged in the past 20 to 30 years, and because of the short-term nature of human-caused disturbance, it is likely that the cumulative effects of the two projects on elk movement within the approach area would be minimal. The portions of the combined agencies' alternative transmission lines that would parallel US 2 would be located upslope and out of the Fisher River valley, and would not likely contribute to any cumulative effects on elk movement in the approach area.

Elk Winter Range on All Lands

All combined mine-transmission line action alternatives, in combination with other reasonably foreseeable actions, especially the Miller-West Fisher Vegetation Management Project, would result in cumulative impacts on elk winter range on all lands in the analysis area, resulting in a reduction of thermal and hiding cover and, once disturbed areas were revegetated, an increase in forage habitat. Cumulative impacts of all combined mine-transmission line action alternatives would be minor due to construction timing restrictions in elk winter range. The combined mine-transmission line action alternatives, in combination with Plum Creek activities, would result in cumulative disturbance to elk on private lands in the analysis area, and could displace of elk away from areas of disturbance. Cumulative disturbance to elk on private lands are expected to be minimal because private lands are generally heavily roaded and elk in these areas may be habituated to higher levels of disturbance than on National Forest System lands.

Cumulative Effects of Plan Amendments for Open Road Density (MA 12)

All action alternatives would reallocate MA 12 lands to MA 23 within a 500-foot corridor designated for the transmission line corridor. Where new or opened roads associated with all action transmission line alternatives would be outside the 500-foot transmission line corridor, a site specific KFP amendment would be required for all action alternatives to allow for exceedance of the MA 12 ORD standard.

Johnson (2006) analyzed the cumulative effects of the KFP amendment for changing the ORD requirements. This analysis looked at post-project changes in ORD, both increases and decreases, and calculated a cumulative change to ORD in MA 12. As of 2006, the cumulative change in available elk habitat was an increase of about 0.16 percent. Since 2006, only six projects have received a project specific amendment for ORD in MA 12, which now total 46 for the KNF (USDA Forest Service 2013b). Of these, four of the projects would have high ORD levels during implementation but would return to the existing condition post-project and would not result in a cumulative change to available elk habitat. One project would improve upon the existing ORD level post-project and ORD would become better than the MA standard.

The transmission line alternatives would decrease the allocation of MA 12 within the Silverfish PSU resulting in less MA 12 acreage with high open road densities. The MA 23 lands resulting from the reallocation have no ORD standard, and after an increase in ORD during the construction and reclamation period, would largely provide similar ORD levels as prior to reallocation. Cumulatively it is expected that available elk habitat on the KNF would be maintained. A measurable change in big game populations would not be expected.

As described under the Affected Environment section, the elk population appears to be increasing which may be due to increased road restrictions and decommission in the past 20 years (USDA Forest Service 2008a). The cumulative effects of past and present land use patterns as well as random natural events have been taken into consideration in this analysis.

Regulatory/Forest Plan Consistency

Organic Administration Act and Forest Service Locatable Minerals Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources and to take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations. All mine and transmission line alternatives would comply with 36 CFR 228.8.

National Forest Management Act/Kootenai Forest Plan

1. Forestwide Management Direction – KFP II-1 #3, #7, II-2 #12, #17, II-7, 22, 23

#3 – *Maintain a balance of open and closed road… (to) insure big-game habitat security…:* In all combined mine-transmission line alternatives, although during transmission line construction some restricted, impassable/barriered, and temporary roads would be opened and some new access roads would be needed, road access changes to mitigate for impacts on grizzly bear would be implemented. The agencies' alternatives would also include access changes in numerous roads to mitigate for the loss of big game security (Figure 35). In all combined mine-transmission line alternatives, security habitat would return to existing levels following construction, and would be greater than recommended levels during all project phases.

#7 – *Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species:* Cover to forage ratios in the Silverfish PSU indicate that the proportion of forage habitat is well below recommended levels. Current populations of elk would likely be maintained in all mine-transmission line action alternatives because changes to cover to forage ratios would be 4 percent or less, and because while cover would decrease relative to forage, the Silverfish PSU provides an abundance of cover.

#12 – *Maintain big-game habitat to support the recreational hunting demand for resident big-game species:* Levels of habitat effectiveness and security throughout the PSU would be maintained above recommended guidelines and would provide for habitat conditions maintaining the existing populations of elk for local hunting demand. Overall, road densities, percent security habitat and habitat effectiveness would likely continue to improve through land acquisition associated with grizzly bear mitigation.

#17 – *Use prescribed fire to simulate natural ecological processes… create habitat diversity for wildlife…* None of the alternatives would include prescribed burns.

p.II-7 – Management of elk habitat will provide for a potential habitat carrying capacity, which, by the third decade, is nearly 40 percent greater than present elk numbers. Habitat maintenance to support huntable populations of all other big game species as well as viable population levels of all endemic vertebrate species of wildlife: Elk population and the number of large bulls on the

Forest has been increasing over the past 20 years, probably because of increased road restrictions and decommissioning which has improved elk security on the KNF (USDA Forest Service 2008c). Proposed activities would not permanently decrease security within the analysis area, and overall, security would increase as a result of the grizzly bear mitigation and land acquisition program.

p.II-22, 23 – *Maintenance of viable populations of existing native and desirable non-native vertebrate species, as monitored through indicator species, attained through the maintenance of a diversity of plant communities and habitats*: See #7. above for habitat diversity. Elk are monitored as an indicator species for general forest habitat. Their occurrence and estimation of population is monitored through District observations, FWP surveys, and KNF Monitoring and Evaluation Reports.

2. Applicable Management Area Direction (MAs 10, 11, 12, 15, 17) –KFP III-39, 44/45, 48/49/51, 65, and 75.

Objectives of the proposed mine-transmission line action alternatives are to facilitate mine development. Mine-transmission line action alternatives would include the re-allocation of MA 10, MA 11 and MA 12 lands in a 500-foot corridor along the transmission line to MA 23. As explained below, outside of this corridor a KFP amendment to allow for increased ORD in MA 12 would be necessary for all combined mine-transmission line alternatives.

MA 10 (Big Game Winter Range) – *Maintain or enhance the habitat effectiveness for winter use by big game species through cover/forage ratios, prescribed fire, and maintenance of wildlife movement patterns:* All transmission line alternatives would include the reallocation of MAs 10 and 11 in a 500-foot corridor along the transmission line to MA 23, which does not have a cover/forage standard. Outside of this corridor, changes to cover to forage ratios would be 2 percent or less for all combined mine-transmission line alternatives and the Silverfish PSU provides an abundance of cover. After transmission line construction disturbed areas would be allowed to establish naturally as grassland or shrubland. Once vegetation is re-established, areas of winter range would provide forage habitat during the life of the mine. Weed control and other BMPs would be implemented. After the transmission line was removed, and vegetation was re-established, forage would be provided on the winter range. All combined mine-transmission line action alternatives would decrease both percent elk security and habitat effectiveness in the Silverfish PSU, however both measurement criteria would remain better than the recommended minimum levels.

MA 11 (Timber/Big Game Winter Range) – *Maintain or enhance the winter range habitat effectiveness for big game species (while also achieving timber and visual goals) through prescribed fire, maintenance of wildlife movement patterns/corridors, management of key habitat components as riparian areas, and utilizing harvest to achieve desired cover/forage ratios, a variety of seral stages, and maximization of edge effect in units generally not exceeding 40 acres:* See description for MA 10 above.

MA 12 (Timber/Big Game Summer Range) – *Maintain or enhance non-winter big game habitat (while also achieving timber goals) through habitat diversity, maximization of edge effect in units generally not exceeding 40 acres, maintaining hiding cover between openings, management of key habitat components as riparian areas, managing open roads to no more than ¾ miles per square mile:* All combined mine-transmission line alternatives would include the reallocation of

MA 12 in a 500-foot corridor along the transmission line to MA 23. The reallocation would be for the duration of the proposed Montanore Project. Where new or opened roads associated with the combined mine-transmission line alternatives would be outside the 500-foot transmission line corridor, a site specific KFP amendment would be required to allow for exceedance of the MA 12 ORD standard of 0.75 mi/mi^2. The KFP amendment to in the MA 12 ORD standard would be required for the life of the project for all Action Alternatives. High levels of security habitat and HE would be maintained in the Silverfish PSU as well as the maintenance of timbered movement areas between openings. All key habitat components have been identified and maintained under all alternatives.

MA 15 (Timber Production) - *Produce timber using various standard silvicultural practices while providing for other resource values such as wildlife, including big game, through maintenance of habitat effectiveness and security by limiting ORD to a maximum of 3 miles per square mile and management of key habitat components, such as riparian areas:* For all combined mine-transmission line alternatives, ORD would remain less than the standard for all project phases. None of the combined mine-transmission line alternatives would increase ORD in MAs 15, 16, 17, and 18 during operations, and it would decrease by 0.2 mi/mi^2 in Alternatives 3D-R and 4D-R. High levels of security habitat and HE would be maintained in the Silverfish PSU as well as the maintenance of timbered movement areas between openings. All key habitat components have been identified and maintained under all alternatives.

MA 16 (Timber with Viewing) - *Produce timber while providing for a pleasing view. Manage wildlife habitat to provide for viable populations of existing native species, including big game, through maintenance of habitat effectiveness and security by limiting ORD to a maximum of 3 miles per square mile and management of key habitat components, such as riparian areas:* See MA 15 above.

MA 17 (Viewing with Timber) - *Provide landscapes that are pleasing to the viewer, while producing a level of timber production that is compatible with visual resource protection. Manage wildlife habitat to provide for viable populations of existing native wildlife species, including big game, through maintenance of habitat effectiveness and security by limiting ORD to a maximum of 3 miles per square mile and management of key habitat components, such as riparian areas:* MA 17 does not occur in the analysis area.

MA 18 (Regeneration Problem Areas; Steep Slopes) – *Maintain existing vegetation (future timber production) and viable populations of existing native wildlife species, including big game, through maintenance of habitat effectiveness and security by limiting ORD to a maximum of 3 miles per square mile and management of key habitat components, such as riparian areas:* See MA 15 above.

Forest Service Management Indicator Species Statement of Findings

KFP direction is to “maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species,… in sufficient quality and quantity to maintain viable populations” (KFP Vol. 1, II-1 #7). Based on the elk analysis and the KNF Conservation Plan (Johnson 2004a), all combined mine-transmission line action alternatives should provide general forest species habitat with sufficient quality and quantity of the diverse age classes of vegetation needed for viable populations. In all combined mine-transmission line alternatives, sufficient general forest habitat should be available; the populations of species using that habitat should remain viable.

Based on the elk analysis of general forest habitat indicators and the KNF Conservation Plan (Johnson 2004a), sufficient quality and quantity of diverse habitat types and age classes of vegetation are available and would continue to be available to support elk populations in the Silverfish PSU. The mine-transmission line action alternatives would decrease cover, increase displacement, decrease security, decrease habitat effectiveness and increase open road densities during construction. All transmission line action alternatives would decrease both percent elk security and habitat effectiveness in the Silverfish PSU; both measurement criteria would remain better than the recommended minimum levels. Overall, the level of security and habitat effectiveness for elk would increase as a result of land acquisition associated with the grizzly bear mitigation. A diversity of habitat types and successional stages would also be maintained within the PSU.

State Requirements

Alternatives 3 and 4 would comply with the MMRA regarding disturbed lands being reclaimed to a post-mining land use with stability and utility comparable to that of the pre-mining landscape. Draft findings regarding compliance with MFSA requirements are discussed in the Summary, beginning on p. S-53. Hunting is managed by FWP. Proposed actions would not prevent the state from continuing to manage this species as a harvestable population.

The analysis area is located in the Lower Clark Fork and Salish Elk Management Units identified in the FWP Statewide Elk Management Plan. All of the agencies' combined mine-transmission line alternatives are consistent with the document because they would maintain high levels of security habitat and habitat effectiveness. In addition, based on helicopter construction timing described in section 2.5.7, *Mitigation Plans*, in the agencies' alternatives, no transmission line construction activities would occur during hunting season on National Forest System lands.

3.25.3.3 White-tailed Deer

The white-tailed deer was selected as the general forest indicator for the Crazy PSU. As described previously in section 3.25.3.2, *Elk*, this selection was based on management emphasis ratings, KFP direction, the biological potential of the area, state wildlife management objectives, public comments during scoping, information contained within the KNF Conservation Plan (Johnson 2004a), and site-specific knowledge of deer and elk use in the Crazy and Silverfish PSUs.

3.25.3.3.1 Analysis Area and Methods

White-tailed deer population ecology, biology, habitat description, and relationships identified by research are described in Baty (1995), Mundinger (1981), Morgan (1993), Lyon (1966), Thomas (1979), and Mackie *et al.* (1998). White-tailed deer population and harvest data come primarily from FWP. Additional information is provided by recent District wildlife observation records and KNF historical data (NRIS Wildlife).

The analysis area for evaluating direct, indirect and cumulative effects on individuals and their habitat on National Forest System lands is the Crazy PSU, because activities in these areas could result in disturbance and displacement effects to white-tailed deer (Figure 89). White-tailed deer emphasis areas were defined by the PSU, although adjacent planning areas were also considered for effects. White- tailed deer have home ranges that include both winter and summer use areas that could extend beyond the Crazy PSU. The PSU is large enough to account for effects on these various components of white-tailed deer habitat and use in this area. Connectivity and movement within home ranges could be impacted by the proposed activities as well as activities in adjacent

PSUs. To evaluate potential direct, indirect and cumulative impacts of the transmission line on white-tailed deer on private and State land, the analysis area includes all land within a corridor 1 mile on each side of the alternative transmission line alignments. The boundaries for determination of population trend and contribution toward population viability are the FWP hunting districts (HD) 103 and 104 and the KNF, respectively.

Data sources used in this analysis include FWP hunting and population data, research, and plans; District vegetation layers; INFRA roads layers; TSMRS data; Summerfield (1991); and field surveys by District biologists and data collection crews. Indicators used to assess effects on white-tailed deer in the KNF are cover/forage ratios, forage openings, ORD, movement areas, and key habitat features. These indicators are described below.

Impacts to white-tailed deer on private and State land from the transmission line alternatives were evaluated based on FWP winter habitat mapping (Figure 89); FWP hunting and population data, research, and plans; KNF and FWP information on wildlife linkage areas; and mapping of broad vegetation types shown on section 3.23, *Wetlands and Other Waters of the U.S.*

Cover/Forage Ratios

Cover and forage are defined in section 3.25.3.2, *Elk*. Effects of the alternatives are evaluated based on cover/forage ratios for summer and winter range; percent cover for combined MAs 15, 16, and 17; and percent thermal cover on winter range (MAs 10 and 11) in the Crazy PSU. MAs 10 and 11 were delineated for the KFP and do not entirely overlap with white-tailed deer winter range mapped by FWP (Figure 89). MA designations, goals, and standards are described in detail in section 3.15, *Land Use*. To avoid confusion with FWP winter range, for impacts evaluated on National Forest System land, winter range is referred to as MAs 10 and 11. The KFP recommends a cover/forage ratio for white-tailed deer of 70 percent to 30 percent for MAs 10 and 11 combined. Summerfield (1991) recommends a cover of 70 percent on winter and 60 percent on summer range (for all MAs not managed for deer winter range). On white-tailed deer winter range, the cover should be at least 50 percent thermal cover. Summer range cover may be in any combination of hiding and thermal cover (Ibid.). The KFP guideline for hiding and thermal cover on MAs 15, 16, and 17 combined for white-tail deer is greater than 30 percent. MAs 15, 16, and 17 are managed for timber production and do not necessarily correspond to areas of seasonal white-tailed deer use.

Open Road Densities

Effects of roads on white-tailed deer are not well documented. White-tailed deer have smaller home ranges than elk, and may be less likely to avoid roads than elk (Lyon 1979), especially where cover is dense. Roads may increase white-tailed deer vulnerability to hunting season mortality by facilitating hunter access and eliminating refugia (Idaho Department of Fish and Game 2004). KFP standards for ORD are the same for white-tailed deer as described for elk.

Forage Openings

For white-tailed deer, the KFP recommends avoiding the creation of openings greater than 20 acres between areas of cover in MAs 11 and 12. MA 12 is managed to enhance big game non-winter habitat. In MA 10, timber is generally only harvested to maintain or enhance big game winter range, and opening size is minimized. Summerfield (1991) recommends that the opening size be the same as the standard for grizzly bear (a maximum of 600 feet to cover from any point inside an opening). TSMRS forage openings are identified through TSMRS database queries to determine type and age of past harvest. For this analysis, effects of forest openings on deer are evaluated based on the regeneration harvest greater than 20 acres occurring after 1986.

Movement Areas

For white-tailed deer, the corridor of thermal cover between openings that do not provide thermal cover in winter range should be at least 600 feet wide or as wide as the opening, whichever is greater (Summerfield 1991). In the KNF, movement corridors along riparian areas and ridges are especially important for white-tailed deer. The analysis of impacts to movement corridors is based on District GIS mapping of thermal cover in winter range and riparian areas and is available in the Project record.

Key Habitat Features

Moist environments are important to white-tailed deer, especially in late summer to early fall, providing water and high-quality forage and allowing regulation of body temperature (Idaho Department of Fish and Game 2004). Effects of the alternatives on key habitat features will be evaluated based on the acres of wetlands potentially impacted. KFP standards for MAs 11 and 12 include avoidance of wallows, wet meadows and bogs when constructing roads. INFS standards for RHCAs, discussed in detail in section 3.6, *Aquatic Life and Fisheries*, provide additional protection of wallows, wet meadows, and bogs that occur in riparian areas.

Alternative Mitigation Measures

MMC's proposed grizzly bear mitigation plan includes an access change on NFS road #4724 from April 1 to June 30 and a yearlong access change on a segment of NFS road #4784. Although the seasonal closure on Road #4724 would benefit deer by restricting motorized access during the spring, it would not change the open status of the road. NFS road #4784 was proposed for an access change previously by the Rock Creek Project and the agencies do not consider it as mitigation in the analysis for direct effects of Alternative 2B. Because of NFS road #4784 was included in the Rock Creek Project mitigation, the agencies did not propose any change to NFS road #4784 as part of the agencies' alternatives. The agencies action alternatives also considered road #4784 open for the analysis of direct effects on ORD.

Following consultation with the USFWS on the grizzly bear mitigation plan, the KNF decided the access change on NFS road #4784 would be implemented before the Evaluation Phase by all the action alternatives if the road closure was not already implemented as part of the Rock Creek Project mitigation. The access change is discussed qualitatively as a potential direct effect of the Montanore Project. The #4784 access change remains attributable to the Rock Creek Project and improvements to ORD are disclosed in the cumulative effects analysis.

The agencies' alternatives would include additional yearlong access changes through the installation of barriers or gates in several roads to mitigate for the loss of big game security and impacts (Table 28 and Table 29 and Figure 35). These road access changes are taken into account in road density calculations.

Additional road access changes may also occur on land acquired as part of the grizzly bear mitigation proposed by MMC or the agencies (see mitigation plan descriptions in sections 2.4, *Alternative 2- MMC's Proposed Mine*, and section 2.5, *Alternative 3—Agency Mitigated Poorman Impoundment Alternative*). Road density calculations do not take into account the effect of land acquisition requirement for grizzly bear mitigation.

Other mitigation measures incorporated into MMC's or the agencies' alternatives that could benefit white-tailed deer include winter construction timing restrictions in white-tailed deer winter range, prohibiting employees from carrying firearms, and monitoring road-killed animals along mine access roads to determine if improved access resulted in increased wildlife mortality.

All alternatives would include the reallocation of MAs 15, 16, 17, and 18 in the mine permit area to MA 31. Transmission line Alternatives D-R and E-R would include the reallocation of MA 12 in a 500-foot corridor along the transmission line to MA 23. Road density calculations take into account MA reallocation.

3.25.3.3.2 Affected Environment

The Crazy PSU is within HD 104. The eastern portions of the transmission line alternatives would occur in HD 103. The FWP evaluates deer population composition and trends based on total deer, fawn/doe ratios, and buck/doe ratios observed during sampling surveys of a portion of the HD referred to as trend areas, harvest data, and hunter effort data (Brown, pers. comm. 2008). Based on FWP data, the KNF's 2007 Monitoring and Evaluation Report (USDA Forest Service 2008c) concluded that white-tailed deer are the most abundant and widespread big game animal in the KNF, and that the white-tailed deer population in the KNF is steadily increasing. The average number of white-tailed deer observed in the trend area for HD 104 from 1996 to 2013 was 276 deer. An average of 36 fawns was observed for every 100 adults (FWP 2013b). In HD 103, an average of 242 adults and 33 fawns per 100 adults was observed from 1996 to 2013 (FWP 2013b). Based on harvest data, white-tailed deer populations declined in northwest Montana from 2006 to 2009, but after the mild winters of 2010 and 2011 appear to be recovering (FWP 2013b, 2013c).

Cover/Forage

Currently, white-tailed deer summer range in the Crazy PSU is comprised of 96 percent cover and 4 percent forage habitat, while MAs 10 and 11 are comprised of 82 percent cover and 18 percent forage habitat (Table 202). The proportion of thermal cover in MAs 10 and 11 is 9 percent. In comparison to the 50 percent minimum recommended by Summerfield (1991), thermal cover is not adequately provided in the Crazy PSU in MAs 10 and 11. MAs 15, 16, and 17 in the Crazy PSU consist of 85 percent thermal and hiding cover combined, which is greater than the recommended 30 percent minimum. MAs 15, 16, 17, and 18 have a limited distribution in the Crazy PSU (Figure 89). Cover to forage ratios in the Crazy PSU indicate that while cover is abundant, thermal cover and forage habitat may be lacking in the Crazy PSU. Forage habitat is underestimated because white-tailed deer will forage underneath forest canopies and in harvested areas currently mapped as cover.

Most forage habitat occurs in lower elevation areas of the Little Cherry Creek drainage and the mouths of its tributaries, or in isolated patches of past disturbance. Most past harvest areas have recovered to the point they are no longer considered openings and contribute to the high cover to forage ratio in the PSU. Historically, wildfire would create a mosaic of successional stages and result in vegetative diversity in this area. In contrast, fire suppression and past timber management has resulted in a trend toward homogenous stand composition and structure consisting of high density stands of shade-tolerant species (see section 3.22, *Vegetation*) that reduce the presence and productivity of understory forage species. In summary, the PSU is currently outside the desired conditions for white-tailed deer and other big game species with high cover and limited forage availability.

Open Road Density

The Crazy PSU contains 93 acres of allocated summer range (MA 12) (Figure 89). Current ORD in the Crazy PSU are 5.27 mi/mi^2 in MA 12, and 4.3 mi/mi^2 in MAs 15, 16, 17, and 18. Road density standards are not met for either MA 12 or MAs 15, 16, 17, and 18. ORD worse than the standard may increase mortality during hunting season by facilitating hunter access (Idaho Department of Fish and Game 2004).

Forage Openings

Recently, created forage openings in MAs 11 and 12 range from less than 1 acre to 320 acres. The Crazy PSU contains six openings greater than 20 acres in MAs 11 and 12. Of the six openings, five have points greater than 600 feet from cover. The distance to cover may discourage white-tailed deer from foraging in these openings.

Movement Areas

Movement corridors along drainage bottoms and ridgetops are especially important for many wildlife species; most of these areas or travel ways are intact. Portions of private land along Libby Creek may lack suitable cover, especially where timber harvests have occurred, affecting the ability of some species to move freely or securely through these areas.

Key Habitat Features

Wetland and riparian areas are described in section 3.23, *Wetlands and Other Waters of the U.S.* About 172 acres of wetlands occur in the Crazy PSU.

Impacts to White-tailed Deer on State or Private Lands

As shown on Figure 89, only a small portion of white-tailed deer winter range occurs in the Crazy PSU, along the lower reaches of Bear Creek. White-tailed deer winter range potentially affected by the transmission line alternatives occurs in the Fisher, West Fisher, and Miller creek corridors. The majority of state and private lands has been harvested for timber, limiting the availability of thermal cover, and currently has high road densities.

A wildlife approach area important to white-tailed deer has been identified in the Fisher River valley between the Barren Peak and Teeters Peak areas to the west of US 2 and the Kenelty Mountain and Fritz Mountain areas to the east of US 2 (see Project record). A detailed description of this wildlife approach area is provided in the elk analysis.

3.25.3.3.3 Environmental Consequences

Impacts on white-tailed deer habitat and open road densities in the Crazy PSU from the various project features of the mine, transmission line, and combined mine-transmission line alternatives are shown in Table 202, Table 203, and Table 204, and are described in the following subsections.

Table 202. Impacts on White-tailed Deer Habitat on National Forest System Land in the Crazy PSU by Mine Alternative.

Habitat Component	[1] No Mine/ Existing Conditions	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative	[4] Agency Mitigated Little Cherry Creek Impoundment Alternative
Percent Cover/forage Summer Range[1] Guide is 60/40	96/4	92/8	93/7	93/7
Percent Cover/forage in MAs 10 and 11 Standard is 70/30	82/18	82/18	82/18	82/18
Percent Thermal Cover in MAs 10 and 11 Guide is >50	9	9	9	9
Percent Cover in MAs 15, 16, and 17 Guide is >30	85	82	84	82
ORD in MA 12 (mi/mi^2) Standard is <0.75[2]	5.27	5.27	5.27	5.27
ORD in MAs 15, 16, 17, and 18 (mi/mi^2) Standard is <3.0[2]	4.3	4.6	3.8	3.8
# Openings >20 acres in MAs 11 and 12	6	7	7	7
Key Habitat Features Potentially Affected (acres)[3]	NA	40	13	40
# Movement Areas Affected[4]	NA	3	3	4

NA = Does not apply.
Impacts on white-tailed deer habitat would be the same for the Construction and Operations Phases.
[1] White-tailed deer summer range includes all MAs except MAs 10 and 11. MA designations, goals, and standards are described in detail in section 3.15, *Land Use*.
[2] All MA 15, 16, 17, and 18 in the mine alternative permit area would be reallocated to MA 31. MA reallocation was taken into account in road density calculations.
[3] Key habitat features, such as bogs and wet meadows, are represented by wetlands, as described in section 3.23, *Wetlands and Other Waters of the U.S.* Values shown are wetlands and streams directly affected from Table 184 and indirectly affected discussed in section 3.23.4.
[4] Movement areas are represented by ridgelines of third order or larger drainages and riparian areas.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Alternative 1 – No Mine

Alternative 1 would not have direct impacts on white-tailed deer or their habitat. Over time, with continued fire suppression and lack of active forest management, indirect effects of this alternative would include a continued trend toward later successional habitats. Forage habitat would decrease over time unless harvest or other stochastic events, such as a wildfire or windstorm, creating additional forage. Large-scale fires could potentially occur in the Crazy PSU. Although vegetative succession would reduce forage openings over time, openings created following large fires would likely be relatively large, with long distances between hiding cover. Until hiding cover develops (about 15 to 20 years, depending on site conditions), individual animals may be more vulnerable to predation and hunting mortality in areas where large openings develop following wildfire. Introduced species that are often unpalatable to deer, would continue to spread in the analysis area, displacing native forage species. Current KNF, state, and local weed management programs Forest Service, state, and county-wide noxious weed management practices would continue to reduce noxious weed infestations. The white-tailed deer population in the KNF is expected to continue to steadily increase.

Alternative 2 – MMC's Proposed Mine

Cover/Forage

Alternative 2 would reduce the percent of cover habitat relative to forage habitat by 4 percent to 92 percent in summer range, moving the cover-to-forage ratios toward the KFP-recommended conditions, while cover habitat relative to forage in winter MAs 10 and 11 would not change (Table 202). Most areas disturbed as a result of Alternative 2 would not be available as foraging habitat until after mine closure and reclamation. Some areas would be reclaimed during operations and would provide foraging habitat once vegetation was established. In the long term, after reclamation success criteria are achieved, areas disturbed by Alternative 2 would provide forage for white-tailed deer, thereby moving toward KFP objectives for forage habitat. The proportion of thermal cover in MAs 10 and 11 would not change as a result of Alternative 2 and would continue to be less than the desired minimum. Percent cover in MAs 15, 16, and 17 in the Crazy PSU would decrease 3 percent, but would continue to be greater than the 30 percent KFP guideline minimum.

Open Road Density

Alternative 2 would not change ORD in MA 12 and would continue to exceed standards in the Crazy PSU (Table 202) requiring a site specific KFP amendment. Alternative 2 would increase ORD in MAs 15, 16, 17, and 18 in the Crazy PSU, where standards are not currently met, to 4.6 mi/mi^2. Where new or opened roads associated with Alternative 2 would be outside the permit area, a KFP amendment to allow for increased ORD in MAs 15, 16, 17, would be necessary. Specifically, the KFP amendment for increases in ORD would apply to MAs 16 and 17 in sections 14, 15, and 24 in T28N, R31W, and sections 18 and 19 in T28N, R30W.

Overall, road densities would likely improve through MMC's proposed land acquisition for grizzly bear mitigation, as described in section 2.5.6, *Mitigation Plans*. Acquired parcels would be managed for grizzly bear use in perpetuity, and could decrease road densities where roads could be gated or barriered, thereby benefitting white-tailed deer.

Widening, improvement, and yearlong access of the Bear Creek Road would lead to increased vehicle volumes and speed. Estimates of increased annual traffic volume range from 187 percent to 234 percent (Table 172 in section 3.21, *Transportation*). The increase in traffic in Alternative 2 would substantially increase the risk of increased deer mortality on the access road. MMC would limit concentrate haulage to daylight hours during the day shift (0800 to 1630), which would minimize vehicular-deer collisions during the early morning, evening and night time-periods. MMC would provide transportation to employees using buses, vans, and pickup trucks thereby limiting the use of personal vehicles. MMC would report road-killed animals to the FWP as soon as road-killed animals were observed. The FWP would either remove road-killed animals or direct MMC how to dispose of them. When the mill ceased operations in the Closure Phase, mine traffic volume would be substantially less than shown in Table 172 in section 3.21, *Transportation*. Future traffic volume when all activities at the mine are completed in the Post-Closure Phase would be higher than in Alternative 1 because of reconstruction of Bear Creek Road and loss of the Little Cherry Loop Road beneath the impoundment. Mortality risk to white-tailed deer would decrease on the Bear Creek Road compared to operations, but the permanently improved road conditions (increased road width, improved sight distance, paving) and higher traffic speeds would result in a permanently higher deer mortality risk compared to pre-mine conditions. At mine closure, all new roads (except the Bear Creek access road) constructed for the project would be reclaimed, which would include grading to match the adjacent topography and obliterating the road prism. After reclamation success criteria are achieved, areas disturbed by road use would provide forage for the white-tailed deer.

Forage Openings

Alternative 2 would create one opening greater than 20 acres in MA 11 along the Bear Creek Road near US 2. Effects on white-tailed deer of this new opening would likely be minimal because no point would be more than 600 feet to cover, and due to its proximity to US 2 and private property. The loss in forage capacity may impact individual white-tailed deer in the short term, until disturbed areas were successfully revegetated.

Movement Areas

Alternative 2 may affect potential white-tailed deer movement corridors in the Little Cherry, Poorman, and Ramsey creek drainages where the tailings impoundment, plant site, and LAD Areas would be constructed, and where other mine-related activities would occur. Facilities associated with Alternative 2 would not occur on ridgetops and would not likely directly interfere with white-tailed deer movement in these areas. Individual animals may have to adjust their localized movement patterns, but no movement barriers would be created by Alternative 2.

KFP standards for MAs 11 and 12 include avoidance of wallows, wet meadows and bogs when constructing roads. INFS standards for RHCAs, discussed in detail in section 3.6, *Aquatic Life and Fisheries*, provide additional protection of wallows, wet meadows, and bogs that occur in riparian areas.

Key Habitat Features

About 39 acres of wetlands providing water and high-quality forage would be impacted by Alternative 2 in the Crazy PSU. An additional 3 acres or more may be affected by a pumpback well system, if installed at the impoundment site. The feasibility of MMC's proposed Wetland Mitigation Plan to replace the lost functions of all potentially affected wetlands is uncertain. MMC's plan is conceptual and would be refined during the 404 permitting process. MMC did not update its mitigation plan for Alternative 2 to reflect new wetland and stream mitigation regulations and procedures. Section 3.23, *Wetlands and other Waters of the U.S.*, discusses proposed wetland mitigation in more detail.

Mine Water Management

MMC would store mine, adit, or tailings water at the Ramsey Plant Site, a surge pond at the LAD Areas, and the tailings impoundment. The metals in the tailings water would be similar to what is found at the Troy Mine decant ponds (see Table 120 in the *Water Quality* section), where adverse effects on wildlife have not been observed (USDA Forest Service and DEQ 2012). Concentrations of metals in mine and adit water, which would be stored in mine/yard pond at the Ramsey Plant Site and in a surge pond at the LAD Areas, would be lower than tailings water (see Table 120 in the *Water Quality* section). The Ramsey Plant Site would be fenced, restricting deer access.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Cover/Forage

Impacts of Alternative 3 on cover-to-forage ratios would be similar to Alternative 2 except that in Alternative 3, cover relative to forage habitat would be reduced by 3 percent to 93 percent in summer range, and the percent cover in MAs 15, 16, and 17 in the Crazy PSU would be 1 percent less than existing conditions (Table 202).

Open Road Density

Alternative 3 would not affect ORD in MA 12, but would improve ORD in MAs 15, 16, 17, and 18 to 3.8 mi/mi^2 (Table 202). ORD would continue to be worse than standards in MA 12 and MAs 15, 16, 17, and 18 in the Crazy PSU. Because ORD would decrease (improve), a KFP amendment to increase ORD would not be necessary except in MA 12.

Overall, road densities would likely improve through the agencies' proposed land acquisition requirement for grizzly bear mitigation, as described in section 2.5.7, *Mitigation Plans*. Acquired parcels would be managed for grizzly bear use in perpetuity, and may decrease road densities where roads could be gated or barriered, thereby benefitting white-tailed deer. The effect of increased traffic on the Bear Creek Road would be the same as Alternative 2, except that in Alternative 3, MMC would remove big game animals killed by any vehicles daily from road rights-of-way within the permit area and along roadways used for access or hauling ore for the life of the mine and monitor the number of big game animals killed by vehicle collisions on these roads and report findings annually. Highway safety signs such as "Caution – Truck Traffic" would help slow public traffic speeds in anticipation of meeting oncoming trucks. Staging shipments of supplies in a general location prior to delivery to the mine site would reduce traffic and deer mortality risk.

Forage Openings

The effect of new openings created by Alternative 3 would be the same as Alternative 2.

Movement Areas

Alternative 3 may affect potential white-tailed deer movement corridors in the Little Cherry, Poorman, and Libby creek drainages where the tailings impoundment and plant site would be constructed, and where other mine-related activities would occur. Alternative 3 would affect fewer riparian corridors than Alternative 2 because disturbance from the plant and adits would be concentrated in Libby Creek. Also, the Alternative 3 impoundment would occupy less of the Little Cherry Creek riparian corridor than the Alternative 2 impoundment. Facilities associated with Alternative 3 would not occur on ridgetops and would not directly interfere with white-tailed deer movement in these areas. Individual animals may have to adjust their localized movement patterns, but no movement barriers would be created by Alternative 3.

Key Habitat Features

About 13 acres of wetlands providing water and high-quality forage would be directly affected by Alternative 3 in the Crazy PSU; an additional 16 acres may be affected by a pumpback well system at the tailings impoundment (Table 202). Impacts on wetlands would be mitigated through implementation of the agencies' Wetland Mitigation Plan, which would have a greater likelihood of replacing lost functions than the Alternative 2 Wetland Mitigation Plan.

Mine Water Management

Water management in Alternatives 3 and 4 would reduce the risk to wildlife from contaminant uptake from storage of mine, adit, and tailings water. All mine and adit water would be treated and discharged at the Libby Adit Water Treatment Plant and not stored in ponds. The LAD Areas would not be used and the surge ponds would not pose a risk to white-tailed deer. Tailings water quality would have lower metal concentrations than in Alternative 2; the factors leading to lower metal concentrations in tailings water quality in Alternatives 3 and 4 are discussed in section 3.13, *Water Quality*, p. 674.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

The effects of Alternative 4 on road density, forage openings, and movement areas would be the same as Alternative 3.

Cover/Forage

Impacts of Alternative 4 on cover-to-forage ratios for summer range and MAs 10 and 11 would be the same as Alternative 3, except that percent cover in MAs 15, 16, and 17 in the Crazy PSU would decrease by 3 percent to 82 percent (Table 202).

Key Habitat Features

About 43 acres of wetlands providing water and high-quality forage would be directly or indirectly affected by Alternative 4 in the Crazy PSU (Table 202). Impacts on wetlands would be mitigated through implementation of the agencies' Wetland Mitigation Plan, which would have a greater likelihood of replacing lost functions than the Alternative 2 Wetland Mitigation Plan.

Alternative A – No Transmission Line

Alternative A would not have direct impacts on white-tailed deer or their habitat. The effects of Alternative A on deer would be the same as Alternative 1.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Cover/Forage

Alternative B would not change cover relative to forage habitat in summer range or MAs 10 and 11, percent thermal cover in MAs 10 and 11, or percent cover in MAs 15, 16, and 17 in the Crazy PSU (Table 203). The proportion of thermal cover in MAs 10 and 11 would continue to be below minimum recommended levels. Percent cover in MAs 15, 16, and 17 in the Crazy PSU would continue to meet the 30 percent recommended level. All disturbed areas, such as access roads, pulling and tensioning sites, and transmission line clearing areas, would be seeded with grass and shrub species after transmission line construction. Areas where trees were trimmed, but otherwise not disturbed, would be allowed to establish naturally as grassland or shrubland. Once vegetation is re-established, disturbed areas of winter range would provide additional forage habitat as forage species become established, thereby moving white-tailed deer habitat conditions in the Crazy PSU toward KFP objectives. Roads built for the installation of the transmission line would be redisturbed during line decommissioning. After the transmission line was removed, all newly constructed roads would be bladed, contoured, and seeded. Once vegetation re-established, redisturbed areas would provide forage habitat.

Alternative B would increase the spread and establishment of noxious weeds and other introduced species associated with surface disturbance. Alternative B would have the largest area of surface disturbance associated with new or upgraded road construction and timber clearing of all transmission line alternatives, but would have the least area of vegetation clearing. Surface disturbances and continued road use would increase the risk of spread of noxious weeds and other introduced species that are unpalatable to white-tailed deer. New roads would be reseeded as an interim measure, but used for maintenance activities, as necessary.

Open Road Density

During Alternative B line construction, ORD in the Crazy PSU would decrease in MA 12 to 4.93 mi/mi^2, due to road access changes, and would increase to 4.7 mi/mi^2 in MAs 15, 16, 17, and 18 (Table 204). ORD in MAs 15, 16, 17, and 18 in the Crazy PSU would be 0.1 mi/mi^2 worse than existing densities during transmission line operations. No areas of MA 12 would be reallocated to MA 23 because no MA 12 would occur in the 500-foot transmission line corridor. In Alternative B, a KFP amendment to increase ORD in MAs 15, 16, 17, and 18 would be needed. Specifically, the KFP amendment for increases in ORD would apply to MAs 15 and 16 in sections 7, 8, 17, and 18 in T27N, R30W, and sections 1, 2, and 12 in T27N, R31W. ORD in MA 12 would continue to be worse than the KFP standard, but because it would decrease, a KFP amendment to increase ORD in MA 12 would not be necessary.

Although the new road prism in Alternative B would remain during transmission line operations, roads opened or constructed for transmission line access would be gated or barriered on National Forest System land after transmission line construction. New roads constructed for Alternative B could improve access for hunters on foot. During the final Closure Phase following mine closure, the transmission line would be removed, roads reclaimed, trees along the line allowed to grow, and all disturbed areas revegetated.

Helicopter line-stringing, which would last about 10 days, could contribute to short-term displacement of individual deer from the transmission line corridor. Similar effects could occur from other transmission line construction activities in areas where helicopters were not used, and would be more extensive for Alternative B than the agencies' alternatives. Except for annual inspection and infrequent maintenance operations, helicopter use and other construction activities would cease after transmission line construction until decommissioning. Helicopter use and other activities associated with decommissioning would cause similar disturbances.

In Alternative B, no construction would occur during winter (assumed to be December 1 to April 30) on winter range, and no motorized activity would occur from April 1 to June 15 in bear habitat in the Miller Creek and Midas Creek drainages. The winter and spring construction timing restrictions would reduce displacement effects. Overall, effects of helicopter activity on white-tailed deer would be minimal because sufficient habitat would be available for any deer displaced due to short-term disturbance, and because construction timing restrictions would reduce the extent of potential displacement effects.

Forage Openings

No additional openings in forest cover greater than 20 acres would be created by the Alternative B in MAs 10 and 11 would be the transmission line clearing area.

Table 203. Impacts on White-tailed Deer Habitat in the Analysis Area by Transmission Line Alternative.

Habitat Component	[A] No Trans-mission Line	[B] North Miller Creek	[C-R] Modified North Miller Creek	[D-R] Miller Creek	[E-R] West Fisher Creek
Crazy PSU					
Percent Cover/forage Summer Range[1] Guide is 60/40	96/4	96/4	96/4	96/4	96/4
Percent Cover/forage in MAs 10 and 11 Standard is 70/30	82/18	82/18	82/18	82/18	82/18
Percent Thermal Cover in MAs 10 and 11 Guide is >50	9	9	9	9	9
Percent Cover in MAs 15, 16, and 17 Guide is >30	85	85	85	85	85
# Openings >20 acres in MAs 11 and 12[2]	6	6	6	6	6
Key Habitat Features Potentially Affected (acres)[2]	NA	1	2	2	2
# Movement Areas Affected[3]	NA	3	3	2	2
All Lands in Analysis Area					
White-tailed Deer Winter Range[4]	0	149	162	144	188
State and Private Lands					
White-tailed Deer Winter Range[4]	0	133	114	114	151

NA = Does not apply.
Impacts on deer habitat would be the same for the Construction and Operations Phases.
[1] White-tailed deer summer range includes all MAs except MAs 10 and 11. MA designations, goals, and standards are described in detail in section 3.15, *Land Use*.
[2] Key habitat features, such as bogs and wet meadows, are represented by wetlands, as described in section 3.23, *Wetlands and Other Waters of the U.S.*
[3] Movement areas are represented by ridgelines of third order or larger drainages and riparian areas.
[4] Based on 2008 FWP mapping.
Source: GIS analysis by ERO Resources Corp. using KNF data and 2008 FWP mapping.

Table 204. Effects to White-tailed Deer Habitat Components on National Forest System Land in the Crazy PSU by Transmission Line Alternative.

Habitat Component	[A] No Trans-mission Line	[B] North Miller Creek		[C-R] Modified North Miller Creek		[D-R] Miller Creek		[E-R] West Fisher Creek	
		Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]
ORD in MA 12 (mi/mi^2) Standard is <0.75[3]	5.27 (≤0.75)	4.93	4.93	4.93	4.93	4.08	4.08	4.08	4.08
ORD in MAs 15, 16, 17, and 18 (mi/mi^2) Standard is <3.0[3]	4.3 (≤3.0)	4.7	4.4	3.7	3.7	3.8	3.7	3.8	3.7

[1] Const = during transmission line construction.
[2] Ops = during transmission line operations.
[3] All MA 12 and MA 15, 16, 17, and 18 within a 500-foot corridor of the transmission line centerline would be reallocated to MA 23. MA reallocation was taken into account in road density calculations.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Key Habitat Features

About 4 acres of wetlands providing water and high-quality forage would be within the clearing area of Alternative B in the Crazy PSU (Table 203). Direct effects to wetlands are expected to be avoided by placement and location of transmission line facilities and roads outside of wetlands and streams. Less than 0.1 acre of wetlands and streams would be affected by new or upgraded road construction.

Movement Areas

Potential white-tailed deer movement corridors in the Crazy PSU may be affected where the Alternative B transmission line traversed or crossed the Howard, Libby, and Ramsey creek drainages. Alternative B could also interfere with deer movement in the Crazy PSU where it followed the ridge between Midas Creek and Howard Creek. Deer could be discouraged from using these areas during transmission line construction due to increased noise and the presence of humans and machinery, but these effects would be short-term, and would be minimized through construction timing restrictions. The width of clearing area would not likely be great enough to affect deer movement in these areas after the Construction Phase because sufficient cover would be present. Individual animals may have to adjust their localized movement patterns in the short term, but no barriers to movement would likely be created by Alternative B.

Impacts on White-tailed Deer on State and Private Lands

Alternative B would affect about 149 acres of white-tailed deer winter range on all lands in the analysis area, including 133 acres of private land, primarily in the Miller Creek drainage. Direct impacts on winter range would include a reduction in thermal and hiding cover and, once the transmission line corridor was revegetated, an increase in forage habitat. The risk of replacement of native forage species with unpalatable introduced species on private land would be similar to those described above for National Forest Systems lands, except that new roads on private land would not be reseeded, potentially increasing the spread of noxious weeds and reducing available forage.

Alternative B would increase road densities on state and private lands. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction, and could result in increased white-tailed deer mortality if hunting access were allowed. Short-term habitat displacement could occur in the analysis area during transmission line construction as a result of increased road use during construction and helicopter use during line stringing. Helicopter use could contribute to short-term displacement of individual white-tailed deer from the transmission line corridor. Helicopter use for line stringing would occur during a relatively short period (about 10 days). Except for annual inspection and infrequent maintenance operations, helicopter use and other construction activities would cease after transmission line construction until decommissioning. Helicopter use and other activities could result in short-term disturbance of white-tailed deer during line decommissioning. Short-term disturbance impacts in white-tailed deer winter range from transmission line construction would be minimized by restricting construction during the winter.

Because white-tailed deer habitat on State and private lands including the Sedlak Park Substation and loop line, is generally degraded due to high road densities and logging in the past 20 to 30 years, and because of the short-term nature of human-caused disturbance, overall, white-tailed deer on private and State land would not likely be affected by Alternative B.

Private and State land in the eastern segment of the Alternative B transmission line alignment would occur within the wildlife approach area in the Fisher River valley. The proximity of this alignment to US 2 would result in a widening of disturbed area and may potentially discourage white-tailed deer movement within the approach area by decreasing cover. Transmission line construction activities could cause white-tailed deer to change their traditional movement patterns within this approach area, but these effects would be short-term because human-caused disturbance directly related to the project would cease when the transmission line construction was completed. Once revegetated, cleared areas could provide additional forage habitat. Some shrub and tree cover would be maintained in the transmission line right-of-way because only the largest trees would be removed, and would continue to provide cover. Because most of the habitat in the approach area, including in the Sedlak Park Substation and loop line footprint, potentially affected by Alternative B is degraded due to high road densities and logging in the past 20 to 30 years, and because of the short-term nature of human-caused disturbance, it is not likely that white-tailed deer movement within the approach area would be greatly affected by Alternative B.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

The effect on forage openings and movement areas of Alternative C-R would be the same as Alternative B. Two acres of wetlands would be within the clearing area. Other effects on key habitat features would be the same as Alternative B.

Cover/Forage

Impacts of Alternative C-R on cover relative to forage habitat in both summer range and MAs 10 and 11, percent thermal cover in MAs 10 and 11, and percent cover in MAs 15, 16, and 17 in the Crazy PSU would be the same as Alternative B (Table 203).

The effects of Alternative C-R on the risk of replacement of native forage species with unpalatable introduced species would be less than those described for Alternative B. The agencies' noxious weed mitigation measures described for Alternative 3 would be implemented in the agencies' transmission line alternatives. To the extent possible, MMC would survey all proposed ground disturbance areas for noxious weeds before initiating disturbance. Where noxious weeds were found, MMC would treat infestation the season before the activity was planned. For example, if timber clearing were planned to be in the spring or early summer, the survey and control would be implemented the previous fall. Areas surveyed would include all areas designated for timber removal. MMC would describe in final design plans the extent of which surveys and pretreatment would not be feasible. The proposed survey and treatment approach would be a part of the final Weed Control Plan, to be reviewed and approved by the lead agencies. Helicopter use for vegetation clearing in some areas would minimize the potential for exotic species introduction associated with road construction or improvement and the extent of vegetation clearing would be greater. The agencies' modifications to MMC's proposed weed control plan for Alternative B would more effectively control the spread of weeds, minimizing the replacement of forage species.

MMC would submit a final Vegetation Removal and Disposition Plan for lead agencies' approval (see section 2.5.2.5.2, *Vegetation Removal and Disposition Plan* in Chapter 2). The plan would apply to all National Forest System lands covered by the Plan of Operations and all State and private lands covered by the transmission line certificate. It would not apply to private lands affected by the substation and loop line. One of the plan's goals would be to minimize vegetation clearing, particularly in riparian areas. The plan would identify areas where clearing would be avoided, such as deep valleys with high line clearance, and measures that would be implemented to minimize clearing.

Open Road Density

No areas of MA 12 would be reallocated to MA 23 because no MA 12 would occur in the 500-foot transmission line corridor. In Alternative C-R, during line construction and operations, ORD in the Crazy PSU would decrease to 4.93 mi/mi^2 in MA 12 and would decrease to 3.7 mi/mi^2 in MAs 15, 16, 17, and 18 (Table 204). In Alternative C-R, ORD in MA 12 and MAs 15, 16, 17, and 18 would continue to be worse than the KFP standard, but because ORD would decrease, a KFP amendment to increase ORD in MA 12 would not be necessary.

The status of new or opened roads associated with Alternative C-R would be the same as Alternative B, except that on National Forest System lands, the status of roads opened or constructed for transmission line access would be gated or barriered and placed in intermittent stored service after line installation was completed. Intermittent stored service roads would be closed to traffic and would be treated so they would cause little resource risk if maintenance were not performed on them during the operation period of the mine and prior to their future need. The service roads would not be used for routine maintenance of the transmission line, but could be used for emergency repairs, such as a damaged insulator. New transmission line roads on National Forest System lands would be decommissioned and revegetated after closure of the mine and removal of transmission line. Although new roads would not result in increased motorized access, they may improve access for hunters on foot.

Helicopter use could contribute to short-term displacement of individual white-tailed deer from the transmission line corridor. In Alternatives C-R, D-R, and E-R, two seasons of helicopter construction would occur and the total duration of helicopter use each season would be about 2 months because helicopters would be used for vegetation clearing and structure construction. The type and duration of impacts from helicopter use for line stringing would be the same as Alternative B (about 10 days). Except for annual inspection and infrequent maintenance operations, helicopter use and other construction activities would cease after transmission line construction until decommissioning. Helicopters use and other activities could result in short-term disturbance of white-tailed deer during line decommissioning. In Alternative C-R, all construction and decommissioning activities on National Forest System and State trust lands would occur between June 16 and October 14, eliminating construction disturbance during winter and spring. Construction timing restrictions would reduce displacement effects. Overall, effects of helicopter activity on white-tailed deer would be minimal because sufficient habitat would be available for any deer displaced due to short-term disturbance, and because construction timing restrictions would reduce the extent of potential displacement effects.

Impacts on White-tailed Deer on State and Private Lands

Alternative C-R would affect about 162 acres of the 21,885 total acres of white-tailed deer winter range on all lands in the analysis area, including 114 acres on state and private lands, primarily in the Miller Creek and Fisher River drainages (Table 203 and Figure 89). Direct impacts on winter range would include a reduction in thermal and hiding cover and, once the transmission line corridor was revegetated, an increase in forage habitat. The risk of replacement of native forage species with unpalatable introduced species on private land would be similar to those described above for National Forest Systems lands, except that new roads on private land would not be reseeded, potentially increasing the spread of noxious weeds and reducing available forage.

The effect of Alternative C-R on road densities on state and private lands would be the same as Alternative B. A relatively short segment of the Alternative C-R transmission line would cross the Fisher River valley in the wildlife approach area, potentially discouraging white-tailed deer movement in a localized area due to transmission line construction activities. These effects would be short-term because human-caused disturbance directly related to Alternative C-R would cease when the transmission line construction was completed. The segment of Alternative C-R that would parallel US 2 would be primarily on private land where habitat is degraded due to high road densities and logging in the past 20 to 30 years and would be located upslope and out of the Fisher River valley; therefore, Alternative C-R, including the Sedlak Park Substation and loop line, would not likely affect white-tailed deer movement in the approach area.

Alternative D-R – Miller Creek Transmission Line Alternative

The effect on forage openings of Alternative D-R would be the same as Alternative B. The effect on key habitat features would be the same as Alternative C-R. Potential white-tailed deer movement corridors in the Crazy PSU could be affected where the Alternative D-R transmission line traversed or crossed the Howard and Libby creek drainages. Other effects of Alternative D-R on white-tailed deer movement would be the same as Alternative B.

Cover/Forage

Impacts of Alternative D-R on cover relative to forage habitat in both summer range and MAs 10 and 11, percent thermal cover in MAs 10 and 11, and percent cover in MAs 15, 16, and 17 in the Crazy PSU would be the same as Alternatives B and C-R (Table 203). The effects of Alternative D-R on the quality of forage due to the introduction of unpalatable species are similar to those described for Alternative C-R, except that the risk of replacing forage species with introduced species would be greater due to a slightly longer line.

Open Road Density

Alternative D-R would include the reallocation of MA 12 in a 500-foot corridor along the transmission line to MA 23. Impacts on ORD in MAs 15, 16, 17, and 18 in the Crazy PSU would be the same in Alternative D-R as Alternative C-R, except that during Alternative D-R construction, ORD would decrease to 3.8 mi/mi^2 in MAs 15, 16, 17, and 18 (Table 204). In Alternative D-R, ORD in MA 12 would decrease to 4.08 mi/mi^2 during transmission line construction and operations (Table 204). In Alternative D-R, ORD in MA 12 and MAs 15, 16, 17, and 18 would continue to be worse than the KFP standard, but because ORD would decrease, a KFP amendment to increase ORD would not be necessary.

The status, use, and reclamation of new or opened roads associated with the transmission line would be the same as Alternative C-R. The effects of vegetation clearing, structure placement, and line stringing would be the same for Alternative D-R as Alternative C-R.

Impacts on White-tailed Deer on State and Private Lands

Impacts of Alternative D-R on white-tailed deer would be the same as Alternative C-R except that Alternative D-R would affect about 144 acres of the 21,885 total acres of white-tailed deer winter range on all lands in the analysis area, including 114 acres on state and private lands, primarily in the Fisher River drainage (Table 203 and Figure 89).

Alternative E-R – West Fisher Creek Transmission Line Alternative

The effect on forage openings of Alternative D-R would be the same as Alternative B. The effect on key habitat features would be the same as Alternative C-R.

Cover/Forage

Impacts of Alternative E-R on cover relative to forage habitat in both summer range and MAs 10 and 11, percent thermal cover in MAs 10 and 11, and percent cover in MAs 15, 16, and 17 in the Crazy PSU would be the same as Alternatives C-R and D-R (Table 203). The effects of Alternative E-R on the quality of forage due to the introduction of unpalatable species are similar to those described for Alternatives C-R and D-R, except that the risk of replacing forage species with introduced species would be greater due to a longer clearing area.

Open Road Density

Impacts on ORD in the Crazy PSU would be the same for Alternative E-R as Alternative D-R. The status, use, and reclamation of new or opened roads associated with the transmission line would be the same as Alternative C-R. The effects of vegetation clearing, structure placement, and line stringing would be the same for Alternative E-R as Alternative C-R.

Movement Areas

Potential white-tailed deer movement corridors in the Crazy PSU could be affected where the Alternative E-R transmission line traversed or crossed the Howard, and Libby creek drainages. Other effects of Alternative D-R on white-tailed deer movement would be the same as Alternative C-R.

Impacts on White-tailed Deer on State and Private Lands

Impacts on white-tailed deer winter range from Alternative E-R would affect the most white-tailed deer winter range (about 188 acres of the 21,885 acres of winter range in the analysis area) on all lands in the analysis area. About 153 acres of white-tailed deer winter range on state and private land would be affected by Alternative E-R, primarily in the Fisher River and West Fisher Creek drainages (Table 203 and Figure 89). Otherwise, impacts of Alternative E-R on elk would be the same as Alternative C-R, except that in Alternative E-R the effects of helicopter use and the risk of replacing forage species with introduced species would be more extensive due to a longer clearing area.

Combined Mine-Transmission Line Effects

Impacts on white-tailed deer habitat in the analysis area from combined mine-transmission line alternatives are described below and shown in Table 205.

Cover/Forage

The combined mine-transmission line alternatives would not change cover relative to forage habitat or the percent thermal cover in MAs 10 and 11. Alternative 2B would result in a 4 percent decrease in cover relative to forage habitat in summer range, while cover in summer range would fall by 3 percent in all other combined action alternatives. Alternatives 2B, 4C-R, 4D-R, and 4E-R would reduce cover in MAs 15, 16, and 17 by 3 percent, indicating that mine Alternatives 2 and 4 would have the greatest influence on cover in MAs 15, 16, and 17. Most areas disturbed as a result of the combined mine-transmission line alternatives would not be available as foraging habitat until after mine closure and reclamation. Some areas would be reclaimed during operations and would provide foraging habitat once vegetation was established. In the long term, after reclamation success criteria are achieved, areas disturbed by the combined mine-transmission line alternatives would provide forage for white-tailed deer, thereby moving toward KFP objectives for forage habitat. The proportion of thermal cover in MAs 10 and 11 would not change as a result of the combined mine-transmission line alternatives and would continue to be less than the desired minimum. Percent cover in MAs 15, 16, and 17 in the Crazy PSU would decrease by 1 to 3 percent in the combined mine-transmission line alternatives, but would continue to be greater than the 30 percent KFP guideline minimum.

Open Road Density

For all combined mine-transmission line alternatives, any MA 15, 16, 17, or 18 in the mine permit area or MA 12 in a 500-foot corridor of the transmission line centerline would be reallocated to MA 31 or MA 23, as appropriate. Road density calculations take into account MA reallocation.

Current ORD in MA 12 and MAs 15, 16, 17, and 18 in the Crazy PSU is higher than the standard (Table 206). In Alternatives 2B, 3C-R, and 4C-R, ORD in MA 12 would decrease to 4.93 mi/mi^2 during construction and operations. In Alternatives 3D-R, 3E-R, 4D-R, and 4E-R, ORD in MA 12 would decrease during construction and operations to 4.08 mi/mi^2. Alternative 2B would increase ORD in MAs 15, 16, 17, and 18 to 4.8 mi/mi^2 during construction and 4.5 mi/mi^2 during operations. In all combined agency mine-transmission line alternatives, ORD in MAs 15, 16, 17, and 18 would decrease during construction and operations to 3.8 mi/mi^2.

Alternative 2B would increase ORD in MAs 15, 16, 17, and 18 in the Crazy PSU, where standards are not currently met (Table 206), and would require a KFP amendment to increase road densities. Specifically, the KFP amendment for increases in ORD would apply to: MAs 16 and 17 in sections 14, 15, and 24 in T28N, R31W; sections 18 and 19 in T28N, R30W; MAs 15 and 16 in sections 7, 8, 17, and 18 in T27N, R30W; and sections 1, 2, and 12 in T27N, R31W.

In the agencies' combined mine-transmission line alternatives, ORD in MAs 15, 16, 17, and 18 would continue to be worse than the KFP standard, but because ORD would decrease, a KFP amendment to increase ORD would not be necessary. None of the combined mine-transmission line alternatives would increase ORD in MA 12 in the Crazy PSU, where road densities continue to exceed standards, and a KFP amendment to increase ORD in MA 12 would not be necessary.

In all combined mine-transmission line alternatives, the new road prism would remain during transmission line operations. In Alternative 2B, roads opened or constructed for transmission line access would be gated or barriered on National Forest System land after transmission line construction. In the agencies' alternatives, roads on National Forest System land would be placed into intermittent stored service after line installation was completed. Intermittent stored service roads would be closed to traffic and would be treated so they would cause little resource risk if maintenance were not performed on them during the operation period of the mine and prior to their future need. The service roads would not be used for routine maintenance of the transmission line, but could be used for emergency repairs, such as a damaged insulator. In all combined mine-transmission line alternatives, roads opened or constructed for transmission line access on private land would be gated after transmission line construction. In all combined mine-transmission line alternatives, new roads could improve access for hunters on foot. During the final Closure Phase following mine closure, the transmission line would be removed, roads reclaimed, trees along the line allowed to grow, and all disturbed areas revegetated. For agencies' alternatives, roads would be decommissioned at mine closure.

Table 205. Impacts on White-tailed Deer Habitat in the Analysis Area by Combined Mine-Transmission Line Alternative.

Measurement Criteria	[1] No Mine Existing Condition	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Little Cherry Creek Impoundment Alternative		
		TL-B	TL-C-R	TL-D-R	TL-E-R	TL-C-R	TL-D-R	TL-E-R
Crazy PSU								
Percent Cover/forage Summer Range[1] Guide is 60/40	96/4	92/8	93/7	93/7	93/7	93/7	93/7	93/7
Percent Cover/forage in MAs 10 and 11 Standard is 70/30	82/18	82/18	82/18	82/18	82/18	82/18	82/18	82/18
Percent Thermal Cover in MAs 10 and 11 Guide is >50	9	9	9	9	9	9	9	9
Percent Cover in MAs 15, 16, and 17 Guide is >30	85	82	84	84	84	82	82	82
# Openings >20 acres in MAs 11 and 12	6	7	7	7	7	7	7	7
Key Habitat Features Potentially Affected (acres)[2]	NA	43	31	31	31	45	45	45
# Movement Areas Affected[3]	NA	5	6	5	5	7	6	6
All Lands in Analysis Area								
White-tailed Deer Winter Range Impacted (acres)[4]	0	149	162	144	188	162	144	188

Represents maximum impacts based on additive impacts of the combined mine-transmission line alternatives.
NA = Does not apply.
Impacts on deer habitat would be the same for the Construction and Operations Phases.
[1] White-tailed deer summer range includes all MAs except MAs 10 and 11. MA designations, goals, and standards are described in detail in section 3.15, *Land Use*.
[2] Key habitat features, such as bogs and wet meadows, are represented by wetlands, as described in section 3.23, *Wetlands and Other Waters of the U.S.*
[3]Movement areas are represented by ridgelines of third order or larger drainages and riparian areas.
[4]Based on 2008 FWP mapping.
Source: GIS analysis by ERO Resources Corp. using KNF data and 2008 FWP mapping.

Table 206. Effects to White-tailed Deer Habitat Components on National Forest System Land in the Crazy PSU by Combined Mine-Transmission Line Alternative.

Measurement Criteria	[1] No Mine/ Existing Conditions	[2] MMC's Proposed Mine		[3] Agency Mitigated Poorman Impoundment Alternative						[4] Agency Mitigated Little Cherry Creek Impoundment Alternative					
		TL-B		TL-C-R		TL-D-R		TL-E-R		TL-C-R		TL-D-R		TL-E-R	
		Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]
ORD in MA 12 (mi/mi^2) Standard is <0.75[3]	5.27	4.93	4.93	4.93	4.93	4.08	4.08	4.08	4.08	4.93	4.93	4.08	4.08	4.08	4.08
ORD in MAs 15, 16, 17, and 18 (mi/mi^2) Standard is <3.0[3]	4.3	4.8	4.5	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8

[1] Const = during mine construction.
[2] Ops = during transmission line and mine operations.
[3] All MA 12 and MA 15, 16, 17, and 18 within a 500-foot corridor of the transmission line centerline would be reallocated to MA 23. All MA 15, 16, 17, and 18 in the mine alternative permit area would be reallocated to MA 31. MA reallocation was taken into account in road density calculations.
Source: GIS analysis by ERO Resources Corp. using KNF data.

In all combined mine-transmission line alternatives, road densities would likely improve through the grizzly bear land acquisition requirement, as described in sections 2.5.6, *Mitigation Plans*. Acquired parcels would be managed for grizzly bear use in perpetuity, and could improve road densities where roads could be closed. The agencies' land acquisition requirement would likely be more effective at reducing road densities than MMC's proposed land acquisition because more land would be protected.

In all combined mine-transmission line alternatives, widening, improvement, and yearlong access of the Bear Creek Road would lead to increased vehicle volumes and speed. and loss of the Little Cherry Loop Road beneath the impoundment percent (Table 172 in section 3.21, *Transportation*). The increase in traffic in the combined mine-transmission line alternatives would substantially increase the risk of increased deer mortality. MMC would provide transportation to employees using buses, vans, and pickup trucks, thereby limiting use of personal vehicles. MMC would report road-killed animals to the FWP as soon as road-killed animals were observed. The FWP would either remove road-killed animals or direct MMC how to dispose of them. In the agencies' combined mine-transmission line alternatives, MMC would remove big game animals killed by any vehicles daily from road rights-of-way within the permit area and along roadways used for access or hauling ore for the life of the mine and monitor the number of big game animals killed by vehicle collisions on these roads and report findings annually. When the mill ceased operations in the Closure Phase, mine traffic volume would be substantially less than shown in Table 172 in section 3.21, *Transportation*. Future traffic volume when all activities at the mine are completed in the Post-Closure Phase would be higher than in Alternative 1 because of reconstruction of Bear Creek Road and loss of the Little Cherry Loop Road beneath the impoundment. Mortality risk to white-tailed deer would decrease on the Bear Creek Road compared to operations, but the permanently improved road conditions (increased road width, improved sight distance, paving) and higher traffic speeds would result in a permanently higher deer risk mortality compared to pre-mine conditions. At mine closure, all new roads (except the Bear Creek access road) constructed for the project would be reclaimed, which would include grading to match the adjacent topography and obliterating the road prism. After reclamation success criteria are achieved, areas disturbed by road use would provide forage for white-tailed deer.

For all action alternatives, helicopter and other transmission line construction activities could result in short-term displacement of white-tailed deer from the transmission line corridor and surrounding habitat. Disturbance from helicopter use and other transmission line construction activities are described for Alternatives B and C-R above.

Forage Openings

In all combined mine-transmission line action alternatives, one opening greater than 20 acres would be created in MA 11 along the Bear Creek Road near US 2. Effects on white-tailed deer of this new opening would likely be minimal because no point would be more than 600 feet to cover, and due to its proximity to US 2 and private property. The loss in forage capacity may impact individual white-tailed deer in the short term, until disturbed areas were successfully revegetated.

Movement Areas

Alternatives 2B, 3D-R, and 3E-R would affect the fewest number of potential white-tailed deer movement areas. The agencies' alternatives could interfere with white-tailed deer movement where it followed the east-facing ridge north of the Sedlak Park Substation. Alternative 2B would be located at a lower elevation in the Fisher River valley and would not impact this area, but could affect white-tailed deer movement in the Ramsey Creek drainage. Alternatives 2B, 3C-R, and 4C-R could interfere with white-tailed deer movement where the transmission lines followed the ridge between Midas Creek and Howard Creek. Potential white-tailed deer movement along the ridge between Miller Creek and Howard Creek could be affected by Alternatives 4C-R and 4D-R. White-tailed deer could be discouraged from using these areas during transmission line construction due to increased noise from helicopters and machinery and the presence of humans, but these effects would be short-term. The width of clearing area would not likely be great enough to affect white-tailed deer movement in this area after the Construction Phase because sufficient cover would be present.

Key Habitat Features

Alternatives 2B, 4C-R, 4D-R, and 4E-R would have the greatest impacts on wetland habitat potentially providing water and high-quality forage for white-tailed deer in the Crazy PSU. Impacts on wetland habitat would range from 31 acres for Alternatives 3C-R, 3D-R, and 3E-R to 45 acres for Alternative 2B.

In Alternative 2B, MMC would implement its proposed Wetland Mitigation Plan. The feasibility of MMC's proposed Wetland Mitigation Plan to replace the lost functions of all potentially affected wetlands is uncertain. MMC's plan is conceptual and would be refined during the 404 permitting process. MMC did not update its mitigation plan for Alternative 2 to reflect new wetland and stream mitigation regulations and procedures. Impacts on wetlands from the agencies' combined mine-transmission line alternatives would be mitigated through implementation of the agencies' Wetland Mitigation Plan, which would have a greater likelihood of replacing lost functions than the Alternative 2 Wetland Mitigation Plan. Section 3.23, *Wetlands and other Waters of the U.S.*, discusses proposed wetland mitigation in more detail.

For the transmission lines, direct effects to wetlands are expected to be mostly avoided by placement and location of transmission line facilities and roads outside of wetlands and streams.

Mine Water Management

In Alternative 2B, MMC would store mine, adit, or tailings water at the Ramsey Plant Site, a surge pond at the LAD Areas, and the tailings impoundment. The metals in the tailings water would be similar to what is found at the Troy Mine decant ponds (see Table 120 in the *Water Quality* section), where adverse effects on wildlife have not been observed (USDA Forest Service and DEQ 2012). Concentrations of metals in mine and adit water, which would be stored in mine/yard pond at the Ramsey Plant Site and in a surge pond at the LAD Areas, would be lower than tailings water (see Table 120 in the *Water Quality* section). The Ramsey Plant Site would be fenced, restricting deer access.

Water management in the agencies' combined mine-transmission line alternatives would reduce the risk to wildlife from contaminant uptake from storage of mine, adit, and tailings water. All mine and adit water would be treated and discharged at the Libby Adit Water Treatment Plant and not stored in ponds. The LAD Areas would not be used and the surge ponds would not pose a risk to white-tailed deer. Tailings water quality would have lower metal concentrations than in Alternative 2; the factors leading to lower metal concentrations in tailings water quality in Alternatives 3 and 4 are discussed in section 3.13, *Water Quality*, p. 674.

White-tailed Deer Winter Range on All Lands

Impacts on white-tailed deer winter range from the combined action alternatives on all lands in the analysis area, including private and State lands, would range between 144 and 188 acres of the 21,885 total acres in the analysis area. Alternatives 3E-R and 4E-R would have the greatest impacts on white-tailed deer winter range, while Alternatives 3D-R and 4D-R would have the fewest impacts on winter range. In all combined action alternatives, direct impacts on winter range would include a reduction in thermal and hiding cover and, once the transmission line corridor was revegetated, an increase in forage habitat. Impacts on white-tailed deer winter range would likely be minor in all combined action alternatives, relative to the total amount of winter range habitat available in the analysis area. Impacts on white-tailed deer winter range would be eliminated through application of construction timing restrictions in white-tailed deer winter range. All combined action alternatives would result in increased road densities on state and private lands. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction, and could result in increased white-tailed deer mortality if hunting access were allowed. State and private lands, including in the Sedlak Park Substation and loop line footprint, currently have high road densities and have been logged in the past 20 to 30 years and overall white-tailed deer populations would not likely be affected. Short-term habitat displacement could occur in the analysis area during transmission line construction as a result of helicopter use.

Wildlife Approach Area

The eastern segment of the Alternative 2B transmission line corridor would occur within the wildlife approach area in the Fisher River valley and relatively small segments of the transmission line corridors for the agencies' combined mine-transmission line alternatives would cross the Fisher River valley in the wildlife approach area, potentially discouraging elk movement in a localized area due to transmission line construction activities. The portions of the agencies' combined alternatives that would parallel US 2 would be primarily on private land and would be located upslope and out of the Fisher River valley. The proximity of the Alternative 2B alignment to US 2 would result in a widening of disturbed area and could potentially discourage white-tailed deer movement within the approach area by decreasing cover. Alternative 2B transmission line construction activities could cause white-tailed deer to change their traditional movement patterns within this approach area, but these effects would be short-term because human-caused disturbance directly related to the project would cease when the transmission line construction was completed. Effects of the combined mine-transmission line alternatives, including construction of the Sedlak Park Substation and loop line, on white-tailed deer movement within the approach area would likely be minimal because: most of the habitat in the approach area in the study area is degraded due to high road densities and logging in the past 20 to 30 years; human-caused disturbance would be short-term; and for the agencies' combined mine-transmission line alternatives, relatively small segments of the transmission line corridors would cross the Fisher River valley.

Cumulative Effects

Past Actions and the Existing Condition

Past actions, including detailed descriptions of previous vegetation and road management activities, are described in section 3.2, *Past and Current Actions*, shown on Figure 50, and listed in Appendix E.

Forest management practices and other human activities (*e.g.,* hunting, wood consumption, and motorized recreation) have had influential cumulative impacts on white-tailed deer and other big-game security, as well as measurable fluctuations in cover to forage ratios. Harvest has occurred in the analysis area since the 1950s and resulting in a diversity of age classes and successional stages which provide forage and cover for white-tailed deer and other big game species; however, most past harvest areas have recovered to the point they are no longer considered openings and contribute to the high cover to forage ratio in the Crazy PSU. Historically, wildfire would create a mosaic of successional stages and result in vegetative diversity in this area. Since the mid-1990s, there has also been a greater use of intermediate harvest methods, which results in both hiding cover and foraging opportunities occurring in close proximity. Although more recent logging and prescribed burning has helped cycle forest cover through successional communities, fire suppression and past timber management has resulted in a trend toward homogenous stand composition and structure consisting of high density stands of shade-tolerant species (see section 3.22, *Vegetation*) that reduce the presence and productivity of understory forage species. The current conditions of various white-tailed deer habitat components are displayed in Table 204 and Table 205.

New roads decrease white-tailed deer and other big-game security (increasing vulnerability or risk of mortality), decrease habitat availability via temporary displacement, and can increase stress levels of resident species. KFP standards for open and total road densities have been and will continue to be an important tool to mitigate the associated cumulative impacts to white-tailed deer and other big-game. Activities affecting white-tailed deer habitat have changed in recent years, with a trend toward reduced motorized access as a result of decisions intended to facilitate grizzly bear recovery. This in turn has benefited white-tailed deer with the resulting decrease in ORD.

Development of private lands within the analysis area, including commercial timber harvest, land clearing, home construction, and road construction has contributed to increased disturbance of white-tailed deer and a loss or reduction in quality of foraging and winter habitat, and is expected to continue.

Areas previously impacted by special use permits such as mineral material sites (pits quarries, borrow, roadsides), water developments, utility corridors, private land access routes, and outfitter/guide trails/camps, would continue to be used. The ground disturbance on resources such as white-tailed deer winter range and cover is described previously for the affected environment and would have no additional impacts. Other public uses such as wildlife viewing, berry picking, firewood gathering, camping, snowmobiling, etc. have negligible impacts on white-tailed deer given their limited scope (time and space). Infra-structure, such as roads and campgrounds, that facilitate these activities have already been accounted in the description of the affected environment.

Effects of Current and Reasonably Foreseeable Actions

Reasonably foreseeable actions are described in section 3.3, *Reasonably Foreseeable Future Action or Conditions*. Current actions are described in section 3.2, *Past and Current Actions* and shown on Figure 50. Reasonably foreseeable actions located in the Crazy PSU include the Libby Creek Venture Drilling Plan and the Poker Hill Rock Quarry. Surface impacts from reasonably foreseeable actions would be minimal, and would not result in any measurable changes in cover or forage habitat.

New roads and roads closed for mitigation associated with reasonably foreseeable actions such as the Rock Creek Project and the Wayup Mine/Fourth of July Road Access Project, will contribute to cumulative effects on ORD in the Crazy PSU (Table 207). Reasonably foreseeable actions would increase ORD in MAs 15, 16, 17, and 18 by 0.1 mi/mi^2 to 4.4 mi/mi^2 and would reduce ORD in MA 12 to 4.87 mi/mi^2.

The Coyote Improvement vegetation management project is in the planning stages and would take place within the Crazy PSU. The project would harvest 240 acres to increase stand resiliency to mountain pine beetles. This project would contribute to open canopy habitat/openings within the analysis area. This habitat component is generally lacking on the landscape and Coyote Improvement project would contribute toward improving its availability within these planning subunits. The transmission line alternatives in Montanore would contribute openings as well, although they are expected to be maintained longer before natural succession is allowed to occur compared to Coyote Improvement.

Silverbutte Bugs timber sale is in the Silverfish PSU and would be a small project like Coyote. Similar to the timber sales mentioned above, it would contribute some openings/open-canopied habitat within this PSU. If Silverbutte Bugs mainly treats stands already impacted by insects/disease, those stands may already be in an open-canopied condition.

Flower Creek timber sale is in the Treasure PSU and only has minimal overlap with the project with a small amount of the access road for Montanore located within this PSU. Flower Creek timber sale, like the timber sales mentioned above, would contribute openings or open-canopied habitat as well. Approximately 900 acres are proposed for treatment. Due to the minimal overlap, cumulative effects would be minimal.

Road management actions such as road maintenance and administrative use associated with permit administration, data collection and monitoring of National Forest System lands are not likely to affect white-tailed deer habitat because they generally do not result in vegetation removal. White-tailed deer and other large ungulates will typically simply avoid the disturbance area until human activities terminate, which usually comprises of a few hours. Although water restoration projects may temporarily displace white-tailed deer and other wildlife from a localized area, they typically benefit wildlife in the long-term by providing pulses of foraging when seeded or by stabilizing soils where certain habitat components can remain available.

With population growth and development, it is reasonable to assume that some corresponding increase in human use of National Forest System lands is likely to occur. Recreational activities such as sightseeing, hiking, cross-country skiing, camping, snowmobiling, fishing, and firewood cutting are ongoing and expected to increase over the next 10 years. This increase is likely to be gradual and incremental and tend to be focused on areas along or near roads open to motorized traffic. White-tailed deer may, over time, experience more frequent disruption of their daily activities if they are in proximity to roads.

Table 207. Cumulative Effects to White-tailed Deer Habitat Components on National Forest System Land in the Crazy PSU by Combined Mine-Transmission Line Alternative.

Measurement Criteria	[1] Existing Condition	[1] No Mine1[1]	[2] MMC's Proposed Mine		[3] Agency Mitigated Poorman Impoundment 1Alternative						[4] Agency Mitigated Little Cherry Creek Impoundment Alternative					
			TL-B		TL-C-R		TL-D-R		TL-E-R		TL-C-R		TL-D-R		TL-E-R	
			Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]	Const[2]	Ops[3]
ORD in MA 12 (mi/mi^2) Standard is <0.75[4]	5.27	4.87	4.93	4.93	4.93	4.93	4.08	4.08	4.08	4.08	4.93	4.93	4.08	4.08	4.08	4.08
ORD in MAs 15, 16, 17, and 18 (mi/mi^2) Standard is <3.0[4]	4.3	4.4	4.6	4.2	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8

[1] Effects shown include effects of the Wayup Mine/Fourth of July Road Access Project, Plum Creek activities, the Rock Creek Project, and the Miller-West Fisher Vegetation Management Project. Alternative 1 (No Transmission Line) would not contribute to cumulative effects on ORD.
[2] Const = during mine construction.
[3] Ops = during transmission line and mine operations.
[4] All MA 12 and MA 15, 16, 17, and 18 within a 500-foot corridor of the transmission line centerline would be reallocated to MA 23. All MA 15, 16, 17, and 18 in the mine alternative permit area would be reallocated to MA 31. MA reallocation was taken into account in road density calculations.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Activities on private land, such as timber harvest, land clearing, home construction, road construction, and livestock grazing, are likely to continue on private lands within the Crazy PSU and would likely slightly impact cover and ORD. Potential effects depend on the magnitude, type and location of developments and include the loss of habitat and localized disturbance on white-tailed deer and other big game species. Private lands occupy 10 percent of the Crazy PSU. Because the proportion of white-tailed deer habitat in the Crazy PSU on private lands is small, development of private lands is expected to have minor cumulative impacts on white-tailed deer and other big game species within the analysis area over the next 10 years.

No Action Alternative

The Montanore Project No Action alternatives (Alternative 1 and Alternative A) would not contribute to cumulative impacts on white-tailed deer.

Combined Mine-Transmission Line Action Alternatives

Open Road Density

Alternatives 2B, 3C-R, and 4C-R, along with reasonably foreseeable actions, would result in an ORD decrease in MA 12 in the Crazy PSU to 4.93 mi/mi^2 during construction and operations, which is less than existing ORD. Cumulative ORD in MA 12 in the Crazy PSU in Alternatives 3D-R, 3E-R, 4D-R, and 4E-R would be 4.08 mi/mi^2 during construction and operations. In all alternatives, cumulative ORD in MA 12 in the Crazy PSU would be less than existing conditions due to road access changes associated with the Montanore mine-transmission line alternatives and other reasonably foreseeable actions.

In MAs 15, 16, 17, and 18 in the Crazy PSU, cumulative ORD would increase to 4.6 mi/mi^2 during construction in Alternative 2B, but would decrease to 4.2 mi/mi^2 during operations. The agencies' combined mine-transmission line alternatives, in combination with other reasonably foreseeable activities, would reduce ORD in MAs 15, 16, 17, and 18 in the Crazy PSU to 3.8 mi/mi^2 during construction and operations due to road access changes associated with the Montanore mine-transmission line alternatives and other reasonably foreseeable actions. In all combined mine-transmission line action alternatives, cumulative ORD would remain greater than KNF standards in MA 12 and MAs 15, 16, 17, and 18.

Forage Openings

Other reasonably foreseeable actions would not occur in MAs 10 and 11 and would not contribute to cumulative effects on forage openings in these areas. In all combined mine-transmission line action alternatives, one opening greater than 20 acres would be created in MA 11 along the Bear Creek Road near US 2. Effects on white-tailed deer of this new opening would likely be minimal because no point would be more than 600 feet to cover, and due to its proximity to US 2 and private property. The loss in forage capacity may impact individual white-tailed deer in the short term, until disturbed areas were successfully revegetated.

Key Habitat Features

All action alternatives would result in the disturbance of wetlands providing potential water and high-quality forage habitat for white-tailed deer in the Crazy PSU. Impacts on wetlands would be mitigated through implementation of the MMC's or the agencies' Wetland Mitigation Plans. Other reasonably foreseeable actions would contribute to losses of wetland habitat. Impacts on wetlands from reasonably foreseeable actions would require mitigation under the Clean Water Act.

Movement Areas

The mine action alternatives could interfere with white-tailed deer movement in the Little Cherry, Poorman, and Libby creek corridors. The transmission line alternatives could affect white-tailed deer movement where the lines traversed or crossed the Howard and Libby creek drainages. Alternative B could also disrupt movement in the Ramsey Creek corridor. Disturbance-related impacts from transmission line construction would be short-term and the width of clearing area would not likely be great enough to affect deer movement after the Construction Phase. Other reasonably foreseeable actions could impede deer movement in specific areas due to increased road use and noise disturbance, but KNF riparian standards would minimize activities in riparian areas. While some cumulative effects to white-tailed deer movement could occur, they would likely be minimal.

White-tailed Deer Winter Range on All Lands

All combined mine-transmission line action alternatives, in combination with other reasonably foreseeable actions, would result in cumulative impacts on white-tailed deer winter range on all lands in the analysis area, resulting in a reduction of thermal and hiding cover and, once disturbed areas were revegetated, an increase in forage habitat. Cumulative impacts of all combined mine-transmission line action alternatives would likely be minor because application of construction timing restrictions in winter range would minimize impacts. The combined mine-transmission line action alternatives, in combination with Plum Creek activities, could result in cumulative disturbance to white-tailed deer on private lands in the analysis area, and could displace white-tailed deer away from areas of disturbance. Because most of the habitat on private land in the study area is degraded due to high road densities and logging in the past 20 to 30 years and because human-caused disturbance would be short-term, effects of the combined mine-transmission line alternatives on white-tailed deer winter range would likely be minimal.

Wildlife Approach Area

The combined mine-transmission line action alternatives, in combination with Plum Creek activities, could result in cumulative disruption of white-tailed deer movement in the wildlife approach area. Because most of the habitat on private land in the wildlife approach area in the study area is degraded due to high road densities and logging in the past 20 to 30 years and because human-caused disturbance would be short-term, effects of the combined mine-transmission line alternatives on white-tailed deer movement within the approach area would likely be minimal.

Cumulative Effects of Plan Amendments for Open Road Density (MA 12)

Alternative 2B would increase ORD in MAs 15, 16, 17, and 18 in the Crazy PSU, where standards are not currently met (Table 206), and would require a KFP amendment to increase road densities. Specifically, the KFP amendment for increases in ORD would apply to: MAs 16 and 17 in sections 14, 15, and 24 in T28N, R31W; sections 18 and 19 in T28N, R30W; MAs 15 and 16 in sections 7, 8, 17, and 18 in T27N, R30W; and sections 1, 2, and 12 in T27N, R31W.

Johnson (2006) analyzed the cumulative effects of the KFP amendment for changing the ORD requirements. This analysis looked at post-project changes in ORD, both increases and decreases, and calculated a cumulative change to ORD in MA 12. Since 2006, only six projects have received a project specific amendment for ORD in MA 12, which now total 46 for the KNF (USDA Forest Service 2013b). Of these, four of the projects would have high ORD levels during implementation but would return to the existing condition post-project. One project would improve upon the existing ORD level post-project and ORD would become better than the MA standard.

As described under the Affected Environment section, the white-tailed deer population appears to be increasing which may be due to increased road restrictions and decommission in the past 20 years (USDA Forest Service 2008c). The cumulative effects of past and present land use patterns as well as random natural events have been taken into consideration in this analysis.

Regulatory/Forest Plan Consistency

Organic Administration Act and Forest Service Mineral Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources and to take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations. Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8. In the proposed action, MMC did not propose to implement feasible measures to minimize effects on the white-tailed deer or all practicable measures to maintain and protect wildlife habitat. The agencies' alternatives (Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R) would comply with 36 CFR 228.8. The agencies' alternatives would incorporate additional feasible and practicable measures to minimize adverse environmental impacts on wildlife habitat that benefit white-tailed deer, including yearlong access changes through the installation of barriers or gates in several roads to reduce ROD and mitigate for impacts to big game (Table 28 and Table 29 and Figure 35), daily removal of any big game animals killed by vehicles from road rights-of-way within the permit area and along roadways used for access or hauling ore for the life of the mine, and monitoring and annual reporting of the number of big game animals killed by vehicle collisions on these roads. In the agencies' alternatives, Highway safety signs such as "Caution – Truck Traffic" would help slow public traffic speeds in anticipation of meeting oncoming trucks, and staging shipments of supplies in a general location prior to delivery to the mine site would reduce traffic and deer mortality risk.

National Forest Management Act/Kootenai Forest Plan

1. Forestwide Management Direction – KFP II-1 #3, #7, II-2 #12, #17, II-7, 22, 23

#3 – *Maintain a balance of open and closed road… (to) insure big-game habitat security…:* In all combined mine-transmission line alternatives, although during transmission line construction some restricted, impassable/barriered, and temporary roads would be opened and some new access roads would be needed, road access changes to mitigate for impacts on grizzly bear would be implemented. The agencies' alternatives would also include additional access changes in numerous roads to mitigate for the loss of big game security (Figure 35 and Table 28 and Table 29).

#7 – *Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species:* Cover to forage ratios in the Silverfish PSU indicate that the proportion of forage habitat is well below recommended levels. Current populations of white-tailed deer would likely be maintained in all mine-transmission line action alternatives because changes to cover to forage ratios would be 4 percent or less, and because while cover would decrease relative to forage, the Crazy PSU provides an abundance of cover. The combined mine-transmission line alternatives would not change cover relative to forage habitat or the percent thermal cover in MAs 10 and 11. In the long term, after reclamation success criteria are achieved, areas disturbed by the combined mine-transmission line alternatives would provide forage for white-tailed deer, thereby moving toward KFP objectives for forage habitat.

#12 – *Maintain big-game habitat to support the recreational hunting demand for resident big-game species:* Except for thermal cover in MAs 10 and 11, levels of cover in the Crazy PSU would be maintained above recommended guidelines in all combined mine-transmission line alternatives, and would provide for habitat conditions maintaining the existing populations of elk for local hunting demand. Overall, road densities would likely continue to improve through land acquisition associated with grizzly bear mitigation.

#17 – *Use prescribed fire to simulate natural ecological processes… create habitat diversity for wildlife…* None of the alternatives would include prescribed burns.

p.II-7 –Habitat maintenance to support huntable populations of all other big game species as well as viable population levels of all endemic vertebrate species of wildlife: Based on FWP data, the KNF's 2007 Monitoring and Evaluation Report (USDA Forest Service 2008c) concluded that white-tailed deer are the most abundant and widespread big game animal in the KNF, and that the white-tailed deer population in the KNF is steadily increasing. Except for thermal cover in MAs 10 and 11, in all combined mine-transmission line alternatives, levels of cover in the Crazy PSU would be maintained above recommended guidelines and would provide for habitat conditions maintaining the existing populations of elk for local hunting demand. Overall, road densities would likely continue to improve through land acquisition associated with grizzly bear mitigation.

p.II-22, 23 – Maintenance of viable populations of existing native and desirable non-native vertebrate species, as monitored through indicator species, attained through the maintenance of a diversity of plant communities and habitats: See #7 above for habitat diversity. White-tailed deer are monitored as an indicator species for general forest habitat. Their occurrence and estimation of population is monitored through District observations, FWP surveys, and KNF Monitoring and Evaluation Reports.

2. Applicable Management Area Direction (MAs 10, 11, 12, 15, 17, and 18) –KFP III-39, 44/45, 48/49/51, 65, and 75.

Objectives of the proposed mine-transmission line action alternatives are to facilitate mine development. Mine-transmission line action alternatives would include the re-allocation of MAs 15, 16, 17, and 18 in the mine permit areas and MA 12 lands in a 500-foot corridor along the transmission line to MA23.

MA 10 (Big Game Winter Range) – Maintain or enhance the habitat effectiveness for winter use by big game species through cover/forage ratios, prescribed fire, and maintenance of wildlife movement patterns: None of the combined mine-transmission line alternatives would affect cover to forage ratios or percent thermal cover in MA 10.

MA 11 (Timber/Big Game Winter Range) – Maintain or enhance the winter range habitat effectiveness for big game species (while also achieving timber and visual goals) through prescribed fire, maintenance of wildlife movement patterns/corridors, management of key habitat components as riparian areas, and utilizing harvest to achieve desired cover/forage ratios, a variety of seral stages, and maximization of edge effect in units generally not exceeding 40 acres: See description for MA 10 above.

MA 12 (Timber/Big Game Summer Range) – Maintain or enhance non-winter big game habitat (while also achieving timber goals) through habitat diversity, maximization of edge effect in units generally not exceeding 40 acres, maintaining hiding cover between openings, management of key habitat components as riparian areas, managing open roads to no more than ¾ miles per square mile: Alternatives 3D-R, 3E-R, 4D-R, and 4E-R would include the reallocation of MA 12 in a 500-foot corridor along the transmission line to MA 23. The amendment would be for the duration of the proposed Montanore Project. ORD in MA 12 would improve in all combined mine-transmission line alternatives.

MA 15 (Timber Production) - Produce timber using various standard silvicultural practices while providing for other resource values such as wildlife, including big game, through maintenance of habitat effectiveness and security by limiting ORD to a maximum of 3 miles per square mile and management of key habitat components, such as riparian areas: For all combined mine-transmission line alternatives, any MA 15, 16, 17, or 18 in the mine permit area would be reallocated to MA 31. The agencies' combined mine-transmission line alternatives would improve ORD in MAs 15, 16, 17, and 18. In MAs 15, 16, 17, and 18 in the Crazy PSU, cumulative ORD would increase to 4.5 mi/mi^2 during construction in Alternative 2B, but would decrease to 4.2 mi/mi^2 during operations. Alternative 2B would require a KFP amendment to increase road densities in MAs 15, 16, 17, and 18. Specifically, the KFP amendment for increases in ORD would apply to: MAs 16 and 17 in sections 14, 15, and 24 in T28N, R31W; sections 18 and 19 in T28N, R30W; MAs 15 and 16 in sections 7, 8, 17, and 18 in T27N, R30W; and sections 1, 2, and 12 in T27N, R31W. All key habitat components have been identified and maintained under all alternatives.

MA 16 (Timber with Viewing) - Produce timber while providing for a pleasing view. Manage wildlife habitat to provide for viable populations of existing native species, including big game, through maintenance of habitat effectiveness and security by limiting ORD to a maximum of 3 miles per square mile and management of key habitat components, such as riparian areas: See MA 15 above.

MA 17 (Viewing with Timber) - Provide landscapes that are pleasing to the viewer, while producing a level of timber production that is compatible with visual resource protection. Manage wildlife habitat to provide for viable populations of existing native wildlife species, including big game, through maintenance of habitat effectiveness and security by limiting ORD to a maximum of 3 miles per square mile and management of key habitat components, such as riparian areas: See MA 15 above.

MA 18 (Regeneration Problem Areas; Steep Slopes) – Maintain existing vegetation (future timber production) and viable populations of existing native wildlife species, including big game, through maintenance of habitat effectiveness and security by limiting ORD to a maximum of 3 miles per square mile and management of key habitat components, such as riparian areas: See MA 15 above.

Forest Service Management Indicator Species Statement of Findings

KFP direction is to "maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species,… in sufficient quality and quantity to maintain viable populations" (KFP Vol. 1, II-1 #7). ***Based on the white-tailed deer analysis and the KNF Conservation Plan (Johnson 2004a), all combined mine-transmission line alternatives would provide general forest species habitat with sufficient quality and quantity of the diverse age***

classes of vegetation needed for viable populations. In all combined mine-transmission line alternatives, sufficient general forest habitat would be available; the populations of species using that habitat should remain viable.

The mine-transmission line action alternatives would decrease cover to forage ratios in summer range, decrease percent cover in MAs 15, 16, 17, and 18, and increase displacement. Alternative 2B would increase ORD in MAs 15, 16, 17, and 18 where ORD is currently worse than the standard. In all combined mine-transmission line alternatives, road densities would likely improve through the grizzly bear land acquisition requirement, as described in sections 2.5.6, *Mitigation Plans*. Acquired parcels would be managed for grizzly bear use in perpetuity, and could improve road densities where roads could be closed. The agencies' land acquisition requirement would likely be more effective at reducing road densities than MMC's proposed land acquisition because more land would be protected. Based on the white-tailed deer analysis of general forest habitat indicators and the KNF Conservation Plan (Johnson 2004a), sufficient quality and quantity of diverse habitat types and age classes of vegetation are available and would continue to be available to support white-tailed deer populations in the Silverfish PSU.

State Requirements

Alternatives 3 and 4 would comply with the MMRA regarding disturbed lands being reclaimed to a post-mining land use with stability and utility comparable to that of the pre-mining landscape. Draft findings regarding compliance with MFSA requirements are discussed in the Summary, beginning on p. S-53. White-tailed deer and other ungulate populations are managed by FWP. Proposed actions would not prevent the state from continuing to manage these species as harvestable populations.

3.25.3.4 Mountain Goat

3.25.3.4.1 Analysis Area and Methods

The mountain goat is the KNF MIS for alpine habitat. Mountain goat ecology, biology, habitat use, status, and conservation are described and summarized in Joslin (1980) and Brandborg (1955). That information is incorporated by reference. Mountain goat occurrence data come from District wildlife observation records, Forest historical data (NRIS Wildlife) and other agencies (FWP).

Habitat mapping for mountain goat is derived from Joslin (1980), and is categorized according to seasonal use (winter and summer, range). Five habitat categories are defined in Joslin (1980) and mapped by Brown (2006). Because winter range is limited and critical for the annual overwinter survival and productivity of mountain goats, any impact on winter range, whether categorized as confirmed, likely, or possible winter range, was considered as an impact on winter range. Likewise, areas used by goats to transition between summer and winter range (transitional summer range) and areas regularly used by mountain goats during summer (summer range) were combined into a single summer range because mountain goats may be found in any of these areas during warm seasons.

Mountain goats have been shown to be sensitive to human disturbances such as helicopter use, blasting, and road building (Joslin 1980; Côte 1996; Côte *et al.* 2013, Goldstein *et al.* 2005, Wilson 2005). Increased disturbance may result in displacement from suitable habitat. Mountain goats may also remain in proximity of the disturbance, potentially suffering increased stress levels that could result in a decline in reproductive rates (Ibid.). Mountain goats have been found to be moderately to strongly disturbed by helicopter flights less than 500 meters horizontal distance (Côte *et al.* 2013) Disturbance responses decrease with horizontal distance up to 1,500 meters where goats have little to no response to helicopter flights (Ibid.). Côte *et al.* (2013) and Cadsand (2012) suggest a minimum separation distance of 1,500 meters between helicopter flights and goat range, thus, the influence zones (1 mile or about 1,600 meters) suggested for grizzly bear in the Cumulative Effects Model (USDA Forest Service *et al.* 1988; USDA Forest Service *et al.* 1990) were used to estimate the displacement effects of disturbances associated with mine and transmission line construction and operations on mountain goats. Disturbance effects were calculated by applying the following buffers: 0.25 mile on each side of open roads (including seasonally open roads that are open during bear year from April 1 to Nov. 30) and 1 mile on each side of helicopter construction disturbance. In all transmission line action alternatives, no transmission line construction would occur on National Forest System or State lands between December 1 and April 30.

Effects of the alternatives were evaluated based on impacts on mountain goat habitat. The analysis area for direct and indirect project impacts on individuals and their habitat includes all mountain goat habitat in the Crazy, and Silverfish PSUs, and a 0.25-mile buffer surrounding the Rock Lake Ventilation Adit in the Rock PSU (Figure 90). The boundaries for determination of population trend and contribution toward population viability are the FWP Mountain Goat HD 100 and the KNF, respectively. Mountain goat habitat does not occur on private land within the zone of influence of the proposed project.

The impacts analysis includes an evaluation of the potential benefits to mountain goats from mitigation measures proposed by MMC or the agencies. The agencies' mitigations include funding for monitoring of mountain goat responses to mine-related impacts, prohibiting blasting at adit portals during kidding (between May 15 and June 15), access changes, land acquisitions, and prohibiting employees from carrying firearms.

3.25.3.4.2 Affected Environment

Mountain goats are found primarily in alpine habitat and high elevation coniferous forest stands throughout the year. Goats annually use the same summer and winter ranges, travel corridors, kidding areas, and mineral licks, and rarely explore new territory, which make them vulnerable to human activities or habitat changes in their range. Habitat use information and traditional use patterns are learned behaviors passed down through generations. If traditional use patterns are altered and seasonal home range knowledge is not transferred to offspring, then suitable ranges may not be recolonized. Mountain goats use steep rock outcrops and escarpments for escape from predators and security during the kidding period, and feed on vegetation found in the rock crevices. They use coniferous timber as shelter from severe weather, particularly during winter. Mountain goats eat a wide variety of foods, but in the Cabinet Mountains, shrubs are the major component of their diet year-round. Grasses are also consumed when available. The analysis area contains about 43,470 acres of summer mountain goat habitat ((Figure 90).

Mountain goat winter range is usually found in spruce-fir forests that are characterized by 80 percent slopes, average snow depths of less than 20 inches, or where the terrain extends to areas of lower elevation with an average snow depth less than 20 inches. During the winter, mountain goats usually forage on shrubs and trees. During mild winters, mountain goats have been known to travel between several winter areas. The analysis area contains about 5,863 acres of winter range (Figure 90).

During the 1988-1989 environmental studies, most goats in the area wintered in Rock Creek, but two were observed above Libby Creek and one above Ramsey Creek (Western Resource Development Corp. 1989f). FWP has identified the area above Rock Creek the south-facing slopes above upper West Fisher Creek; and south-facing slopes above Libby, Ramsey, and Poorman creeks as winter range (Brown 2006).

Historical population numbers were estimated to be 350 goats in the Cabinet Mountains in 1950, declining to between 95 and 160 in 1980 (Casebeer *et al.* 1950; Joslin 1980). Mountain goat counts have fluctuated widely during FWP standardized sampling surveys of HD 100 (Cabinet Mountains) since 2001. A low count of 53 total goats was counted in HD 100 in 2001 with a high count of 105 in 2003. The most recent count (2013) counted 54 total goats, but a high percentage of kids compared to adults (43 percent), indicating a high rate of reproduction (FWP 2013d). During surveys conducted in 1988 and 1989, 40 to 55 mountain goats were estimated to occupy rocky ridges in portions of the analysis area (Western Resource Development Corp. 1989f). During all seasons, most of the activity was in and near the headwalls of the Rock, Libby, and West Fisher creek drainages, but some solitary males were observed in the Ramsey and Poorman creek areas. The closest documented wintering area on the east side of the Cabinet Mountains was on the south-facing slope of Shaw Mountain in Libby Creek. Two goats were seen in this area in 1989 (Ibid.), which is about 0.5 mile north of the Libby Adit Site. More recent observations by FWP personnel indicate that Libby, Ramsey, West Fisher, Poorman, and Rock creeks represent a population epicenter for mountain goats in the southern Cabinet Mountains (Brown, pers. comm. 2008).

Mountain goat breeding occurs primarily in November (Joslin 1980). During the breeding season, mountain goats are primarily observed in the project vicinity in the Libby, Ramsey, and West Fisher creek drainages (Brown, pers. comm. 2007).

Summer transitional mountain goat habitat provides high-quality forage areas within high elevation coniferous forests and rock outcrops. Although winter range appears to be the limiting factor to goat densities in the Cabinet Mountains, quality summer range is also of paramount importance in providing highly nutritious forage, which fortifies the body for winter and sustains the population from year-to-year. Ridgelines are commonly used as travel corridors (Joslin 1980).

Mountain goats generally give birth to their kids in late May or early June on lower slopes at the mouth of drainages (Joslin 1980). The areas around Shaw Mountain and Leigh Lake appear to be important for mountain goat kidding (Brown, pers. comm. 2005, 2008).

3.25.3.4.3 Environmental Consequences

Mine Alternatives

Alternative 1 would have no direct impacts on mountain goats. Physical impacts on mountain goat habitat from the mine alternatives would be greatest for Alternative 2, which would affect 108 acres of summer range, primarily due to the Ramsey Plant Site and LAD Area 1. Alternative 2 would also directly affect 44 acres of winter range along Ramsey Creek. Alternatives 3 and 4 would directly impact 90 acres of summer mountain goat habitat along Libby Creek and at the Rock Lake Ventilation Adit. Alternatives 3 and 4 would not directly affect any winter mountain goat habitat.

In Alternatives 3 and 4, results of mountain goat surveys funded by MMC would be analyzed by the KNF, in cooperation with the FWP, at the end of the construction period to determine the appropriate level and type of survey work needed during the Operations Phase. If the agencies determined that construction disturbance were significantly affecting goat populations, mitigation measures would be developed and implemented to reduce the impacts of mine disturbance. MMC would not conduct any blasting at the entrance to any adit portals during May 15 to June 15 to avoid disturbance to the potential goat kidding area on Shaw Mountain.

Alternative A – No Transmission Line

Alternative A would have no impacts on mountain goat habitat (Table 208).

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

The agencies' transmission line alternatives (C-R, D-R, and E-R) would not affect mountain goats. Construction of the Sedlak Park Substation and loop line would have no impacts to mountain goats with any alternative. Impacts on mountain goats from the Transmission Line Alternative B are shown in Table 208 and described in the following subsections. The analysis of the effects of human activity on goats is based on activity-specific buffers, and includes the effects of open roads. Road access changes associated with mitigation were determined for combined action alternatives. It is not possible to attribute these access changes to individual mine and transmission line alternatives independent of one another. Because the disturbance influence zone applied to new or opened roads associated with the transmission line is encompassed entirely by the buffer applied for helicopter disturbance, human disturbance effects for transmission line construction are calculated based on the area of overlap between the helicopter disturbance influence zone and mountain goat habitat. It is assumed that human activity would not affect mountain goats during transmission line operations. The evaluation of the effects of human activity on mountain goats from individual mine alternatives may be inferred from impact calculations for the combined mine-transmission line alternatives shown in Table 209.

Table 208. Mountain Goat Habitat Affected by North Miller Creek Transmission Line Alternative.

Habitat Component	[A] No Transmission Line (acres)	[B] North Miller Creek (acres)	
		Const[1]	Ops[2]
Summer Mountain Goat Habitat Available (acres)	43,407	43,407	43,407
Summer Mountain Goat Habitat Physically Removed (acres)	0	23	23
Winter Mountain Goat Habitat Available (acres)	5,863	5,863	5,863
Winter Mountain Goat Habitat Physically Removed (acres)	0	24	24
Total Mountain Goat Habitat Available (acres)	49,090	49,090	49,090
Total Mountain Goat Habitat Physically Removed (acres)	0	47	47

[1] Const = during transmission line construction.
[2] Ops = during transmission line operations
Source: GIS analysis by ERO Resources Corp. using KNF Cabinet Mountain goat habitat, 2006 developed by Jerry Brown, Fish Wildlife and Parks, digitized by Barb Young.

Table 209. Summer Mountain Goat Habitat Affected by Combined Mine-Transmission Line Alternative.

Habitat Component	[1] No Mine/ Existing Conditions (acres)	[2] MMC's Proposed Mine (acres)		[3] Agency Mitigated Poorman Impoundment Alternative (acres)						[4] Agency Mitigated Little Cherry Creek Impoundment Alternative (acres)					
	TL-A	TL-B		TL-C-R		TL-D-R		TL-E-R		TL-C-R		TL-D-R		TL-E-R	
		Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]
Summer Mountain Goat Habitat Available (acres)	43,407	43,407	43,407	43,407	43,407	43,407	43,407	43,407	43,407	43,407	43,407	43,407	43,407	43,407	43,407
Summer Mountain Goat Habitat Physically Removed (acres)[3]	0	125	125	90	90	90	90	90	90	90	90	90	90	90	90
Summer Habitat Displacement from Past Human Activity (acres % of available)	3,713 (9)	3,713 (9)	3,713 (9)	3,713 (9)	3,713 (9)	3,713 (9)	3,713 (9)	3,713 (9)	3,713 (9)	3,713 (9)	3,713 (9)	3,713 (9)	3,713 (9)	3,713 (9)	3,713 (9)
Summer Habitat Displacement from Alternative Activity[4,5] (acres % of available)	0 (0.0)	6,791 (16)	2,200 (5)	5,066 (12)	1,707 (4)	5,011 (12)	1,707 (4)	5,011 (12)	1,707 (4)	5,006 (12)	1,707 (4)	5,011 (12)	1,707 (4)	5,011 (12)	1,707 (4)

[1] Const = during project construction.
[2] Ops = during project operations.
[3] Due to overlap between mine and transmission line disturbance footprints, habitat physically removed due to mine alternatives in combination with transmission line alternatives are not additive.
[4] Acres of disturbance do not include areas of overlap from different sources of disturbance.
[5] For Alternative 2B, the use of helicopters during line construction would be at the discretion of MMC. The agencies assumed that helicopters would not be used during vegetation clearing or structure placement for Alternative 2B. Helicopter use was assumed for line stringing only.
Source: GIS analysis by ERO Resources Corp. using KNF Cabinet Mountain goat habitat, 2006, developed by Jerry Brown, Montana Fish Wildlife and Parks, digitized by Barb Young.

Table 210. Winter Mountain Goat Habitat Affected by Combined Mine-Transmission Line Alternative.

Habitat Component	[1] No Mine/ Existing Conditions	[2] MMC's Proposed Mine		[3] Agency Mitigated Poorman Impoundment Alternative						[4] Agency Mitigated Little Cherry Creek Impoundment Alternative					
	TL-A	TL-B		TL-C-R		TL-D-R		TL-E-R		TL-C-R		TL-D-R		TL-E-R	
		Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]
Winter Mountain Goat Habitat Available (acres)	5,683	5,683	5,683	5,683	5,683	5,683	5,683	5,683	5,683	5,683	5,683	5,683	5,683	5,683	5,683
Winter Mountain Goat Habitat Physically Removed (acres)	0	56	56	0	0	0	0	0	0	0	0	0	0	0	0

[1] Const = during project construction.
[2] Ops = during project operations.
[3] Due to overlap between mine and transmission line disturbance footprints, habitat physically removed due to mine alternatives in combination with transmission line alternatives are not additive.
No transmission line construction would occur in any alternative between December 1 and April 30.
Source: GIS analysis by ERO Resources Corp. using KNF Cabinet Mountain goat habitat, 2006, developed by Jerry Brown, Montana Fish Wildlife and Parks, digitized by Barb Young.

Alternative B would physically remove 23 acres of summer mountain goat habitat and 24 acres of winter mountain goat habitat, due to the transmission line clearing area in Ramsey Creek (Table 208). During the Construction Phase, Alternative B would result in additional short-term disturbance to goats, primarily due to displacement from roads and helicopter line stringing in the Ramsey Creek area, between May 1 and November 30. Transmission line construction would not occur between December 1 and April 30. Line stringing conducted by helicopter would likely approach within 500 meters (horizontal distance) of mountain goat groups. Mountain goats within 500 meters of helicopter line stringing would be moderately to strongly disturbed (Côte *et al.* 2013). Disturbance to mountain goats would diminish with distance to 1,500 meters horizontal distance where little to no disturbance would occur (Côte *et al.* 2013). Disturbance could displace goats from suitable habitat or reduce their ability to effectively use the available habitat in the short term. Individual goats or groups could suffer increased stress levels from disturbance during helicopter line stringing, but these impacts would last no more than 10 days and would not likely affect goat populations. Disturbance effects could also occur from other transmission line construction activities in areas where helicopters were not used. Except for annual inspection and infrequent maintenance operations, helicopter and other transmission line construction activities would cease after transmission line construction until decommissioning. Helicopter use and other activities could result in short-term disturbance of mountain goats during line decommissioning.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

Alternative C-R would not physically remove any mountain goat habitat. Helicopter construction of transmission structures would not occur in proximity to mountain goat habitat, and is not expected to affect mountain goats. Line stringing conducted by helicopter may displace goats temporarily from suitable habitat or reduce their ability to effectively use the available habitat. During the Construction Phase, Alternative C-R would result in increased short-term disturbance of goat habitat, primarily due to helicopter line stringing at the mouth of upper Libby Creek. Individual goats may suffer increased stress levels from disturbance during helicopter line stringing, but these impacts would last no more than 10 days and would not likely affect goat populations. In Alternative C-R, except for annual inspection and infrequent maintenance operations, helicopter use and other transmission line construction activities would cease after transmission line construction until decommissioning, similar to Alternative B.

Alternative D-R – Miller Creek Transmission Line Alternative

Impacts of Alternative D-R on mountain goats would be the same as Alternative C-R.

Alternative E-R – West Fisher Creek Transmission Line Alternative

Impacts of Alternative E-R on mountain goats would be the same as Alternative C-R.

Combined Mine-Transmission Line Effects

Impacts of the combined mine-transmission line alternatives are shown in Table 209 and Table 210 and described below. Because some of the impact buffers for the mine alternatives and transmission line alternatives, acres of disturbance do not include areas of overlap from the different sources of disturbance. Construction of the Sedlak Park Substation and loop line would have no impacts to mountain goats with any alternative.

Alternative 2B would result in direct losses of about 125 acres of summer mountain goat habitat and 56 acres of winter mountain goat habitat, mostly due to disturbance from the Rock Lake Ventilation Adit and Ramsey Plant Site (Table 209). Slightly less goat habitat would be directly lost by the combined agencies' alternatives because the adits and plant site would be located in the same drainage (*i.e.*, Libby Creek). All combined agencies' alternatives would physically disturb about 90 acres of summer mountain goat habitat and no winter habitat. However, both Alternative 2B and the combined agencies' alternatives would directly impact one percent or less of the available summer and winter goat habitat.

Disturbance effects from human activity would have a much greater impact on the mountain goat than physical impacts on goat habitat, and would include disturbance from activities associated with blasting, construction of the plant and adit sites, road construction and use, plant and adit operations, and helicopter use that could displace goats from suitable habitat or reduce their ability to effectively use the available habitat. Disturbance from helicopter use and other transmission line construction activities are described above for the transmission line alternatives. Disturbance from blasting during mine construction could result in habitat displacement and increased stress levels for mountain goats, but would be short-term. Blasting would likely be mostly underground at the Libby Adit, where a maximum of two rounds of blasting would occur at the surface. The Ramsey Adits would probably require a maximum of two rounds of surface blasting per adit. The ventilation raise would be constructed from inside the mine and would not require any surface blasting, except for creation of the surface opening. Construction of the Ramsey Adits for Alternative 2B and the lower and upper Libby Adits for the combined agencies' alternatives is expected to take about 1 year. The Construction Phase in all combined action alternatives is expected to last 2 to 3 years. Noise and human activity associated with plant construction could also cause goats inhabiting surrounding areas to move to other portions of their home range for the duration of construction activities. Goats could suffer increased stress levels from disturbance during construction and operations that could result in a decline in reproductive rates (Joslin 1980).

During the Construction Phase, Alternative 2B would result in the most additional human disturbance to goat habitat, affecting about 6,791 acres of summer mountain goat range (16 percent of the habitat available). Human disturbance impacts from Alternative 2B would be greater than the combined agencies' alternatives due to helicopter line stringing, plant construction, and adit construction in Ramsey Creek. Less goat habitat would be disturbed by combined agencies' alternatives because the adits and plant site would be located in the same drainage (*i.e.*, Libby Creek), and because the transmission line would end at the mouth of Libby Creek. The agencies' alternatives would result in additional disturbance to between 5,006 acres and 5,066 acres or 12 percent of the summer mountain goat habitat available during project construction (Table 209). For the combined agencies' alternatives, no blasting would occur at the adits from May 15 to June 15, which would minimize disturbance to the potential goat kidding area on Shaw Mountain. The combined agencies' alternatives also would include funding for monitoring of mountain goat responses to mine-related impacts. In the agencies' mitigation (see section 2.5.7.4.5, *Indicator Species*), MMC would monitor goat populations, and the KNF, in consultation with the FWP, would assess effects. If mine disturbance were found to have a substantial impact on goat populations, MMC would develop, fund, and implement mitigation measures to reduce the impacts of mine disturbance.

During mine operations, additional disturbance to summer mountain goat habitat would range from 1,707 acres for the combined agencies' alternatives to 2,200 acres for Alternative 2B (4 and 5 percent of available summer habitat, respectively). Operations of Alternative 2B would affect slightly less winter goat habitat than the combined agencies' alternatives. During winter, mine operations would result in additional disturbance to winter mountain goat habitat ranging from

290 acres for Alternative 2B to 351 acres for the combined agencies' alternatives (5 and 6 percent of available winter habitat, respectively).Long-term disturbance to mountain goats during operations, such as noise and human activity, could cause goats to experience increased stress levels or to move from currently inhabited surrounding areas to other portions of their home range.

Most disturbances to goats would be short-term, and long-term disturbance (habitat removal) would increase on a relatively small proportion of goat habitat in the analysis area (Table 209). Alternative 2B would result in 0.3 percent of the summer mountain goat habitat and 1 percent of the winter mountain goat habitat available. The agencies' combined alternatives would result in less than 1 percent of the summer mountain goat habitat available and no loss of winter habitat. In all combined action alternatives, some disturbance effects would be offset by access changes (installation of gates or barriers and public access restrictions) and habitat acquisitions planned as mitigation for the impacts on grizzly bear and big game security. Acquired parcels would be managed for grizzly bear use in perpetuity, and could improve or contribute suitable mountain goat habitat if the acquired parcels were located within goat habitat. The combined agencies' alternatives would include more road access changes and habitat acquisition, and would more effectively mitigate potential effects of disturbance to mountain goats. The combined mine-transmission line alternatives are not anticipated to result in the loss of goat herd occurrence or abundance in the southern Cabinet Mountains. In all combined action alternatives, the risk of mountain goat mortality would increase as a result of increased access to summer mountain goat habitat.

Cumulative Effects

Past actions are described in section 3.2, *Past and Current Actions,* shown on Figure 50, and listed in Appendix E. Past actions, particularly timber harvest. Past actions (Appendix E) applicable to cumulative effects on mountain goats include mineral activities and road construction, maintenance and obliteration.

Neither Alternative 1 nor Alternative A would cumulatively impact mountain goats. Mineral exploration has occurred and would continue to occur throughout the Cabinet Mountains, cumulatively displacing goats from suitable habitat or reducing their ability to effectively use the available habitat. Disturbance impacts on mountain goats from the combined action alternatives would be compounded when impacts from other reasonably foreseeable actions are taken into account. Although unlikely to occur concurrently, the Wayup Mine/Fourth of July Road Access Project, the Rock Creek Project, and the Bear Lakes Access Project would collectively influence about 4,561 acres of MS-1 goat habitat (Bratkovich, pers. comm. 2008), potentially resulting in this habitat becoming less desirable or less effective for mountain goats.

Some of the disturbance associated with construction of the proposed project and other reasonably foreseeable actions, such as blasting and helicopter line stringing and construction, would be short-term. Noise generated by construction and blasting for the evaluation adits for the Rock Creek Project would occur sporadically for several weeks. Underground blasting would be considered after the adit reaches a depth of about 500 feet at the Rock Creek site to reduce the effects of blasting, based on experience at the Troy Mine adit. If surface blasting and other construction activities occurred concurrently for the Rock Creek and Montanore projects, cumulative noise disturbance could result in habitat displacement and increased stress levels for mountain goats.

While cumulative disturbance impacts on goats would be mostly short-term, disturbance during project operations, such as noise and human activity, would be long-term. Road access into critical goat habitat is the single biggest threat to goats in the Cabinet Mountains (Joslin 1980), and the Fourth of July proposal would construct a new road to the edge of the CMW and MS-1 habitat. Cumulative long-term disturbance to mountain goats could result in changes in seasonal habitat use, potentially causing goats to shift their use of both summer and winter habitat in Ramsey Creek (Alternative 2B only), and summer ranges in Libby Creek (all combined action alternatives), upper West Fisher Creek and Rock Creek basins. These potential changes in seasonal habitat use could increase the use of unaffected summer ranges creating potential conflicts with resident goats in the CMW. The cumulative disturbance effects of the mine alternatives and other reasonably foreseeable actions could result in reduced reproductive rates and a decrease in population of the Rock Creek herd. Some cumulative human-caused disturbance effects would be offset by road access changes (installation of barriers and gates and public access restrictions) and habitat acquisitions planned as mitigation for the Montanore, Rock Creek, and other projects.

No other past, current, or reasonably foreseeable actions are anticipated to contribute to cumulative impacts on mountain goats.

Regulatory/Forest Plan Consistency

Organic Administration Act and Forest Service Locatable Minerals Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources and to take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations. Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8. In these alternatives, MMC did not propose to implement feasible measures to minimize effects on the mountain goat or practicable measures to maintain and protect wildlife habitat. The agencies' alternatives (Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R) would incorporate feasible and practicable measures to minimize adverse environmental impacts on the mountain and wildlife habitat. These measures would include adding timing restrictions to blasting, and implementing monitoring and adaptive management during construction and operations. The agencies' land acquisition requirements in Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R would more likely provide mountain goat habitat than the land acquisition requirements of Mine Alternative 2 and Transmission Line Alternative B.

National Forest Management Act/Kootenai Forest Plan

The KFP does not provide specific direction for mountain goats. In all combined mine-transmission line alternatives, adequate amounts of mountain goat habitat would continue to be provided for mountain goats. All combined mine-transmission line alternatives would be consistent with KFP direction on MIS (KFP Vol. I, II-1 #3 and #, pp. II-1#3, II-2#12, and II-23-23.

Based on the analysis for mountain goat and the KNF Conservation Plan (Johnson 2004a), in all action alternatives, habitat for alpine habitat species would be provided in sufficient quality and quantity of the diverse age classes of vegetation needed for viable populations.

Forest Service Management Indicator Species Statement of Findings

All of the action alternatives would have a minor long-term effect on mountain goats. Less than 0.3 percent of the available summer habitat would be directly lost from the construction of any alternative. About 1.2 percent of the available winter habitat would be directly lost from the construction of Alternative 2B. Operational activities of the mine under Alterative 2B could displaces goats from 5.1 percent of the available summer and winter habitat, whereas, the agencies' modified alternative could displace goats from about 3.9 and 6.2 percent of available summer and winter habitat, respectively. Mosaics of habitat types, forage opportunities, and secure habitat away from open roads and mine facilities are available within alpine habitats in the analysis area. ***Therefore, sufficient quality and quantity of the diverse age classes of vegetation currently found within the analysis area would be available for mountain goats in the Crazy and Silverfish PSUs to maintain a viable population.***

State Requirements

Alternatives 3 and 4 would comply with the MMRA regarding disturbed lands being reclaimed to a post-mining land use with stability and utility comparable to that of the pre-mining landscape. Draft findings regarding compliance with MFSA requirements are discussed in the Summary, beginning on p. S-53. Hunting is managed by the FWP. Proposed actions would not prevent the state from continuing to manage these species as harvestable populations.

3.25.3.5 Pileated Woodpecker

3.25.3.5.1 Analysis Area and Methods

Pileated woodpecker is the MIS for old growth and snag habitat on the KNF. Old growth habitat provides both nesting habitat and year-round foraging habitat for pileated woodpecker (Thomas 1979). Large diameter snags characteristically found in old growth forests provide nesting habitat for this species (the largest woodpecker in the Rocky Mountains), while both the snags and coarse woody debris provide habitat for the woodpecker's primary prey species, the carpenter ant (Warren 1990).

Pileated woodpecker population ecology, biology, habitat description, and relationships in the northern Rocky Mountains are described in McClelland and McClelland (1999), McClelland (1979, 1977), McClelland *et al.* (1979), and Warren (1990). Research conducted in the Pacific and Inland Northwest is described in Bull and Jackson (1995), Bull and Holthausen (1993), Bull *et al.* (1992b), Bull (1987, 1980, 1975), Bull and Meslow (1977), Mellen *et al.* (1992), Mellen (1987), Thomas (1979), Mannan (1977), and Jackman (1974). This research provided guidance in evaluating potential habitat and effects to pileated woodpeckers and is incorporated by reference.

Pileated woodpecker occurrence data come from recent District wildlife observation records, the Region One Landbird Monitoring Program (Avian Science Center, University of Montana), and Forest historical data (NRIS Wildlife). Potential habitat for this species on National Forest System land was estimated using designated and undesignated old growth habitat and replacement old growth habitat that has been mapped for the KNF. General pileated woodpecker habitat was identified using KNF vegetation data. Often specific pileated woodpecker habitat information was not available for private or state-owned lands in the analysis area, much of which has been logged in the past 20 to 30 years.

The analysis area includes the PSUs impacted by proposed activities. While the bulk of activities occur within the Crazy and Silverfish PSUs, there are also project activities within McElk, Riverview, Treasure, and Rock PSUs. The analysis area boundary for direct effects is the proposed activity areas, as activities and alteration of the habitat would affect suitability for different species. The acres directly impacted by activities are put into the context of the PSU scale to provide a consistently sized analysis unit and better gauge the relative impacts of the activities. The boundaries for indirect and cumulative effects are the planning subunits that contain the analysis area as alteration of habitat could affect the availability and use of habitats. Analysis at the PSU scale allows the effects of the proposed activities to be put into context and their relative impacts gauged. The impacts to the Rock PSU are limited to a less than 1 acre of patch of steep, rocky ground, the impacts are nearly undetectable at the PSU scale, and therefore this PSU is not carried forward in detailed analysis.

Project impacts are evaluated based on impacts to important attributes of pileated woodpecker habitat, primarily impacts to designated and undesignated old growth habitat. Specific features of old growth stands evaluated for project impacts include preferred nest tree species, preferred nest tree size, down logs (both size and quantity), basal area, and canopy closure.

The overall assessment of habitat quality also accounts for potential adverse factors discussed in the old growth habitat analysis that relate to size and connectivity, and include fragmentation, edge effect, and lack of interior habitat. Risk to firewood cutting is also evaluated. Other stands (not designated as old growth) may have one or more important attributes of old growth forests, or perhaps provide for connectivity and interior habitat. These stands were also reviewed as part of this analysis. The impacts analysis includes an evaluation of the potential benefits to pileated woodpeckers from mitigation measures proposed by MMC or the agencies, such as designation of old growth-associated with the agencies' proposed old growth mitigation and land acquisitions.

3.25.3.5.2 Affected Environment

No population estimate is available for pileated woodpeckers within the KNF. However, trend data for many species, including the pileated woodpecker are being gathered through the Northern Region Landbird Monitoring Program. The objective of this program is long-term population-trend monitoring on the National Forests in Region One. Seven surveys have been conducted over a 10-year period on the KNF (USDA Forest Service 2008d).

Within the Crazy and Silverfish PSU, no pileated woodpeckers were observed during breeding bird surveys conducted in 2005 at the Little Cherry Creek Tailings Impoundment Site, the Ramsey Plant Site, the LAD Areas, and MMC's proposed transmission line alignment (Westech 2005a). The pileated woodpecker has been documented in the Crazy and Silverfish PSUs during 1995, 1996, 2000, 2004, 2007, and 2012 during different bird surveys conducted by either the MNHP, the Avian Science Center as part of the Region 1 Landbird monitoring program, and most recently the Rocky Mountain Bird Observatory monitoring program which has replaced the previous Region 1 Landbird Monitoring program. Data gathered through the Regional bird monitoring programs, do not indicated any noticeable population change for the species on the KNF (USDA Forest Service 2008d).

The Crazy PSU contains 8,373 acres of effective old growth habitat (both designated and undesignated), and the Silverfish PSU contains 5,887 acres of effective old growth habitat (both designated and undesignated). The Crazy PSU contains 465 acres of replacement old growth habitat (both designated and undesignated), and the Silverfish PSU contains 1,506 of replacement old growth habitat (both designated and undesignated). Existing pileated woodpecker nesting territories likely encompass a large portion of this old growth habitat. Snags and down wood provide food resources such as carpenter ants and their larvae, one of the primary prey items for pileated woodpeckers in the Northern Rockies (McClelland and McClelland 1999; McClelland 1977). Existing snag densities and amounts of down wood in the Crazy and Silverfish PSUs are greater than KFP-recommended levels. Existing PPL for snag habitat and are 73 percent in the Crazy PSU and 90 percent in the Silverfish PSU (KFP recommended level is 40 percent PPL) (see 3.25.2, *Key Habitats*).

3.25.3.5.3 Environmental Consequences

The following section discusses the direct and indirect, and cumulative effects on pileated woodpeckers for each of the mine alternatives, transmission line alternatives, and combined mine-transmission line alternatives, on federal and private land. Impacts on pileated woodpecker in the Crazy and Silverfish PSUs from the mine and transmission line alternatives are summarized in Table 211 and Table 212 and described below.

Alternative 1 – No Mine

In Alternative 1, natural successional processes would continue to occur throughout old growth stands and habitat would continue to be provided for pileated woodpecker nesting pairs where feeding and breeding conditions are suitable. There would be no direct impacts on pileated woodpecker (old growth habitat) from Alternative 1 (Table 211).

Replacement old growth habitat currently provides less suitable stand conditions for territory occupation. Over the next several decades, in the absence of catastrophic fires or windstorms, these stands would develop habitat features suitable for pileated woodpeckers such as larger trees, larger snags, more down logs, and more dead and dying trees that provide food resources such as carpenter ants and their larvae.

In Alternative 1, an indirect effect of continued disruption of the historical pattern of frequent fires in the drier ponderosa pine/Douglas-fir cover type would be ecological changes, such as the encroachment of Douglas-fir saplings in the understory. Eventually, these sites would develop a higher percentage of Douglas-fir trees, snags, and down logs more suitable as foraging habitat for pileated woodpeckers. This successional trend may result in a reduction in quality pileated woodpecker nest trees (ponderosa pine) since Douglas-fir was not found to be important for pileated woodpecker nest cavity excavation in the northern Rocky Mountains (McClelland and McClelland 1999; McClelland 1977; Weydemeyer and Weydemeyer 1928), in northeast Oregon (Bull 1987, 1975; Thomas 1979), or in British Columbia (Harestad and Keisker 1989).

Table 211. Effects on Potential Pileated Woodpecker Habitat and Population Index in Crazy PSU by Mine Alternative.

Analysis Area	[1] No Mine/ Existing Conditions	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative	[4] Agency Mitigated Little Cherry Creek Impoundment Alternative
Unmitigated Effects				
Effective OG (acres)	8,373	8,072 (301)	8,219 (154)	8,197 (176)
Replacement OG (acres)	465	418 (47)	465 (0)	418 (47)
General pileated woodpecker habitat	8,788	8,584 (204)	8,720 (68)	8,649 (139)
Mitigated Effects				
Total old growth designated for mitigation (acres)[1]	NA	NA	797	828

OG = old growth.
Number in parentheses is the reduction in habitat acres due to the alternative compared to Alternative 1 No Mine/Existing Conditions.
Mine alternatives would not impact potential pileated woodpecker habitat (old growth) in the Silverfish PSU and are not shown.
[1] Old growth designated to mitigate impacts on old growth. See section 2.5.7.4.4, *Key Habitats* for a more detailed description of old growth mitigation.

Alternative 2 – MMC's Proposed Mine

As shown in Table 211, Alternative 2 would affect about 301 acres of effective old growth habitat, 47 acres of replacement old growth, and 204 acres of general habitat in the Crazy PSU, reducing nesting and foraging habitat and habitat quality for the pileated woodpecker. No effective or replacement old growth would be directly affected by Alternative 2 in the Silverfish PSU or on private or State land east of the Silverfish PSU. The majority of impacts on potential pileated woodpecker habitat would occur in Little Cherry Creek Impoundment and LAD Area 2 at the mouth of Ramsey and Poorman creeks, reducing habitat connectivity between these drainages. Several old growth blocks would be reduced in size, diminishing their capacity to support pileated woodpeckers. The Alternative 2 tailings impoundment would result in the loss of 158 acres of effective old growth, 47 acres of replacement old growth, and 172 acres of general pileated woodpecker habitat in one localized area, which could displace one or more nesting pairs that may have traditionally used the area. Old growth impacts associated with Alternative 2 could include the removal of a nest tree or night winter roost tree used by the pileated woodpecker. Impacts on old growth habitat are described in section 3.22.2, *Old Growth Ecosystems*. Loss of old growth providing potential pileated woodpecker habitat may be offset by private land acquisition associated with grizzly bear habitat mitigation. As described in section 3.25.2.2, *Snags and Woody Debris*, Alternative 2 would result in the loss of snags greater than 20 inches diameter at breast height (dbh) and down logs greater than 10 inches dbh that provide potential nesting and foraging habitat for pileated woodpeckers. Snag densities and quantities of down wood would remain greater than KNF-recommended levels and would continue to be sufficient to sustain viable populations of cavity-dependent species on the KNF. Snag losses would not likely increase due to roads constructed for Alternative 2 because these roads would be closed to the public.

Table 212. Effects on Potential Pileated Woodpecker Habitat and Population Index by Transmission Line Alternative.

Analysis Area and Indicator	[A] No Transmission Line	[B] North Miller Creek	[CR] Modified North Miller Creek	[DR] Miller Creek	[ER] West Fisher Creek
Crazy PSU					
Unmitigated Effects					
Effective OG (acres)	8,373	8,361 (12)	8,373 (0)	8,371 (2)	8,371 (2)
Replacement OG (acres)	465	465 (0)	465 (0)	465 (0)	465 (0)
General Pileated Woodpecker Habitat (acres)	8,788	8,779 (9)	8,776 (12)	8,761 (27)	8,761 (27)
Silverfish PSU					
Unmitigated Effects					
Effective OG (acres)	5,887	5,887 (0)	5,887 (0)	5,883 (0)	5,887 (0)
Replacement OG (acres)	1,506	1,506 (0)	1,506 (0)	1,506 (0)	1,506 (0)
General Pileated Woodpecker Habitat (acres)	9,124	9,124 (0)	9,121 (3)	9,088 (36)	9,072 (52)
State Land (acres)	338	338 (0)	332 (6)	332 (6)	321 (17)
Plum Creek (acres)	499	499 (0)	499 (0)	499 (0)	496 (3)
		McElk PSU			
Unmitigated Effects					
Plum Creek (acres)	2,292	2,286 (6)	2,282 (10)	2,282 (10)	2,282 (10)
Crazy and Silverfish PSUs					
Mitigated Effects					
Total old growth designated for mitigation (acres)[1]	NA	0	29	12	6

OG = old growth.
Number in parentheses is the reduction in habitat acres due to the alternative compared to Alternative A, No Transmission Line.
[1] Old growth designated to mitigate impacts on old growth. See section 2.5.7.4.4*, Key Habitats* for a more detailed description of old growth mitigation.
Source: GIS analysis by KNF.

Noise and other human-caused disturbances, such as blasting, construction of the plant and adit sites, road construction and use, and plant and adit operations could cause pileated woodpeckers to avoid nearby habitat, at least temporarily. Disturbance impacts would likely be greatest during the Construction Phase, but could persist through mine operations.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Direct impacts of Alternative 3 on old growth habitat potentially supporting pileated woodpeckers would be similar to Alternative 2, except that Alternative 3 would affect less old growth. About 154 acres of effective old growth and 68 acres of general pileated habitat in the Crazy PSU would be disturbed In Alternative 3 (Table 211). The majority of impacts on designated old growth would occur as a result of the Poorman Impoundment construction or in LAD Area 2 at the mouth of Ramsey and Poorman creeks, reducing habitat connectivity between these drainages. Several old growth blocks would be reduced in size, diminishing their capacity to support pileated woodpeckers. The Alternative 3 tailings impoundment would result in the loss of 117 acres of effective old growth and 60 acres of general pileated woodpecker habitat in one localized area, which could displace one or more nesting pairs that may have traditionally used the area. Old growth impacts associated with Alternative 3 could include the removal of a nest tree or night winter roost tree used by the pileated woodpecker or some of the old growth-associated wildlife species it represents.

The agencies' mitigation in Alternative 3 would include the designation of 797 acres of additional old growth on National Forest System lands. Designation of additional areas of old growth would not create new old growth, but would ensure that these areas are managed to retain or develop old growth characteristics, potentially improving the quality of habitat for pileated woodpeckers. Loss of old growth providing potential pileated woodpecker habitat also may be offset by private land acquisition associated with grizzly bear habitat mitigation.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Impacts of Alternative 4 on old growth habitat potentially supporting pileated woodpeckers would be similar to Alternative 2, except that Alternative 4 would affect less old growth. Alternative 4 would affect about 176 acres of effective habitat, 47 acres of replacement habitat, and 139 acres of general pileated habitat in the Crazy PSU (Table 211).

Impacts from noise and human activities associated with Alternative 4 would be similar to Alternatives 2 and 3.

The Alternative 4 tailings impoundment would result in the loss of 135 acres of effective old growth, 47 acres of replacement old growth, and 133 acres of general pileated woodpecker habitat in one localized area, which could displace one or more nesting pairs that may have traditionally used the area. Old growth impacts associated with Alternative 4 could include the removal of a nest tree or night winter roost tree used by the pileated woodpecker or some of the old growth-associated wildlife species it represents.

Alternative 4 would include the designation of 828 acres additional old growth on National Forest System lands. Designation of additional areas of old growth would not create new old growth, but would ensure that these areas are managed to retain or develop old growth characteristics, potentially improving the quality of habitat for pileated woodpeckers. Also, loss of old growth providing potential pileated woodpecker habitat may be offset by private land acquisition associated with grizzly bear habitat mitigation.

Alternative A – No Transmission Line

There would be no impacts on pileated woodpecker from Alternative A (No Transmission Line) (Table 212). There will be no impacts to the Riverview PSU from any of the transmission line alternatives. Based on the lack of old growth habitat and pileated woodpecker sightings, construction of the Sedlak Park Substation and loop line would not affect pileated woodpeckers in any transmission line alternative.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Alternative B would affect about 12 acres of effective old growth habitat in the Crazy PSU and 9 acres of general pileated habitat (Table 212). No replacement old growth would be impacted in the Crazy PSU and no effective or replacement old growth would be impacted in the Silverfish or Riverview PSUs. Alternative B would impact about 6 acres of pileated habitat on Plum Creek land in the McElk PSU. The majority of impacts on old growth would occur in the Ramsey Creek corridor and at the confluence of Libby and Howard creeks, reducing habitat connectivity in these drainages. Reducing the size of old growth blocks would diminish their capacity to support pileated woodpeckers. Loss of old growth providing potential pileated woodpecker habitat may be offset by private land acquisition associated with grizzly bear habitat mitigation.

As described in section 3.25.2.2, *Snags and Woody Debris*, Alternative B would result in the loss of snags greater than 20 inches dbh and down logs greater than 10 inches dbh that provide potential nesting and foraging habitat for pileated woodpeckers. Snag densities and quantities of down wood would remain greater than KNF-recommended levels and would continue to be sufficient to sustain viable populations of cavity-dependent species in the KNF. Snag losses would not likely increase due to roads constructed for Alternative B because these roads would be closed to the public.

Noise from helicopters during line stringing could cause pileated woodpeckers to avoid nearby habitat, at least temporarily. Similar effects could occur from other transmission line construction activities in areas where helicopters were not used, and would be more extensive for Alternative B than the agencies' alternatives. Disturbance impacts would be short-term and, with the exception of line maintenance activities, would cease after transmission line construction until decommissioning. Helicopter use and other activities would cause similar disturbances with similar durations during line decommissioning.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

Alternative C-R would have similar physical impacts on pileated woodpecker habitat as Alternative B, except that no effective or replacement old growth would be disturbed in the Crazy or Silverfish PSUs. As shown in Table 212, Alternative C-R would affect 12 acres of general pileated habitat in the Crazy PSU and 3 acres of general habitat in the Silverfish PSU. Additionally, 6 acres of State land would be impacted in the Silverfish PSU and 10 acres of Plum Creek land in the McElk PSU would be impacted. Reducing the size of old growth blocks would diminish their capacity to support pileated woodpeckers. The majority of impacts on old growth would occur at the confluence of Libby and Howard creeks, reducing habitat connectivity between these drainages. Alternative C-R would include the designation of 29 acres of additional old growth on National Forest System lands. Designation of additional areas of old growth would not create new old growth, but would ensure that these areas are managed to retain or develop old growth characteristics, potentially improving the quality of habitat for pileated woodpeckers. Impacts on old growth on private and State lands would be minimized through implementation of the Environmental Specifications (Appendix D) and Vegetation Removal and Disposition Plan. Loss of old growth providing potential pileated woodpecker habitat may also be offset by private land acquisition associated with grizzly bear habitat mitigation.

Impacts on snag habitat from Alternative C-R would be similar to Alternative B, except that disturbance would be more extensive for Alternative C-R (see section 3.25.2.2, *Snags and Woody Debris*).

Alternative D-R – Miller Creek Transmission Line Alternative

Impacts of Alternative D-R on old growth habitat potentially supporting pileated woodpeckers would be similar to Alternative C-R. As shown in Table 212, Alternative D-R would directly affect 2 acres of effective old growth habitat. There would be no impact on replacement old growth in the Crazy PSU. General pileated habitat would be reduced by 27 acres in the Crazy

PSU. Alternative D-R would have no effect on effective or replacement old growth habitat in the Silverfish PSU. Thirty-six acres of general pileated habitat would be impacted. Alternative D-R would include the designation of 12 acres of additional old growth on National Forest System lands. Impacts on snag habitat from Alternative D-R would be similar to Alternatives B and C-R, except that disturbance would be more extensive for Alternative D-R (see section 3.25.2.2, *Snags and Woody Debris*).

Noise and other human-caused disturbance to pileated woodpeckers would be similar to Alternative C-R, except that disturbance would be more extensive for Alternative D-R.

Alternative E-R – West Fisher Creek Transmission Line Alternative

Direct impacts on pileated woodpecker habitat from Alternative E-R would be similar to Alternative D-R, a 2 acre reduction in effective old growth and a 27 acre reduction in general pileated habitat in the Crazy PSU. There would be no impact on replacement old growth habitat in the Crazy PSU. In the Silverfish PSU, 52 acres of general pileated habitat, 17 acres of habitat on State of Montana land, and 3 acres of Plum Creek land would be impacted. In the McElk PSU 10 acres of Plum Creek land would be impacted. Alternative E-R would include the designation of 6 acres of additional old growth on National Forest System lands. Noise and other human-caused disturbance to pileated woodpeckers on private and State land would be similar for Alternatives E-R and Alternatives C-R and D-R, except that the extent of the disturbance would be greater for the longer Alternative E-R.

Combined Mine-Transmission Line Effects

Impacts on pileated woodpecker in the Crazy, Silverfish, and McElk PSUs from the combined mine-transmission line alternatives are summarized in Table 213. There are no impacts to the Riverview PSU from any of the alternative combinations. Based on the lack of old growth habitat and pileated woodpecker sightings, construction of the Sedlak Park Substation and loop line would not affect pileated woodpeckers in any transmission line alternative.

In the Crazy PSU, MMC's proposed alternative (2B) impacts 313 acres of effective old growth, 47 acres of replacement old growth, and 213 acres of general pileated woodpecker habitat. The agencies' combined alternatives will impact between 154 and 156 acres of effective old growth, 0 acres of replacement old growth, and 80 to 95 acres of general pileated habitat for the Poorman Impoundment Alternatives. Under the Little Cherry Creek Impoundment Alternatives, between 176 and 178 acres of effective old growth, 0 to 47 acres of replacement old growth, and 151 to 166 acres of general pileated habitat will be impacted.

In the Silverfish PSU none of the alternatives impact effective or replacement old growth habitat. The alternatives that include the Poorman Impoundment would impact between 3 and 52 acres of general pileated habitat, 6 to 17 acres of state of Montana land, and 0 to 10 acres of Plum Creek land. Under the alternatives that include the Little Cherry Creek impoundment no effective or replacement old growth habitat will be impacted, between 3 and 52 acres of general pileated habitat, 6 to 17 acres of State of Montana land, and 0 to 3 acres of Plum Creek land will be impacted.

In the McElk PSU each of the agency combined alternatives impacts 10 acres of Plum Creek land. The MMC alternative impacts 6 acres of Plum Creek land. There are no impacts to the Riverview PSU from any of the alternative combinations.

Table 213. Effects on Potential Pileated Woodpecker Habitat and Population Index by Combined Mine-Transmission Line Alternative.

Measurement Criteria	[1] No Mine Existing Condition	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Little Cherry Creek Impoundment Alternative		
		TL-B	TL-C-R	TL-D-R	TL-E-R	TL-C-R	TL-D-R	TL-E-R
Crazy PSU								
Unmitigated Effects								
Effective OG (acres)	8,373	8,060 (313)	8,219 (154)	8,217 (156)	8,217 (156)	8,197 (176)	8,195 (178)	8,195 (178)
Replacement OG (acres)	465	418 (47)	465 (0)	465 (0)	465 (0)	418 (47)	418 (47)	465 (0)
General Pileated Woodpecker Habitat (acres)	8,788	8,575 (213)	8,708 (80)	8,693 (95)	8,693 (95)	8,637 (151)	8,622 (166)	8,622 (166)
Silverfish PSU								
Unmitigated Effects								
Effective OG (acres)	5,887	5,887 (0)	5,887 (0)	5,887 (0)	5,887 (0)	5,887 (0)	5,887 (0)	5,887 (0)
Replacement OG (acres)	1,506	1,506 (0)	1,506 (0)	1,506 (0)	1,506 (0)	1,506 (0)	1,506 (0)	1,506 (0)
General Pileated Woodpecker Habitat (acres)	9,124	9,124 (0)	9,121 (3)	9,088 (36)	9,072 (52)	9,121 (3)	9,088 (36)	9,072 (52)
State of Montana Land (acres)	338	338 (0)	332 (6)	332 (6)	321 (17)	332 (6)	332 (6)	321 (17)
Plum Creek (acres)	499	499 (0)	499 (0)	499 (0)	496 (3)	499 (0)	499 (0)	496 (3)
McElk PSU								
Unmitigated Effects								
Plum Creek (acres)	2,292	2,286 (6)	2,282 (10)	2,282 (10)	2,282 (10)	2,282 (10)	2,282 (10)	2,282 (10)
Crazy and Silverfish PSUs								
Mitigated Effects								
Total old growth designated (acres)[1]	NA	NA	826	809	802	857	840	833

OG = old growth.
Number in parentheses is the reduction in habitat acres due to the alternative compared to Alternative 1, No Mine/Existing Condition.
[1] Old growth designated to mitigated impacts on old growth. See 2.5.7.4.4, *Key Habitats* for a more detailed description of old growth mitigation.
Source: GIS analysis by KNF.

For all combined action alternatives, the tailings impoundment would result in the loss of 117 to 158 acres of effective old growth, 0 to 47 acres of replacement old growth, and 60 to 172 acres of general pileated habitat in one localized area, which could displace one or more nesting pairs that may have traditionally used the area. Old growth impacts associated with all combined action alternatives could include the removal of a nest tree or night winter roost tree used by the pileated woodpecker. Impacts on old growth from the combined mine-transmission line alternatives are described in section 3.22.2*, Old Growth Ecosystems*.

As described in section 3.25.2.2, *Snags and Woody Debris*, all combined action alternatives would result in the loss of snags greater than 20 inches dbh and down logs greater than 10 inches dbh that provide potential nesting and foraging habitat for pileated woodpeckers. In all combined mine-transmission line alternatives, snag densities and quantities of down wood would remain greater than KNF-recommended levels and would continue to be sufficient to sustain viable populations of cavity-dependent species in the KNF. Snag losses would not likely increase due to roads constructed for the combined action alternatives because these roads would be closed to the public.

In all combined action alternatives, noise from helicopters during line stringing and from other construction-related activities may cause pileated woodpeckers to avoid nearby habitat, at least temporarily. Disturbance impacts from blasting and helicopters would be short-term and, with the exception of line maintenance activities, would cease after transmission line construction until decommissioning. Disturbance from helicopter use and other transmission line construction activities are described for Alternatives B and C above. Disturbance impacts during mine operations would probably be lower in intensity, but would last through the life of the mine.

The agencies' alternatives would include the designation of between 802 and 857 acres of additional old growth on National Forest System lands (see section 2.5.7.4.4, *Key Habitats*), potentially improving habitat for an additional breeding pair of pileated woodpeckers. Designation of additional areas of old growth would not create new old growth, but would ensure that these areas are managed to retain or develop old growth characteristics, potentially improving habitat quality for pileated woodpeckers. For all combined action alternatives, impacts on old growth on private land would be minimized through implementation of the Environmental Specifications (Appendix D) and Vegetation Removal and Disposition Plan described in section 2.5.2.5.2, *Vegetation Removal and Disposition Plan*. In all combined action alternatives, losses and degradation of providing potential pileated woodpecker habitat may be offset by private land acquisition associated with grizzly bear habitat mitigation.

Cumulative Effects

Summary of Existing Condition

Past actions, particularly timber harvest, road construction, and fire-suppression activities, have altered the old growth ecosystems in the analysis area. These changes have resulted in a reduction in late succession habitats; conditions favoring shade-tolerant, fire-intolerant species; loss of large snags and down wood; and increases in tree density and a shift to a largely mid-seral structural stage (USDA Forest Service 2003b).

Timber harvest has occurred in the analysis area since the 1950s. Prior to the 1990s, timber harvest often resulted in the loss of old growth, snags and down wood habitat. Road construction reduced the availability of snags and downed wood both directly and from firewood collection.

Detailed description of previous vegetation and road management activities are found in Appendix E, of this document. In unharvested areas, natural disturbances such as wildfire would have resulted in the development of complex forest structure used by pileated woodpeckers. In contrast, fire suppression since the early 1900s has altered stand structure resulting in more homogenous stands with increased fuel loading in the understory and reduced development of large diameter trees, snags, and down woody materials. Since the 1990s, application of KFP standards has resulted in the retention of snags and down woody materials as well as protection of old growth habitat. Also, there has been more reliance on intermediate harvest that leaves more forest structure (including large old trees) and cover.

Effects of No Action alternatives

The no action alternatives do not directly contribute any cumulative effects to pileated woodpeckers or their habitat.

Effects of Ongoing and Reasonably Foreseeable actions

Reasonably foreseeable actions include those federal, state, or private activities that are ongoing or scheduled to occur within the next five years, independent of this federal action. Appendix E identifies those current and foreseeable actions in the analysis area that were determined to be appropriate for inclusion in the analysis of environmental effects.

As described above, loss of pileated habitat due to past actions has occurred within the analysis area. However, potential pileated habitat occurs throughout the analysis area due to the moist environment and associated forest cover types found here. Changes in harvest methods and protection of old growth areas in recent years has created/maintained higher quality habitat throughout the analysis area.

Vegetation Management and Fuels Reduction Activities

Regeneration harvest included in the Miller-West Fisher Vegetation Management Project, the Coyote Improvement Vegetation Management Project, and the Silverbutte Bugs timber sale, which would occur in the Silverfish PSU, would not directly affect old growth providing potential pileated woodpecker habitat. Cumulatively, the proposed action alternatives activities in designated and undesignated old growth would not reduce the amount and distribution of old growth below KFP requirements.

Public Use

Firewood gathering would continue to remove some snags from old growth along open road corridors and these acres were previously accounted for as part of the existing condition. Other forest uses such as mushroom and berry picking, camping, hunting, Christmas tree cutting, bough collection, etc. have little to no measurable impact on old growth and the pileated woodpecker because they are largely non-consumptive or rapidly re-established and would not contribute to the cumulative effect on snags and the old growth resource

While the combined action alternatives, in combination with other past, current, and reasonably foreseeable actions, would result in minimal losses and degradation of pileated woodpecker habitat. In addition, mitigation associated with combined agencies' alternatives would increase the proportion of designated old growth and promote the maintenance or development of pileated woodpecker habitat in the analysis area.

Private Lands

Development of private lands, including timber harvest, home construction, and land clearing, are likely to continue within the Crazy and Silverfish PSUs. Therefore, on private and State lands there would likely be a decrease in at least general forest habitat. Impacts on pileated woodpecker on private, corporate timberlands and State lands would probably be minimal because it is likely that limited amounts of old growth occur on these lands, based on development and past and current harvest practices.

Cumulative noise and other human-caused disturbances could occur as a result of the combined action alternatives and other reasonably foreseeable actions. Cumulative disturbance effects could affect individual pileated woodpeckers, but would not likely affect pileated woodpecker populations in the KNF.

Regulatory/Forest Plan Consistency

Organic Administration Act and Forest Service Locatable Minerals Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources and to take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations. Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8. In these alternatives, MMC did not propose to implement feasible measures to minimize effects on the mountain goat or practicable measures to maintain and protect wildlife habitat. The agencies' alternatives (Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R) would incorporate feasible and practicable measures to minimize adverse environmental impacts on the mountain and wildlife habitat. These measures would include adding timing restrictions to blasting, and implementing monitoring and adaptive management during construction and operations. The agencies' land acquisition requirements in Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R would more likely provide mountain goat habitat than the land acquisition requirements of Mine Alternative 2 and Transmission Line Alternative B.

National Forest Management Act/Kootenai Forest Plan

1. Forestwide Management Direction – KFP II-1 #7, #8, II-22-23
a. #7 – *Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species:* The action alternatives would be consistent with KFP direction to maintain diverse age classes of vegetation for viable populations because the reduction in potential old growth habitat would be 3 percent (313 acres in Alternative 2) and the reduction in general pileated woodpecker habitat would be 5 percent (213 acres in Alternative 2) or less.

b. #8 – *Manage for sufficient snags and snag replacement trees to maintain viable populations of snag-dependent species:* Snag density would remain at 71 percent in the Crazy PSU and 72 percent in the Silverfish PSU and are better than the recommended 40 and 60 percent levels (see Cavity Habitat section). All action alternatives would be consistent with KFP direction for snags and down wood (see section 3.25.2.2, *Snags and Woody Debris*). In all combined mine-transmission line alternatives, a wide range of successional habitats and associated amounts of down wood would be available.

c. 22 – *Maintenance of 10 percent of the KNF land base below 5,500 feet in old growth condition that is representative of the major forest types, spread evenly through most major drainages, and providing for old-growth dependent wildlife species:* All combined mine-transmission alternatives would require a project-specific amendment to change the current MA 13 allocation of all old growth that would be harvested either as a result of transmission line construction to MA 23 (Electric Transmission Corridor) or as a result of mine related facility or impoundment development or MA 31 (Mineral Development) (See Forest Plan section)

MA 13). All action alternatives would be consistent with KFP direction to maintain a minimum of 10 percent old growth below 5,500 feet in elevation in each third order drainage or compartment, or a combination of compartments.

Analysis of old growth forest-wide (USDA Forest Service2012c) concludes that at least 10 percent of the KNF below 5,500 feet is managed as old growth, as required in the KFP. Specifically, National Forest System lands below 5,500 feet include 298,348 acres (16 percent) of old growth or replacement old growth. About 10.8 percent (201,472 acres) of those lands were determined to be effective old growth, and 5.2 percent (96,876 acres) were identified as replacement old growth.

The action alternatives would result in between 16.8 and 16.9 percent designated old growth below 5,500 feet elevation in the Crazy PSU, and 13.6 percent designated old growth below 5,500 feet elevation in the Silverfish PSU. The KFP established that maintaining 10 percent of old growth habitat is sufficient to support viable populations of old-growth dependent species (KFP Vol. 1, II-1 #7 and III-54; Vol. 2, A-17).

d. 22, 23 – Maintenance of viable populations of existing native and desirable nonnative vertebrate species, as monitored through indicator species, attained through the maintenance of a diversity of plant communities and habitats: See 1.a. above for habitat diversity. The pileated woodpecker is monitored as an indicator species for snag and old growth habitats. Their occurrence and estimation of population is monitored through District observations, Region One Landbird monitoring effort, and KNF Monitoring and Evaluation Reports.

2. Appendix 12 – Management indicator species: See 1.d. above.

3. Appendix 16 – Cavity Habitat (Snags and Down Wood): For cavity habitat, see 1.b. above. Retention of recommended tons/acre of coarse woody debris would be met by following Graham *et al.* (1994) and emphasizing the retention of larger diameter pieces where available and snags felled for safety.

4. Appendix 17 and Kootenai FSM 2432.22 Supplement No. 85 – Old Growth: See 1c.above and the Old Growth section.

National Forest Management Act: The combined mine alternatives comply with NFMA direction to provide diverse populations of plant and animal communities by following KFP standards and guidelines (Johnson 2004a).

Forest Service Management Indicator Species Statement of Findings

KFP direction is to "maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species,… in sufficient quality and quantity to maintain viable populations" (KFP Vol. 1, II-1 #7). Based on the pileated woodpecker analysis and the KNF Conservation Plan (Johnson 2004a), all combined mine-transmission line alternatives would provide general forest species habitat with sufficient quality and quantity of the diverse age classes of vegetation needed for viable populations. ***In all combined mine-transmission line alternatives, sufficient general forest habitat would be available and the populations of species using that habitat would remain viable.***

State Requirements

Alternatives 3 and 4 would comply with the MMRA regarding disturbed lands being reclaimed to a post-mining land use with stability and utility comparable to that of the pre-mining landscape. Draft findings regarding compliance with MFSA requirements are discussed in the Summary, beginning on p. S-53.

3.25.4 Forest Service Sensitive Species

Sensitive species are administratively designated by the Regional Forester (Forest Service Manual (FSM) 2670.5) and are those species for which population viability is a concern. Conservation Assessments have been completed for some sensitive species to assist land managers with planning efforts. The KNF completed Conservation Plan to demonstrate forest-wide conservation of sensitive species and their habitat and help prevent sensitive species from being listed as threatened or endangered (Johnson 2004a).

3.25.4.1 Regulatory Framework

The Organic Administration Act authorizes the Forest Service to regulate the occupancy and use of National Forest System lands. The Forest Service's locatable minerals regulations are promulgated at 36 CFR 228, Subpart A. The regulations apply to operations conducted under the U.S. mining laws as they affect surface resources on National Forest System lands under the jurisdiction of the Secretary of Agriculture. One of these regulations (36 CFR 228.8) requires that mining activity be conducted, where feasible, to minimize adverse environmental impacts on National Forest surface resources. 36 CFR 228.8 also requires that mining operators take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations.

The National Forest Management Act requires the Secretary of Agriculture to promulgate regulations specifying guidelines for land management plans that "provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives…" The "specific land area" (scale) for providing diversity is established in the framework as the area covered by the Forest Plan, or the entire KNF. One of the KFP goals is to "maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species… and in sufficient quality and quantity to maintain habitat diversity representative of existing conditions" (II-1 #7).

Sensitive species are designated by the Regional Forester (FSM 2670.5). FSM 2672.42 directs the Forest Service to conduct a biological evaluation (BE) to analyze impacts on sensitive species. The sensitive species analysis in this document meets the requirements for a BE as outlined in

FSM 2672.42. FSM 2670.22 requires that the Forest Service develop and implement management practices to ensure that sensitive species do not become threatened or endangered because of Forest Service actions and maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands. Any decision on the Montanore Project cannot result in loss of sensitive species viability or create significant trends toward federal listing (FSM 2670.32). Sensitive plant species identified within the analysis area are listed in Table 214. State wildlife Species of Concern are discussed in section 3.25.7, *Other Species of Interest*.

3.25.4.2 Bald Eagle

3.25.4.2.1 Regulatory Framework

Federal Requirements

The bald eagle was removed from the federal threatened species list in 2007 (USFWS 2007b) and was subsequently added to the Forest Service sensitive species list. Bald eagles are also protected by two federal laws: the Bald and Golden Eagle Protection Act (Eagle Act) and the Migratory Bird Treaty Act (MBTA). The Eagle Act prohibits the “take, possession, sale, purchase, barter, offer to sell, purchase, or barter, transport, export, or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit.” “Take” is defined as “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb.” The term “disturb” is defined as “to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior” (50 CFR 22).

Regulations under the Eagle Act (50 CFR 22) allow for the limited take of bald eagles, or their nests, when the take is associated with otherwise lawful activities and the take would be compatible with the preservation of the bald eagle (74 Federal Register 46835). Compatible with the preservation of the bald eagle means the actions would have to be consistent with the goal of stable or increasing populations. Under these regulations, the USFWS may issue take permits, based on regional population thresholds, to allow take that results in mortality of eagles or an eagle nest under special circumstances. The permits authorize limited, non-purposeful take of bald eagles and golden eagles; authorizing individuals, companies, government agencies (including tribal governments), and other organizations to disturb or otherwise take eagles in the course of conducting lawful activities such as operating mines. Most permits issued under the regulations authorize disturbance. In limited cases, a permit may authorize the physical take of eagles, but only if every precaution is taken to avoid physical take. Removal of an eagle nest is allowed only where it is necessary to alleviate a safety hazard to people or eagles, necessary to protect human health or safety, the nest prevents the use of a human-engineered structure, or the activity, or mitigation for the activity, will provide a net benefit to eagles (50 CFR 22.27).

Table 214. Sensitive Wildlife Species on the KNF and Status within the Montanore Project Analysis Area.

Sensitive Species	Status[1]	Determination[2]	Comments
American Peregrine Falcon (*Falco peregrinus anatum*)	NS	No Impact	May occur in the analysis area, but no suitable habitat would be affected by project alternatives. Species dropped from further analysis.
Bald Eagle (*Haliaeetus leucocephalus*)	K	May Impact	Species and suitable habitat observed in analysis area
Bighorn Sheep (*Ovus canadensis*)	NS	No Impact	No suitable habitat available in analysis area
Black-backed Woodpecker (*Picoides arcticus*)	S	May Impact	Observed outside, but in vicinity of analysis area and suitable habitat available
Coeur d'Alene Salamander (*Plethodon vandykei idahoensis*)	S	May Impact	Adverse effect not likely because species not observed in analysis area since 1989 and habitat in analysis area degraded
Common Loon (*Gavia immer*)	NS	No Impact	No suitable habitat available in analysis area
Fisher (*Martes pinnanti*)	K	May Impact	Species and suitable habitat observed in analysis area
Flammulated Owl (*Otus flammeolus*)	K	May Impact	Species and suitable habitat observed in analysis area
Gray Wolf (*Canus lupus*)	K	May Impact	Species and suitable habitat observed in analysis area
Harlequin Duck (*Histrionicus histrionicus*)	K	May Impact	Species and suitable habitat observed in analysis area
North American Wolverine (*Gulo gulo*)	K	May Impact	Species and suitable habitat observed in analysis area
Northern Bog Lemming (*Synaptomys borealis*)	NS	No Impact	Analysis area not within species range
Northern Leopard Frog (*Rana pipiens*)	NS	No Impact	No suitable habitat available in analysis area
Townsend's Big-eared Bat (*Corynorhinus townsendii*)	K	May Impact	Species and suitable habitat observed in analysis area
Western Toad (*Bufo boreas*)	K	May Impact	Species and suitable habitat observed in analysis area

[1] Status Key:
K = Species is known to occur within the analysis area.
S = Species is suspected to occur within analysis area.
NS = Species is not suspected to occur within the analysis area, and is dropped from further evaluation.
[2] Determination Key:
No Impact = Species is not suspected to occur within the analysis area.
May Impact = May impact individuals or their habitat but will not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species.
Source: USDA Forest Service 2011f; Westech 2005a; MNHP 2014; and KNF data for District observation and historical records (NRIS Wildlife).

The MBTA specifically protects migratory bird nests from possession, sale, purchase, barter, transport, import, and export, and take. The other prohibitions of the MBTA, capture, pursue, hunt, and kill, are inapplicable to nests. The regulatory definition of take, as defined by 50 CFR 10.12, means to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt hunt, shoot, wound, kill, trap, capture, or collect. Executive Order 13186, Responsibilities of Federal agencies to Protect Migratory Birds, requires analysis of effects of federal actions on migratory birds as part of the environmental analysis process. In 2008, the USDA Forest Service and USFWS signed an MOU outlining the responsibilities of both parties in implementing the Executive Order. Under the MOU, the Forest Service will, during the NEPA process, evaluate the effects of agency actions on migratory birds, focusing first on species of management concern along with their priority habitats and key risk factors.

State Requirements

The State of Montana also has regulations in place to protect bald eagles. The intent of the Nongame and Endangered Species Act (87-5-103, MCA) is to "provide adequate remedies for the protection of the environmental life support system from degradation and provide adequate remedies to prevent unreasonable depletion and degradation of natural resources." This Act has similar language to the MBTA.

3.25.4.2.2 Analysis Area and Methods

Analysis Area

The analysis area for direct, indirect, and cumulative impacts to individuals and their habitat are all lands along US 2 from the Sedlak Park Substation to the Libby Loadout and within 1 mile of the transmission line alignment that are within the Bald Eagle Consultation Area (USFWS 2001). The 1-mile buffer adjacent to the transmission line alignments is based on the impact assessment requirements for linear features under MFSA (DEQ 2004). The analysis area occurs in the Crazy, Silverfish, McSwede, McElk and Riverview PSUs. This area includes the Sedlak Park Substation and loop line. The analysis area for assessing trend toward federal listing and population viability is the KNF.

Methods

The National Bald Eagle Management Guidelines (NBEMG) (USFWS 2007c) provide recommendations for avoiding disturbance to bald eagles, and also encourage the continued development and use of state-specific management plans. The Montana Bald Eagle Management Plan (MBEMP) (Montana Bald Eagle Working Group 1994) and the 2010 addendum developed by the Montana Bald Eagle Working Group (Montana Bald Eagle Working Group 2010) stated that the Plan "will also serve as the conservation and management plan when bald eagles are delisted." The MBEMP and addendum provides guidance for bald eagle habitat management on the KNF. The effect of any proposed activity on potential eagle habitat (½ mile of major water source) and any known eagle nests located within the bald eagle habitat will be discussed in relation to the 2010 Montana Bald Eagle Management Guidelines in lieu of the NBEMG. The NBEMG are more appropriate for states such as Florida, which have higher concentrations of bald eagles and have built nests near pre-existing human activity whereas Montana bald eagles are likely more accustomed to areas with less human activity and rural areas.

Eagle population ecology, biology, habitat description, and relationships identified by research are described in Montana Bald Eagle Working Group (MBEWG) (1991, 1994, 2010); USFWS (1995b, 1999); and USFWS (2007b). Eagle occurrence data come from recent District wildlife observation records, Forest historical data (NRIS Wildlife), and KNF monitoring data (USDA Forest Service 2008c). Nesting attempts on the KNF have increased significantly over the last two decades. Only one active nest was known to occur in 1978, whereas 35 active nests (15 on National Forest System lands and 20 on private land) were known and monitored in 2008. Nest success for active nests in 2008 was 41 fledglings. This is above the 20-year average of 24.5 fledges calculated for the last KNF monitoring reporting period (1988-2007, USDA Forest Service 2008c)

MBEMP guidelines identify four general areas of management concerns for bald eagles: nest sites, concentrated foraging areas winter communal roost sites, and mortality risks. In addition, the MBEMP describes seasonal restrictions and buffers around nests, foraging, and winter roost sites, based on activity type, to minimize disturbance to (MBEWG 2010). Buffers consist of visual buffers based on whether the human activity is visible from the nest, and distance buffers determined by the type of activity. MBEWG (2010) recommends seasonal restrictions from February 15 through August 15 for the following activities:

- Construction and maintenance including buildings roads, trails, or any other outside construction within direct line of sight of an active nest.
- Loud noises including fireworks, blasting, and operation of forest harvest machinery (skidders, trucks, chainsaws, etc.), jackhammers, construction equipment, etc.
- Forest management activities, thinning, and fuels reduction including all activities associated with the removal forest vegetation around occupied nests.
- Concentrated recreation including, but not limited to, hiking, bird-watching, fishing (on and offshore), hunting, boating and use of personal watercraft.

Foraging areas, especially in the winter, often are found along highway and railroad corridors where animals killed by vehicles or trains occur. Winter habitat is generally dictated by the presence and abundance of food, open water, and secure night roost sites (MBEWG 1994). Effects indicators will be a quantitative (acres affected) or qualitative (potential to increase risk of mortality) effects analysis for the four habitat categories/management concerns. The impacts analysis includes an evaluation of the mitigation measures proposed by MMC or the agencies described in sections 2.4.6.3, *Grizzly Bear* and 2.9.6, *Wildlife Mitigation Measures*, recommendations outlined in Suggested Practices for Avian Protection on Power Lines (APLIC 2006) and Reducing Avian Collisions with Power Lines (APLIC 2012), and measures described in MMC's proposed Environmental Specifications (MMI 2005b) and the agencies' Environmental Specifications (Appendix D).

3.25.4.2.3 Affected Environment

Bald eagles occur as both seasonal migrants and year-round residents within the boundaries of the KNF. Based on the bald eagle habitat area boundaries agreed to by the USFWS (USFWS 2001), about 564,558 acres (242,965 acres National Forest System land, 275,470 acres private land, and 46,123 acres open water) of potential bald eagle habitat occurs in the KNF (USFWS 2001). Nesting on the KNF has increased significantly over the last 2 decades. Only one active nest was known to occur in 1978, whereas 35 active nests (15 on National Forest System lands and 20 on private land) were known and monitored in 2008. Nest success for active nests in 2008 was 41 fledglings. This is above the 20 year average of 24.5 fledges calculated for the last KNF monitoring reporting period (1988-2007, USDA Forest Service 2008c).

Three known eagle nests are within the analysis area (Figure 91). In 2006, a pair of bald eagles initiated nesting at a site, known as the Silverfish nest, located along the Fisher River just north of Silver Butte Road and just west of US 2 in the Silverfish PSU, about 600 feet west of MMC's proposed transmission line alignment Alternative B. Another active nest site is located along the Fisher River on private land about 1.4 miles north of the proposed transmission line. A third active nest is along Libby Creek about a mile south of the Libby Loadout and east of US 2. Bald eagles tend to use the same breeding area, and often the same nest, each year (MBEWG 1994) and these nests are likely to be active in the future.

Several bald eagle foraging, perching, and roosting areas are located along the Fisher River. Bald eagle foraging is occasionally observed along US 2 and in the major drainages in the Silverfish PSU (Bratkovich, pers. comm. 2006). In the fall, eagle use of Libby Creek is usually limited to about 8 miles upstream of its confluence with the Kootenai River.

Wintering bald eagle numbers have fluctuated over the years depending on food sources (fish from open waters and dead animals along roads and railroad tracks) and winter conditions (open versus frozen water for foraging habitat). Mid-winter bald eagle counts have averaged 88 bald eagles over the past 25 years (1989-2013, KNF bald eagle monitoring records). Winter use within the analysis area occurs along the US 2 corridor.

3.25.4.2.4 Environmental Consequences

Alternative 1 – No Mine

Alternative 1 would not directly or indirectly affect bald eagle nesting, foraging, communal roost, or other potential habitat. Without the proposed mine, traffic on US 2 from White Haven to Bear Creek Road would grow at an annual rate of 1.2 percent, increasing from a predicted 1,914 vehicles per day in 2010 to 2,401 vehicles in 2029. The traffic on Bear Creek Road averaged 16,338 vehicles per year between 1986 and 1991. Assuming traffic on the Bear Creek Road increased at the same rate as traffic on US 2, average traffic would be 20,493 vehicles per year in 2010. Without the proposed mine, traffic would grow at an annual rate of 1.2 percent increasing to 25,707 vehicles per year in 2029. No improvements would be completed to Bear Creek Road under this alternative. The increase in traffic in Alternative 1 would slightly increase the risk of increased eagle mortality on the Bear Creek Road and US 2 in the Bald Eagle Consultation Area.

Alternative 2 – MMC's Proposed Mine

The proposed mine would generate a negligible increase in traffic during the Evaluation Phase and the Construction Phase between Libby and the intersection with the Libby Creek Road. The increase would have a negligible effect on eagle mortality risk in the Bald Eagle Consultation Area. After the Bear Creek Road was reconstructed, traffic volume would increase, with an additional 132 vehicles per day on US 2, including 52 trucks and six buses. The increase in traffic would be 5 to 7 percent. Eagles are vulnerable to oncoming high-speed traffic, especially when gorged, ambient temperatures are well below freezing and wind is calm (MBEWG 1994). The increase in US 2 traffic in Alternative 2 during operations would slightly increase the risk of increased eagle mortality on US 2 in the Bald Eagle Consultation Area.

Traffic would increase substantially on the Bear Creek Road, a short (less than 1 mile) segment of which is in the Bald Eagle Consultation Area. Estimates of increased annual traffic volume range from 187 percent to 234 percent (Table 172 in the *Transportation* section). The increase in U.S. traffic in Alternative 2 would substantially increase the risk of increased eagle mortality on the short segment of the Bear Creek Road that is in the Bald Eagle Consultation Area. When the mill ceased operations in the Closure Phase, mine traffic volume would be substantially less than shown in Table 172. Future traffic volume when all activities at the mine are completed in the Post-Closure Phase would be higher than in Alternative 1 because of reconstruction of Bear Creek Road and loss of the Little Cherry Loop Road beneath the impoundment. Mortality risk to the bald eagle would decrease on the Bear Creek Road compared to operations, but the permanently improved road conditions (increased road width, improved sight distance, paving) and higher traffic speeds would result in a permanently higher bald eagle mortality risk the compared to pre-mine conditions.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative and Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Alternatives 3 and 4 would have similar effects on traffic volume on the Bear Creek Road and US 2 as Alternative 2. Creation of a supply staging area in Libby and consolidating shipments to the mine area would slightly reduce traffic and associated eagle mortality risk from that estimated for Alternative 2.

Alternative A – No Transmission Line

Alternative A would not directly or indirectly impact bald eagle nesting, foraging, communal roost, or other potential habitat. The increase in traffic in Alternative A would slightly increase the risk of increased eagle mortality on US 2 in the Bald Eagle Consultation Area.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

About 0.5 mile of MMC's Proposed Transmission Line would have direct impacts on about 9 acres of bald eagle habitat in the nesting zone (Table 215). Alternative B would also temporarily disturb 33 acres of home range foraging area for nesting bald eagles, and 103 acres of other potential bald eagle habitat during transmission line construction. The clearing area for Alternative B would include 4 acres of old growth habitat on private land along the Fisher River and a short stretch of Miller Creek. Alternative B would likely result in the clearing of large spruce and cottonwood trees in these old growth areas that provide potential bald eagle nest sites. The clearing area associated with Alternative B would be within both the visual and distance buffers of an existing nest site. Bald eagles often avoid areas of high human use for nesting, foraging, perching, and roosting; they have shown a wide range of sensitivity to human disturbance (Stalmaster and Newman 1978; Knight and Knight 1984; Martell 1992; Beuhler *et al.* 1991; McCarigal *et al.* 1991). In addition to physical losses of habitat, impacts on bald eagles from Alternative B may include disturbance of breeding bald eagles and nest abandonment due to increased noise and the presence of humans and machinery and would likely require a federal take permit under the Eagle Act. Temporary disturbance impacts from Alternative B may also occur if increased noise and human presence associated with construction, including construction of the Sedlak Park Substation and loop line, caused eagles to avoid foraging in some areas.

Table 215. Transmission Line Impacts on Bald Eagle Nesting Habitat and Potential Bald Eagle Habitat by Transmission Line Alternative.

Transmission Line Alternative	Nearest Distance to Nest Site (miles)	Nest Site Area (Visual Buffer)[1] (acres)	Primary Use Area (Distance Buffer)[2] (acres)	Home Range Foraging Area[3] (acres)	Other Potential Bald Eagle Habitat[4] (acres)
B-North Miller Creek	0.07	9	10	33	103
C-Modified North Miller Creek	0.58	0	0	13	107
D-Miller Creek	0.58	0	0	13	107
E-West Fisher Creek	0.58	0	0	26	112

The transmission line disturbance area includes typical tree clearing width of 150 feet for Alternative B and 200 feet for Alternatives C-R, D-R, and E-R; and the disturbance area for the Sedlak Park Substation and access road. Areas of impact overlap between zones are not counted.
[1] Visual buffer = The initial buffer implemented based on whether the human activity is visible from within 0.25 mile radius of nest site.
[2] Distance Buffer = In the absence of adequate visual buffers, a distance buffer from 0.25 to 0.5 mile radius of nest site determined by the type of activity.
[3] Foraging Area (formally Zone 3) = suitable foraging habitat within 2.5 miles of nest site. Foraging habitat consists of rivers, streams, and wetland areas.
[4] Other potential bald eagle habitat = all lands within the analysis area.
Source: GIS analysis by ERO Resources Corp. using KNF data.

The likelihood of the 230-kV transmission line resulting in the electrocution of bald eagles or other raptors is extremely low; electrocution of raptors is primarily a problem associated with lower-voltage distribution lines (APLIC 2006). Also, electrocutions potentially caused by the transmission line would be minimized through implementation of recommendations outlined in APLIC (2006), which are based on a minimum spacing of 60 inches between phases or between phase and ground wires. The transmission line from BPA's loop line would not pose a risk of electrocution of raptors because phase spacing would be a minimum of 20 feet.

Although raptors are generally less vulnerable to collisions with power lines than other bird species (Olendorff and Lehman 1986), the proximity of the Alternative B transmission line, including BPA's Substation and loop line, to nesting bald eagles and their foraging habitat along the Fisher River would add to the risk of bald eagle collisions with the transmission line. Potential collisions of bald eagles with the transmission line would be reduced by constructing the transmission line according to recommendations outlined in APLIC (2012). Applicable recommendations outlined in APLIC include locating the transmission line away from streams and other potential flight corridors, placement of the lines below treeline or other topographical features, and installation of line-marking devices. MMC indicated no aviation flight paths were identified for the preferred corridor and no markers or other warning devices were planned (MMI 2005b).

MMC did not propose any timing restrictions for winter-time transmission line construction. Winter-time transmission line construction would slightly increase traffic on US 2 in the analysis area and would slightly increase eagle mortality risk.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

Alternative C-R would have no direct physical impacts on bald eagle habitat in the nesting zone. About 13 acres of bald eagle foraging habitat and 107 acres of other potential habitat would be temporarily disturbed during construction of Alternative C-R (Table 215). The clearing area for

Alternative C-R would not include any old growth habitat on private land along the Fisher River. Temporary disturbance impacts from Alternative C-R may also occur if increased noise and human presence associated with construction, including construction of the Sedlak Park Substation and loop line, caused eagles to avoid foraging in some areas. These impacts are likely to be minor, given the availability of foraging habitat in the surrounding area.

The location of the Alternative C-R transmission line alignment on an east-facing ridge immediately north of the Sedlak Park Substation would reduce the risks of bald eagle wire strikes and electrocutions relative to Alternative B. Similar to Alternative B, recommendations outlined in Suggested Practices for Avian Protection on Power Lines (APLIC 2006) and Reducing Avian Collisions with Power Lines (APLIC 2012) would be implemented.

Section 2.9.6.2.1, *Bald Eagle* describes the agencies' mitigation for the bald eagle. MMC would either: 1) not clear vegetation or conduct other construction activities during the breeding season (February 1 to August 15) in potential bald eagle nesting habitat or; 2) fund or conduct field and/or aerial reconnaissance surveys to locate any new bald eagle or osprey nests along specific segments of the transmission line corridor in Alternatives C-R, D-R, and E-R. Surveys would be conducted between March 15 and April 30, one nesting season immediately before transmission line construction. If an active nest were found, guidelines from the Montana Bald Eagle Management Plan (Montana Bald Eagle Working Group 2010) would be followed to provide management guidance for the immediate nest site area (Zone 1), the primary use area (Zone 2), and the home range area (Zone 3) as long as they were in effect. This mitigation would minimize affecting a bald eagle nest.

The agencies' mitigation also includes other timing restrictions. All activities for both transmission line construction seasons and during decommissioning of the transmission line on National Forest System and State trust lands located within the CYRZ and Cabinet Face BORZ would occur between June 16 and October 14. No transmission line construction in elk, white-tailed deer, or moose winter range between December 1 and April 30 unless approved by the agencies. The agencies' timing restrictions would minimize any increase in traffic on US 2 in the analysis area and increased eagle mortality risk.

The agencies' Environmental Specifications (Appendix D) include additional monitoring and mitigation not described in MMC's Environmental Specifications. As described in Appendix D, areas of high risk for bird collisions where line-marking devices may be needed, such as the Fisher River crossing, and recommendations for type of marking device would be identified through a study conducted by a qualified biologist and funded by MMC.

Alternative D-R – Miller Creek Transmission Line Alternative

The impacts on bald eagles from Alternative D-R would be the same as Alternative C-R. Modifications to the transmission line alignment and mitigation described in Alternative C-R would be implemented in Alternative D-R.

Alternative E-R – West Fisher Creek Transmission Line Alternative

Alternative E-R would have no direct physical impacts on bald eagle habitat in the nesting zone. About 26 acres of bald eagle foraging habitat and 112 acres of other potential habitat would be temporarily disturbed during construction of Alternative E-R (Table 215). The clearing area for Alternative E-R would include about 7 acres of old growth habitat on private and State land where the transmission line crossed the Fisher River and paralleled West Fisher Creek.

Alternative E-R would likely result in the clearing of large spruce and cottonwood trees in these old growth areas that provide potential bald eagle nest sites. Temporary disturbance impacts from Alternative E-R may also occur if increased noise and human presence associated with construction, including construction of the Sedlak Park Substation and loop line, caused eagles to avoid foraging in some areas. These impacts are likely to be minor, given the availability of foraging habitat in the surrounding area. The risks of bald eagle wire strikes and electrocutions would be the same as Alternatives C-R and D-R. Modifications to the transmission line alignment and mitigation described in Alternative C-R would be implemented in Alternative E-R.

Cumulative Effects

Past actions (Appendix E) applicable to cumulative effects on bald eagle include existing road and associated traffic volume, primarily on US 2, and existing roads and human disturbance in the analysis area. Future actions that may increase traffic volume on US 2, and human disturbance in the analysis area include private land development, the Miller-West Fisher Vegetation Management Project, the Coyote Improvement Vegetation Management Project, the Silverbutte Bugs timber sale and the Flower Creek Vegetation Management Project. If timber harvest activities occurred concurrently with mine or transmission line construction and operations, higher traffic volume and associated increased eagle mortality risk along US 2 may occur. No other past, current, or reasonably foreseeable actions are anticipated to contribute to cumulative impacts on bald eagles.

Regulatory/Forest Plan Consistency

Organic Administration Act and Forest Service Locatable Minerals Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources and to take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations. Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8. In these alternatives, MMC did not propose to implement feasible measures to minimize effects on the bald eagle or practicable measures to maintain and protect wildlife habitat. The agencies' alternatives (Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R) would incorporate feasible and practicable measures to minimize adverse environmental impacts on the bald eagle and wildlife habitat. These measures would include realigning the transmission line away from an active eagle nest, limiting winter-time transmission line construction, either not clearing vegetation or conducting construction activities during breeding season in bald eagle habitat, or fund or conduct surveys to locate active nests in appropriate habitat, creating a supply staging area in Libby and consolidating shipments to the mine area to reduce traffic, and assessing areas of high risk for bird collisions where line-marking devices may be needed. Transmission Line Alternatives C-R and D-R would avoid old growth habitat on private land along the Fisher River.

National Forest Management Act/Kootenai Forest Plan

p.II-1 #6 – *Determine the status of sensitive species and provide for their environmental needs as necessary to prevent them from becoming threatened or endangered:* Bald eagle habitat and nest sites occur with analysis area between and NFS road #278 (Bear Creek Road) to the Libby Loadout near Libby and along the Fisher River. In Mine Alternative 2 and Transmission Line Alternative B, MMC did not propose to implement all feasible measures to minimize effects on the bald eagle. The agencies' alternatives would include measures to minimize effect on the bald eagle. All alternatives may affect individual bald eagles and their habitat within the analysis area, but would not contribute to a trend toward federal listing or cause a loss of viability to the population or species.

p.II-1 #7 – *Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species:* All action alternatives would maintain diverse age classes for viable populations of the bald eagle. Transmission Line Alternatives C-R and D-R would avoid old growth habitat on private land along the Fisher River.

p.II-22, 23 – *Maintenance of viable populations of existing native and desirable non-native vertebrate species, as monitored through indicator species, attained through the maintenance of a diversity of plant communities and habitats:* See p.II-1 #7 above for habitat diversity. Bald eagles are monitored as an indicator species for river and lake habitats. Their occurrence and estimate of population is monitored through District observations and FWP reports.

p.II-23 – *Best Management Practices, as specified by the MBEWG (updated by the MBEWG in 2010) will be applied to all known bald eagle nest sites, important roost or perch sites, and know wintering foraging sites:* Alternative B would not comply with this direction. In Alternative B, MMC did not propose to implement all feasible measures to minimize effects on the bald eagle, such as avoiding the nest along the Fisher River. All other alternatives would include BMPs or avoidance to minimize effect on known bald eagle nest sites, important roost or perch sites, and know wintering foraging sites.

Forest Service Sensitive Species Statement of Findings

The no action alternatives would not impact individual bald eagles or their habitat within the analysis area, and would not contribute to a trend toward federal listing or cause a loss of viability to the population or species. ***All action alternatives may impact individual bald eagles and their habitat within the analysis area, but would not contribute to a trend toward federal listing or cause a loss of viability to the population or species.*** All action alternatives may affect the bald eagle and their habitat by increasing mortality risks in winter foraging area. All action transmission line alternatives would disturb home range foraging areas and may displace eagles from foraging areas during transmission line construction. The USFWS has removed the bald eagle from federal listing. Nesting on the KNF has increased significantly over the last 2 decades.

Bald and Golden Eagle Protection Act

Alternative B would not comply with the Eagle Act, as it would likely require obtaining a federal eagle take permit for which MMC has not applied. The agencies' transmission line alternatives would result in minimal impacts on individual bald eagles or eagle populations and habitat, and would comply with the Eagle Act.

Migratory Bird Treaty Act and Executive Order 13186

All action alternatives would comply with the MBTA, Executive Order 13186, and its associated MOU by evaluating the effects of federal actions on migratory birds as part of the NEPA process and promoting conservation of and minimizing adverse impacts on migratory birds.

State Requirements

Alternatives 3 and 4 would comply with the MMRA regarding disturbed lands being reclaimed to a post-mining land use with stability and utility comparable to that of the pre-mining landscape.

Draft findings regarding compliance with MFSA requirements are discussed in the Summary, beginning on p. S-53. All alternatives would comply with the Nongame and Endangered Species Act.

3.25.4.3 Black-backed Woodpecker

3.25.4.3.1 Analysis Area and Methods

Black-backed woodpecker population ecology, biology, habitat description, and relationships identified by research are described in Samson (2006a, 2006b), O'Connor and Hillis (2001), Dixon and Saab (2000), Powell (2000), Cherry (1997) and Hutto (1995).These provided guidance in evaluating habitat and potential effects to black-backed woodpeckers, and are incorporated by reference. Black-backed woodpecker occurrence data come from recent District wildlife observation records and KNF historical data (NRIS Wildlife).

Other than NFMA and KFP direction previously described for sensitive species, there is no federal management direction specific to black-backed woodpeckers. Bonn *et al*. (2007) provides some Regional guidance for conducting project-level analysis to determine effects to black-backed woodpeckers. Black-backed woodpecker habitat was analyzed using GIS layers on fire and timber harvest history, stand type, and stand age/size. Additional sources used for analysis includes snag data, prescribed burn records for the analysis area, and Regional fire history summaries (Northern Rockies Coordination Center 2004-2011).

High quality habitat is defined as areas where recent (less than 8 years old) mixed-lethal or stand-replacement fires have occurred. Black-backed woodpeckers have been found to be almost entirely restricted to early post-fire forests (Hutto 1995). General forest (low quality) habitat consists of forested areas with patches of snags produced by insect and disease. Specific black-backed woodpecker habitat information was not available for private or state-owned lands in the analysis area, much of which has been logged in the past 20 to 30 years.

Indicators for comparing alternative effects on black-backed woodpecker included changes in high-quality and general forest habitat.

The analysis area for black-backed woodpeckers is described in section 3.25.1, *Introduction.* The analysis area for determination of population trend and contribution toward population viability is the KNF.

3.25.4.3.2 Affected Environment

Habitat for black-backed woodpeckers consists of boreal and montane forest where wood-boring beetle (Cerambycidae and Buprestidae) and bark beetle (Dendroctus spp.) outbreaks are occurring as a result of disturbances caused by fire, wind, and disease.

Research conducted in Montana (Hutto 1995; Caton 1996; Hitchcox 1996; Hejl and McFadzen 2000; Powell 2000) strongly suggests black-backed woodpeckers require fire-killed trees for long-term survival. High quality black-backed woodpecker habitat is defined as recent (≤8 years old) mixed-lethal or stand-replacement fire areas where an abundance of snags are available. Fire-created black-backed woodpecker habitat provides the best conditions for 2 to 3 years following the fire then begins to decline as tree moisture content decreases and wood borer larvae decline (Bonn *et al*. 2007). Fire-killed trees generally do not provide insect food sources beyond 5 to 7 years (Caton1996; Murphy and Lehnhausen 1998); however, secondary mortality from fire and insect attacks often extend the availability of quality habitat. Hoyt and Hannon (2002) documented black-backed woodpecker use of fire areas up to 8 years after a fire occurred.

The analysis area has no high quality habitat because there have been no fires during the past 8 years. Low quality black-backed woodpecker habitat in the Crazy, Silverfish, McElk, and Riverview PSUs consists of general forest habitat that supports populations of resident black-backed woodpeckers. Based on potential habitat data, about 15,143 acres of general forest habitat is in the Crazy PSU, while 15,437 acres of general forest habitat is in the Silverfish PSU.

As primary cavity-nesters, black-backed woodpeckers require dead or live trees with heartwood rot and show a preference for Douglas-fir, ponderosa pine, lodgepole pine, and western larch. According to Thomas (1979), a PPL of 40 percent or more should maintain viable populations of birds dependent on cavities for nest sites. The existing PPL for the Crazy and Silverfish PSUs is 73 and 90 percent, respectively.

On a forest-wide level, potential black-backed woodpecker habitat is abundant, broadly distributed, and totals 1,317,790 acres of general forest habitat. Across the KNF, wildfires over the last 8 years ranged from 11 to 4,723 acres per year and created a total of about 9,390 acres of high quality habitat (Northern Rockies Coordination Center 2004-2011).

The nearest recorded observation of a black-backed woodpecker to the analysis area occurred in 1995 in a burned area west of Rock Creek (MNHP 2014). No black-backed woodpeckers were observed during black-backed woodpecker surveys of more than 1 mile of the Libby Creek wildfire burn area in 2003 and 2004 (see Project record). No black-backed woodpeckers were observed during breeding bird monitoring and point count surveys of old growth stands in and adjacent to the proposed impoundment sites and Libby Plant Site conducted in 1992 (Mitchell and Bratkovich 1993), 2002, and 2004 (see Project record). Similarly, no black-backed woodpeckers have been observed during Region One (Forest Service) landbird monitoring surveys of transects established directly northwest of the proposed LAD Area 1 and in Miller Creek along NFS road #4724 in 1994, 1995, 1996, 1998, 2000, 2002, and 2004 (Ibid). The majority of the private and State lands in the analysis area has high road densities, allowing access for firewood collection, and has been logged in the past 20 to 30 years, and it is not likely that snags have been left standing. As a result, snag and down wood important to black-backed woodpeckers is likely to be less available on private and State lands.

Across the Forest Service Northern Region, the black-backed woodpecker is considered secure in terms of persistence (Samson 2006a, 2006b). The Northern Region Black-backed Woodpecker Overview (Bonn *et al*. 2007) shows region-wide populations are increasing. High quality habitat is also on the rise due to large wildfire activity since 2000.

3.25.4.3.3 Environmental Consequences

Activities associated with mine and transmission line construction and operation have the potential to impact black-backed woodpecker habitat. Impacts from the mine (Table 216) and transmission line alternatives (Table 217) are described in the following subsections. None of the proposed alternatives for the mine or the transmission line will impact high-quality black-backed woodpecker habitat (recently burned forest).

Alternative 1 – No Mine

The No Mine Alternative would not have any direct, indirect, or cumulative impacts on black-backed woodpeckers or their habitat. Over time, with continued fire suppression and lack of active forest management, indirect effects of this alternative would include a continued trend toward later successional habitats.

Alternative 2 – MMC's Proposed Mine

Alternative 2 would have no effect on black-backed woodpecker habitat in the Silverfish PSU. In the Crazy PSU, 889 acres of general forest habitat would be impacted (Table 216). The Alternative 2 tailings impoundment would result in the loss of 715 acres of general forest habitat in one localized area, which could displace one or more nesting black-backed woodpecker pairs that may have traditionally used the area.

Table 216. Impacts on Black-backed Woodpecker Habitat in the Analysis Area by Mine Alternative.

Habitat Type	[1] No Mine/Existing Conditions	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment	[4] Agency Mitigated Little Cherry Creek Impoundment
General Forest Habitat (acres/%)	15,143	14,254 (889/6%)	14,425 (718/5%)	14,478 (665/4%)

Number in parentheses is the reduction in habitat acres/percent in habitat area compared to existing conditions.
Source: GIS analysis by KNF using KNF data.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Direct and indirect impacts from Alternative 3 on black-backed woodpecker would be slightly less than Alternative 2. In the Crazy PSU, Alternative 3 would affect 718 acres of general forest foraging habitat (Table 216). The Alternative 3 tailings impoundment would result in the loss of 627 acres of habitat in one localized area, which could displace one or more nesting black-backed woodpecker pairs that may have traditionally used the area.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Direct and indirect impacts from Alternative 4 on black-backed woodpecker would be less than Alternative 2. In the Crazy PSU, Alternative 4 would affect 665 acres of general forest habitat (Table 216). The Alternative 4 tailings impoundment would result in the loss of 571 acres of mapped habitat in one localized area, which could displace one or more nesting black-backed woodpecker pairs that may have traditionally used the area.

Alternative A – No Transmission Line

The No Transmission Line Alternative would have no direct or indirect impacts on black-backed woodpecker habitat. The effects would be the same as Alternative 1.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Alternative B would affect 35 acres of general forest habitat in the Crazy PSU, and 28 acres of general forest habitat in the Silverfish PSU (Table 217). The Alternative B clearing area would include 15 acres of potential black-backed woodpecker habitat on State and private land outside of the Crazy and Silverfish PSUs. The quality of the black-backed woodpecker habitat on private land is unknown. Based on the lack of suitable habitat and black-backed woodpecker sightings, construction of the Sedlak Park Substation and loop line would not affect black-backed woodpeckers in any transmission line alternative.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

Impacts on black-backed woodpecker from Alternative C-R would be similar to Alternative B (Table 217), affecting 2 additional acres of general forest habitat in the Crazy PSU, 6 additional acres of general forest habitat in the Silverfish PSU, and 13 more acres of potential habitat on State and private land. The quality of the black-backed woodpecker habitat on private land is unknown. Impacts on general forest foraging habitat in the agencies' alternatives would be minimized through implementation of the agencies' Environmental Specifications (Appendix D) and a Vegetation Removal and Disposition Plan.

Alternative D-R – Miller Creek Transmission Line Alternative

Alternative D-R would affect 39 acres of general forest habitat in the Crazy PSU, and 82 acres of general forest habitat in the Silverfish PSU (Table 217). The Alternative D-R clearing area would include about 31 acres of coniferous forest providing potential black-backed woodpecker habitat on State and private land. The quality of the black-backed woodpecker habitat on private land is unknown.

Alternative E-R – West Fisher Creek Transmission Line Alternative

Effects of Alternative E-R would be similar to Alternative D-R (Table 217).

Table 217. Impacts on Black-backed Woodpecker Habitat in the Analysis Area by Transmission Line Alternative.

Habitat Type	[A] No Transmission Line	[B] North Miller Creek	[C-R] Modified North Miller Creek	[D-R] Miller Creek	[E-R] West Fisher Creek
Crazy PSU					
General Forest Habitat (acres/%)	15,143	15,108 (35/<1%)	15,108 (35/<1%)	15,104 (39/<1%)	15,104 (39/<1%)
Silverfish PSU					
General Forest Habitat (acres/%)	15,437	15,409 (28/<1%)	15,388 (49/<1%)	15,353 (82/<1%)	15,358 (79/<1%)
State and Private Land					
General Forest Habitat (acres)	NA	15	28	28	31

NA = Not applicable.
Numbers in parentheses is the reduction in habitat acres/percent in habitat area compared to existing conditions.
Source: GIS analysis by KNF using KNF data.

Combined Mine-Transmission Line Effects

Combined mine-transmission line impacts on black-backed woodpecker habitat in the analysis area are shown in Table 218. Impacts on black-backed woodpecker in the Crazy PSU would range from 700 to 922 acres of general forest foraging habitat. For all combined action alternatives, impacts on black-backed woodpecker in the Silverfish PSU would be due entirely to the transmission line. Impacts in the Silverfish PSU would range from 28 to 82 acres of potential general forest foraging habitat. Impacts on potential black-backed woodpecker habitat on State and private lands would be 59 acres for Alternative B, 47 acres for Alternatives 3C-R and 3D-R, 50 acres for Alternative 3E-R, 72 acres for Alternatives 4C-R and 4D-R, and 75 acres for Alternative 4E-R. The quality of the black-backed woodpecker habitat on private land is unknown. Based on the lack of suitable habitat and black-backed woodpecker sightings, construction of the Sedlak Park Substation and loop line would not affect black-backed woodpeckers with any alternative.

The loss of potential habitat resulting from the combined action alternatives could reduce the quality of the habitat in these PSUs for nesting black-backed woodpeckers through increased habitat fragmentation, edge effects, and disturbance effects. For all alternatives, construction of the tailings impoundment would result in the loss of between 571 and 715 acres of potential habitat in one localized area, which could displace one or more nesting black-backed woodpecker pairs that may have traditionally used the area. None of the alternatives would affect burned forest habitat or areas of bark-beetle outbreak preferred by black-backed woodpeckers. Despite several surveys conducted in the Crazy and Silverfish PSUs, no black-backed woodpecker nests were identified in the analysis area.

Cumulative Effects

The Affected Environment/Existing Condition describes the existing suitable habitat within the analysis area, primarily general forest habitat as no wildfires have occurred within the analysis area in recent years (≤8 years). In addition, adjacent planning areas were evaluated for potential impacts to high-quality habitat related to areas of disturbance that occur across project boundaries. There are no apparent conditions within proximity of the analysis area that would contribute to effects to black-backed woodpeckers.

Past Actions

The primary measure of habitat suitability is changes to nesting and foraging habitat, primarily changes to high quality habitat that developed as a result of wildfire. Past actions, particularly timber harvest, road construction, fire suppression, and firewood gathering activities, have contributed to a reduction in potential black-backed woodpecker habitat (USDA Forest Service 2003b). Fire suppression since the early 1900s has resulted in fewer severe fires on the landscape and has affected the creation of high quality habitat for black-backed woodpeckers. Timber harvest has occurred in the analysis area since the 1950s. Harvests that targeted beetle infested stands and post-fire areas for salvage reduced natural disturbance areas targeted by the woodpecker. In addition, regeneration harvests would have had the most impact on general forest habitat. Detailed description of previous vegetation management activities are found in Appendix E. Since the 1990s, application of KFP standards has resulted in the retention of snags and protection of old growth and riparian habitats. Also, there has been more reliance on intermediate harvest that leaves more forest structure (including large old trees), snags, and downed wood. Applications of these standards and management trends results in maintenance of general forest habitat.

Table 218. Impacts on Black-backed Woodpecker Habitat in the Analysis Area by Combined Mine-Transmission Line Alternative.

Measurement Criteria	[1] Existing Condition	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Little Cherry Creek Impoundment Alternative		
	TL-A	TL-B	TL-C-R	TL-D-R	TL-E-R	TL-C-R	TL-D-R	TL-E-R
Crazy PSU								
General Forest Foraging Habitat (acres/%)	15,143	14,221 (922/6%)	14,391 (752/5%)	14,386 (757/5%)	14,386 (757/5%)	14,443 (700/5%)	14,439 (704/5%)	14,439 (704/5%)
Silverfish PSU								
General Forest Foraging Habitat (acres/%)	15,437	15,409 (28/<1%)	15,388 (49/<1%)	15,355 (82/<1%)	15,358 (79/<1%)	15,388 (49/<1%)	15,355 (82/<1%)	15358 (79/<1%)
State and Private Land								
Potential habitat affected (acres)	NA	59	47	47	50	72	72	75

Number in parentheses is the reduction in habitat acres compared to existing conditions.
Source: GIS analysis by KNF using KNF data.

There are no recent burned areas to provide high-quality habitat however, snag habitat, which is above the minimum needed of 40 percent in both PSUs, would assist in perpetuating the species through time until new areas of wildfire occur on the landscape.

No Action

The No Action alternatives (Alternative 1 and Alternative A) would not contribute to cumulative impacts on the black-backed woodpecker.

Action Alternatives

Ongoing and Reasonably Foreseeable Actions

Reasonably foreseeable actions include those federal, state, or private activities that are ongoing or scheduled to occur within the next five years, independent of this federal action. Appendix E, identifies those current and foreseeable actions in the analysis area that were determined to be appropriate for inclusion in the analysis of environmental effects.

Vegetation Management

The Miller-West Fisher Vegetation Management Project would include intermediate harvest of 1,206 acres, regeneration harvest of about 692 acres, precommercial thinning of 351 acres, and prescribed burning of 2,830 acres of National Forest System lands in the Silverfish PSU. The Coyote Improvement Vegetation Management Project is in the planning stages and would take place within the Crazy PSU. The project would harvest 240 acres to increase stand resiliency to mountain pine beetles. Silverbutte Bugs timber sale is in the Silverfish PSU and would be a small project like Coyote. Timber harvest and other clearing activities planned for the projects will contribute to cumulative losses of snags important to black-backed woodpecker. Activities associated with the projects are expected to retain cavity habitat within KFP-recommended levels for the Silverfish and Crazy PSUs. Also, while treatments associated with the projects will consume some snags and down wood, they also will create snags and down wood by killing live trees. Snags and down wood created in burned areas would provide both feeding and nesting habitat for the black-backed woodpecker.

Flower Creek timber sale is in the Treasure PSU and only has minimal overlap with the project with a small amount of the access road for Montanore located within this PSU. Flower Creek timber sale, like the timber sales mentioned above, would contribute openings or open-canopied habitat as well. Approximately 900 acres are proposed for treatment. Due to the minimal overlap, cumulative effects would be minimal.

In recent years, old growth habitats have been left unmanaged to maintain old growth characteristics. The absence of natural disturbances, such as large fires, occurring within the analysis area since 2000 has limited the type of habitat available for black-backed woodpeckers to general forest habitat. The action alternatives would remove old growth habitat, but KFP standards for old growth would be met and there are minimal, cumulative effects to this component of general forest habitat.

Normal road and trail maintenance activities have the potential to remove nesting and foraging trees if they are close to a trail or road and present a safety hazard. Similarly, firewood cutting would remove snags and would reduce nesting and foraging habitat availability along open roads. The decrease in habitat would be limited to areas within about 150 to 200 feet of open roads. This loss of snag habitat was accounted for in the analysis of available snag habitat.

Within the analysis area, continued development of private land is anticipated and, depending on the type of development, such as timber harvest, home construction or land clearing would reduce general forest habitat by varying levels. This loss of general forest habitat would have minimal effect on black-backed woodpecker populations. The existing situation on federal land provides adequate available habitat for black-backed woodpeckers based on the availability of potential territories that are of adequate size and available snag habitat of 71 and 90 percent in the Crazy and Silverfish PSUs, respectively, which are above the minimum needed of 40 percent. Proposed removal of vegetation associated with this project would result in a 6 percent reduction of general forest habitat and would not reduce areas of high quality habitat.

Similarly, other agency and public actions identified in Appendix E (description of ongoing and foreseeable actions) would have little to no effect on black-backed woodpeckers or their habitat as most activities would occur within general forest habitat. A 71 to 90 percent snag habitat level would be available following the past, present, and foreseeable actions. This snag habitat level would maintain minimum viable population levels of cavity nesting birds, including the black-backed woodpecker, and no adverse cumulative effects are expected.

Regulatory/Forest Plan Consistency

Organic Administration Act and Forest Service Locatable Minerals Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources and to take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations. Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8. In the proposed action, MMC did not propose to implement feasible measures to minimize effects on the black-backed woodpecker or all practicable measures to maintain and protect wildlife habitat. The agencies' alternatives (Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R) would comply with 36 CFR 228.8. The agencies' alternatives would incorporate additional feasible and practicable measures to minimize adverse environmental impacts on wildlife habitat that benefit black-backed woodpecker, including minimizing the disturbance area in the agencies' mine alternatives and implementing a Vegetation Removal and Disposition Plan and Environmental Specifications in the agencies' transmission line alternatives.

National Forest Management Act/Kootenai Forest Plan

KFP - Forestwide Management Direction – KFP II-1 #6, #7, #8, #17, II-22 and 23

The KNF is directed to "identify, protect, and manage" habitat for sensitive species in order to assist in maintaining viable populations. The KFP contains the following goals and direction for sensitive species: "determine the status of sensitive species and provide for their environmental needs as necessary to prevent them from becoming threatened or endangered" (KFP Vol. 1, II-1 #6). All alternatives would meet this direction for the black-backed woodpecker.

b. #7 – *Maintain diverse age classes of vegetation for viable populations of all* existing native, vertebrate, wildlife species: The action alternatives would be consistent with KFP direction to maintain diverse age classes of vegetation for viable populations (KFP Vol. 1, II-1 #7).

#8 – *Manage for sufficient snags and snag replacement trees to maintain viable populations of snag-dependent species*: All action alternatives would be consistent with KFP direction for snags and down wood (see section 3.25.2.2, *Snags and Woody Debris*). In all combined mine-transmission line alternatives, a wide range of successional habitats, and associated amounts of down wood would be available.

22, 23 – Maintenance of viable populations of existing native and desirable nonnative vertebrate species, as monitored through indicator species, attained through the maintenance of a diversity of plant communities and habitats: See1.b. above for habitat diversity

Appendix 16 – Cavity Habitat (Snags and Down Wood): For cavity habitat, see #8 above.

Forest Service Sensitive Species Statement of Findings

The no action alternatives would not impact individual black-backed woodpeckers or their habitat within the analysis area, and would not contribute to a trend toward federal listing or cause a loss of viability to the population or species. ***All combined action alternatives may impact individual black-backed woodpeckers or their habitat, but will not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species.*** This determination is based on: 1) no impact on high quality (post-fire) habitat would occur; 2) general forest habitat reduction would be 6 percent or less; 3) no black-backed woodpeckers have been observed in the Crazy or Silverfish PSU, despite several recent surveys; 4) individual nest trees or localized patches of insect infestation within the analysis area removed during project activities may disturb individuals or pairs.

3.25.4.4 Coeur D'Alene Salamander

3.25.4.4.1 Analysis Area and Methods

The analysis of potential impacts of the proposed project on individuals of the Coeur d'Alene salamander or their habitat is limited to where the Coeur d'Alene salamander could potentially occur, adjacent to Bear Creek Road (NFS road #278). Other areas of the analysis area do not provide suitable habitat for this species.

Coeur d'Alene salamander population ecology, biology, habitat description, and relationships identified by research are described in Cassirer *et al.* (1994), Maxell (2000), Maxell *et al*. (2003), and MNHP (2014a), which are incorporated by reference. Coeur d'Alene salamander occurrence data come from recent District wildlife observation records and KNF historical data (NRIS Wildlife), MNHP, and other agencies, such as FWP. The impacts analysis includes an evaluation of the benefits to the Coeur d'Alene salamander from mitigation measures proposed by the agencies such as implementation of a final Road Management Plan and a Vegetation Removal and Disposition Plan and adherence to INFS standards and guidelines and Montana water quality standards.

3.25.4.4.2 Affected Environment

The Coeur d'Alene salamander has been found below 5,000 feet in western Montana and is the only species of lungless salamander in the northern Rocky Mountain region (Cassirer *et al.* 1994). The salamander is associated with seepages, waterfalls, and small creeks near talus with fractured rock and with dense overstory canopies (Werner *et al.* 2004; MNHP 2014).

Johnson (1999) reports Coeur d'Alene salamander confirmed presence in four of the eight planning units on the KNF at 13 different sites. The salamander has been confirmed in two additional planning units since 1999 and the known sites total 36. The Coeur d'Alene salamander is lungless and respirates entirely through its skin. This necessitates moist conditions to prevent dessication and death. Known populations on the KNF are isolated by miles of dry, unsuitable habitat that cannot be crossed (Maxell 2000; Maxell *et al.* 2003).

Historical records show that Coeur d'Alene salamanders were observed prior to 1990 above and below the Bear Creek Road (NFS road #278) on the northwest side of Big Hoodoo Mountain. A single adult Coeur d'Alene salamander was recorded in 1989 adjacent to the Libby Creek Road (NFS road #231) about 1.5 miles northeast of MMC's proposed Little Cherry Creek Impoundment (Westech 2005a). No recent observations of the Coeur d'Alene salamander in the Crazy and Silverfish PSUs have been recorded (MNHP 2014). The site description for the Libby Creek record indicated it lacks the moist environment typical of Coeur d'Alene salamanders. The site could not be located during 2005 surveys (Westech 2005a). Where Coeur d'Alene salamanders were recorded adjacent the Bear Creek Road (NFS road #278), past timber harvest appears to have reduced canopy cover needed to ensure moist conditions (Westech 2005a).

3.25.4.4.3 Environmental Consequences

The transmission line alternatives, including construction of the Sedlak Park Substation and loop line, would not affect the Coeur d'Alene salamander due to the absence of nearby suitable habitat and are not included in the analysis.

Alternative 1 – No Mine

Alternative 1 would not disturb Coeur D'Alene salamanders or their habitat and would have no effect on this species.

Alternative 2 – MMC's Proposed Mine

According to Maxell (2000), the greatest threats to the Coeur d'Alene salamander are timber harvest, fire, road and trail development and maintenance, vehicle use on roads, and isolation of populations. About 10 miles of the Bear Creek Road (NFS road #278), from US 2 to the Bear Creek bridge, would be widened on its existing alignment and chip-sealed. The roadway width would be 20 to 29 feet wide and designed to handle speeds of 35 to 45 mph. The disturbed area, included ditches and cut-and-fill slopes, is expected to be up to 100 feet wide. Because the Bear Creek Road would be chip-sealed, use of mine or adit water and/or chemical stabilizers for dust suppression along the Bear Creek Road would be unlikely. Widening and improvement of the Bear Creek Road would affect 0.2 acres of wetlands along the road (see Table 184 in the *Wetlands and Other Waters of the U.S.* section) and may remove small areas of potential Coeur d'Alene salamander habitat. Some incidental mortality may occur due to forest clearing and increased traffic associated with Alternative 2. Although impacts on the Coeur d'Alene salamander are possible, they are not likely to occur because no Coeur d'Alene salamanders have been recently observed in the analysis area and because habitat in the analysis area does not appear to provide characteristics typically favored by this species, in particular adequate canopy cover to ensure moist conditions.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Impacts on the Coeur d'Alene salamander from Alternative 3 would be the same as Alternative 2, except that the likelihood of impacts would be less. The agencies' alternatives would include implementation of several measures that would further minimize adverse effects, if any, on the Coeur d'Alene salamander. MMC would implement a final Road Management Plan and a Vegetation Removal and Disposition Plan and comply with INFS standards and guidelines for any work in a RHCA along an access road.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Impacts on the Coeur d'Alene salamander from Alternative 4 would be the same as Alternative 3.

Cumulative Effects

Timber harvest has occurred in the analysis area since the 1950s and, up until the early 1990s, harvest occurred within riparian habitats resulting in alterations and reduction of riparian habitat. High levels of road construction to facilitate harvest occurred through the 1980s and resulted in sedimentation into streams. Detailed descriptions of previous vegetation and road management activities are found at the beginning of Chapter 3 and Appendix E lists all past actions considered in the cumulative effects analysis. Since the adoption of the KFP in 1986, application of KFP standards has resulted in the protection of riparian habitats, less road construction and road closures, and BMP work on existing roads to reduce sedimentation.

Alternative 1 would not have cumulative impacts on the Coeur d'Alene salamander. The likelihood of mine alternatives directly or indirectly affecting the Coeur d'Alene salamander is low. No other reasonably foreseeable actions would affect any known locations of Coeur d'Alene salamander. All mine alternatives would have no cumulative impacts on this species.

Regulatory/Forest Plan Consistency

Organic Administration Act and Forest Service Locatable Minerals Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources and to take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations. All Mine Alternatives and Transmission Line Alternatives would comply with 36 CFR 228.8 with regard to effects to the Coeur d'Alene salamander.

National Forest Management Act/Kootenai Forest Plan

p. II-1 #6 – *Determine the status of sensitive species and provide for their environmental needs as necessary to prevent them from becoming threatened or endangered* and p. II-1 #7 – *Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species:* Coeur d'Alene salamanders have not been documented in areas potentially affected by any of the mine or transmission line alternatives since 1990. The site above and below the Bear Creek Road (NFS road #278) where they were documented prior to 1990 does not appear to provide sufficient canopy cover or other conditions to ensure moist conditions required by Coeur d'Alene salamanders. The agencies' alternatives would include implementation of several measures that would further reduce any effects on the Coeur d'Alene salamander, specifically: 1) implementation of a final Road Management Plan and a Vegetation Removal and Disposition Plan, 2) the use of either a chemical stabilization, groundwater, or segregated mine or adit water with nitrate concentrations of 1 mg/L or less and with concentrations of all other parameters below the mine drainage ELG to control dust on mine access roads, and 3) as described in section 3.23, *Wetlands and Other Waters of the U.S.*, compliance with INFS standards and guidelines for any work in a RHCA along an access road.

KFP riparian standards and guidelines, KFP Vol. 1, II-28 thru 33, as amended by INFS: Compliance with INFS, including RHCA standards and guidelines, are discussed in detail in section 3.6, *Aquatic Life and Fisheries*.

Forest Service Sensitive Species Statement of Findings

The no action alternatives would not impact individual Coeur d'Alene salamanders or their habitat within the analysis area, and would not contribute to a trend toward federal listing or cause a loss of viability to the population or species. ***Although unlikely, Alternatives 2, 3, and 4 (action alternatives) may impact individual Coeur d'Alene salamanders or their habitat, and but would not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species.*** This determination is based on: 1) Widening and improvement of the Bear Creek Road would affect 0.2 acres of wetlands along the road and may remove or degrade small areas of potential Coeur d'Alene salamander habitat, 2) Some incidental mortality could occur due to forest clearing and increased traffic associated with the mine alternatives, 3) No Coeur d'Alene salamanders have been observed in the analysis area since 1989, 4) Habitat in the analysis area does not appear to provide characteristics favored by this species, in particular moist conditions, and 5) the agencies' alternatives would include implementation of several measures that would further reduce the likelihood of any adverse effects on the Coeur d'Alene salamander, including implementation of a final Road Management Plan, a Vegetation Removal and Disposition Plan, and compliance with INFS standards and guidelines for any work in a RHCA along an access road.

State Requirements

Alternatives 3 and 4 would comply with the MMRA regarding disturbed lands being reclaimed to a post-mining land use with stability and utility comparable to that of the pre-mining landscape. Draft findings regarding compliance with MFSA requirements are discussed in the Summary, beginning on p. S-53.

3.25.4.5 Fisher

3.25.4.5.1 Regulatory Framework

In 2011, the USFWS determined that listing the fisher as threatened or endangered was not warranted at the time (USFWS 2011a). This finding was in response to a petition to list a distinct population segment of the fisher in its U.S. Northern Rocky Mountain range, including portions of Montana, Idaho, and Wyoming. The USFWS determined that fishers in the Northern Rocky Mountains met the definition of a distinct population segment because they are geographically separated from other fisher populations, and because the loss of this population would result in a significant gap in the range of the species and the loss of a unique genetic identity found nowhere else within the range of the species. Based on the existence of fisher throughout much of its historical range in Montana and Idaho, including "an increase in number and distribution since their perceived extirpation in the 1920s," and no indications that other natural or anthropogenic factors are likely to significantly threaten the existence of this distinct population segment of fisher, the USFWS concluded that the distinct population segment "is not now, or in the foreseeable future, threatened by other natural or anthropogenic factors affecting its continued existence, or that these factors act cumulatively with other potential threats, to the extent that listing under the Act [ESA] as an endangered or threatened species is warranted at this time" (USFWS 2011a).

3.25.4.5.2 Analysis Area and Methods

Fisher population ecology, biology, habitat description and relationships are described in Jones (1991), Powell (1993), Vinkey (2003), Lofroth *et al*. (2010), USFWS (2011a), and Raley *et al*. (2012). These provided guidance in evaluating potential habitat and effects to fisher, and are incorporated by reference. That information is incorporated by reference. Fisher occurrence data come from recent District wildlife observation records and KNF historical data (NRIS Wildlife) and other agencies, such as the FWP. Potential fisher habitat was recently modeled for Region One (USDA Forest Service 2012d, Ecosystems Research Group 2012) and includes old growth forest, as well as a diversity of forest successional stages and plant communities that provide seasonal fisher habitat and riparian areas that are important for travel, resting and denning. The modeling includes both National Forest System and private and State lands. Specific fisher habitat information is not available for private or state-owned lands in the analysis area, much of which has been logged in the past 20 to 30 years. Fisher habitat on private land was included in the Region One modeling.

The analysis area for the fisher is described in section 3.25.1, *Introduction.* The analysis area for determination of population trend and contribution toward population viability is the KNF.

The impacts analysis includes an evaluation of the benefits to fisher from mitigation measures proposed by the agencies such as implementation of a final Road Management Plan, a Vegetation Removal and Disposition Plan, and adherence to INFS standards and the agencies' Environmental Specifications (Appendix D) or MMC's Environmental Specifications (MMI 2005b).

3.25.4.5.3 Affected Environment

In the western United States, fishers prefer late-successional forests (mature or old growth forests), and low elevation, moist riparian corridors for resting, denning, and travel (Heinemeyer and Jones 1994). The fisher feeds on a variety of prey, from small to medium-sized mammals, birds, and carrion (Powell and Zelinski 1994). Fishers use an assortment of habitats for feeding, although they avoid non-forested areas (Jones and Garton 1994, and Roy 1991). Complex forest structure such as large snags, large down wood material, and high canopy cover are important components of fisher habitat.

In the western United States, fisher populations are limited to certain mountain ranges in the Pacific Northwest and Rocky Mountains. Fisher distribution in United States Northern Rocky Mountains is thought to be similar to the presumed historical range (USFWS 2011a). These isolated populations may be acutely susceptible to local extinction (Heinemeyer and Jones 1994). Fishers once occurred in the Cabinet Mountains, but were eliminated locally by overtrapping and habitat alteration (Ruggiero *et al.* 1994; Vinkey *et al.* 2006). Between 1989 and 1991, 110 fishers from the Midwest were released in the Cabinet Mountains as part of a state translocation program. Vinkey (2003) studied the distribution of fishers in the Cabinet Mountains using winter snow tracking, track plates, and live-trapping surveys conducted from 2001 to 2003. All verified records of fishers from this study were from the west Cabinet Mountains. Vinkey (2003) concluded that the introduction of fishers to the Cabinet Mountains has established a small population, but that the long-term viability of this population is uncertain. Similarly, surveys for fishers in the Northern Rockies since 2004 has only detected fishers at 222 out of 4,813 snares deployed in eight years (Schwartz *et al*. 2006, USDA Forest Service 2012d). The KNF provides suitable fisher habitat, but both current and historical information suggests that fisher have never been abundant in the Cabinet Mountains (Heinz 1996; Vinkey 2003). The current population of fishers in the Cabinet Mountains is unknown. Fishers are generally more common where human density is low and human disturbance is reduced (Ruggiero *et al.* 1994).

Johnson (1999) reported fisher presence was confirmed in five of the eight planning units on the KNF. Fisher observation and monitoring data indicates that suitable habitat is present within the analysis area, especially along forested streams. There have been no recent (since 2000) sightings of fishers within the analysis area, but historical observations have been recorded within the Crazy and Silverfish PSUs. A fisher den was found in 1989 near Horse Mountain (Roy 1991). Fishers are known to be present within the Libby Creek drainage, and are possibly present within the Poorman Creek, Ramsey Creek, and West Fisher Creek drainages (Westech 2005a).

Ruediger (1994) reported the KNF as a primary habitat area for fisher. More recently, fisher habitat was modeled for Region One and is found within the analysis area (USDA Forest Service 2012d). Forestwide, fisher habitat is abundant at 703,423 acres and exceeds the upper range of historic variation of 671,150 acres (Ecosystems Research Group 2012). Although fisher are found within landscapes that have high levels of contiguous cover and mid to late seral conditions, their home ranges include a diversity of forest successional stages and plant communities (Lofroth *et al*. 2010, Raley *et al*. 2012). Some studies have shown positive association with young successional stages such as pole-sapling and young forest (*e.g.*, Jones 1991), possibly because of prey resources associated with these environments. In particular, Jones (1991) observed fisher shifting their use of habitat seasonally, with mature and old-growth forests being used in the summer and young forest cover types used more in the winter. Riparian areas are important habitat for travel, resting, and denning. Based on habitat modeling, 19,178 acres of potential yearlong fisher habitat occur in the Crazy PSU and 13,262 acres in the Silverfish PSU, including state and private lands. The Crazy PSU is within the Kootenai planning unit, and the Silverfish PSU is within the Fisher planning unit. Following the identification process outlined in Ruediger (1994), these planning units are designated as secondary fisher conservation areas (Johnson 2004b). The Crazy and Silverfish PSUs are considered high-quality fisher habitat areas (Ibid.).

Old growth habitat on private and State land in the analysis area consists mostly of cottonwood/ spruce riparian habitat. The majority of the private and State lands in the analysis area has high road densities and has been logged in the past 20 to 30 years (Figure 85), resulting in fragmented forest habitat. Based on recent modeling, potential fisher habitat on private and State lands is limited and of marginal quality (USDA Forest Service 2012d).

FWP currently manages the species as a furbearer with a limited harvest of 7 animals in 2014.

3.25.4.5.4 Environmental Consequences

Alternative 1 – No Mine

Alternative 1 would not disturb the fisher or its habitat and would have no effect on this species (Table 219). Over time, with continued fire suppression and lack of active forest management, indirect effects of this alternative would include a continued trend toward later successional habitats, which would favor fisher habitat. Large-scale fires could potentially occur in the analysis area. Over the next five decades, Ecosystems Research Group (2012) reported that the driving force behind habitat change on the KNF is due to natural disturbance processes, especially wildfire. Similarly, the USFWS 2011a listing decision notes that fisher populations have increased in numbers and distribution despite the effects of anthropogenic activities.

Alternative 2 – MMC's Proposed Mine

No impacts on fisher would occur as a result of Alternative 2 in the Silverfish PSU. Alternative 2 would reduce the amount of yearlong fisher habitat in the Crazy PSU by 746 acres, or 4 percent of the habitat available. Winter fisher habitat would be reduced by 1,798 acres or about 12 percent of the winter habitat available (Table 219). Most of the habitat impacts to both yearlong and winter habitat would be in the Little Cherry Creek Tailings Impoundment Site.

Table 219. Available Fisher Habitat and Potential Effects in the Analysis Area by Mine Alternative.

Measurement Criteria	[1] No Mine/Existing Conditions	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment	[4] Agency Mitigated Little Cherry Creek Impoundment
Crazy PSU				
Yearlong Habitat (acres)	19,178	18,432 (746/3.9)	18,690 (488/2.5)	18,644 (534/2.8)
Winter Habitat (acres)	14,722	12,924 (1,798/12.2)	13,686 (1,036/7.0)	13,369 (1,353/9.2)
Silverfish PSU				
Yearlong Habitat (acres)	13,262	13,262 (0/0)	13,262 (0/0)	13,262 (0/0)
Winter Habitat (acres)	12,964	12,964 (0/0)	12,964 (0/0)	12,964 (0/0)

Number in parentheses is the reduction in habitat acres/percent in habitat area compared to existing conditions.
Source: GIS analysis by ERO Resources Corp. using KNF data.

The risk of fisher mortality would increase as a result of increased traffic and increased winter access to fisher habitat from Alternative 2. Alternative 2 would include snowplowing Bear Creek Road (NFS road #278) and Libby Creek Road (NFS road #231) during the evaluation program, and while the Bear Creek Road is reconstructed, allowing trappers easy winter access to old growth and riparian areas providing good fisher habitat. Trapping has a negligible impact on fisher populations in the KNF. The annual quota for fisher across FWP Region 1 is just two animals, mostly from the Flathead and Whitefish areas.

Annual traffic would be about three times existing levels throughout the life of the mine (Table 172). The increase in traffic in Alternative 2 would substantially increase the risk of increased fisher mortality. MMC would provide transportation to employees using buses, vans, and pickup trucks thereby limiting the use of personal vehicles. MMC would limit concentrate haulage to daylight hours during the day shift (0800 to 1630), which would minimize vehicular-fisher collisions during the early morning, evening and night time-periods. MMC would report road-killed animals to the FWP as soon as road-killed animals were observed. The FWP would either remove road-killed animals or direct MMC how to dispose of them. Increased traffic noise may also displace fishers from suitable habitat. When the mill ceased operations in the Closure Phase, mine traffic volume would be substantially less than shown in Table 171. Future traffic volume when all activities at the mine are completed in the Post-Closure Phase would be higher than in Alternative 1 because of reconstruction of Bear Creek Road and loss of the Little Cherry Loop Road beneath the impoundment. Mortality risk to fisher would decrease on the Bear Creek Road compared to operations, but the permanently improved road conditions (increased road width, improved sight distance, paving) and higher traffic speeds that would continue Post-Closure would result in a permanently higher fisher mortality risk compared to pre-mine conditions. All action alternatives would include snowplowing the Libby Creek Road (NFS road #231) during the Evaluation Phase and while the Bear Creek Road was reconstructed, providing trappers easier winter access to fisher habitat in old growth and riparian areas. A gate would limit motorized access to snowplowed areas.

While not highly sensitive to human activity, the fisher is a species that generally avoids humans (Powell 1993). Disturbance effects may occur due to the presence of people and machines during construction and operations, potentially displacing fishers from nearby suitable habitat. Displacement effects would probably be the greatest during the Construction Phase, but would continue at lower levels during operations. According to Heinemeyer and Jones (1994), the most sensitive time for fishers is the breeding, denning, and rearing period (February 15 to June 30).

Impacts within 200 meters of perennial streams are especially important to avoid (Ibid.). Impacts of Alternative 2 on riparian fisher habitat may be reduced through implementation of MMC's proposed Wetland Mitigation Plan. The feasibility of MMC's proposed Wetland Mitigation Plan to replace the lost functions of all potentially affected wetlands is uncertain. MMC's plan is conceptual and would be refined during the 404 permitting process. MMC did not update its mitigation plan for Alternative 2 to reflect new wetland and stream mitigation regulations and procedures. Section 3.23, *Wetlands and Other Waters of the U.S.*, discusses proposed wetland mitigation in more detail. MMC would store mine, adit, or tailings water at the Ramsey Plant Site, a surge pond at the LAD Areas, and the tailings impoundment. The metals in the tailings water would be similar to what is found at the Troy Mine decant ponds (see Table 120 in the *Water Quality* section), where adverse effects on wildlife have not been observed (USDA Forest Service and DEQ 2012). Concentrations of metals in mine and adit water, which would be stored in mine/yard pond at the Ramsey Plant Site and in a surge pond at the LAD Areas, would be lower than tailings water (see Table 120 in the *Water Quality* section). The Ramsey Plant Site would be fenced, restricting deer access.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

The types of impacts on fisher from Alternative 3 would be the same as Alternative 2, except that less yearlong and winter fisher habitat would be affected (488 and 1,036 acres, respectively) (Table 219). Yearlong habitat would be reduced 2.5 percent and winter habitat reduced 7.0 percent from existing conditions. The agencies' mine alternatives would have fewer disturbances in RHCAs and other riparian areas, minimizing effect on the fisher. The effect of increased traffic on the Bear Creek Road would be the same as Alternative 2. MMC would remove big game animals killed by any vehicles daily from road rights-of-way within the permit area and along roadways used for access or hauling ore (NFS roads #231, #278, #4781, and #2316 and new roads built for the project) for life of mine. MMC also monitor the number of big game animals killed by vehicle collisions on these roads and report findings annually. These measures would minimize fisher mortality along the access road.

Impacts of Alternative 3 on riparian fisher habitat would be minimized through implementation of the agencies' proposed Wetland Mitigation Plan, which would have a greater likelihood of replacing lost functions than the Alternative 2 Wetland Mitigation Plan. The agencies' alternatives would include implementation of several measures that would further minimize adverse effects, if any, on the fisher. MMC would implement a final Road Management Plan and a Vegetation Removal and Disposition Plan and comply with INFS standards and guidelines for any work in a RHCA along an access road. Habitat acquisitions and road closures associated with grizzly bear mitigation would also benefit fisher. Road closures would reduce trappers' winter access to fisher habitat in old growth and riparian areas.

Water management in Alternatives 3 and 4 would reduce the risk to wildlife from contaminant uptake from storage of mine, adit, and tailings water. All mine and adit water would be treated and discharged at the Libby Adit Water Treatment Plant and not stored in ponds. The LAD Areas would not be used and the surge ponds would not pose a risk to the fisher. Tailings water quality would have lower metal concentrations than in Alternative 2; the factors leading to lower metal concentrations in tailings water quality in Alternatives 3 and 4 are discussed in the *Water Quality* section, p.674.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Impacts on fisher from Alternative 4 would be about the same as Alternative 3, except that slightly more yearlong and winter fisher habitat would be affected (534 and 1,353 acres, respectively) (Table 219). Yearlong habitat would be reduced 2.8 percent and winter habitat reduced 9.2 percent from existing conditions. The effect of mitigation on the fisher would be the same as Alternative 3.

Alternative A – No Transmission Line

Table 220 summarizes the changes in yearlong and winter habitat due to each alternative. Alternative A would not disturb the fisher or its habitat and would have no effect on this species.

Alternative B – MMC’s Proposed Transmission Line (North Miller Creek Alternative)

Alternative B would reduce the amount of yearlong and winter fisher habitat by less than 1 percent in both the Crazy PSU and Silverfish PSUs. Yearlong and winter fisher habitat would be reduced by 42 and 39 acres, respectively in the Crazy PSU; and 6 and 39 acres in the Silverfish PSU, respectively (Table 220). The risk of fisher mortality may increase as a result of increased construction traffic from any of the action alternatives, including Alternative B. Traffic increases are anticipated to be minimal during the 2-year transmission line construction and 1-year decommissioning periods. While not highly sensitive to human activity, the fisher is a species that generally avoids humans (Powell 1993). Disturbance effects could occur due to the presence of people and machines during transmission line construction, potentially displacing fishers from nearby suitable habitat. According to Heinemeyer and Jones (1994), the most sensitive time for fishers is the breeding, denning, and rearing period (February 15 to June 30). Displacement effects would be negligible during operations because activities would be limited to line maintenance. Alternative B would affect about 1 acre of coniferous forest and 4 acres of old growth providing fisher habitat on private land. Because fisher habitat on private land, including in the Sedlak Park Substation and loop line footprint, is of marginal quality, impacts on fisher would be minimal. MMC’s Environmental Specifications (MMI 2005b) included limited measures that would protect riparian habitat.

Table 220. Available Fisher Habitat and Potential Effects in the Analysis Area by Transmission Line Alternative.

Measurement Criteria	[A] No Transmission Line	[B] North Miller Creek	[C-R] Modified North Miller Creek	[D-R] Miller Creek	[E-R] West Fisher Creek
Crazy PSU					
Yearlong Habitat (acres)	19,178	19,136 (42/0.2)	19,149 (29/0.2)	19,142 (36/0.2)	19,142 (36/0.2)
Winter Habitat (acres)	14,722	14,682 (39/0.3)	14,706 (16/0.1)	14,699 (23/0.2)	14,699 (23/0.2)
Silverfish PSU					
Yearlong Habitat (acres)	13,262	13,256 (6/<0.1)	13,254 (8/<0.1)	13,220 (42/0.3)	13,200 (62/0.5)
Winter Habitat (acres)	12,964	12,925 (39/0.3)	12,929 (35/0.3)	12,904 (60/0.5)	12,922 (42/0.3)

Number in parentheses is the reduction in habitat acres/percent in habitat area compared to existing conditions.
Source: GIS analysis by ERO Resources Corp. using KNF data.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

Impacts on fisher from Alternative C-R on National Forest System land would be similar to Alternative B, except that slightly less yearlong and winter fisher habitat would be impacted. Yearlong and winter fisher habitat would be reduced by 29 and 16 acres, respectively in the Crazy PSU; and 8 and 35 acres in the Silverfish PSU, respectively (Table 220). Due to lack of suitable habitat, construction of the Sedlak Park Substation and loop line would not affect fishers.

Impacts of Alternative C-R on riparian fisher habitat would be minimized through implementation of the agencies' Vegetation Removal and Disposition Plan, and the agencies' Environmental Specifications (Appendix D). The agencies' Environmental Specifications describe mitigation activities that would benefit fisher, including locating structures outside of riparian forest, minimizing clearing of riparian forests and the use of heavy equipment in these areas, restoring degraded riparian habitats and improving passage for terrestrial wildlife along riparian corridors. One of the goals of the Vegetation Removal and Disposition Plan would be to minimize vegetation clearing. The plan would identify areas where clearing would be avoided, such as deep valleys with high line clearance, and measures that would be implemented to minimize clearing. It would evaluate the use of monopoles to reduce clearing in select areas, such as old growth. For example, the growth factor used to assess which trees would require clearing could be reduced in sensitive areas, such as RHCAs, from 15 years to 5 to 8 years. Reducing the growth factor could reduce clearing width, but increase maintenance costs. Heavy equipment use in RHCAs would be minimized. Shrubs in RHCAs and in the line of sight between the line and private land would be left in place unless they had to be removed for safety reasons.

Alternative D-R – Miller Creek Transmission Line Alternative

Impacts on fisher from Alternative D-R on National Forest System land would be similar to Alternative B. Alternative D-R would reduce the amount of yearlong and winter fisher habitat by less than 1 percent in both the Crazy PSU and Silverfish PSUs. Yearlong and winter fisher habitat would be reduced by 36 and 23 acres, respectively in the Crazy PSU; and 42 and 60 acres, respectively in the Silverfish PSU (Table 220). The acres impacted by Alternative D-R in the

Silverfish PSU would be slightly greater than Alternative B, but still less than 1 percent of the habitat available. Due to lack of suitable habitat, construction of the Sedlak Park Substation and loop line would not affect fishers. The mitigation measures described for Alternative C-R would be implemented in Alternative D-R.

Alternative E-R – West Fisher Creek Transmission Line Alternative

Impacts on fisher from Alternative E-R on National Forest System land would be similar to Alternative D-R except that the relative effects to yearlong and winter fisher habitat vary slightly in the Silverfish PSU. Alternative E-R would reduce the amount of yearlong and winter fisher habitat by less than 1 percent in both the Crazy PSU and Silverfish PSUs. Yearlong and winter fisher habitat would be reduced by 36 and 23 acres, respectively in the Crazy PSU; and 60 and 42 acres, respectively in the Silverfish PSU (Table 220). Due to lack of suitable habitat, construction of the Sedlak Park Substation and loop line would not affect fishers. The mitigation measures described for Alternative C-R would be implemented in Alternative E-R.

Combined Mine-Transmission Line Effects

Alternative 2B would have the greatest impacts on fisher habitat in the Crazy PSU, impacting 783 acres (4.1 percent) of yearlong habitat and 1,826 acres (12.4 percent) of winter habitat. Alternatives 3C-R, 3D-R, and 3E-R would impact between 517 and 524 acres (2.7 percent of habitat available), and Alternatives 4C-R, 4D-R, and 4E-R would affect 563 and 571 acres (2.9 to 3.0 percent of habitat available) of yearlong fisher habitat in the Crazy PSU (**Error! Reference source not found.**). Impacts on both yearlong and winter fisher habitat in the Silverfish PSU for the other combined mine transmission line alternatives would all be less than 1 percent of the habitat available, range from 8 to 62 acres or yearlong habitat and 35 to 60 acres of winter habitat. Due to lack of suitable habitat, construction of the Sedlak Park Substation and loop line would not affect fishers. All combined action alternatives would fragment fisher habitat through the reduction of habitat and placement of human structure on the landscape. Although habitat fragmentation would increase, sufficient habitat would remain to provide connectivity to the species.

In all combined action alternatives, the risk of fisher mortality would increase as a result of increased traffic and increased access to fisher habitat. Annual traffic on the mine access road (Bear Creek Road) would be about three times existing levels throughout the life of the mine (Table 171 in the *Transportation* section), increasing the mortality risk. Increased traffic noise may also displace fishers from suitable habitat. All combined action alternatives would include snowplowing the Libby Creek Road (NFS road #231) during the Evaluation Phase and while the Bear Creek Road was reconstructed, providing trappers easier winter access to fisher habitat in old growth and riparian areas. Gates would limit motorized access. While research does not show fishers to be highly sensitive to human activity, disturbance effects could occur due to the presence of people and machines during transmission line construction, potentially displacing fishers from nearby suitable habitat. According to Heinemeyer and Jones (1994), the most sensitive time for fisher is the breeding, denning, and rearing period (February 15 to June 30). In Alternative 2B, impacts on riparian fisher habitat would be reduced through implementation of MMC's proposed wetland mitigation and Environmental Specifications (MMI 2005b). Impacts of the agencies' combined alternatives would be more effectively minimized through the agencies' Wetland Mitigation Plan and Vegetation Removal and Disposition Plan, and the Environmental Specifications (Appendix D), as described above. Impacts on fisher habitat would be somewhat reduced through MMC's and the agencies' proposed land acquisition associated with grizzly bear mitigation. Acquired parcels would be managed for grizzly bear use in perpetuity and may improve or contribute suitable fisher habitat if the acquired parcels provided appropriate habitat characteristics. Road closures would reduce trappers' winter access to fisher habitat in old growth and riparian areas.

Cumulative Effects

Past actions, including detailed descriptions of previous vegetation and road management activities, are described in section 3.2, *Past and Current Actions*, shown on Figure 50, and listed in Appendix E. Past actions, such as timber harvest, road construction, and fire-suppression activities, have altered the old growth ecosystems in the analysis area, resulting in a reduction in early and late succession habitats; conditions favoring shade-tolerant, fire-intolerant species; loss of large snags and down wood; increases in tree density, and a shift to a largely mid-seral structural stage (USDA Forest Service 2003b). Continuing development of private lands, including timber harvest, home construction, and land clearing would contribute to losses of fisher habitat in the analysis area. Impacts on fisher on private and State lands would probably be minimal because it is likely that fisher habitat in these areas is of marginal quality.

Future actions that may further reduce fisher habitat in the analysis area include the Miller-West Fisher Vegetation Management Project, the Coyote Improvement Vegetation Management Project and the Silverbutte Bugs timber sale. Forest treatments proposed for these vegetation management projects, could contribute to cumulative losses and fragmentation of fisher habitat. The projects will not directly impact old growth that could provide potential fisher habitat. Surface impacts from other reasonably foreseeable actions in the analysis area would be minimal.

Other cumulative effects include existing road and associated traffic volume, primarily on US 2, and existing roads and human disturbance in the analysis area. If timber harvest activities occurred concurrently with mine or transmission line construction and operations, higher traffic volume and associated increased fisher mortality risk may occur. No other past, current, or reasonably foreseeable actions are anticipated to contribute to cumulative impacts on fishers.

Regulatory/Forest Plan Consistency

Organic Administration Act and Forest Service Locatable Minerals Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources and to take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations. Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8. In the proposed action, MMC did not propose to implement feasible measures to minimize effects on the fisher or all practicable measures to maintain and protect wildlife habitat. The agencies' alternatives (Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R) would comply with 36 CFR 228.8. These alternatives would incorporate additional feasible and practicable measures to minimize adverse environmental impacts on wildlife habitat that benefit fisher. These measures would include substantially reducing disturbance in yearlong and winter habitat in the mine area, reducing effects on old growth, locating structures outside of riparian forest, minimizing clearing of riparian forests and the use of heavy equipment in these areas, restoring degraded riparian habitats and improving passage for terrestrial wildlife along riparian corridors.

Table 221. Available Fisher Habitat and Potential Effects in the Analysis Area by Combined Mine-Transmission Line Alternative.

Measurement Criteria	[1] No Mine Existing Condition	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Little Cherry Creek Impoundment Alternative		
		TL-B	TL-C-R	TL-D-R	TL-E-R	TL-C-R	TL-D-R	TL-E-R
Crazy PSU								
Yearlong Habitat (acres)	19,178	18,395 (783/4.1)	18,661 (517/2.7)	18,654 (524/2.7)	18,654 (524/2.7)	18,615 (563/2.9)	18,607 (571/3.0)	18,607 (571/3.0)
Winter Habitat (acres)	14,722	12,896 (1,826/12.4)	13,674 (1,048/7.1)	13,666 (1,056/7.2)	13,666 (1,056/7.2)	13,357 (1,365/9.3)	13,350 (1,372/9.3)	13,350 (1,372/9.3)
Silverfish PSU								
Yearlong Habitat (acres)	13,262	13,256 (6/<0.1)	13,254 (8/0.1)	13,220 (42/0.3)	13,200 (62/0.5)	13,254 (8/0.1)	13,220 (42/0.3)	13,200 (62/0.5)
Winter habitat (acres)	12,964	12,925 (39/0.3)	12,929 (35/0.3)	12,904 (60/0.5)	12,922 (42/0.3)	12,929 (35/0.3)	12,904 (60/0.5)	12,922 (42/0.3)

Number in parentheses is the reduction in habitat acres/percentage compared to existing conditions.

Source: GIS analysis by ERO Resources Corp. using KNF data.

National Forest Management Act/Kootenai Forest Plan

p.II-1 #6 – *Determine the status of sensitive species and provide for their environmental needs as necessary to prevent them from becoming threatened or endangered*: Fisher habitat occurs within the analysis area. In Mine Alternative 2 and Transmission Line Alternative B, MMC did not propose to implement practicable measures to minimize effects on the fisher. The agencies' alternatives would include measures to minimize effect on the riparian and old growth forest that provide habitat for fisher. ***All alternatives may impact individual fishers or their habitat within the analysis area, but would not contribute to a trend toward federal listing or cause a loss of viability to the population or species.***

p.II-1 #7 – *Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species:* All action alternatives would maintain diverse age classes for viable populations of the fisher.

p. II-22 – *Maintenance of 10 percent of the KNF land base below 5,500 feet in old-growth condition that is representative of the major forest types, spread evenly through most major drainages, and providing for old-growth dependent wildlife species:* Transmission Line Alternatives C-R and D-R would avoid old growth habitat on private land. All action alternatives would require a project-specific amendment to allow harvest within designated old growth stands (MA 13). The project-specific amendment would change the current MA 13 (Old Growth) allocation of all harvested stands to either MA 23 (Electric Transmission Corridor) or MA 31 (Mineral Development). The action alternatives would result in between 16.8 and 16.9 percent designated old growth below 5,500 feet elevation in the Crazy PSU, and 13.6 percent designated old growth below 5,500 feet elevation in the Silverfish PSU. All action alternatives would be consistent with KFP direction to maintain a minimum of 10 percent old growth below 5,500 feet in elevation in each third order drainage or compartment, or a combination of compartments.

p.II-22, 23 – *Maintenance of viable populations of existing native and desirable non-native vertebrate species, as monitored through indicator species, attained through the maintenance of a diversity of plant communities and habitats:* See #7. above for habitat diversity.

Compliance with the INFS and RHCA standards and guidelines is discussed in section 3.6, *Aquatic Life and Fisheries*.

Forest Service Sensitive Species Statement of Findings

The no action alternatives would not impact individual fisher or their habitat within the analysis area, and would not contribute to a trend toward federal listing or cause a loss of viability to the population or species. ***All combined action alternatives may impact individual fishers or their habitat, but will not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species for fishers.*** This determination is based on: 1) the mine alternatives would have no impact on fishers in the Silverfish PSU; 2) all combined action alternatives would result in the direct loss of fisher habitat, but these impacts represent less than 1 percent of potential fisher habitat; 3) all action alternatives could result in an increase in the risk of fisher mortality due to increased traffic and winter access to fisher habitat; 4) all action alternatives would result in increased habitat fragmentation and disruption of movement in riparian corridors, and potential displacement from suitable habitat due to human disturbance; and 5) all combined mine-transmission line alternatives would be consistent with KFP direction to maintain a minimum of 10 percent old growth (fisher habitat) below 5,500 feet in elevation. While some individuals could be affected, impacts would not be severe enough to limit fisher viability on the KNF. Given the availability of habitat, these impacts would not affect fisher populations in either the Crazy or Silverfish PSU.

State Requirements

Alternatives 3 and 4 would comply with the MMRA regarding disturbed lands being reclaimed to a post-mining land use with stability and utility comparable to that of the pre-mining landscape. Draft findings regarding compliance with MFSA requirements are discussed in the Summary, beginning on p. S-53. Trapping is managed by FWP. Proposed actions would not prevent the state from continuing to manage this species as a harvestable population.

3.25.4.6 Flammulated Owl

Flammulated owls are cavity-dependent owls that inhabit mostly mature to old ponderosa pine and ponderosa pine/Douglas-fir stands with low to medium stem densities. They are migratory and are found on the KNF from May to mid-October. These small owls are strongly dependent on large-diameter trees (generally 18 inches DBH or more), especially for nesting habitat, and prefer open stands with understory grass species for hunting moths and other insects. Pockets of dense understory conifer thickets are important for roosting, thermal and escape cover. Detailed flammulated owl population ecology, biology, habitat description and relationships identified by research are summarized in Hayward and Verner (1994). More recent research on nesting, food habits, home range and territories, and habitat quality conducted in Colorado, Idaho, and Montana is discussed in Linkhart (2001), Linkhart and Reynolds (1997), Linkhart *et al.* (1998), Groves *et al.* (1997), Powers *et al.* (1996), Wright (1996) and Wright *et al.* (1997). These provided guidance in evaluating potential habitat and potential effects to flammulated owls, and are incorporated by reference. In general, flammulated owls typically favor dry, relatively open forest at low to moderate elevation, generally dominated by ponderosa pine and Douglas-fir. They are obligate cavity nesters, generally using holes excavated by pileated woodpeckers or common flickers. Territory size during the nesting season averages about 40 acres (Hayward and Verner 1994). They feed primarily on moths and, in some areas, grasshoppers and cricket). They are neotropical migrants, breeding in North America as far north as southern British Columbia, Canada and at least as far south as Mexico and winter as far south as Guatemala (Hayward and Verner 1994).

3.25.4.6.1 Analysis Area and Methods

Flammulated owl occurrence data come from recent District wildlife observation records and KNF historical data (NRIS Wildlife). Potential flammulated owl habitat was mapped using TSMRS/FACTS vegetation data and photo-interpreted timber strata on private lands. Dry habitat types containing mature stands of ponderosa pine and/or Douglas-fir with relatively open canopies were identified.

The amount of habitat available in PSUs where activities are proposed was mapped and evaluated for potential effects to habitat due to facility siting, clearing associated with transmission line siting and installation and activities associated with road construction and widening. Effects of the alternatives were evaluated based on changes in habitat and potential disturbance during the breeding season.

The analysis area for project impacts and cumulative effects to individuals and their habitat consists of the Crazy, Silverfish, McElk, and Riverview PSUs. The analysis area includes private and State lands crossed by the various transmission line alternatives. The analysis area includes the PSUs impacted by proposed activities. While the bulk of activities occur within the Crazy and Silverfish PSUs, there are also project activities within McElk, Riverview, Treasure, and Rock PSUs. The analysis area boundary for direct effects is the proposed activity areas, as activities and alteration of the habitat would affect suitability for different species. The acres directly impacted by activities are put into the context of the PSU scale to provide a consistently sized analysis unit and better gauge the relative impacts of the activities. The boundaries for indirect and cumulative effects are the planning subunits that contain the analysis area as alteration of habitat could affect the availability and use of habitats. Analysis at the PSU scale allows the effects of the proposed activities to be put into context and their relative impacts gauged. The impacts to the Rock PSU are limited to a less than 1 acre of patch of steep, rocky ground, the impacts are nearly undetectable at the PSU scale, and therefore this PSU is not carried forward in detailed analysis.

3.25.4.6.2 Affected Environment

The KNF provides about 40,000 acres of potential flammulated owl habitat (Ecosystem Research Group 2012) and potential flammulated owl habitat occurs across all eight planning units (Johnson 1999). Field surveys have confirmed flammulated owl presence in five of eight planning units (Johnson 1999). The owl population size on the KNF is unknown (Ibid.). Flammulated owl surveys using taped owl calls to draw a response from nesting birds have been conducted intermittently within the Crazy and Silverfish PSUs over the last decade. The probability of detecting a male Flammulated Owl varies considerably depending on the nesting phase: from 100 percent detection probability during pair bonding and incubation, to 80 – 35 percent detection probability during brooding, to less than 15 percent detection probability during the post-fledgling period (Barnes and Belthoff 2008). Weather may also influence the timing of the breeding season (Fylling *et al.* According to District flammulated owl observation and monitoring data, the species has been observed on numerous occasions in the past 13 years in the North Fork Miller Creek and the Miller Creek drainages. No observations of flammulated owls have been recorded within the Crazy PSU. No flammulated owls were found during surveys conducted in 2005 (Westech 2005a) in the Crazy and Silverfish PSUs. As part of the Northern Region Landbird Monitoring program, forest-wide flammulated owl surveys were conducted in 2005 (Cilimburg 2006) and 2007 (Smucker and Cilimburg 2008) on the KNF. These surveys included the Teeters Peak area (NFS road #231) and Miller Creek (NFS roads #4725 and #4724,) with the species being detected along the North and South Fork Miller Creek roads (#4725 and #4724).

Mapped habitat from the KNF TSMRS/FACTS and timber strata/habitat type data indicate about 265 acres of potential flammulated owl habitat occur in the Crazy PSU, 581 acres in the Silverfish PSU, 2,490 acres in the Riverview PSU, 70 acres in the Treasure PSU and 3,368 acres in the McElk PSU. Of the 6,774 acres in the affected PSUs, 2,478 acres of potential habitat occur on National Forest System lands. Recent habitat analysis of forest-wide habitat (Ecosystem Research Group 2012) predicts an increase in actual and potential flammulated owl habitat over the next 5 decades.

The majority of the private lands in the analysis area has high road densities and the lands have been logged in the past 20 to 30 years, resulting in loss of snags and fragmented forest habitat. Coniferous forest on private lands is primarily dominated by dry ponderosa pine/Douglas-fir communities.

3.25.4.6.3 Environmental Consequences

Impacts on flammulated owls from mine and transmission line alternatives are shown in Table 222, and are described in the following subsections. Impacts from the mine alternatives would not affect flammulated owl habitat in any of the potentially affected PSUs.

Alternative 1 – No Mine

Impacts on potential flammulated owl habitat caused by the mine alternatives would not directly affect flammulated owl habitat. Alternative 1 would not impact flammulated owls or their habitat.

Alternative 2 – MMC's Proposed Mine

There is no identified flammulated owl habitat associated with any facilities (adit, tailings impoundment, or associated roads) proposed in Alternative 2. Alternative 2 would not directly affect flammulated owl habitat.

Alternative 2 would include tree clearing within disturbance boundaries. There is no identified potential flammulated owl habitat within the footprint of facilities including the adit or tailings impoundments. There would be no direct effects to the species due to clearing at these sites. Noise and other human-caused disturbances, such as blasting, construction of the plant and adit sites, road construction and use, and plant and adit operations could result in disturbance to nearby habitat, at least temporarily. Ambient illumination may disrupt orientation in nocturnal animals and competitive and predator-prey interactions (Longcore and Rich 2004). Lighting from permanent facilities could disrupt normal nocturnal activities of any nearby flammulated owls. One block of potential habitat is 0.25 mile north of the Little Cherry Creek Tailings Impoundment Site. Flammulated owls appear to be relatively tolerant of disturbance during the nesting season (Linkhart *et al.* 1998), and it is likely that low intensity activities of tailings-related operations would not unduly affect suitability of that habitat block. Disturbance impacts would likely be greatest during the Construction Phase, but could persist at lower intensities through mine operations.

Table 222. Effects on Flammulated Owl Habitat in the Analysis Area by Transmission Line Alternative.

Measurement Criteria	[A] No Transmission Line	[B] North Miller Creek	[C-R] Modified North Miller Creek	[D-R] Miller Creek	[E-R] West Fisher Creek
Crazy PSU					
Flammulated Owl Habitat (acres/%)	265	265	265	265	265
McElk PSU					
Flammulated Owl Habitat (acres/%)	3,368	3,360 (8/<1%)	3,360 (8/<1%)	3,360 (8/<1%)	3,360 (8/<1%)
Riverview PSU					
Flammulated Owl Habitat (acres/%)	2,490	2,485 (5/<1%)	2,490 (0/0%)	2,490 (0/0%)	2,490 (0/0%)
Silverfish PSU					
Flammulated Owl Habitat (acres/%)	581	580 (1/<1%)	581 (0/0%)	581 (0/0%)	579 (2/<1%)
All Affected PSUs					
Flammulated Owl Habitat (acres/%)	6,704	6,690 (14/<1%)	6,696 (8/<1%)	6,696 (8/<1%)	6,694 (10/<1%)

Number in parentheses is the reduction in habitat acres/percent in habitat area compared to existing conditions.
Source: GIS analysis by KNF using KNF data.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Alternative 3 would not directly affect any flammulated owl habitat and is identical to Alternatives 2 and 4 in this regard. The tailings impoundment would be located 1 mile from the nearest potential habitat and would be unlikely to have any direct effects on that habitat. Disturbance impacts on flammulated owls would be the same for Alternative 3 as Alternative 2, except that MMC would use fixture baffles and directional light sources to minimize ambient light emanating from the mine facilities during operations. Some ambient light would remain, however, and behavior of any nearby flammulated owls could be disrupted. One block of potential habitat is located 1 mile north of Little Cherry Creek. Based on the distance to identified potential habitat and the owl's apparent ability to tolerate moderate levels of disturbance during the nesting season (Linkhart *et al.* 1998), this alternative would have only minor impacts to flammulated owls.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

There would be no direct effects to flammulated owl habitat due to implementation of Alternative 4, as there is no identified habitat within established limits of the adit, tailings impoundment, or road clearing widths associated with this alternative. Potential effects would be similar to those discussed for Alternative 2, with the addition of fixture baffles and directional light sources to minimize ambient light emanating from the mine facilities during operations and have, at most, minimal effects to flammulated owls in terms of potential disturbance.

Alternative A – No Transmission Line

Impacts on potential flammulated owl habitat caused by the transmission line alternatives are shown in Table 222. Alternative A would not impact flammulated owl habitat.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Alternative B would reduce the amount of flammulated owl habitat in the McElk, Riverview, and Silverfish PSUs by 14 acres of. These impacts would represent less than 1 percent of the flammulated owl habitat in each PSU (Table 222).

Alternative B would include tree clearing within disturbance boundaries. Removal of large ponderosa pine or Douglas-fir trees and snags that provide potential nesting, feeding, singing, or roost sites could impact flammulated owls (Wright 1996). Given the existing snag levels (see section 3.25.2.2, *Snags and Woody Debris*), the loss of snags providing potential flammulated owl nesting habitat would have minor impacts on this owl. The reduction by 14 acres of potential flammulated owl habitat would be a negligible decrease, with 6,690 acres of habitat remaining in the affected PSUs (Table 222). Once reclaimed and once successional processes were allowed to take place, areas of disturbed flammulated owl habitat could potentially be restored to suitable habitat for this species in the long term.

Alternative B would affect about 8 acres of coniferous forest providing potential flammulated owl habitat on State or private land. The area potentially impacted by alignment of the transmission line would affect portions of two blocks, 325 acres and 91 acres in size. The majority of this area has been previously harvested but would still provide suitable owl habitat with an additional linear opening within its perimeter. Due to the relatively large amount of contiguous habitat still available and the already open nature of these blocks, impacts of Alternative B would be minimal.

Due to lack of suitable habitat, construction of the Sedlak Park Substation and loop line would not affect flammulated owls.

Noise from helicopters during line stringing and from other construction-related activities could disturb nearby habitat temporarily. Owls are more active at night when helicopters would not be operating, and it is doubtful that short-term operations would cause territory abandonment. Disturbance impacts would be short-term and, with the exception of line maintenance activities, would cease after transmission line construction until decommissioning.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

Alternative C-R would reduce the amount of flammulated owl habitat in the McElk PSU by 8 acres. These impacts would represent less than 1 percent of the flammulated owl habitat in the PSU. The clearing associated with transmission line installation is almost identical to that described for all action alternatives, and effects would be similar (Table 222). The effect on State and private land would be the same in all alternatives. Due to lack of suitable habitat, construction of the Sedlak Park Substation and loop line would not affect flammulated owls.

Alternative D-R – Miller Creek Transmission Line Alternative

Alternative D-R would have the same effects as Alternative C-R.

Alternative E-R – West Fisher Creek Transmission Line Alternative

Alternative E-R impacts on flammulated owl would be the same as Alternatives C-R and D-R in the McElk PSU. There would be an additional 2 acres impacted in the Silverfish PSU. The habitat block affected in the Silverfish PSU is 39 acres. A small sliver of the block (one acre) would be isolated from the larger block, reducing the effective size of the block to 36 acres, roughly the average breeding home range of flammulated owls. This may slightly reduce the suitability of this habitat block, though a range of home range sizes has been observed (Linkhart *et al.* 1998). Due to lack of suitable habitat, construction of the Sedlak Park Substation and loop line would not affect flammulated owls.

Combined Mine-Transmission Line Effects

The effects of the combined mine-transmission line alternatives would be the same as the transmission line alternatives because the mine alternatives would have no effect on flammulated owl habitat.

Cumulative Effects

The Affected Environment section describes the suitable habitat within the analysis area, specifically the warm/dry ponderosa pine and Douglas-fir habitat types within the analysis area. This cumulative effects section summarizes the past actions as well as further describes ongoing and other reasonably foreseeable contributions potentially impacting flammulated owl habitat. As described under the section “Analysis Area and Methods”, the analysis area for cumulative effects to individuals and their habitat consists of the Crazy, Silverfish, McElk, and Riverview PSUs and includes private and State lands crossed by the various transmission line alternatives.

Past Actions

Past actions, including detailed descriptions of previous vegetation and road management activities, are described in section 3.2, *Past and Current Actions*, shown on Figure 50, and listed in Appendix E.

The measure of habitat suitability is alterations to the mapped suitable habitat described in the Affected Environment section of this analysis. Past actions, particularly timber harvest, road construction, and fire-suppression activities, have altered the old growth ecosystems in the analysis area, resulting in a reduction in early and late succession habitats; conditions favoring shade-tolerant, fire-intolerant species; loss of large snags and down wood; increases in tree density; and a shift to a largely mid-seral structural stage (USDA Forest Service 2003b). Timber harvest has occurred in the analysis area since the 1950s and, up until the early 1990s, included regeneration harvest, high grading of large old trees, and loss of snags that resulted in alterations and reduction of flammulated owl habitat. Fire suppression since the early 1900s has generally resulted in stand conversion from open ponderosa pine/Douglas-fir to more shade intolerant species, smaller tree growth and higher stem density, higher canopy cover, and a reduction in productive understory.

Firewood cutting would continue to occur where open roads provide access to old growth habitat, contributing to the removal of snags important to flammulated owls. Continuing development of private lands, including timber harvest, home construction, and land clearing would contribute to losses of flammulated owl habitat in the analysis area. Impacts on flammulated owl on private and State lands would probably be minimal because it is highly fragmented due to high road densities and past timber harvest activities.

No Action Alternative

Alternative 1A would not contribute to cumulative losses of snags and would not contribute to cumulative effects on flammulated owl

Action Alternatives

Ongoing federal actions have been considered and included when formulating the existing condition of this analysis area. Ongoing public firewood gathering has the potential to remove individual snags and other potential nest trees but is not likely to substantively change the character of suitable habitat. Other ongoing activities such as weed spraying, road maintenance, general recreation, and most small mining activities would have negligible impacts to flammulated owl habitat.

The Miller-West Fisher Vegetation Management Project would include intermediate harvest of 1,206 acres, regeneration harvest of about 692 acres, precommercial thinning of 351 acres, and prescribed burning of 2,830 acres of National Forest System lands in the Silverfish PSU. The Coyote Improvement Vegetation Management Project is in the planning stages and would take place within the Crazy PSU. The project would harvest 240 acres to increase stand resiliency to mountain pine beetles. Silverbutte Bugs timber sale is in the Silverfish PSU and would be a small project like Coyote. Timber harvest and other clearing activities planned for the projects will contribute to cumulative losses of snags important to flammulated owls. Activities associated with the projects are expected to retain cavity habitat within KFP-recommended levels for the Silverfish and Crazy PSUs. Also, while treatments associated with the projects will consume some snags and down wood, they also will create snags and down wood by killing live trees. Snags and down wood created in burned areas would provide both feeding and nesting habitat for the flammulated owl.

While the combined action alternatives, in combination with other past, current, and reasonably foreseeable actions, would result in some losses and degradation of flammulated owl habitat in the analysis area, cumulative impacts on overall areas of flammulated owl habitat would likely be minimal and would not likely affect populations in the analysis area. Sufficient habitat would remain within the affected PSUs to support existing populations, and habitat would continue to increase as the recent habitat analysis of forest-wide habitat (Ecosystem Research Group 2012), shows an increase in actual and potential flammulated owl habitat over the next 5 decades. In addition, mitigation associated with combined agencies' alternatives would increase the proportion of designated old growth and promote the maintenance or development of flammulated owl habitat in the analysis area.

Cumulative noise and other human-caused disturbances could occur as a result of the combined action alternatives and other reasonably foreseeable actions. Cumulative disturbance effects could affect individual flammulated owls, but would not likely affect flammulated owl populations in the KNF.

Regulatory/Forest Plan Consistency

Organic Administration Act and Forest Service Locatable Minerals Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources and to take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations. All mine alternatives would comply with 36 CFR 228.8. Transmission Line Alternative B would not fully comply with 36 CFR 228.8. In the proposed action, MMC did not propose to implement feasible measures to minimize effects on the flammulated owl or all practicable measures to maintain and protect wildlife habitat. The agencies' transmission line alternatives would comply with 36 CFR 228.8. The agencies' alternatives would incorporate additional feasible and practicable measures to minimize adverse environmental impacts on wildlife habitat that benefit the flammulated owl, including minimizing clearing in flammulated habitat and implementing a Vegetation Removal and Disposition Plan and Environmental Specifications in the agencies' transmission line alternatives.

National Forest Management Act/Kootenai Forest Plan

The KNF is directed to "identify, protect, and manage" habitat for sensitive species in order to assist in maintaining viable populations. The KFP contains the following goals and direction for sensitive species: "determine the status of sensitive species and provide for their environmental needs as necessary to prevent them from becoming threatened or endangered" (KFP Vol. 1, II-1 #6); All alternatives would meet this KFP direction for the flammulated owl.

All alternatives are consistent with KFP direction for snags, snag replacement trees, and down wood (KFP Vol. 1, II-1 #8 and II-7; Vol. 2, Appendix 16).

Forest Service Management Sensitive Species Statement of Findings

The no action alternatives would not impact individual flammulated owls or their habitat within the analysis area, and would not contribute to a trend toward federal listing or cause a loss of viability to the population or species. ***All combined action alternatives may impact individual flammulated owls or their habitat, but will not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species for flammulated owls.*** This determination is based on: 1) the mine alternatives would have no impact on flammulated owls in the Crazy, McElk, Riverview, or Silverfish PSUs; 2) all transmission line would result in the direct loss of small areas of flammulated owl habitat (8 to 14 acres), but sufficient habitat would remain in the analysis area (6,700 acres) to support a large number of nesting pairs; 3) no active flammulated owl nests were identified in the analysis area during surveys conducted in 2005 (Westech 2005b) implementation of timing restrictions included in the agencies' combined action alternatives would minimize potential impacts on nesting flammulated owls; 6) mitigation measures for the action alternatives and other actions, such as habitat acquisitions and road access changes, could offset some of the impacts on flammulated owl habitat; 7) all combined mine-transmission line alternatives would be consistent with KFP direction to maintain a minimum of 10 percent old growth below 5,500 feet in elevation that may provide flammulated owl habitat; and 8) sufficient habitat within affected PSUs and across the KNF would remain to support existing populations, and habitat would continue to increase as the recent habitat analysis of forest-wide habitat (Ecosystem Research Group 2012), shows an increase in actual and potential flammulated owl habitat over the next 5 decades.

3.25.4.7 Gray Wolf

3.25.4.7.1 Regulatory Framework

In 2011, the USFWS reissued the wolf delisting rule first published in 2009 that delisted biologically recovered gray wolf populations in the Northern Rocky Mountains, including all wolves in Montana (USFWS 2011b). The final rule authorized the State of Montana (FWP) to manage wolves under the state's approved Gray Wolf Conservation and Management Plan. Following delisting, the gray wolf was subsequently added to the Forest Service sensitive species list for a period of 5 years, after which a status review will be made to determine the need to remain on or be removed from that list. The FWP currently manages active harvest of wolves in northwest Montana including within the analysis area.

3.25.4.7.2 Analysis Area and Methods

The Northern Rocky Mountain Wolf Recovery Plan and the Montana Gray Wolf Conservation and Management Plan provide descriptions of wolf ecology, biology, and habitat (USFWS 1987; FWP 2002). The KNF is within the Northwest Montana Recovery Area, one of three wolf recovery areas identified for the Northern Rocky Mountain wolf population (USFWS *et al.* 2004). Information for this recovery area is provided in Bradley *et al*. (2013) and is incorporated herein by reference. The Montana Gray Wolf Conservation and Management Plan identifies the Northwest Montana Recovery Area as Wolf Management Unit 1 (WMU 1). Wolf occurrence data come from recent District wildlife observation records, forest historical data (NRIS Wildlife), other agencies (USFWS, FWP), and Wolf and Wildlife Studies, a private organization.

The analysis area for the gray wolf is described in section 3.25.1, *Introduction*. The analysis area for determination of population trend and contribution toward population viability is the KNF.

The Montana Gray Wolf Conservation and Management Plan Final EIS (FWP 2003) specifies strategies to protect and manage wolf populations in Montana and is based on an adaptive management strategy with more management flexibility granted as the number of breeding pairs in Montana increases above the 15 pair benchmark. Potential management activities cover a range of concerns that include maintaining viable populations of wolves and their prey, resolving wolf-livestock conflicts, and assuring human safety.

Measurement indicators for evaluating effects of the alternatives on the gray wolf are based on the following key habitat components described in the Wolf Recovery Plan (USFWS 1987): year-round prey base, suitable denning and rendezvous sites, and sufficient space with minimal exposure to humans. The rationale for basing the impacts evaluation on these components and the indicators of effects are described in the following paragraphs.

Sufficient Year-Round Prey Base

The condition of the prey base for the gray wolf is evaluated based on KFP management standards and objectives for white-tailed deer and elk. Effects of the alternatives on white-tailed deer and elk are described in section 3.25.3, *Management Indicator Species*. Because the mine alternatives would not affect big game habitat in the Silverfish PSU, the effects of the mine alternatives on prey were evaluated for the Crazy PSU only. As described in section 3.25.3, *Management Indicator Species*, the white-tailed deer was selected as the general forest indicator for the Crazy PSU. Security habitat and HE are among the parameters used to evaluate elk, but not white-tailed deer, habitat quality. For the mine alternatives, effects on habitat supporting big game were evaluated based on effects to cover and forage habitat and ORD. For the transmission line alternatives, effects on elk security habitat and HE were also considered.

Suitable Denning and Rendezvous Sites

Gray wolf den sites are generally greater than 1 mile from open roads and 1 to 2 miles from campsites (USFWS 1987). These sites are normally on southerly aspects, on moderate slopes, within 400 yards of surface water, and at an elevation overlooking surrounding low-lying areas. Sensitivity to disturbance at den sites and subsequent abandonment varies greatly among individual wolves (Thiel *et al.* 1998; Claar *et al.* 1999). Rendezvous sites (resting and gathering areas) are usually complexes of meadows and adjacent timber, with surface water nearby (USFWS 1987). They tend to be situated away from human activity and on drier sites that are slightly elevated above riparian areas (Ibid.). FWP encourages land management agencies to consider the locations of wolf den and rendezvous sites in their planning activities to maintain the habitat integrity of these sites (FWP 2002). Den and rendezvous sites can also be protected by enacting timing restrictions on proposed activities within the den/rendezvous site areas. These restrictions would limit operating periods to the fall or winter seasons when these sites are unoccupied.

Sufficient Space with Minimal Exposure to Humans

Providing sufficient space with minimal exposure to humans can reduce the risk of human-caused mortality to wolves. Human disturbance and accessibility of wolf habitats (*i.e.*, road densities) are the principal factors limiting wolf recovery in most areas (Leirfallom 1970; USFWS 1978, 1987 all in Frederick 1991; Thiel 1978). These components can be generally measured by maintaining ORD standards required by the KFP as well as maintaining any security habitat recommended in the big game habitat recommendations.

Because the mine alternatives would not affect big game habitat in the Silverfish PSU, the effects of the mine alternatives on space with minimal exposure to humans were evaluated for the Crazy PSU only. As described in section 3.25.3, *Management Indicator Species*, the white-tailed deer was selected as the general forest indicator for the Crazy PSU. Security habitat and HE are parameters used to evaluate elk, but not white-tailed deer, habitat quality. For the mine alternatives, the principle big game habitat parameter used to analyze impacts on space with minimal exposure to humans was ORD. For the transmission line alternative, effects on elk security habitat and HE were also considered.

Alternative Mitigation Measures

MMC's proposed Alternatives 2 and B include an access change in NFS road #4724 from April 1 to June 30 and a yearlong access change in a segment of NFS road #4784 to mitigate for impacts on grizzly bears. NFS road #4784 is proposed for an access change by the Rock Creek Project. The access change on NFS road #4784 would be implemented for all action alternatives only if it was not already implemented as part of the Rock Creek Project mitigation. The agencies' alternatives would include additional yearlong access changes through the installation of barriers or gates in several roads to mitigate for the loss of big game security and impacts (see Table 28 and Table 29 in Chapter 2 and Figure 35). Additional road access changes may also occur on land acquired as part of the grizzly bear mitigation proposed by MMC or the agencies (see mitigation plan descriptions in sections 2.4, *Alternative 2- MMC's Proposed Mine*, and section 2.5, *Alternative 3—Agency Mitigated Poorman Impoundment Alternative*). These road access changes would reduce potential exposure of wolves to humans.

Other mitigation measures incorporated into MMC's or the agencies' alternatives that could benefit the gray wolf include prohibiting employees from carrying firearms, busing employees to the work site, removing road-killed big game animals, and monitoring road-killed animals along mine access roads to determine if improved access resulted in increased wildlife mortality. The agencies' alternatives including funding of FWP personnel to implement adverse conditioning techniques before wolves concentrate their activity around any den sites or rendezvous sites located in or near the project facilities.

3.25.4.7.3 Affected Environment

Distribution

The Montana wolf population decreased about 4 percent from 2011 to 2012. At the end of 2012, there were at least 147 wolf packs in Montana, with at least 37 meeting breeding pair criteria. These packs contained a minimum estimate of 625 wolves. At least 400 wolves, consisting of 100 packs and 25 breeding pairs, inhabited the Montana portion of the NWMT Recovery area, which includes the KNF (Bradley *et al.* 2013).

Following the delisting of wolves in Montana in 2011, the FWP partitioned the state into 14 individual wolf management units. In 2012, 175 wolves were harvested across Montana, including 26 from resident packs within the KNF. FWP continued a statewide general hunting season in 2014. A majority of the packs in NWMT have little to no livestock present within home ranges. Depredation of livestock was documented for two KNF area packs and 10 wolves were lethally removed (Bradley *et al.* 2013).

The KNF is home to 26 resident packs (6 with breeding pairs) with the home ranges of several packs located along the border between the United States and Canada, the state line between Montana and Idaho, and adjacent National Forest System lands in Montana. These packs had a minimum total of 83 wolves at the end of 2012 (Bradley *et al*. 2013). An estimate of 89 wolves was recorded in 2011 (Hanauska-Brown *et al*. 2012). Considering pack movement, unknown pack numbers, and increased human related mortality (1 dispersed, 5 human-caused, 26 harvested by hunters, and 11 management removal) the numbers between years are similar and appear to have increased slightly (Bradley *et al*. 2013).

Two known breeding wolf packs (Cabinet and Satire packs) have been identified within the Crazy PSU and could potentially be affected by the Montanore Project (USFWS *et al.* 2013). Tracks and other signs of Cabinet pack wolves have been consistently observed in the Libby, Midas, Poorman, Ramsey, Bear, and Big Cherry creek drainages since 2004 (Laudon, pers. comm. 2010, 2014). Wolf sign has also been observed in the West Fisher Creek, Miller Creek, and Swamp Creek drainages, west of Howard Lake, and north of Horse Mountain. In 2012, the Satire pack was estimated to consist of a minimum of 2 individuals each. In 2012, 5 wolves were harvested from the Satire pack (Bradley *et al*. 2013). In 2013, the Cabinet Pack was estimated to consist of 5 adults and 5 pups; nine of these wolves were likely harvested in 2013. At least one adult, and likely several others, continue to use the Cabinet Pack territory, but it is unknown how many are Cabinet Pack members or their relatives. Sustained wolf mortality since the beginning of sport hunting in Montana in 2012 has changed wolf behavior and population dynamics, making it difficult to determine the status, composition, and habitat use of previously identified wolf packs (Laudon, pers. comm. 2014).

The Cabinet pack's territory includes areas proposed for mine facility construction and operations. The Satire pack's territory includes the eastern portion of the transmission line alternatives. Other than the Cabinet and Satire packs, active wolf packs closest to the analysis area include the McGinnis pack to the southeast, the McKay pack to the southwest, and the Lost Girl pack to the west (USFWS *et al.* 2013).

Prey Base

The Crazy and Silverfish PSUs support year-round habitat for most big game species, including elk, moose, and white-tailed deer that provide a prey base for wolves. The Crazy and Silverfish PSUs are currently outside the desired conditions for big game species with high cover and limited forage availability. Fire suppression and past timber management have resulted in limited foraging habitat for big game in the two PSUs. Most forage habitat occurs in lower elevations of drainages, or in isolated patches of past disturbance. Although cover to forage ratios in the analysis area (see section 3.25.3, *Management Indicator Species* and section 3.25.7, *Other Species of Interest*) indicate that the proportion of forage habitat is well below recommended levels, elk and deer populations on the KNF are increasing, probably because of increased road restrictions and decommissioning which has reduced ORD and improved elk security on the KNF (USDA Forest Service 2008c).

Den and Rendezvous Sites

Wolf den and rendezvous sites are monitored annually. Based on wolf activity documented during summer 2010, a possible pup rearing/rendezvous site was identified in the area between Little Cherry Creek and Poorman Creek. One probable rendezvous site was also identified in the same general area and others are likely to occur in the vicinity of the Montanore Project. No activity has been documented at these two rendezvous sites since 2011. Several other rendezvous sites potentially occur in the Crazy and Silverfish PSUs, but the status of these sites is unknown (Laudon, pers. comm. 2014).

No other known established den sites or rendezvous sites are within either the Silverfish or Crazy PSU. At least one known den site and three documented rendezvous sites are located near McGinnis Meadows, about 6 miles south of US 2 as it turns eastward toward Kalispell.

Sufficient Space with Minimal Exposure to Humans

Areas that experience little to no human use reduce the potential risk for disturbance and mortality often associated with roads that facilitate human access into wolf habitat. For big game management, security habitat provides areas of reduced human use that provide secure areas for wolves. HE and ORD are also measurements of reduced human use.

The western half of the Crazy and Silverfish PSUs is dominated by the CMW and Inventoried Roadless Area (IRAs), which provide habitat for wolves and their prey base where exposure to humans is minimal. As described in section 3.25.3, *Management Indicator Species*, existing elk security habitat (57 percent) and HE (72 percent) in the Silverfish PSU are greater than minimum levels recommended by Hillis *et al*. (1991) and Christensen *et al*. (1993). In the Crazy PSU, KFP standards for ORD are not met, while in the Silverfish PSU, all ORD standards are met except for ORD in MA 12. Based on observations of wolves or their sign, adequate space for wolves appears to be provided in the Crazy PSU, where the Cabinet pack has been observed along drainages where roads are more concentrated than in the upper elevations. Areas to the west and south of the analysis area with lower overall road densities and exposure to humans are known to be currently occupied by wolf packs.

Private and State Land

Private and State land in the analysis area provides habitat for wolf prey species such as elk, moose, and deer, but this land has more roads that could provide human access to potential wolf habitat than National Forest System lands. Most private lands in the analysis area occur east of US 2 and are not frequently used by the Cabinet pack. Private and State land in the eastern segments of the alternative transmission line alignments would occur within the Satire pack's home range (USFWS *et al.* 2013).

3.25.4.7.4 Environmental Consequences

Alternative 1 – No Mine

Alternative 1 would not affect the gray wolf and would not change existing conditions for prey base, denning and rendezvous sites, or space with minimal exposure to humans.

Alternative 2 – MMC's Proposed Mine

Prey Base

In Alternative 2, current populations of white-tailed deer, the MIS for general forest species in the Crazy PSU, as well as elk and moose, would likely be maintained and continue to provide a good year-round prey base for wolves. Changes to cover to forage ratios would be 4 percent or less, and while cover would decrease relative to forage, an abundance of cover is available in the analysis area. Alternative 2 would increase ORD in MAs 15, 16, 17, and 18 in the Crazy PSU. Overall, however, road densities would likely improve through MMC's proposed land acquisition for grizzly bear mitigation. Acquired parcels would be managed for grizzly bear use in perpetuity, and could decrease road densities where roads could be gated or barriered, thereby benefitting big game. Alternative 2 effects on habitat conditions for big game species are described in detail in section 3.25.3, *Management Indicator Species* and section 3.25.7, *Other Species of Interest*.

Den and Rendezvous Sites

It is unknown if the pup rearing/rendezvous sites documented during the summer of 2010 are still active (Laudon, pers. comm. 2014). If any den was within the impoundment disturbance footprint, and if construction began after the den was being used, the den could be destroyed. Alternative 2 would likely deter wolves from denning or congregating nearby. Based on general habitat availability; location of roads, campsites, private residences, and other areas of human activity (Figure 87 and Figure 79); and the presence of features typical of den or rendezvous sites, such as streams and other areas of open water (Figure 52) it appears that other potentially suitable, secluded denning or rendezvous sites are available in the analysis area.

Sufficient Space with Minimal Exposure to Humans

As described in section 3.25.3, *Management Indicator Species*, Alternative 2 would increase ORD in MAs 15, 16, 17, and 18 in the Crazy PSU, resulting in increased potential for human disturbance and an increased risk of human-caused wolf mortality. Overall, however, road densities would likely improve through MMC's proposed land acquisition for grizzly bear mitigation. Acquired parcels would be managed for grizzly bear use in perpetuity, and could decrease road densities where roads could be gated or barriered, thereby benefitting big game and wolves. Where parcels acquired for grizzly bear mitigation occurred in Cabinet or Satire pack territories, any road access changes would directly benefit wolves in those packs.

Widening, improvement, and yearlong access of the Bear Creek Road would lead to increased vehicle volumes and speed. Estimates of increased annual traffic volume range from 187 percent to 234 percent (Table 172 in section 3.21, *Transportation*). The increase in traffic in Alternative 2 would substantially increase the risk of increased wolf, as well as big game, mortality on the access road. MMC would limit concentrate haulage to daylight hours during the day shift (0800 to 1630), which would minimize vehicle-wildlife collisions during the early morning, evening and night time-periods. MMC would provide transportation to employees using buses, vans, and pickup trucks, thereby limiting the use of personal vehicles. MMC would report road-killed animals to the FWP as soon as road-killed animals were observed. The FWP would either remove road-killed animals that could attract wolves to the road or direct MMC how to dispose of them. When the mill ceased operations in the Closure Phase, mine volumes levels would be substantially less than shown in Table 172 in section 3.21, *Transportation*. Future traffic volume when all activities at the mine are completed in the Post-Closure Phase would be higher than in Alternative 1 because of reconstruction of Bear Creek Road and loss of the Little Cherry Loop Road beneath the impoundment. Mortality risk to the wolf would decrease on the Bear Creek Road compared to operations, but the permanently improved road conditions (increased road width, improved sight distance, paving) and higher traffic speeds would result in a permanently higher wolf mortality risk compared to pre-mine conditions.

MMC would store mine, adit, or tailings water at the Ramsey Plant Site, a surge pond at the LAD Areas, and the tailings impoundment. The metals in the tailings water would be similar to what is found at the Troy Mine decant ponds (see Table 120 in the *Water Quality* section), where adverse effects on wildlife have not been observed (USDA Forest Service and DEQ 2012). Concentrations of metals in mine and adit water, which would be stored in mine/yard pond at the Ramsey Plant Site and in a surge pond at the LAD Areas, would be lower than tailings water (see Table 120 in the *Water Quality* section). The Ramsey Plant Site would be fenced, restricting wolf access.

The Cabinet pack may occupy this general area and could be affected by Alternative 2. Increased human access and disturbance from mine activities could displace prey species but adequate prey availability is expected to remain in surrounding less-disturbed areas to support any resident or transient wolves. Disturbance created by the project, starting with the Construction Phase and continuing through the Closure Phase, is expected to deter any establishment of new pack territories in or near the analysis area due to the constant and long-term nature of the disturbance.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Prey Base

The potential impacts of Alternative 3 on current populations of white-tailed deer and other big game would be the same as Alternative 2, except that Alternative 3 would decrease road densities in MAs 15, 16, 17, and 18 in the Crazy PSU and maintain existing road densities in MA 12 due to road access changes (installation of gates or barriers and public access restrictions) included in the agencies' Wildlife Mitigation Plan (see section 2.5.7, *Mitigation Plans*).

Den and Rendezvous Sites

The potential impacts of Alternative 3 on wolf den or rendezvous sites would be similar to Alternative 2, except that in Alternative 3, MMC would fund FWP to implement adverse conditioning techniques to deter wolves from denning in or near the mine facilities, if appropriate. If FWP determined that den or rendezvous site destruction or disturbance was likely, adverse conditioning to discourage use of the den would be used prior to the Construction Phase in early to mid-March before wolves concentrate their activity around the den site. Implementation of adverse conditioning techniques to deter wolves from denning in or near the analysis area would give wolves time to excavate an alternate den site at a safer, more secluded location. Construction prior to den use would likely deter wolves from denning nearby and from using the existing rendezvous site. Based on general habitat availability; location of roads, campsites, private residences, and other areas of human activity (Figure 87 and Figure 79); and the presence of features typical of den or rendezvous sites, such as streams and other areas of open water (Figure 52) it appears that other potentially suitable, secluded denning or rendezvous sites are available in the analysis area.

Sufficient Space with Minimal Exposure to Humans

As described in section 3.25.3, *Management Indicator Species* and section 3.25.7, *Other Species of Interest*, Alternative 3 would decrease road densities in MAs 15, 16, 17, and 18 in the Crazy PSU and maintain existing road densities in MA 12 due to road access changes (installation of gates or barriers and public access restrictions) included in the agencies' Wildlife Mitigation Plan (see section 2.5.7, *Mitigation Plans*). Alternative 3 would include snowplowing Libby Creek Road (NFS road #231) and the Upper Libby Creek Road (NFS road #2316) during the evaluation program and while the Bear Creek Road was reconstructed, allowing poachers, legal hunters, and trappers easy winter access to potential wolf habitat.

The effect of increased traffic on the Bear Creek Road would be the same as Alternative 2, except that in Alternative 3, MMC would remove big game animals killed by any vehicles that could attract wolves to the road daily from road rights-of-way within the permit area and along roadways used for access or hauling ore for the life of the mine and monitor the number of big game animals killed by vehicle collisions on these roads and report findings annually. Highway safety signs such as "Caution – Truck Traffic" would help slow public traffic speeds in anticipation of meeting oncoming trucks. Staging shipments of supplies in a general location prior to delivery to the mine site would reduce traffic and wolf mortality risk.

Water management in Alternatives 3 and 4 would reduce the risk to wildlife from contaminant uptake from storage of mine, adit, and tailings water. All mine and adit water would be treated and discharged at the Libby Adit Water Treatment Plant and not stored in ponds. The LAD Areas would not be used and the surge ponds would not pose a risk to wolves. Tailings water quality would have lower metal concentrations than in Alternative 2; the factors leading to lower metal concentrations in tailings water quality in Alternatives 3 and 4 are discussed in section 3.13, *Water Quality*, p. 674.

Impacts on wolf habitat would be reduced through the agencies' land acquisition requirement, and would likely be more effective than MMC's proposed land acquisition because more land would be protected. Road densities would likely improve through the agencies' proposed land acquisition for grizzly bear mitigation. Acquired parcels would be managed for grizzly bear use in perpetuity, and could decrease road densities where roads could be gated or barriered, thereby benefitting big game and wolves. Where parcels acquired for grizzly bear mitigation occurred in Cabinet or Satire pack territories, any road access changes would directly benefit wolves in those packs.

Impacts to the Cabinet and Satire packs from human disturbance associated with Alternative 3 would be similar to Alternative 2.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Impacts of Alternative 4 on the wolf would be the same as Alternative 3.

Alternative A – No Transmission Line

Alternative A would not affect the gray wolf and would not change existing conditions for prey base, denning and rendezvous sites, or space with minimal exposure to humans.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Construction of the Sedlak Park Substation and loop line would not affect gray wolves in any transmission line alternative because they would be close to US 2 and are not in proximity to any identified territories, dens, or rendezvous sites.

Prey Base

In Alternative B, current populations of white-tailed deer, elk, and moose, would likely be maintained, and would continue to provide a good year-round prey base for wolves. Changes to cover to forage ratios would be 1 percent or less, and while cover would decrease relative to forage, an abundance of cover is available in the analysis area. During transmission line construction some restricted, impassable/barriered, and temporary roads would be opened and some new access roads would be needed, but road densities would generally return to existing levels during operations. ORD would likely improve through land acquisition associated with grizzly bear mitigation. Alternative B would decrease both percent elk security habitat and HE in the Silverfish PSU during construction, but during transmission line operations, security habitat and HE would return to existing levels. Alternative B effects on habitat conditions for these species are described in detail in section 3.25.3*, Management Indicator Species* and section 3.25.7, *Other Species of Interest*.

Den and Rendezvous Sites

No known gray wolf den or rendezvous sites would be affected by Alternative B.

Sufficient Space with Minimal Exposure to Humans

During transmission line construction, Alternative B would increase ORD in the analysis area, but road densities would generally return to existing levels during operations. ORD would likely improve through land acquisition associated with grizzly bear mitigation. Alternative B would decrease both percent elk security habitat and HE in the Silverfish PSU during construction, but during transmission line operations, security habitat and HE would return to existing levels.

Although new roads on National Forest System land would be revegetated after transmission line construction, the roads would allow increased pedestrian access to potential wolf habitat, resulting in increased potential for human disturbance and an increased risk of human-caused wolf mortality from poaching, legal hunting, and trapping. Alternative B could result in an increased risk of human-caused mortality during transmission line construction due to increased traffic, although traffic increases are anticipated to be minimal and short-term. In Alternative B, helicopter line stringing, which would last about 10 days, could temporarily displace wolves from the transmission line corridor and surrounding habitat. Similar effects could occur from other transmission line construction activities associated in areas where helicopters were not used, and would be more extensive for Alternative B than the agencies' alternatives. Alternative B construction activities could result in the short-term, temporary avoidance by transient, Cabinet or Satire pack wolves of the transmission line corridor and adjacent habitat. Effects on Cabinet pack wolves would be greatest where their activities have been documented in the Libby Creek and Ramsey Creek drainages. Except for annual inspection and infrequent maintenance operations, helicopter use and other transmission line construction activities would cease after transmission line construction until decommissioning. Helicopter use and other activities could cause similar displacement during line decommissioning.

Road densities would likely improve through MMC's proposed land acquisition for grizzly bear mitigation. Acquired parcels would be managed for grizzly bear use in perpetuity, and could decrease road densities where roads could be gated or barriered, thereby benefitting big game and wolves. Where parcels acquired for grizzly bear mitigation occurred in Cabinet or Satire pack territories, any road access changes would directly benefit wolves in those packs. Overall, Alternative B would have a minimal effect on the gray wolf.

Impacts on Private and State Land

Trees would be cleared from some big game winter range on private and State land, but effects on big game habitat would be small relative to habitat available (see section 3.25.3*, Management Indicator Species* and section 3.25.7, *Other Species of Interest*). Where big game winter range occurs (Figure 89 and Figure 96), short-term disturbance of wolves would be minimized by restricting construction in elk winter range during winter. Alternative B would result in increases in road densities on state and private lands. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction, but could result in a reduction of elk security habitat and increased wolf or big game mortality if hunting access were allowed.

In Alternative B, helicopter line stringing, which would last about 10 days, could temporarily displace wolves from the transmission line corridor and surrounding habitat. Similar effects could occur from other transmission line construction activities in areas where helicopters were not used, and would be more extensive for Alternative B than the agencies' alternatives. Alternative B construction activities could result in the short-term, temporary avoidance by transient, Cabinet or

Satire pack wolves of the transmission line corridor and adjacent habitat. Except for annual inspection and infrequent maintenance operations, helicopter use and other transmission line construction activities would cease after transmission line construction until decommissioning. Helicopter use and other activities could cause similar displacement during line decommissioning. Because State and private lands generally have high road densities and have been logged in the past 20 to 30 years, and because of the short-term nature of human-caused disturbance, overall, wolf populations on private and State land would not likely be affected by Alternative B.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

Prey Base

The effects of Alternative C-R on current populations of elk and white-tailed deer would be the same as Alternative B, except that Alternative C-R would decrease road densities after construction in some areas due to road access changes (installation of gates or barriers and public access restrictions) included in the agencies' Wildlife Mitigation Plan (see section 2.5.7, *Mitigation Plans*).

Den and Rendezvous Sites

No known den or rendezvous sites would be affected by Alternative C-R.

Sufficient Space with Minimal Exposure to Humans

Alternative C-R effects on ORD, HE, and elk security habitat would be the same as Alternative B, except that Alternative C-R would have a smaller effects on ORD during construction and would decrease ORD after construction in some areas due to road access changes (installation of gates or barriers and public access restrictions) included in the agencies' Wildlife Mitigation Plan (see section 2.5.7, *Mitigation Plans*).

Effects of Alternative C-R on pedestrian access and traffic would be the same as Alternative B. In Alternative C-R, helicopters would be used for stringing the entire transmission line and in some segments for vegetation clearing and structure placement, extending the duration of disturbance by about 2 months. Vegetation clearing and structure placement where helicopters were not used could contribute to short-term displacement of wolves. Like Alternative B, Alternative C-R construction activities could result in the short-term, temporary avoidance of the transmission line corridor and adjacent habitat by transient, Cabinet pack, or Satire pack wolves. Alternative C-R would affect less of the Cabinet pack's known area of activity than Alternative B. In Alternative C-R, the Cabinet pack could be affected by temporary disturbance, especially where their activities have been documented in the Libby Creek drainage. In Alternative C-R, except for annual inspection and infrequent maintenance operations, helicopter and other transmission line construction activities would cease after transmission line construction until decommissioning, similar to Alternative B. Helicopter use and other activities could cause similar displacement during line decommissioning.

As described for Alternative B, road densities would likely improve through the agencies' land acquisition requirement for grizzly bear mitigation, which would likely be more effective than MMC's proposed land acquisition because more land would be protected. Where parcels acquired for grizzly bear mitigation occurred in Cabinet or Satire pack territories, any road access changes would directly benefit wolves in those packs. Overall, Alternative C-R would have a minimal effect on the gray wolf.

Impacts on Private and State Land

Impacts to wolves on private land would be the same as Alternative B, except that short-term impacts on private land from road and helicopter use would be less extensive for Alternative C-R than for Alternative B. Within the Silverfish PSU, short-term impacts on State trust lands from road and helicopter use would be similar to impacts on National Forest System lands. This is because mitigations applied to State trust land would be consistent with mitigations applied to affected National Forest System lands.

Alternative D-R – Miller Creek Transmission Line Alternative

The impacts of Alternative D-R on gray wolves would be the same as Alternative C-R.

Alternative E-R – West Fisher Creek Transmission Line Alternative

The impacts of Alternative E-R on gray wolves would be the same as Alternative D-R.

Combined Mine-Transmission Line Effects

None of the activities associated with the mine alternatives would occur in the Silverfish PSU; all impacts on wolves in the Silverfish PSU would be due to the transmission line.

Prey Base

In all combined mine-transmission line alternatives, current populations of white-tailed deer and elk, the MIS for general forest species in the Crazy and Silverfish PSUs, and moose would likely be maintained, and would continue to provide a good year-round prey base for wolves. While cover would decrease relative to forage, an abundance of cover is available in the analysis area. Due to road access changes (installation of gates or barriers and public access restrictions), ORD would decrease in MA 12 in the Crazy PSU in all combined mine-transmission line alternatives. In Alternative 2B, ORD would increase in MA 15, 16, 17, and 18 in the Crazy PSU. In all combined mine-transmission line alternatives, ORD would generally increase in the Silverfish PSU during transmission line construction, but would return to existing levels during transmission line operations. In general, the agencies' combined mine-transmission line alternatives would have fewer effects on ORD, and would improve ORD after construction in some areas, because more road access changes would be included in the agencies' Wildlife Mitigation Plan (see section 2.5.7, *Mitigation Plans*). In all combined mine-transmission line alternatives, HE and percent elk security habitat in the Silverfish PSU would decrease during transmission line construction but return to existing levels when construction was complete. Combined mine-transmission line alternative effects on habitat conditions for big game species are described in detail in section 3.25.3, *Management Indicator Species* and section 3.25.7, *Other Species of Interest*.

Den and Rendezvous Sites

It is unknown if the pup rearing/rendezvous sites documented during the summer of 2010 are still active (Laudon, pers. comm. 2014). If any den or site was within the Alternative 2B impoundment disturbance footprint, and if construction began after the den was being used, the den site could be destroyed. In the agencies' alternatives, MMC would fund FWP to implement adverse conditioning techniques to deter wolves from denning in or near the mine facilities, if appropriate. If FWP determined that den or rendezvous site destruction or disturbance was likely, adverse conditioning to discourage use of the den would be used prior to the Construction Phase in early to mid-March before wolves concentrate their activity around the den site.

Implementation of adverse conditioning techniques to deter wolves from denning in or near the analysis area would give wolves time to excavate an alternate den site at a safer, more secluded location. For any action alternatives, construction of the impoundment prior to den use would likely deter wolves from denning or congregating nearby. Based on general habitat availability; location of roads, campsites, private residences, and other areas of human activity (Figure 87 and Figure 79); and the presence of features typical of den or rendezvous sites, such as streams and other areas of open water (Figure 52) it appears that other potentially suitable, secluded denning or rendezvous sites are available in the analysis area.

Sufficient Space with Minimal Exposure to Humans

Alternative 2B would increase road densities in the Crazy PSU, and during transmission line construction all combined mine-transmission line alternatives would increase ORD and reduce HE and elk security habitat in the Silverfish PSU. Increases in ORD would in increase potential for human disturbance and increase the risk of human-caused wolf mortality. In general, the agencies' combined mine-transmission line alternatives would have fewer effects on ORD, HE, and elk security habitat and in some areas would improve conditions after construction, because more road access changes would be included in the agencies' Wildlife Mitigation Plan (see section 2.5.7, *Mitigation Plans*).

The effect of snowplowing Libby Creek Road (NFS road #231) and the Upper Libby Creek Road (NFS road #2316) during the evaluation program and while the Bear Creek Road was reconstructed, increased vehicle volumes and speed, helicopter use and other transmission line construction activities, storage of mine, adit, or tailings water, and MMC's and the agencies' proposed mitigation would be as described in the mine and transmission line alternatives.

Impacts on Private and State Land

Trees would be cleared from some big game winter range on private and State land, but effects on big game habitat would be small relative to habitat available (see section 3.25.3*, Management Indicator Species* and section 3.25.7, *Other Species of Interest*). Where big game winter range occurs (Figure 89 and Figure 964), short-term disturbance of wolves, in particular those from the Satire pack, would be minimized by restricting construction in elk winter range during winter. Alternative B would result in increases in road densities on state and private lands. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction, but could result in a reduction of elk security habitat and increased wolf or big game mortality if hunting access were allowed.

In all combined mine-transmission line alternatives, helicopter line stringing, which would last about 10 days, could temporarily displace wolves from the transmission line corridor and surrounding habitat. Similar effects could occur from other transmission line construction activities in areas where helicopters were not used, and would be more extensive for Alternative 2B than the agencies' alternatives. Construction activities associated with all combined mine-transmission line alternatives could result in the short-term, temporary avoidance by transient or Satire pack wolves of the transmission line corridor and adjacent habitat. Except for annual inspection and infrequent maintenance operations, helicopter use and other transmission line construction activities would cease after transmission line construction until decommissioning. Helicopter use and other activities could cause similar displacement during line decommissioning. Because State and private lands generally have high road densities and have been logged in the past 20 to 30 years, and because of the short-term nature of human-caused disturbance, overall, wolf populations on private and State land would not likely be affected by the combined mine-transmission line alternatives.

Cumulative Effects

Past Actions and the Existing Condition

Past actions are described in section 3.2, *Past and Current Actions,* shown on Figure 50, and listed in Appendix E. Section 3.25.4.6.3, *Affected Environment* above summarizes the existing condition, which reflects the prey base, den and rendezvous sites, and sufficient space with minimal exposure to humans within the project area.

Harvest has occurred in the project area since the 1950s, resulting in a diversity of age classes and successional stages and providing forage and cover for big game. Historically, natural disturbances such as wildfire resulted in a mosaic of habitats and forage conditions. Fire suppression since the early 1900s has altered stand structure resulting in more homogenous stands with greater canopy closure in some areas, which has in turn reduced forage production for prey species on some sites. Roads constructed in association with timber harvest, mining, and other development have cumulatively reduced big game habitat effectiveness, improved human access, and decreased wolf security in the analysis area. Activities affecting wolf habitat have changed in recent years, with a trend toward reduced motorized access as a result of decisions intended to facilitate grizzly bear recovery. Reduced motorized access has resulted in increased wolf security in the analysis area. Since the mid-1990s, there has also been a greater use of intermediate harvest methods, which results in both big game hiding cover and foraging opportunities occurring in close proximity. Prescribed burning has worked successfully to cycle forest cover through the many periods of succession. Protection of water bodies and associated habitats as a result of compliance with INFS standards and the Clean Water Act maintain characteristics often used for denning and rendezvous sites. Also, since the mid-1990s, there has been more reliance on intermediate harvest, which provides both greater foraging opportunities and hiding cover within the same area improving conditions for big game species.

Development of private lands within the analysis area, including commercial timber harvest, land clearing, home construction, and road construction has contributed to increased disturbance of wolves and their prey and is expected to continue. Areas previously impacted by special use permits such as mineral material sites (pits quarries, borrow, roadsides), water developments, utility corridors, private land access routes, and outfitter/guide trails/camps, would continue to be present and used. Other public uses such as wildlife viewing, berry picking, firewood gathering, camping, snowmobiling, etc. have negligible impacts on wolves given their limited scope (time and space). Infra-structure, such as roads and campgrounds, that facilitate these activities have already been accounted for in the description of the affected environment.

Effects of Current and Reasonably Foreseeable Actions

Reasonably foreseeable actions are described in section 3.3, *Reasonably Foreseeable Future Action*. Current actions are described in section 3.2, *Past and Current Actions* and shown on Figure 50.

The Miller-West Fisher Vegetation Management Project will occur entirely in the Silverfish PSU and will include intermediate harvest of 1,206 acres, regeneration harvest of about 692 acres, precommercial thinning of 351 acres, and prescribed burning of 2,830 acres of National Forest System lands in the Silverfish PSU. Surface impacts from other reasonably foreseeable actions would be minimal, and would not result in any measurable changes in habitat for wolves or their prey.

New roads and roads closed for mitigation associated with reasonably foreseeable actions such as the Wayup Mine/Fourth of July Road Access Project, Plum Creek activities, and the Miller-West Fisher Vegetation Management Project, would contribute to cumulative effects on ORD, HE, and elk security habitat. New roads and access changes for these reasonably foreseeable actions would increase ORD and reduce HE and elk security habitat in the Silverfish PSU, but reduce ORD in the Crazy PSU.

Road management actions such as road maintenance and administrative use associated with permit administration, data collection and monitoring of National Forest System lands are not likely to affect big game habitat because they generally do not result in vegetation removal. Wolves and their prey will typically avoid the disturbance area until human activities terminate, which usually last a few hours. These activities include work on existing roads for the Miller-West Fisher Project. This action would not result in a loss of cover because the roads already exists. Although water restoration projects may temporarily displace wolves or big game from a localized area, they typically benefit wildlife in the long-term by increasing security, providing pulses of foraging when seeded, or by stabilizing soils where certain habitat components can remain available.

With population growth and development, it is reasonable to assume that some corresponding increase in human use of National Forest System lands is likely to occur. Recreational activities such as sightseeing, hiking, cross-country skiing, camping, snowmobiling, fishing, and firewood cutting are ongoing and expected to increase over the next 10 years. This increase is likely to be gradual and incremental and tend to be focused on areas along or near roads open to motorized traffic. Wolves may, over time, experience more frequent disruption of their daily activities if they are in proximity to roads.

Activities on private land in the analysis area, such as timber harvest, land clearing, home construction, and road construction are likely to continue on private lands and would likely slightly impact big game cover and security. Potential effects depend on the magnitude, type and location of developments and include the loss of secure habitat and localized disturbance of wolves and big game. Private lands occupy 10 percent of the Crazy PSU and 12 percent of the Silverfish PSU and are intermixed with public and corporate/State land. Most recommended guidelines are met on National Forest System lands within the Silverfish PSU, and development of private lands is expected to have minor cumulative impacts on big game species in the analysis area over the next 10 years.

No Action Alternative

The Montanore Project No Action alternatives (Alternative 1 and Alternative A) would not contribute to cumulative impacts on wolves.

Combined Mine-Transmission Line Action Alternatives

Cumulative effects of the combined mine-transmission line alternatives, in combination with past, present, and reasonably foreseeable actions, on road densities, cover and forage, and habitat security in the Crazy and Silverfish PSUs are discussed in the deer and elk subsections, respectively, of section 3.25.3, *Management Indicator Species*. In summary, with the exception of

Alternative 2B, for all combined mine-transmission line alternatives, cumulative ORD in the Crazy PSU would be less than existing ORD. In Alternative 2B, during construction cumulative ORD in MAs 15, 16, 17, and 18 in the Crazy PSU would increase by 0.3 mi/mi^2. In the Silverfish PSU, ORD would increase and percent elk security habitat would decrease for all combined mine-transmission line alternatives, but increases would be primarily due to other reasonably foreseeable actions, especially after the transmission line was built. ORD in MAs 15, 16, 17, and 18 would return to existing levels during Alternative 3D-R and 4D-R operations. Increased ORD and reduced HE and elk security habitat in the Silverfish PSU would reduce habitat quality for big game that provide prey for wolves. Cumulative increases in road densities from the combined action alternatives, in combination with other reasonably foreseeable actions, could impact wolves using the analysis area by increasing human access and increasing mortality risk.

The combined mine-transmission line alternatives in combination with other reasonably foreseeable actions could deter wolves from denning or using rendezvous sites in the analysis area. Based on general habitat availability; location of roads, campsites, private residences, and other areas of human activity (Figure 87 and Figure 79); and the presence of features typical of den or rendezvous sites, such as streams and other areas of open water (Figure 52) it appears that other potentially suitable, secluded denning or rendezvous sites are available in the analysis area.

Helicopter use and other construction activities associated with the combined action alternatives could also contribute to cumulative impacts on wolves, although their effects would be temporary. All combined mine-transmission line alternatives would include the funding of one law enforcement position and one grizzly bear specialist. The agencies' combined mine-transmission line alternatives would include funding of a habitat conservation biologist. Although the objective of these positions would be focused on reducing mortality risk for grizzly bears, they would likely indirectly benefit wolves by increasing public awareness of issues related to threatened and endangered species and sensitive species in general, and improving enforcement of road access changes.

Cumulative effects of the combined mine-transmission line alternatives in combination with other reasonably foreseeable actions are not likely to change big game populations that provide prey for wolves. While cumulative losses of both cover and forage habitat would occur, areas disturbed as a result of the combined action alternatives and other reasonably foreseeable actions could provide additional forage habitat after reclamation, thereby improving habitat conditions for big game. Impacts on wolves would be somewhat reduced through road access changes and land acquisition requirement associated with grizzly bear and big game mitigation for the combined action alternatives and reasonably foreseeable actions, especially the Rock Creek Project. Acquired parcels would be managed for grizzly bear use in perpetuity, and could contribute additional wolf habitat where roads could be closed. Acquired parcels would be managed for grizzly bear use in perpetuity, and could decrease road densities where roads could be gated or barriered. Road access changes would create security habitat for prey species and reduce motorized access of wolf habitat. Where parcels acquired for grizzly bear mitigation occurred in Cabinet or Satire pack territories, any road access changes would directly benefit wolves in those packs. Current populations of white-tailed deer and elk, the MIS for general forest species in the Crazy and Silverfish PSUs, would likely be maintained and would continue to provide a good year-round prey base for wolves.

Regulatory/Forest Plan Consistency

Organic Administration Act and Forest Service Mineral Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources and to take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations. Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8. In the proposed action, MMC did not propose to implement feasible measures to minimize effects on the wolf or all practicable measures to maintain and protect wildlife habitat. The agencies' alternatives (Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R) would comply with 36 CFR 228.8. These alternatives would incorporate additional feasible and practicable measures to minimize adverse environmental impacts on wildlife habitat that benefit the gray wolf. These measures would include requiring MMC to fund FWP implementation of adverse conditioning techniques to deter wolves from denning in or near the mine facilities, if appropriate, minimizing disturbance in big game winter range, implementing yearlong access changes through the installation of barriers or gates in several roads to reduce ORD and mitigate for impacts to big game, and increasing land acquisition requirements that would likely provide protection of big game habitat.

National Forest Management Act/Kootenai Forest Plan

p.II-1 #6 – *Determine the status of sensitive species and provide for their environmental needs as necessary to prevent them from becoming threatened or endangered*: habitat for gray wolves and their prey occurs within the analysis area. In Mine Alternative 2 and Transmission Line Alternative B, MMC did not propose to implement practicable measures to minimize effects on the wolf. The agencies' alternatives would include measures to minimize effects on wolves and big game prey species. All alternatives may affect individual wolves and their habitat within the analysis area, but would not contribute to a trend toward federal listing or cause a loss of viability to the population or species.

p.II-1 #7 – *Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species:* The diversity requirement of NFMA is met by all alternatives as documented in the wolf analyses and supported by the statement of findings. All action alternatives may impact individual wolves or their habitat, but would not likely contribute to a trend toward federal listing or cause a loss of viability.

p.II-22, 23 – Maintenance of viable populations of existing native and desirable non-native vertebrate species, as monitored through indicator species, attained through the maintenance of a diversity of plant communities and habitats: See #7 above for habitat diversity. White-tailed deer and elk are monitored as an indicator species for general forest habitat. Their occurrence and estimation of population is monitored through District observations, FWP surveys, and KNF Monitoring and Evaluation Reports.

Forest Service Sensitive Species Statement of Findings

The no action alternatives would not impact individual gray wolves or their habitat within the analysis area, and would not contribute to a trend toward federal listing or cause a loss of viability to the population or species. ***All combined mine-transmission line action alternatives may impact individual wolves or their habitat, but will not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species for gray wolves.*** This determination is based on: 1) the mine alternatives would have no impact on wolves or their prey in the Silverfish PSU; 2) all action alternatives would minimize disturbance in big game winter range, 3) Two potential rendezvous sites may be affected by the combined mine-transmission line alternatives. For the agencies' alternatives, if a wolf den or rendezvous site was located in or near the analysis area by FWP wolf monitoring personnel, MMC would provide funding for FWP personnel to implement adverse conditioning techniques to deter wolves from denning in or near the analysis area to give wolves time to excavate an alternate den site at a safer, more secluded location; 4) Sufficient populations of elk, deer, and other prey species would continue to be maintained, and would continue to provide a good year-round prey base for wolves. For the agencies' alternatives, access changes associated with big game and grizzly bear mitigation would create security habitat for prey species; 6) In Alternative 2B, overall road densities would increase in the analysis area and near the mine facilities. These increases would last until after mine closure and reclamation. Combined agencies' alternatives would result in short-term increases in overall road densities and disturbance from helicopter use and other activities in the analysis area during transmission line construction;7) Impacts on the wolf would be reduced through MMC's and the agencies' land acquisition requirement. Acquired parcels would be managed for grizzly bear use in perpetuity, and could improve big game habitat and wolf security where roads could be gated or barriered. Where parcels acquired for grizzly bear mitigation occurred in Cabinet or Satire pack territories, any road access changes would directly benefit wolves in those packs; 8) Other measures included in all action alternatives to reduce mortality risks include prohibiting employees from carrying firearms; removing road-killed big game animals; and funding of grizzly bear specialists and one law enforcement position, which could indirectly benefit wolves through improved enforcement of access changes and by increasing public awareness of issues related to threatened and endangered species as well as other species. The agencies' alternatives also include implementation of a transportation plan and a requirement that MMC stage shipments of supplies in a general location prior to delivery to the mine site to reduce mine traffic and mortality risk. While some individual wolves could be affected, impacts would not be severe enough to affect wolf viability on the KNF.

Montana Gray Wolf Conservation and Management Plan

All alternatives would comply with direction in the State Management Plan.

3.25.4.8 Harlequin Duck

3.25.4.8.1 Analysis Area and Methods

Population ecology, biology, habitat description and relationships identified by research are described in Cassirer and Groves (1991), Reichel and Genter (1995), Cassirer *et al*. (1996), Hendricks (2000), and Carlson (2004). These provided guidance in evaluating potential habitat and potential effects to harlequin ducks, and are incorporated by reference.

Cassirer *et al*. (1996) completed a Conservation Assessment and Strategy for the U.S. Rocky Mountains that provides some management recommendations for harlequin ducks. The overall strategy is to maintain riparian and instream habitat. Potential threats to harlequin ducks include activities that affect riparian habitats, water yield and water quality, and activities that increase disturbance during the breeding season.

Harlequin duck occurrence data comes from MNHP surveys conducted on the Forest, District wildlife observation records, Forest historical data (NRIS Wildlife) and other agencies (FWP).

The KNF Conservation Plan (Johnson 2004a) identified streams that provide actual or suspected harlequin duck habitat on the KNF.

The analysis area includes areas where aquatic resources may be affected either by mine construction, operations, and closure or by construction, maintenance, and decommissioning of the transmission line. Mine alternatives may affect the named and unnamed streams in the East Fork Bull River, Rock Creek, Ramsey Creek, Poorman Creek, Little Cherry Creek, Bear Creek, Cable Creek, Big Cherry Creek, and Libby Creek watersheds and any other areas where roads would be closed. The transmission line alternatives would have no effect on the harlequin duck and are not discussed further.

The Conservation Assessment (Cassirer *et al.* 1996) identified activities within two improved sight distances (an improved sight distance is the distance at which the riparian area is obscured from view prior to leaf out) of active sites as a disturbance factor to harlequin ducks. A qualitative discussion of the potential changes in water yield and water quality will also be used to compare the effects of alternatives.

3.25.4.8.2 Affected Environment

The harlequin duck is small sea duck that travels inland to breed in fast mountain streams on the KNF. Breeding habitat consists of second order or larger streams with high water quality and reaches with two to seven percent gradients. Habitat characteristics include riffle habitat, gravel to boulder-sized substrate, forested or shrubby banks with overhanging bank vegetation, logs, rocks, islands and gravel bars. Harlequin ducks are very sensitive to human presence and disturbance, especially during the nesting season. Harlequin ducks show a high degree of fidelity to their breeding grounds.

In the analysis area, Rock Creek and East Fork Rock Creek are occupied harlequin duck habitat, and possess necessary habitat parameters to support the duck. Similar to other high quality streams in Western Montana, Rock Creek and East Fork Rock Creek support a diversity of invertebrates with relative low total. Large woody debris, gravel bars and boulders in and adjacent to Rock Creek and East Fork Rock Creek provide loafing areas and cover. Riparian deciduous tree and shrub communities and cedar-hemlock forested stands, of various successional stages, border the majority of both streams. These riparian and streamside communities provide cover and possible nesting areas.

Harlequin ducks breeding in Montana arrive primarily from late April to early May (MNHP 2014). Males depart in June while females and young depart from late July to early September (MNHP 2014). In Montana, breeding birds are found on 25 to 30 streams, referred to as “breeding streams.” These streams are clumped in four general areas: some tributaries of the lower Clark Fork River; some tributaries of the North, Middle and South Fork the Flathead River; selected streams on Rocky Mountain Front; and on the Boulder River. Groups of breeding streams could be considered to sustain a subpopulation of harlequins because the ducks are geographically fragmented from other breeding birds and little interaction between these breeding communities occurs. One of these subpopulations is found in the Lower Clark Fork drainage in the Noxon/Trout Creek area. Breeding occurs on four streams: Rock Creek, Marten Creek, Swamp Creek and the Vermillion River. Monitoring and inventory of the lower Clark Fork subpopulation shows a small but stable breeding group with a maximum of 15 breeding pairs. In 1995, three breeding pairs were found on Rock Creek (Fairman *et al.* 1995). One female and three young were documented on Rock Creek about 1 mile upstream of the Clark Fork River in late July 2010

(KNF 2010). Of the four breeding streams in the Lower Clark Fork subpopulation, Marten Creek produces the most broods, followed by Rock Creek (Fairman *et al.* 1995).

Johnson (2004a) reported harlequin duck breeding confirmed on 10 streams in six of the eight PSUs on the KNF. These streams provide about 71 miles of suitable habitat.

3.25.4.8.3 Environmental Consequences

None of the transmission line alternatives, including the Sedlak Park Substation and loop line, would affect the harlequin duck due to the absence of nearby suitable habitat and are not included in the analysis.

Alternative 1 – No Mine

Alternative 1 would not disturb the harlequin duck or their habitat and would have no effect on this species.

Alternative 2 – MMC's Proposed Mine

The total disturbance area within the Rock Creek drainage (for the ventilation adit) would be small (less than 1 acre. The potential for any increase in sediment delivery to the Rock Creek drainage from these activities is minimal. The ventilation adit would be on a steep slope above Rock Lake and noise generated during adit construction would be short-term and limited East Fork Rock Creek above Rock Lake. Construction noise would have no effect on the harlequin duck or their habitat.

In Rock Creek, without MMC's modeled mitigation, streamflow is predicted to decrease by 0.65 cfs at the mouth of Rock Creek (RC-2000) (Table 112). Flows of 100 cfs or greater in Rock Creek at RC-2000, located about 100 feet upstream of MT 200 occurred in 2011 during most days between mid-May and to the first week of July. 2012 and 2013 were wetter years, with flows of 100 cfs or greater starting at the end of March/beginning of April and occurring during most days through early to mid-July (see section 3.11.3.2.1, *Surface Water Hydrology*). According to Grant *et al.* (2008), changes in peak flow that fall in a range of ±10 percent are within the error of peak flow measurement and natural variability and cannot be ascribed as an effect.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative and Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

The effect of construction noise above Rock Lake would be the same as Alternative 2. In Alternatives 3 and 4, streamflow in Rock Creek, with MMC's modeled mitigation, is predicted to decrease by 0.15 cfs at the mouth of Rock Creek (RC-2000) (Table 112). According to Grant *et al*. (2008), changes in peak flow that fall in a range of ±10 percent are within the error of peak flow measurement and natural variability and cannot be ascribed as an effect. In Alternatives 3 and 4, sediment delivery to East Fork Rock Creek from NFS road #150A would decrease by almost 87 percent with the project and BMPs. No sediment decreases to East Fork Rock Creek were predicted under Alternative 2.

Cumulative Effects

Past actions are described in section 3.2, *Past and Current Actions,* shown on Figure 50, and listed in Appendix E. Section 3.25.4.6.3, *Affected Environment* above summarizes the existing condition, which reflects the streamflow and habitat conditions found in Rock Creek and East Fork Rock Creek. Timber harvest has occurred in the analysis area since the 1950s and, up until the early 1990s, harvest occurred within riparian habitats resulting in alterations and reduction of riparian habitat. High levels of road construction to facilitate harvest occurred through the 1980s and resulted in sedimentation into streams. Since the adoption of the KFP in 1986, application of KFP standards has resulted in the protection of riparian habitats, less road construction and road closures, and BMP work on existing roads to reduce sedimentation.

With MMC' modeled mitigation, streamflow in Rock Creek is predicted to decrease by 0.19 cfs at the mouth of Rock Creek (RC-2000) (Table 117), assuming the Rock Creek Project and the Montanore Project operated and closed simultaneously. According to Grant *et al*. (2008), changes in peak flow that fall in a range of ±10 percent are within the error of peak flow measurement and natural variability and cannot be ascribed as an effect. The cumulative effect on the harlequin duck and its habitat from changes in streamflow during the breeding season would be negligible. Other activities associated with the Rock Creek Project may impact individual harlequin ducks or their habitat, but would not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species.

Regulatory/Forest Plan Consistency

Organic Administration Act and Forest Service Locatable Minerals Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources and to take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations. All alternatives would comply with 36 CFR 228.8.

National Forest Management Act/Kootenai Forest Plan

p. II-1 #6 – *Determine the status of sensitive species and provide for their environmental needs as necessary to prevent them from becoming threatened or endangered*: All action alternatives would have minor effect on streamflow in Rock Creek and East Fork Rock Creek during breeding season.

p.II-1 #7 – *Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species:* All action alternatives would have no effect on vegetation in Rock Creek and East Fork Rock Creek during breeding season.

p.II-22, 23 – *Maintenance of viable populations of existing native and desirable non-native vertebrate species, as monitored through indicator species, attained through the maintenance of a diversity of plant communities and habitats:* See p.II-1 #7 above for habitat diversity.

KFP riparian standards and guidelines, KFP Vol. 1, II-28 thru 33, as amended by INFS: Compliance with INFS, including RHCA standards and guidelines, are discussed in detail in section 3.6, *Aquatic Life and Fisheries*.

Forest Service Sensitive Species Statement of Findings

The no action alternatives not impact individual harlequin duck or its habitat, and would not contribute to a trend toward federal listing or cause a loss of viability to the population or species. ***All combined action alternatives may impact individuals or their habitat, but will not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species for harlequin ducks.*** This determination is based on the minor effect on streamflow in Rock Creek and East Fork Rock Creek during the breeding season.

State Requirements

Alternatives 3 and 4 would comply with the MMRA regarding disturbed lands being reclaimed to a post-mining land use with stability and utility comparable to that of the pre-mining landscape. Draft findings regarding compliance with MFSA requirements are discussed in the Summary, beginning on p. S-53.

3.25.4.9 North American Wolverine

3.25.4.9.1 Regulatory Framework

On February 4, 2013, the USFWS proposed listing the wolverine as threatened and published a proposed 4(d) rule that listed several activities that are not considered significant threats to the species (USFWS 2013c). On August 13, 2014, the USFWS withdrew its proposal to list wolverine under the Endangered Species Act (USFWS 2014d), and as a result of this action the wolverine returned to the R1 Sensitive Species list.

In the proposed ruling, the USFWS thought that global climate change is the primary threat to the species and that legal and incidental trapping of wolverines were substantial threats in concert with climate change. Although the goods and services provided by National Forest System programs and activities have been, and will undoubtedly continue to be, affected by climate change (USDA Forest Service 2010a), the activities described in the project alternatives are not the cause of climate change. In their withdrawal of the proposed listing, USFWS found that none of the factors, including climate change, posed a threat to the species and it was not warranted to list wolverine under the ESA (USFWS 2014d). The USFWS found that there are no Forest Service land management activities or public use activities on National Forest System lands that threaten wolverines (direct effects) or high-elevation habitats (indirect effects) due to the nature and scale of such human activities. These activities include: 1) dispersed recreation such as snowmobiling, skiing, backpacking, and hunting for other species; 2) land management activities such as timber harvest, wildland firefighting, prescribed fire, and silviculture; and 3) mining (USFWS 2013c). These activities are not likely to disturb wolverines or habitat to an extent that threatens the viability of the population or species (USFWS 2013c). Wolverines occur naturally in low densities, and current population levels and trends are not definitively known (USFWS 2013c). However, there is evidence that their population is increasing (USFWS 2014d) and that wolverines are expanding both within areas currently occupied as well as suitable habitat not currently occupied (USFWS 2014d).

The NFMA directs the Forest Service to "provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple use objectives." Providing ecological conditions to support diversity of native plant and animal species in the planning area satisfies the statutory requirements. The Forest Service's focus for meeting the requirements of NFMA and its implementing regulations is on assessing habitat to provide for diversity of species.

The KFP establishes forest-wide goals, objectives, standards, guidelines and monitoring requirements. KFP direction for sensitive species includes determining the status of sensitive species and providing for their environmental needs as necessary to prevent them from becoming endangered. The KFP also requires the maintenance of diverse age classes of vegetation for viable populations of all existing native, vertebrate wildlife species (II-1).

3.25.4.9.2 Analysis Area and Methods

The analysis area for direct, indirect, and cumulative effects to individuals and their habitat is primarily the contiguous area of persistent spring snow near the proposed and alternative mine and transmission line facilities, although movement/dispersal through areas outside of persistent spring snow was also considered.

Recent research provides guidance in identifying potential denning habitat within proposed analysis areas. In North America, 69 percent of den sites were located in areas where snow cover persists until mid-May for an average of 6 to 7 years (*i.e.*, "persistent snow") while 98 percent of all den sites were located in areas of at least 1 year of snow cover (Copeland *et al*. 2010). Based on this, wolverine denning habitat was mapped using Region 1 persistent snow layer, which is the same as Copeland *et al.*'s 2010 map. The presence of a persistent snow layer is an indicator of climatic conditions in the analysis area and whether the area could support wolverines. Proposed activities will be assessed in relation to their impacts to the persistent snow conditions.

The persistent snow layer from Copeland *et al*. (2010), which is also the R1 persistent snow layer, was the primary map used during this project analysis. The persistent snow layer was the primary layer used due to USFWS (2013c) focusing on persistent spring snow as one of two main factors potentially impacting wolverines. The agencies also considered four habitat maps developed by Inman *et al*. (2013). The four habitats were primary wolverine habitat, female maternal habitat, and male and female dispersal habitat. Maps of both were overlayed with maps of the alternatives. As Inman *et al.* (2013) reported, their map of primary wolverine habitat matches well with Copeland *et al*.'s persistent snow map, and this holds true for the analysis area as well. Inman *et al*. 2013 map of female maternal habitat covers a smaller area and has less overlap with the analysis area than Copeland *et al.*'s persistent snow map. The male and female dispersal habitat maps from Inman *et al*. have more overlap with the analysis area than Copeland *et al.*'s persistent snow map because wolverines wander over a wider area during dispersal. Inman *et al.*'s dispersal maps were based on habitats used briefly by their study animals while moving between primary habitat patches (Inman *et al*. 2013). The contiguous block of female dispersal habitat overlapping the project consists of the entire Cabinet Mountains and some adjacent areas. The male dispersal contiguous block that overlaps the project is much larger and covers most of western Montana and northern Idaho. This section summarizes a specialist's report on the wolverine available in the Project record.

The regulation of trapping activities is FWP's responsibility and is beyond the authority of the Forest Service to control. Currently, the state does not have a trapping season for wolverines in or near the analysis area. At the time of the 2013 listing proposal, Montana was the only state in the Forest Service Region 1 still maintaining an open wolverine trapping season, using seasonal quotas to monitor and regulate harvest levels. This season was administratively closed in 2012, and as of the 2014-2015 trapping period, it remains closed. There are currently no open trapping seasons for wolverine in Forest Service Region 1. None of the alternatives would increase trapping; trapping is not discussed further.

Wolverine occurrence data come from recent District wildlife observation records, NRIS wildlife database, research studies, or other agencies (FWP, MNHP).

3.25.4.9.3 ***Affected Environment***

Due to their large home range size and habitat needs, the North American wolverine is rare and uncommon and most likely always has been. Wolverines use higher elevation, steep, remote habitat. Wilderness and roadless lands account for much of the areas wolverines are known to use, although it is unknown if this is due to avoidance of people or that wolverine tend to choose areas that are not conducive to human development (Copeland *et al*. 2007). Wolverines appear capable of adjusting to human disturbance (USFWS 2013c and USFWS 2014d). Wolverines travel long distances throughout large home ranges that average between 186 to 310 square miles (USFWS 2013c) but can range from 28 to over 360 square miles (Banci 1994). Wolverines are considered to be a generalist species (*i.e.,* not dependent on one vegetation type or prey species), one that is able to thrive in different habitat types and makes use of a variety of different resources within their home range. Wolverines are generally scavengers of carrion, but do prey on small mammals and birds and will eat berries, fruits, and insects (Hornocker and Hash 1981). Dens are dug into the snow to ground level and are generally located on north-facing slopes under rocks, boulders, tree roots, or avalanche debris (Magoun and Copeland 1998). Females enter dens in mid-February, giving birth to a litter of young, and then use a series of dens or rendezvous sites until mid-May when her offspring are mobile enough to travel (Copeland and Yates 2008, Magoun and Copeland 1998).

Wolverines are not thought to be dependent on vegetation or habitat features that may be manipulated by land management activities. They have been documented using both recently logged areas and burned areas (USFWS 2013c). It is unlikely that wolverine avoid the type of low-use roads that generally occur in wolverine habitat (USFWS 2013c). The best scientific information available does not substantiate dispersed recreational activities (even at high levels) as a threat to the wolverine population (USFWS 2014d). Additionally, the scale at which most land management decisions (including Forest Service vegetative management activities) occur is relatively small compared to the average size of a wolverine home range and although impacts to individual animals may occur, they do not rise to the level to be a threat to the population (USFWS 2014d). While there are no definitive effects currently known at the population level, there are ongoing scientific investigations to better understand potential recreational impacts to wolverine.

Deep, persistent, and reliable spring snow cover (April 15 to May 14) is the best overall predictor of wolverine occurrence in the contiguous United States. Wolverine year-round habitat use takes place almost entirely within the area defined by deep, persistent spring snow (USFWS 2013c). This is likely related to the wolverine's need for deep snow during the denning period (USFWS 2013c). No records exist of wolverines denning anywhere but in snow, despite the wide availability of snow-free denning opportunities within the species range (USFWS 2013c). The deep, persistent spring snow layer in the Copeland *et al*. (2010) analysis captures all known wolverine dens in the DPS [Distinct Population Segment] (USFWS 2013c). However, it should be noted that their analysis depicts areas that are snow covered through May 15 in at least 1 out of 7 years (USFWS 2014d). Additionally, except for denning females (denning habitat is not considered scarce or limiting to wolverine reproduction), wolverines are occasionally observed in areas outside the mapped deep, persistent snow zone, and factors beyond snow cover may play a role in overall wolverine distribution (USFWS 2014d).

Wolverines require a lot of space and the availability and distribution of food is likely the primary factor in determining female wolverine movements and home range size. Male home range size and location is likely tied to the presence of active female home ranges and breeding opportunities (USFWS 2013c). The size of adult wolverine home ranges varies widely depending upon geographic location; food availability and distribution; and individual animal age and gender (USFWS 2013c). Wolverine home ranges generally do not occur near human settlements due to differential habitat selection by humans and wolverines, but wolverines do not avoid human development of the types that occur within suitable wolverine habitat (USFWS 2013c).

Inman *et al*. (2012b) described wolverine habitat as “steep terrain with a mix of tree cover, alpine meadow, boulders, and avalanche chutes” (Inman *et al*. 2012b). They also state that wolverines experience a trade-off “…between resource acquisition on one hand and avoidance of predation and competition on the other. Wolverines balance these competing interests by exploiting an unproductive niche where predation and interspecific competition are reduced” (Inman *et al*. 2012b).

Inman *et al*. (2012a) found a link between persistent snow and wolverine foraging strategy. Wolverines appear to rely on the cold and snow to cache carrion. Cold, structured microsites are used to cache food and this reduces competition from insects, bacteria, and other scavengers for this food source. The authors referred to this as the “refrigeration-zone” hypothesis (Inman *et al*. 2012a).

Wolverines are opportunistic feeders and consume a variety of foods depending on availability. They primarily scavenge on carrion, but also prey on small animals and birds, and eat fruits, berries, and insects (Hornocker and Hash 1981, Banci 1994). They are primarily scavengers and feed upon carrion or ungulates killed by large predators, such as wolves, bears, cougars, and humans, or animals that have died from natural causes. They also kill their own prey occasionally, when the opportunity arises, typically small mammals. The constant search for food keeps them moving throughout their range; daily movements of 20 miles are common. Hornocker and Hash (1981) suggested that food availability is the main factor determining movements and range of wolverines in western Montana.

Recent work on wolverine habitat requirements suggests that they are restricted to areas that retain snow until mid-May and where the average temperature in August is less than 72 degrees (Schwartz *et al*. 2009, Copeland *et al*. 2010). Talus slopes and alpine cirques may, therefore, provide important thermal and denning habitat. Based on current research it appears that wolverine habitat is limited to areas at or above the subalpine zone on the KNF. Detailed wolverine population ecology, biology, habitat description and relationships identified by research are described in Hornocker and Hash (1981), Banci (1994), Copeland *et al*. (2007), Schwartz *et al*. (2009), Copeland *et al*. (2010), and USFWS (2013c). These provided additional guidance in evaluating potential habitat and effects to wolverine, and are incorporated by reference.

Johnson (1999) reported wolverine presence was confirmed in seven of the eight planning units on the KNF. Wolverines and their signs have been documented in the Crazy and Silverfish PSUs. A wolverine was photographed in the upper Libby Creek drainage in 2006 and another was videotaped in the Ramsey Creek drainage in 2007 (Brown, pers. comm. 2008; Williams, pers. comm. 2008). Wolverine tracks were documented in the upper Bear Creek drainage in 1995 and 2001 during winter track surveys conducted by FWP of the Snowshoe, Leigh, Big Cherry, Bear, and Poorman creek drainages. In the Silverfish PSU, there have been 18 track observations and 2 visual sightings of wolverines from 1984 to 2008 (1 in the Porcupine Creek drainage and 1 in the Baree Creek drainage). Eleven sets of wolverine tracks and one potential den site have been documented along the Baree Lake Trail during annual or biannual surveys conducted by the Forest Service since 1989 (Ibid). In June 2014, FWP reported wolverine tracks on Ojibway Peak (Chilton 2014).

While wolverines appear to be relative generalists in selection of habitat for most activities, female wolverines are more selective in their choice of natal denning sites, preferring high-elevation snowy cirque basins where they can dig through deep snow for protective cover for their young. Denning habitat may be a factor limiting distribution and abundance (Copeland 1996), and the persistence of a snowpack into late spring is a strong determining factor in wolverine presence due to its importance in denning (Copeland *et al*. 2010, USFWS 2013c). Persistent spring snow cover may also be a determining factor in wolverine dispersal and has consequences on gene flow (Schwartz *et al*. 2009).

Forest-wide, about 555,500 acres of persistent snow (average 1 to 7 years) have been identified of which 89,900 acres have persisted on the landscape until mid-May for 6 to 7 years on average. Such sites, where snow more consistently persists until mid-May, may provide more suitable habitat for denning wolverines. Three blocks of persistent spring snow are found in the analysis area. The largest block consists of the higher elevations within the Cabinet Mountains and is mostly within the wilderness and is 143,025 acres. Two other smaller blocks are potentially impacted by one or more of the transmission line alternatives. These two small blocks are located to the east of the mine facilities. One 120-acre block is between upper Midas Creek and Howard Creek (sections 7 and 18 T27N, R30W). A 360-acre block is between upper Midas Creek and Swamp Creek (sections 8 and 9 T27N, R30W). These two smaller blocks are lower quality habitat. They averaged persistent spring snow in 1 out of 7 years, further limiting the probability that a wolverine would use these areas. The large block within the Cabinet Mountains has 36,735 acres of higher quality habitat and 106,290 acres of lower quality habitat. Features such as large snowdrifts that were not captured by the snow layer coverage may exist within the periphery of the mapped habitat and could be used by denning wolverines (Copeland *et al*. 2010). Persistent snow areas also appear to influence summer habitat use by wolverines and connectivity between wolverine populations and habitat patches (Copeland *et al*. 2010, Schwartz *et al*. 2009).

3.25.4.9.4 *Environmental Consequences*

Alternative 1 – No Mine

Alternative 1 would not affect areas of persistent spring snow or impact trapping, nor would there be any impacts to individual wolverines.

Alternative 2 – MMC’s Proposed Mine

In Alternative 2, the Rock Creek Ventilation Adit would be located in the larger Cabinet Mountains block of persistent spring snow. It falls within an area that is classified as lower quality habitat. The site is expected to have persistent spring snow in an average of 5 out of 7 years. The footprint of the ventilation adit would be small, and the ground disturbance area would be 1 acre. About 35 acres of low quality habitat would be within the disturbance area for the Ramsey Plant Site, including the conveyor system from the adit to the plant. The Ramsey Plant Site is expected to have persistent spring snow for an average of 1 to 3 years out of 7. Eight acres of low quality habitat would be within the existing ground disturbance area of the Libby Adit Site. The Libby Adit Site is expected to have persistent snow for an average of 1 to 2 years out of 7. Some water monitoring sites are within areas of persistent spring snow. None of the other components of Alternative 2 would be within areas predicted to have persistent spring snow. Total acres (44 acres) of Alternative 2 within areas of persistent spring snow, all of which are within the larger Cabinet Mountains block, would be 0.03 percent of that block, or approximately 0.2 percent of an average female’s home range.

Given the small size of the area affected, that the quality of the habitat is low, and that USFWS (2013c) states that mining is an activity not expected to impact wolverine populations, the effects of Alternative 2 on habitat in areas of persistent spring snow are not expected to impact the wolverine population. The scale at which Forest Service activities occur is relatively small compared to the average size of a wolverine home range and although impacts to individual animals may occur, they do not rise to the level to be a threat to the population (USFWS 2014d). Individual wolverines may be impacted through the alteration of habitat in areas of persistent spring snow, but given the small extent of impacts, the availability of habitat elsewhere within the Cabinet Mountains immediately adjacent to the project, the mobility of the species, and their apparent ability to coexist in areas of human activities, the effects on individual wolverines are likely to be small.

Alternative 2 would have slightly more overlap of project activities with primary wolverine habitat identified by Inman *et al*. (2013). The Ramsey Plant Site and Libby Adit Site would affect 17 acres of primary wolverine habitat outside areas predicted to have persistent snow. The Rock Lake Ventilation Adit would be within primary habitat mapped by Inman *et al*. (2013). All other alternative components would not affect primary habitat. A comparison with Inman *et al*. (2013) maternal habitat map revealed that only the Rock Lake Ventilation Adit and 14 acres of the Ramsey adit/Plant Site overlaps that map. This is less than the overlap with the persistent snow layer. Because the two dispersal habitat maps (male and female) from Inman *et al.* (2013) contain a broad array of habitats, most of Alternative 2 components would be within these habitats. Similar to the persistent spring snow map, the overlap of Alternative 2 acres with the Inman *et al*. (2013) maps (each of the four) are still tiny when looking at the contiguous blocks of habitat that overlap project activities. Similarly to the persistent spring snow map, the overlap with the Inman *et al*. (2013) maps, and the potential effects from this alternative, were based on USFWS (2013c and 2014d) by looking at the factors that would potentially impact wolverine populations. Regardless of how much overlap with wolverine habitat, mining was one of the activities in USFWS (2013c and 2014d) that was not expected to impact wolverine populations. In other words, it doesn’t matter if the map of persistent spring snow from Copeland *et al*. (2010) or the habitat maps from Inman *et al*. (2013) are used, the effects of the alternative on the population, based on USFWS (2013c and 2014d), would be the same. Also, the effects on individual wolverines would be the same as described previously.

The removal of vegetation for the mine related activities under Alternative 2 would not impact this population of wolverine. As described in USFWS (2013c), wolverine are not tied to any specific vegetation type, and as described in Copeland *et al*. (2010), wolverines generally use areas where the snow persists into the spring. There is very little overlap with the areas of persistent spring snow under this alternative, as described above. Therefore the effects of the loss and/or conversion of vegetation to the ground disturbance under this alternative would be similarly tiny. Given the large home range sizes, mobility of the species, availability of adjacent habitat, and the species’ apparent ability to coexist in areas of human activities, the impacts on individual wolverines that may use the project area would likely be small. Wolverines have been documented to persist and reproduce in areas with high levels of human use and disturbance, including developed alpine ski areas and areas with motorized use of snowmobiles (USFWS 2013c).

Wolverines may occur in areas outside of persistent spring snow as they move between patches of higher quality habitat (*i.e.,* areas with a greater likelihood of having persistent spring snow). Wolverines may move long distances in an attempt to establish new home ranges. Although they prefer to travel in habitat that is similar to habitat they use for home range establishment, wolverines are capable of long-distance movements through variable and anthropogenically altered terrain (USFWS 2013c). The likelihood of a wolverine occurring outside of areas that have persistent spring snow is low, as wolverines appear to select for these areas even during the summer. “Ninety-five percent of summer locations and 86 percent of winter locations fell within the spring snow coverage…” (Copeland *et al*. 2010). Therefore, there is a low likelihood that a wolverine would wander near the mine-related activities in areas outside of persistent spring snow. This includes all of the impoundment site, LAD areas, and most of the access road. Consequently there is a correspondingly low likelihood of any effects from those activities/facilities on wolverines. Human activity/presence associated with the Evaluation, Construction, Operations, Closure, and Post-Closure Phases of the mine and associated features would not affect wolverine populations. Disturbance associated with human activities during the Evaluation, Construction, Operations, Closure, and Post-Closure Phases would be identical or comparable to the activities USFWS (2013c) found would not impact wolverine populations. Mining was specifically mentioned in USFWS (2013c) as one of the activities not expected to impact wolverine populations. As stated previously, wolverines have been documented to persist in areas with high levels of human use and disturbance (USFWS 2013c). Therefore, human activities associated with the access/haul route (including winter plowing), impoundment site, processing/mill facility, mine adits (including blasting during construction), monitoring sites, ore conveyor system, LAD sites, or any other Montanore-related human activities are not expected to impact wolverine populations in the Cabinet Mountains. It is possible that individual wolverines may be impacted and not use areas near project activities as much as they may have in the absence of those activities, although these impacts to a few individuals would not rise to the level of impacting the population. This conclusion is based on the information described previously regarding the apparent ability of wolverines to coexist in areas of human disturbance, the mobility of the species, and the availability of habitat adjacent to the project area within the Cabinet Mountains.

Even with the expected increase in traffic on the haul/access route, wolverines are expected to be able to move through the area. Connectivity between wolverine populations and habitat patches is generally tied to persistent spring snow, and wolverines appear to currently be able to disperse between habitats and through areas where human developments occur (Schwartz *et al*. 2009, USFWS 2013c). As concluded in USFWS (2013c), “the available evidence indicates that dispersing wolverines can successfully cross transportation corridors.”

A wolverine may find it difficult to cross under the 1,200-foot long ore conveyor system between the adit and the plant site across Ramsey Creek. The configuration of the conveyor may allow passage of smaller animals through the framework supporting the conveyor, whereas larger animals the size of a bear or deer would have difficulty passing under (Klepfer, pers. comm. 2014). The noise associated with the conveyor, coupled with the framework that a wolverine would have to negotiate, may deter a wolverine from passing under the conveyor. Wolverines are capable of covering many miles in a day, as described in the beginning of this wolverine analysis, and with the length of the conveyor system being 1,200 feet, a wolverine would be able to bypass this site. The conveyor system would be mostly within areas of persistent spring snow. Connectivity between wolverine populations and habitat patches is generally tied to persistent spring snow, and wolverines appear to currently be able to disperse between habitats and through areas where human developments occur (Schwartz *et al*. 2009, USFWS 2013c). Proposed activities would not affect the overall extent of persistent spring snow that provides connectivity for wolverine populations. Changes associated with motorized access with this alternative, and therefore access for trappers, would likely result in impacts to relatively few individual wolverines, if any, as most of the wolverines in this vicinity would be using the wilderness area where the bulk of the persistent spring snow is located. This also happens to be where motorized use is not allowed and Alternative 2 would not change this. Therefore, there would be no threat to the viability of the species as a result of Alternative 2. Trapping mortality (including incidental trapping) undoubtedly can impact local population levels of wolverine, but in their withdrawal of the proposed ESA listing, the USFWS concluded that based on the best scientific and commercial information available the mortality level from trapping (including incidental trapping in Montana and Idaho) is not by itself a threat to the wolverine population (USFWS 2014d). Seasonal closure and low harvest quotas are the predominant factors affecting trapping mortality, as is the naturally low density of wolverines, which helps minimize the likelihood of incidental trapping mortality.

The chemical makeup of the tailings water is not likely to pose a risk to wildlife, including wolverine. Wolverines are not likely to be in the area of the impoundment or LAD Areas due to a lack of persistent spring snow, as discussed earlier in this analysis. The metals in the water would be similar to what is found at the Troy Mine decant ponds (see Table 120 in the *Water Quality* section), and those do not appear to have posed a risk to wildlife (USDA Forest Service and DEQ 2012). Concentrations of metals in mine and adit water, which would be stored in mine/yard pond at the Ramsey Plant Site and in a surge pond at the LAD Areas, would be lower than tailings water (see section 3.13,*Water Quality*). The Ramsey Plant Site would be fenced, restricting wolverine access.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative and Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

The effects of the Rock Creek Ventilation Adit and the Libby Adit Site in Alternatives 3 and Alternative 4 would be the same as Alternative 2. About 8 acres of low quality habitat is within the ground disturbance acres for the access road between the Libby Adit and the Libby Plant Site, including the existing ground disturbance from the road. This portion of the access road is expected to have persistent snow for an average of 1 to 2 years out of 7. Some of the water monitoring sites would be within areas of persistent spring snow. None of the other components of Alternative 3 lie within areas predicted to have persistent spring snow. Total acres (about 18 acres) of Alternative 3 within areas of persistent spring snow, all of which are within the larger Cabinet Mountains block, would be 0.01 percent of that block, or approximately 0.07 percent of an average female home range.

Given the small size of the area affected, that the quality of the habitat is low, and that USFWS (2013c) states that mining is an activity not expected to impact wolverine populations, the effects of Alternatives 3 and 4 on habitat in areas of persistent spring snow are not expected to impact the wolverine population. The scale at which Forest Service activities occur is relatively small compared to the average size of a wolverine home range and although impacts to individual animals may occur, they do not rise to the level to be a threat to the population (USFWS 2014d). Individual wolverines may be impacted through the alteration of habitat in areas of persistent spring snow, but given the small extent of impacts, the availability of habitat elsewhere within the Cabinet Mountains immediately adjacent to the project, the mobility of the species, and their apparent ability to coexist in areas of human activities, the effects on individual wolverines are likely to be small.

Alternatives 3 and 4 would have slightly more overlap of project activities with primary wolverine habitat identified by Inman *et al*. (2013). In the area of the Libby Adit/conveyor/access road, the Inman *et al*. (2013) primary habitat map would overlap a similar sized area to the persistent spring snow map, just a slightly different set of acres. The result is a net increase of 2 acres of overlap with the Inman *et al*. 2013 primary habitat map. The rest of the alternative activities would not overlap the primary habitat map from Inman *et al*. (2013). The effect on dispersal habitat identified by Inman *et al*. (2013) would be the same as Alternative 2.

The effect of vegetation clearing and increased traffic on access roads would be negligible and the same as Alternative 2. The 6,000 to 7,500-foot conveyor from the adit site to the plant site would be longer than Alternative 2 and may deter a wolverine from passing under the conveyor. The effect would be similar to Alternative 2.

Water management in Alternatives 3 and 4 would reduce the risk to wildlife from contaminant uptake from storage of mine, adit, and tailings water. All mine and adit water would be treated and discharged at the Libby Adit Water Treatment Plant and not stored in ponds. The LAD Areas would not be used and the surge ponds would not pose a risk to wolverines. Tailings water quality would have lower metal concentrations than in Alternative 2; the factors leading to lower metal concentrations in tailings water quality in Alternatives 3 and 4 are discussed in section 3.13, *Water Quality*, p. 674.

None of the proposed activities in Alternatives 3 and Alternative 4 would affect the persistent spring snow that provides connectivity for wolverine populations. Therefore, there would be no threat to the viability of the species as a result of Alternatives 3 and 4.

Alternative A – No Transmission Line

Alternative A would not affect areas of persistent spring snow or impact trapping, nor would there be any impacts to individual wolverines.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

In Alternative B, about 0.3 miles of the transmission line would be within low quality habitat within the large block of persistent spring snow in the Cabinet Mountains. This section of transmission line is expected to have persistent snow for an average of 1 to 3 years out of 7. About 0.25 miles of the transmission line would cross a 120-acre block of low quality habitat to the east of the Cabinet Mountains. This segment of the transmission line is expected to have persistent snow for an average of 1 year out of 7. As stated in the Affected Environment section, this small block is too small to support an entire home range of a wolverine and would likely only be used as part of a larger home range that includes part of the Cabinet Mountains block of persistent spring snow. None of the other components of Alternative B would be within areas predicted to have persistent spring snow, including the Sedlak Park Substation, and would therefore be unlikely to impact wolverines. Vegetation clearing of 0.6 miles for the transmission line in Alternative B within areas of persistent spring snow would change the vegetation in low quality wolverine habitat. Given the small area affected, that the quality of the habitat is low, and that USFWS (2013c) states that wolverines are not tied to a specific vegetation type Alternative B effects in areas of persistent snow are not expected to impact the wolverine population. The scale at which Forest Service activities occur is relatively small compared to the average size of a wolverine home range and although impacts to individual animals may occur, they do not rise to the level to be a threat to the population (USFWS 2014d). Individual wolverines may be impacted through the alteration of habitat in areas of persistent spring snow, but given the small extent of impacts, the availability of habitat elsewhere within the Cabinet Mountains immediately adjacent to the project, the mobility of the species, and their apparent ability to coexist in areas of human activities, the effects on individual wolverines are likely to be small.

Alternative B would have slightly more overlap of project activities with primary wolverine habitat identified by Inman *et al*. (2013). The transmission line, which would parallel the Ramsey Plant access road, would affect an additional 0.5 miles of primary habitat outside areas of persistent spring snow. The rest of the alternative activities would not affect primary habitat. Alternative B would not affect maternal habitat. Most or all of Alternative B would be within dispersal habitat. Similar to the persistent spring snow map, the overlap of Alternative B activities with the Inman *et al*. 2013 maps (each of the four) are still tiny when looking at the contiguous blocks of habitat that overlap project activities. Similarly to the persistent spring snow map, the overlap with the Inman *et al*. 2013 maps, and the potential effects from this alternative, were based on USFWS (2013c and 2014d) by looking at the factors that would impact wolverine populations. Regardless of how much overlap with wolverine habitat, mining and other land management activities were identified in USFWS (2013c and 2014d) and were not expected to impact wolverine populations. In other words, it doesn't matter if the map of persistent spring snow from Copeland *et al*. 2010 or the habitat maps from Inman *et al*. 2013 are used, the effects of the alternative on wolverine populations, based on USFWS (2013c and 2014d), would be the same. Also, the effects on individual wolverines would be the same as described previously.

The discussion in Alternative 2 regarding the likelihood of a wolverine occurring outside of areas that have persistent spring snow would apply to all transmission line alternatives. Helicopter use for line stringing and line inspection and repair, as well as road use to monitor/maintain the line, is not expected to impact wolverine populations based on the range of activities discussed in USFWS (2013e). No motorized activity associated with transmission line construction would occur from April 1 to June 15 within bear habitat in the Miller Creek and Midas Creek drainages. Construction would not occur during the winter in big-game winter range areas. Clearing of the vegetation from the transmission line corridor would not adversely impact a generalist forager/hunter like a wolverine. Wolverines are habitat generalists and changes to the vegetative condition of its home range do not appear to negatively impact the species (USFWS 2013c). Additionally, as described above, there is very little overlap with areas of persistent spring snow with this alternative. Connectivity between wolverine populations and habitat patches is generally tied to persistent spring snow, and wolverines appear to currently be able to disperse between habitats and through areas where human developments occur (Schwartz *et al*. 2009; USFWS 2013c, 2014d). Proposed activities would not affect the overall extent of persistent spring snow that provides connectivity for wolverine populations. Therefore, there would be no threat to the viability of the species as a result of Alternative B. It is possible that individual wolverines may be impacted and not use areas near project activities as much as they may have in the absence of those activities, although these impacts to a few individuals would not rise to the level of impacting the population. This conclusion is based on the information described previously regarding the apparent ability of wolverines to coexist in areas of human disturbance, the mobility of the species, and the availability of habitat adjacent to the project area within the Cabinet Mountains.

Changes associated with motorized access with this alternative, and therefore access for trappers, would likely result in impacts to relatively few individual wolverines, if any, as most of the wolverines in this vicinity would be using the wilderness area were the bulk of the persistent spring snow is located. This also happens to be where motorized use is not allowed and Alternative B would not change this. Therefore, there would be no threat to the viability of the species as a result of this alternative. Trapping mortality (including incidental trapping) undoubtedly can impact local population levels of wolverine, but in their withdrawal of the proposed ESA listing, the USFWS concluded that based on the best scientific and commercial information available the mortality level from trapping (including incidental trapping in Montana and Idaho) is not by itself a threat to the wolverine population (USFWS 2014d). Seasonal closure and low harvest quotas are the predominant factors affecting trapping mortality, as is the naturally low density of wolverines, which helps minimize the likelihood of incidental trapping mortality.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

In Alternative C-R, about 0.25 miles of the transmission line would cross a 120-acre block of low quality habitat to the east of the Cabinet Mountains described in Alternative B. One of the potential helicopter landing sites associated with the transmission line construction is located within this same block of persistent spring snow, with another landing site located farther east near the other small block of persistent spring snow (low quality patch of wolverine habitat). None of the other components of Alternative C-R would be within areas predicted to have persistent spring snow. Total miles (about 0.25 miles) of the transmission line in Alternative C-R within areas of persistent spring snow would change the vegetation on a small amount of low quality wolverine habitat. Other effects on the wolverine would be the same as Alternative B. Proposed activities would not affect the persistent spring snow that provides connectivity for wolverine populations. Therefore, there would be no threat to the viability of the species as a result of Alternative C-R.

Alternative D-R – Miller Creek Transmission Line Alternative

In Alternative D-R, there would be no overlap of transmission line activities and any block of persistent spring snow. Other effects on the wolverine would be the same as Alternative B.

Alternative E-R – West Fisher Creek Transmission Line Alternative

The effect of Alternative E-R would be the same as Alternative D-R.

Combined Mine-Transmission Line Effects

None of the mine/transmission line combined alternatives would result in impacts to wolverine populations. As described above in the individual alternative discussions, the activities associated with the Evaluation, Construction, Operations, Closure, and Post-Closure Phases of the mine and all the constituent components, including the transmission line and Sedlak Park Substation, would not result in habitat changes or disturbance that would impact wolverine populations. Given the small size of the area affected, that the quality of the habitat impacted is low, and that USFWS (2013c) states that mining is an activity not expected to impact wolverine populations, effects of the combined mine-transmission line alternatives on habitat in areas of persistent spring snow are not expected to impact the wolverine population. The scale at which Forest Service activities occur is relatively small compared to the average size of a wolverine home range and although impacts to individual animals may occur, they do not rise to the level to be a threat to the population (USFWS 2014d). Individual wolverines may be impacted through the alteration of habitat in areas of persistent spring snow, but given the small extent of impacts, the availability of higher quality habitat elsewhere within the Cabinet Mountains immediately adjacent to the project, the mobility of the species, and their apparent ability to coexist in areas of human activities, the effects on individual wolverines are likely to be small.

Mining was among the activities that USFWS (2013e) specifically identified that they did not expect to cause negative impacts to wolverine populations. USFWS (2013c) identified the availability of persistent spring snow and trapping mortalities as the two main potential threats to wolverine populations. USFWS (2014d) determined that even those two factors do not threaten the species and therefore wolverine is not warranted for listing under ESA. Climate determines the extent of persistent spring snow, and the state determines if there is a trapping season on wolverines or other species, neither of which is impacted by any of the alternative combinations.

The mitigation plan (Alternatives 3, 4, C-R, D-R, and E-R) for the project is unlikely to greatly improve habitat for wolverines. It is unlikely that the parcels of land that may be purchased as mitigation for grizzly bear would occur in areas of persistent spring snow, particularly high quality wolverine habitat. Most of the wolverine habitat is located at higher elevations, and those higher elevations within the Cabinet Mountains are already National Forest System land. There may be a few parcels that contain wolverine habitat. The acquisition of these parcels would not change the extent of persistent spring snow or change state trapping regulations, the two factors identified in USFWS (2013c) as the main concerns for wolverine populations. If roads are closed on these parcels, particularly in winter, then a reduction in easy motorized access to trappers may result in fewer individual wolverines being caught either incidentally or during a wolverine trapping season if the State re-opens the wolverine trapping season.

Road closures done as mitigation (those done in addition to closures on the parcels purchased for mitigation mentioned above) for grizzly bear are unlikely to greatly benefit wolverine. Most of the roads are at elevations outside of the area of persistent spring snow, and those that do extend to higher elevations are generally already gated. The mitigation, depending on the road, may put in barriers and convert those to trails, but they would still be restricted to motorized use. The segment of road in Bear Creek that would be barriered is only seasonally gated currently but would be barriered under the project. This road is partially within low quality wolverine habitat. The road restrictions would not change the extent of persistent spring snow or change the state's trapping regulations, and wolverines have been shown to persist in areas of human use (USFWS 2013c), so limitations on motorized use as a result of this project are not expected to have more than minimal benefits for wolverines.

The potential mitigation parcels and the mitigation road closures were also compared to the Inman *et al*. (2013) maps. The effects would be the same as discussed above with the persistent snow map. The overlap with the Inman *et al*. (2013) maps was consistent with the alternatives compared to the persistent spring snow map from Copeland *et al*. (2010). There was slightly more overlap with the primary habitat map from Inman *et al*. (2013) due to the slightly larger size of that mapped area compared to the persistent spring snow. On the other hand, there was less overlap with the maternal habitat map from Inman *et al*. (2013) compared to the persistent spring snow map. Again, nearly all the mitigation roads/parcels would overlap the dispersal maps for either male or females from Inman *et al*. (2013). However, the effects would be the same as discussed above. The road restrictions would not change the extent of persistent spring snow or change the state's trapping regulations (the two main concerns for wolverine populations), and wolverines have been shown to persist in areas of human use (USFWS 2013c), so limitations on motorized use as a result of this project are not expected to have more than minimal benefits for wolverines.

It is possible that individual wolverines may be impacted and not use areas near project activities as much as they may have in the absence of those activities, although these impacts to a few individuals would not rise to the level of impacting the population. This conclusion is based on the information described previously regarding the apparent ability of wolverines to coexist in areas of human disturbance, the mobility of the species, and the availability of habitat adjacent to the project area within the Cabinet Mountains.

Changes associated with motorized access with the alternatives and mitigation, and therefore access for trappers, would likely result in impacts to relatively few individual wolverines, if any, as most of the wolverines in this vicinity would be using the wilderness area were the bulk of the persistent spring snow, and high quality habitat, is located. This also happens to be where motorized use is not allowed and none of the alternatives would change this. Therefore, there would be no threat to the viability of the species as a result of the alternatives. Trapping mortality (including incidental trapping) undoubtedly can impact local population levels of wolverine, but in their withdrawal of the proposed ESA listing, the USFWS concluded that based on the best scientific and commercial information available the mortality level from trapping (including incidental trapping in Montana and Idaho) is not by itself a threat to the wolverine population (USFWS 2014d). Seasonal closure and low harvest quotas are the predominant factors affecting trapping mortality, as is the naturally low density of wolverines, which helps minimize the likelihood of incidental trapping mortality.

Of all of the phases of the project (Evaluation, Construction, Operations, Closure, and Post-Closure), the most human activity would be during the Construction and Operations Phases. As stated previously, wolverines appear to be able to persist in areas of disturbance (USFWS 2013c). Most of the vegetative changes would occur during the same phase. Being habitat generalists and not tied to a specific vegetative type (USFWS 2013c), wolverines would have habitat elsewhere for foraging. Additionally, as discussed for each alternative, very little of the proposed activity is within areas of persistent spring snow, and wolverines spend most of their time in areas of persistent spring snow (Copeland *et al*. 2010).

Cumulative Effects

Relevant past and present factors influencing the existing habitat conditions in the project area are described in the affected environment and environmental consequences sections above. This cumulative effects section summarizes the past actions as well as further describes ongoing and other reasonably foreseeable contributions potentially impacting wolverine habitat and the DPS. As described in the *Analysis Area and Methods* section, the analysis area for cumulative effects consists primarily of the contiguous area of persistent spring snow near the proposed and alternative mine and transmission line facilities, although movement/dispersal through areas outside of persistent spring snow was also considered.

Past Actions and the Existing Condition

Land management activities are not considered to significantly affect the conservation of the distinct population segment (USFWS 2013c and 2014d). Wolverines have been able to use and persist on this landscape over the past in association with land management activities. Wolverines may move long distances in an attempt to establish new home ranges. Although they prefer to travel in habitat that is similar to habitat they use for home range establishment (USFWS 2013c p. 7878), wolverines are capable of long-distance movements through variable and anthropogenically altered terrain (USFWS 2013c p. 7879). Connectivity between wolverine populations and habitat patches is generally tied to persistent spring snow, and wolverines appear to currently be able to disperse between habitats and through areas where human developments occur (Schwartz *et al.* 2009, USFWS 2013c p. 7879). As concluded in USFWS 2013c (p. 7879), “The available evidence indicates that dispersing wolverines can successfully cross transportation corridors.”

Alternative 1 – No Mine; Alternative A – No Transmission Line

The No Action Alternative would not contribute any cumulative effects. The existing persistent snow conditions would continue to support use by wolverines and there would be no impact on trapping activities.

Action Alternatives for the Mine and Transmission Line: Ongoing and Reasonably Foreseeable Actions

Because habitat suitability for wolverines is tied to persistent snow areas (generally higher elevation and rugged habitats) there are no apparent conditions within the analysis area that would contribute to effects to wolverine or its habitat. Implementation of the proposed activities would not impact state trapping regulations related to wolverines or other species. There would be no threat to the viability of the wolverine as a result of this project.

The proposed rule stated: “The available scientific and commercial information does not indicate that other potential stressors such as land management, recreation, infrastructure development, and transportation corridors pose a threat to the DPS [distinct population segment]” (USFWS 2013c). Past, present, and reasonably foreseeable actions within the analysis area fall within this list of potential stressors and consists largely of land management activities. They each occur at a small scale compared to a wolverine home range, are found outside large expanses of suitable habitat found within places like wilderness areas, and do not impact the persistent snow areas that wolverines are associated with. Proposed activities in addition with past, present, and reasonably foreseeable actions would not negatively impact the DPS. Although individual wolverines may be impacted by the project, the effects would not impact the population given the availability of high quality habitat adjacent to the project area within the Cabinet Mountains, the mobility of the species, the large size of home ranges, and their apparent ability to coexist with human disturbance. There would be no cumulative effects anticipated that would change the effects determination to the wolverine from implementation of the proposed federal action.

Regulatory/Forest Plan Consistency

Organic Administration Act and Forest Service Mineral Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources and to take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations. All mine and transmission line alternatives would comply with 36 CFR 228.8. Mine Alternatives 3 and 4 would minimize effect on the wolverine by siting the plant site outside areas predicted to have persistent snow. Transmission Line Alternatives D-R and E-R would avoid road construction and vegetation clearing in areas of persistent snow.

Endangered Species Act

The USFWS 2014 determined that it was not warranted to list wolverine as a threatened species under ESA. Consequently, wolverine has no federal status and reverts back to being a R1 Sensitive Species.

National Forest Management Act/Kootenai Forest Plan

The KFP does not contain direction specific to wolverine. KFP direction regarding viable wildlife populations is discussed below.

p.II-1 #7. *Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species:* As discussed in the above analysis, wolverines are generalists that are not tied to a specific vegetation type. The footprint of some of the mine facilities (*e.g.*, adits, mine buildings, processing/mill site, impoundment) would remove vegetation and convert it to a non-vegetated condition during the life of the mine (well under one tenth of a percent of the Cabinet Mountains block of persistent spring snow overlaps project activities). The transmission line would generally convert forested types to open habitat conditions that may still provide foraging opportunities for a generalist such as a wolverine.

p.II-22, 23. *Maintenance of viable populations of existing native and desirable non-native vertebrate species, as monitored through indicator species, attained through the maintenance of a diversity of plant communities and habitats:* See p.II-1 #7 above for habitat diversity.

Forest Service Sensitive Species Statement of Findings

The no action alternatives would not impact individual wolverine or their habitat within the analysis area, and would not contribute to a trend toward federal listing or cause a loss of viability to the population or species. ***Implementation of the action alternatives results in a determination for wolverine of may impact individuals or habitat, but will not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species.*** In all action alternatives, mining related activities are consistent with those described under the previously proposed special rule of the ESA (USFWS 2013c) and are not considered to result in impacts that would significantly affect the conservation of the species. This determination is consistent with USFWS' withdrawal of the proposed rule (USFWS 2014d) which found that the factors potentially affecting the population are not a threat.

Climate change is no longer considered an immediate threat to the wolverine at the population level (USFWS 2014d). It was also determined that the action alternatives won't affect the presence, absence, or abundance of snow remaining late into the spring at the wolverine home range level. Within the footprint of the ground disturbance, which has little overlap with persistent spring snow at the home range level, those acres may have a lower likelihood of being used by wolverine as denning habitat due to snow removal during the life of the mine. The analysis in the project record shows that the action alternatives would not affect climate change.

Trapping is no longer considered a secondary threat to the wolverine at the population level (USFWS 2014d). The trapping season for wolverines is currently closed in Forest Service Region 1, but trapping for other species does occur and incidental wolverine mortality is a possibility. Proposed changes in the level of access via roads are not likely to facilitate enough of a change in trapping pressure to affect wolverines at the population level.

Land management activities, recreation, infrastructure development, and transportation corridors have all been identified as actions that do not pose a threat to wolverines at a population level (USFWS 2014d). At the local level, there may be impacts to individual wolverines, but population level effects are unlikely because: (1) wolverines can travel long distances and are not adverse to crossing open spaces; therefore, if temporarily displaced, they can easily move into the large areas of undisturbed habitat adjacent to the analysis area; and (2) any habitat impacted will not be rendered unsuitable for wolverines post-project and will continue to contribute toward maintaining wolverine viability post-project. The analysis area has very little overlap with persistent spring snow areas, and there is a large patch of higher quality habitat (persistent spring snow in an average of at least 6 out of 7 years), as well as a large amount of low quality habitat (persistent spring snow in an average of 1-5 years out of 7) adjacent to the analysis area within the Cabinet Mountains that would not be impacted by the action alternatives and would provide habitat for wolverines.

Land management activities occurring as part of the action alternatives do not pose a threat to wolverines at a population level (USFWS 2014d). Additionally, although the action alternatives may affect individuals, they are of little consequence due to the flexibility of habitat use shown by wolverines and their large home range size. Any effects to individual wolverines caused by the action alternatives would not be elevated directly, indirectly, or cumulatively to a level that would represent a loss of viability. The action alternatives may impact individuals or habitat, but will not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species.

State Requirements

Alternatives 3 and 4 would comply with the MMRA regarding disturbed lands being reclaimed to a post-mining land use with stability and utility comparable to that of the pre-mining landscape. Draft findings regarding compliance with MFSA requirements are discussed in the Summary, beginning on p. S-53. All alternatives would comply with the Nongame and Endangered Species Act.

3.25.4.10 Townsend's Big-Eared Bat

3.25.4.10.1 Analysis Area and Methods

Townsend's big-eared bat population ecology, biology, habitat description, and relationships identified by research are described in Reel *et al.* (1989); Perkins and Schommer (1991); Kunz and Martin (1982); MNHP (2014); Christy and West (1993); Ross (1967); Whitaker *et al.* (1977); Thomas and West (1991); Pierson *et al.* (1999) and Gruver and Kenaith (2006). That information is incorporated by reference. Townsend's big-eared bat occurrence data come from recent District wildlife survey records and KNF historical data (NRIS Wildlife) and the MNHP.

Conservation assessments for Townsend's big-eared bat (Pierson *et al.* 1999, Gruver and Kenaith 2006) provide recommendations for forest management activities such as vegetative conversions and timber harvest. Primary concerns are for the protection of known and potential hibernating/roosting habitat, especially caves and abandoned mines, and maintenance or enhancement of foraging habitat within proximity of these sites. No specific prescriptions for vegetation management are provided as Townsend's big-eared bat forage in a variety of habitats and knowledge of local conditions that may influence use is limited. Habitat edges (both forested and riparian), riparian corridors, and water quality appear beneficial and provide a suitable prey base, drinking opportunities, and movement areas.

The analysis area for the Townsend's big-eared bat is described in section 3.25.1, *Introduction.* The boundaries for determination of population trend and contribution toward population viability are is the KNF.

The impacts analysis includes an evaluation of the potential benefits to Townsend's big-eared bat from mitigation measures proposed by MMC or the agencies, such as implementation of the Vegetation Removal and Disposition Plan (section 2.5.2.5.2*, Vegetation Removal and Disposition Plan*), land acquisition associated with grizzly bear mitigation (sections 2.4.6.3, *Grizzly Bear* and 2.5.7.3.1, *Grizzly Bear*), and the designation of additional old growth habitat (section 2.5.7.3.4, *Key Habitats*).

3.25.4.10.2 Affected Environment

Townsend's big-eared bats are year-round residents of Montana and the KNF and are found in a variety of habitat types from grasslands, shrublands, and forested habitats across the United States. However, availability of suitable hibernating and/or roosting habitat influences local distribution and seasonal use by Townsend's big-eared bat populations. They are highly associated with caves or other cave like rock structures for roosting. Following European settlement, in areas where this habitat is limited Townsend's big-eared bat have been documented to use man-made structures that provide cave like features including abandoned mines, buildings, bridges, and concrete culverts. More recently, they have been documented to also use basal hollows of old growth redwoods for day and maternity roosts (Fellers and Pierson 2002, Mazurek 2004). Townsend's big-eared bats are known to feed along forest edges, and can be associated with either dry or wet type coniferous forests. Tree cavities provide potential roosting habitat for the Townsend's big-eared bat (Perkins and Schommer 1991; MNHP 2014), and preference is shown for old growth forest (Thomas and West 1991). Caves and mines are used as winter hibernacula, day and night roosts, and maternity roosts, and are important habitat for this species (USDA Forest Service 2003b). Young and mature forests are used for feeding (Ibid.), with primary foraging areas near lakes (Grindal 1995). A KNF status summary of the Townsend's big-eared bat was documented by Johnson (1999). During surveys of the KNF conducted from 1993 to 1995 by Hendricks *et al.* (1995, 1996), the species was located in all planning units, but no key roosting sites such as caves or mines were located. The bat population size on the KNF is unknown.

Observations recorded prior to 1997 by the District, Forest, and MNHP have documented the Townsend's big-eared bat within the Crazy and Silverfish PSUs, specifically at Howard Lake and in the Libby Creek Recreational Gold Panning Area on Libby Creek (Westech 2005a). Abandoned mines potentially providing hibernacula are known to exist within the Crazy and Silverfish PSUs, and include the Gloria, Copper Reward, Golden West, and Snowshoe mines (Hargrave *et al.* 1999). Hibernaculum for Townsend's big-eared bats have been documented at an abandoned mine in the Silverfish PSU. As part of the Abandoned Mine Lands Program, the KNF installed grates designed to allow access for bats and claimants while providing for human safety on adits located at the Gloria, Granite Trailhead, Golden West, and American Kootenai mines.

Larger diameter snags or trees in the analysis area may be used for summer roosting. As discussed in section 3.22.2, *Old Growth Ecosystems*, the Crazy PSU contains 16.4 percent designated effective old growth (7,862 acres), and 18.4 percent total old growth (8,815 acres), including both designated and undesignated old growth. The Silverfish PSU contains 10.1 percent designated effective old growth (5,251 acres), and 13.0 percent total old growth (6,789 acres). These stands and the remaining timbered habitat provide suitable roosting habitat in the form of large snags with cavities, as well as abundant foraging habitat across the forest landscape. As described for snag habitat, snag levels are greater than KFP-recommended levels. Existing conditions for cavity habitat are also described for the pileated woodpecker in section 3.25.3, *Management Indicator Species*.

3.25.4.10.3 Environmental Consequences

Alternative 1 – No Mine

There would be no expected change in the existing condition with implementation of Alternative 1. No direct effect to Townsend's habitat would occur. There would be no impacts to roost sites (*e.g.,* caves, mines, old buildings, or large snags). No snags or old growth would be impacted under this alternative. The addition or loss of snags would depend on other factors, such as firewood cutting, wind events, natural attrition, or wildfire. The level of impact from these factors cannot be calculated due to the high uncertainty in predicting occurrence and intensity levels.

Alternative 2 – MMC's Proposed Mine

In Alternative 2, no impacts on potential Townsend's big-eared bat habitat would occur in the Silverfish PSU. Alternative 2 would affect 185 acres of designated old growth and 182 acres of undesignated old growth for a total of 367 acres of old growth habitat affected in the Crazy PSU (Table 179), a 4 percent decrease from the 8,815 acres of total old growth available. Harvest of old growth habitat and losses of other coniferous habitat associated with Alternative 2 would reduce and fragment available day-roosting habitat for the Townsend's big-eared bat in the Crazy PSU. The percentage of old growth in the PSU after mitigation would be 16.5 percent. In Alternative 2, the KNF standards for minimum 10 percent old growth and for snag habitat would be met for both PSUs and the KNF. Impacts on coniferous forest, old growth, and cavity habitat are further described in sections 3.22.2, *Old Growth Ecosystems,* 3.25.2.2, *Snags and Woody Debris,* and 3.25.3, *Management Indicator Species*. Alternative 2 would not affect caves, mines, tunnels, or lakes in either the Crazy or Silverfish PSU. Although Townsend's big-eared bats prefer caves and mines, disturbance or mortality of bats may occur if bats were using a snag that was cut down during construction. The loss of snags providing potential Townsend's big-eared bat roosting habitat resulting from Alternative 2 would have negligible to minor impacts on this bat, given the existing snag levels and the bat's preference for cave habitat (see section 3.25.2.2, *Snags and Woody Debris*).

Indirect impacts to Townsend's big-eared bats would include potential mortality of injury from collision with haul trucks, contaminant uptake of mine, adit, or tailings water at ponds, and displacement or altered behavior caused by noise. If bats drank from mine, adit, or tailings water or foraged on insects with increased metal loading, they risk ingesting toxins and heavy metals, which may result in reduced reproductive ability or increased mortality (O'Shea *et al.* 2000). The metals in the water would be similar to what is found at the Troy Mine decant ponds (see Table 120 in the *Water Quality* section), where adverse effects on wildlife have not been observed (USDA Forest Service and DEQ 2012). Concentrations of metals in mine and adit water, which would be stored in mine/yard pond at the Ramsey Plant Site and in a surge pond at the LAD Areas, would be lower than tailings water (see Table 120 in the *Water Quality* section).

Mine traffic, particularly large, nighttime traffic in riparian areas, may collide with foraging Townsend's big-eared bats, increasing injury or mortality. MMC would limit concentrate haulage to daylight hours during the day shift (0800 to 1630), which would minimize vehicular-bat collisions during the early morning, evening and night time-periods. During the Construction Phase, waste rock would be hauled to the LAD Areas and the tailings impoundment. Noise and other disturbances, such as blasting, construction of the plant and adit sites, road construction and use, and plant and adit operations may cause Townsend's big-eared bats to avoid nearby habitat, at least temporarily. Disturbance impacts would likely be greatest during the Construction Phase, but may persist through mine operations.

Acquisition of 2,758 acres of private land associated with grizzly bear habitat mitigation would provide additional old growth habitat if bat habitat were present on the acquired parcels. Alternative 2 would not affect caves, mines, tunnels, or lakes in either the Crazy or Silverfish PSU. Although some individual Townsend's big-eared bats may be impacted by Alternative 2, given the availability of surrounding snags and old growth habitat, the proposed project is not expected to reduce local bat populations.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative and Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Impacts on Townsend's big-eared bat from Alternatives 3 and 4 would be similar to Alternative 2. Alternative 3 would affect 228 acres of designated old growth and 8 acres of undesignated old growth, for a total of 236 acres of old growth habitat in the Crazy PSU. Alternative 4 would have the least effect on old growth habitat of the mine alternatives, affecting 82 acres of designated old growth and 132 acres of undesignated old growth, for a total of 214 acres of old growth habitat in the Crazy PSU (Table 179).

Impacts on potential Townsend's big-eared bat habitat would be minimized through implementation of mitigation measures. Bats would be at less risk of contaminant uptake from storage of mine, adit, and tailings water in Alternatives 3 and 4. All mine and adit water would be treated and discharged at the Libby Adit Water Treatment Plant and not stored in ponds. The LAD Areas would not be used and the surge ponds would not pose a risk to bats. Tailings water quality would have lower metal concentrations than in Alternative 2; the factors leading to lower metal concentrations in tailings water quality in Alternatives 3 and 4 are discussed in the *Water Quality* section, p. 674.

MMC would leave snags within the disturbance area of the Alternatives 3 or 4, unless required to be removed for safety or operational reasons. This mitigation would be incorporated into the Vegetation Removal and Disposition Plan (section 2.5.2.5.2, *Vegetation Removal and Disposition Plan*). Additional areas of old growth would be managed to retain or develop old growth characteristics (see section 2.5.7.3.4, *Key Habitats* and subsequent discussion of combined mine-transmission line alternatives). The agencies' land acquisition requirement of 5,387 acres (Alternative 3) or 6,151 acres (Alternative 4) of private land (section 2.5.7.3.1, *Grizzly Bear*) would likely be more effective at improving bat habitat because more land would be protected. Although some individual may be impacted by Alternatives 3 and 4, given the availability of surrounding habitat and that no impacts on key roosting habitat or potential hibernacula such as caves, mines, or buildings would occur, Alternative B would not reduce local Townsend's big-eared bat populations.

Alternative A – No Transmission Line

Alternative A would not physically affect cavity habitat or populations of Townsend's big-eared bat. The addition or loss of snags would depend on other factors, such as firewood cutting, wind events, natural attrition, or wildfire. The level of impact from these factors cannot be calculated due to the high uncertainty in predicting occurrence and intensity levels.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Alternative B would have the greatest impact on old growth habitat of the transmission line alternatives, affecting 20 acres of designated old growth in the Crazy PSU (Table 180). Seven acres of undesignated old growth would be affected by Alternative B. Two acres of undesignated old growth would be affected by Alternative B in the Silverfish PSU. Designated old growth in the Silverfish PSU would not be affected by Alternative B. Harvest of 27 acres of old growth habitat associated with Alternative B would reduce available day-roosting habitat for Townsend's big-eared bat in the Crazy PSU by 0.3 percent of the total old growth available (8,815 acres) in the Crazy PSU. In Alternative B, designated old growth in the Crazy PSU after mitigation would be 17.2 percent, exceeding the KNF standards for 10 percent old growth and for snag habitat for both PSUs and the KNF. Alternative B would remove about 4 acres of old growth providing potential roosting habitat on private land along the Fisher River and a short portion of Miller Creek. Construction of the Sedlak Park Substation and loop line would not affect Townsend's big-eared bat due to lack of suitable habitat. Impacts on old growth are described in sections 3.22, *Vegetation* and 3.25.3*, Management Indicator Species*. Disturbance or mortality of bats may occur if bats were using a snag that was cut down during line construction.

Noise from helicopters during line stringing and from other construction-related activities may cause Townsend's big-eared bats to avoid nearby habitat, at least temporarily. Disturbance impacts would be short-term and, with the exception of line maintenance activities, would cease after transmission line construction. None of the transmission line alternatives would affect caves, mines, tunnels, or lakes in either the Crazy or Silverfish PSU. Although some individual may be impacted by Alternative B, given the availability of surrounding habitat and that no impacts on key roosting habitat or potential hibernacula such as caves, mines, or buildings would occur, Alternative B would not reduce local Townsend's big-eared bat populations.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

For Alternative C-R, no designated old growth habitat would be removed in the Crazy PSU, and 4 acres would be removed in the Silverfish PSU (Table 180; Table 181). No undesignated old growth would be removed by Alternative C-R in the Crazy PSU, while 2 acres of undesignated old growth in the Silverfish PSU would be affected. Six acres of old growth potentially providing bat habitat on private land would be impacted by Alternative C-R. Construction of the Sedlak Park Substation and loop line would not affect Townsend's big-eared bat due to lack of suitable habitat. Impacts on potential Townsend's big-eared bat roosting habitat also would be minimized through implementation of mitigation measures. MMC would leave snags within the clearing width of Alternatives C-R, D-R, and E-R, unless required to be removed for safety or operational reasons. This mitigation would be incorporated into the Vegetation Removal and Disposition Plan (section 2.5.2.5.2). Although some individual may be impacted by Alternative C-R, given the availability of surrounding habitat and that no impacts on key roosting habitat or potential hibernacula such as caves, mines, or buildings would occur, Alternative B would not reduce local Townsend's big-eared bat populations.

Alternative D-R – Miller Creek Transmission Line Alternative

Impacts on the Townsend's big-eared bat from Alternative D-R would be the same as Alternative C-R, except four acres of old growth would be impacted by Alternative D-R. The agencies' mitigation would be similar to Alternative C-R; designation of additional areas of old growth that would be managed to retain or develop old growth characteristics would vary by alternative (see section 2.5.7.3.4, *Key Habitats* and subsequent discussion of combined mine-transmission line alternatives).

Alternative E-R – West Fisher Creek Transmission Line Alternative

Impacts on the Townsend's big-eared bat from Alternative E-R would be the same as Alternative C-R, except that no old growth potentially providing roosting habitat would be removed in the Crazy or Silverfish PSU. Seven acres of old growth habitat would be impacted on private and State land where the transmission line would cross the Fisher River and parallel West Fisher Creek. Construction of the Sedlak Park Substation and loop line would not affect Townsend's big-eared bat due to lack of suitable habitat. The agencies' mitigation would be similar to Alternative C-R; designation of additional areas of old growth that would be managed to retain or develop old growth characteristics would vary by alternative (see section 2.5.7.3.4, *Key Habitats* and subsequent discussion of combined mine-transmission line alternatives).

Combined Mine-Transmission Line Effects

Impacts on old growth from combined mine and transmission line alternatives before mitigation would be the greatest (395 acres of old growth removed in the Crazy and Silverfish PSUs) for MMC's proposed alternative (Alternative 2B). Old growth removed in the Crazy and Silverfish PSUs for the agencies' alternatives (Alternatives 3C, 3D, 3E, 4C, 4D, and 4E), including private and State land, would range from 214 acres for Alternative 4E-R to 242 acres for Alternatives 3C-R. Indirect impacts to Townsend's big-eared bats, such potential mortality of injury from collision with haul trucks, contaminant uptake of mine, adit, or tailings water at ponds, and displacement or altered behavior caused by noise, would be the same as described for the individual mine and transmission line alternatives. Construction of the Sedlak Park Substation and loop line would not affect Townsend's big-eared bat due to lack of suitable habitat.

The agencies' alternatives would include mitigation for impacts on old growth, such as the designation of additional old growth on National Forest System lands (shown in (Table 32) and implementation of the Environmental Specifications and Vegetation Removal and Disposition Plan. Designation of additional areas of old growth would range from 857 acres in Alternative 4C-R to 802 acres in Alternative 3E-R. Designation of additional areas of old growth would not create new old growth, but would ensure that these areas are managed to retain or develop old growth characteristics. In all combined mine-transmission line alternatives, the KNF standards for minimum 10 percent old growth would be exceeded for both PSUs. Percent designated old growth in the Crazy PSU would decrease from 16.8 percent to 16.4 percent in Alternative 2B and increase to about 18 percent in the agencies' combined alternatives. Percent designated old growth in the Silverfish PSU would be 13.6 or 13.7 percent in all alternatives. Impacts on coniferous forest and old growth are described in sections 3.22.2, *Old Growth Ecosystems* and 3.25.3*, Management Indicator Species*. The loss of snags providing potential Townsend's big-eared bat roosting habitat resulting from the combined action alternatives would have minor impacts on this bat, given the existing snag levels (see section 3.25.2.2, *Snags and Woody Debris*). None of the combined mine-transmission line alternatives would affect caves, mines, tunnels, or lakes in either the Crazy or Silverfish PSU. Although some individual Townsend's big-eared bats may be impacted by the combined action alternatives, given the availability of surrounding habitat, all combined mine-transmission line alternatives would not reduce local bat populations.

Cumulative Effects

Past actions are described in section 3.2, *Past and Current Actions*, shown on Figure 50, and listed in Appendix E. Past actions, particularly timber harvest, road construction, and fire-suppression activities, have altered the old growth ecosystems in the analysis area, resulting in a reduction in early and late succession habitats; conditions favoring shade-tolerant, fire-intolerant species; loss of large snags and down wood; and increases in tree density and a shift to a largely mid-seral structural stage (USDA Forest Service 2003b). Firewood cutting would continue to occur where open roads provide access to old growth habitat, contributing removal of snags important to Townsend's big-eared bats. Continuing development of private lands, including timber harvest, home construction, and land clearing would contribute to losses of bat habitat in the analysis area. Impacts on Townsend's big-eared bats on private and State lands would probably be minimal because it is likely that limited amounts of old growth occur on private and State lands, based on past and current harvest practices. Alternative 1A would not have cumulative impacts on the Townsend's big-eared bat or its habitat.

Activities associated with the Miller-West Fisher Vegetation Management Project, the Coyote Improvement Vegetation Management Project, and the Silverbutte Bugs timber sale, which would occur in the Silverfish PSU, would not directly affect old growth providing potential Townsend's big-eared bat habitat. While the combined action alternatives, in combination with other past, current, and reasonably foreseeable actions, would result in some losses and degradation of bat habitat, cumulative impacts on overall areas of old growth would likely be minimal. In addition, mitigation associated with combined agencies' alternatives would increase the proportion of designated old growth and promote the maintenance or development of old growth providing Townsend's big-eared bat habitat in the analysis area.

Cumulative noise and other disturbances may occur as a result of the combined action alternatives and other reasonably foreseeable actions. Cumulative disturbance effects may affect individual Townsend's big-eared bats, but would not likely affect their populations in the KNF.

Cumulatively, the timber harvest activities on public and private lands and the removal of dead standing trees, as well as the removal of live trees with cavities (depending on their diameter) may reduce potential summer roosting sites for the Townsend's big-eared bat in other parts of the analysis area. No direct cumulative effects on key hibernacula would occur.

None of the action alternatives would change the existing PPI for the MIS for cavity-nesting species, and would not likely contribute to cumulative effects on Townsend's big-eared bats or their habitat. The existing snag levels are greater than KFP-recommended levels. Cumulatively, with all other reasonably foreseeable actions on private and corporate lands considered, sufficient cavity habitat would remain in the Crazy and Silverfish PSUs and the KNF to maintain existing Townsend's big-eared bat populations.

Regulatory/Forest Plan Consistency

Organic Administration Act and Forest Service Locatable Minerals Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources and to take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations. Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8. In these alternatives, MMC did not propose to implement feasible measures to minimize effects on the

Townsend's big-eared bat or practicable measures to maintain and protect wildlife habitat. The agencies' alternatives (Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R) would incorporate feasible and practicable measures to minimize adverse environmental impacts on the mountain and wildlife habitat. These measures would include eliminating storage of mine and adit water, eliminating use of the LAD Areas and their associated surge pond, requiring a water management plan that would reduce tailings water concentrations, implementing the Environmental Specifications and a Vegetation Removal and Disposition Plan, and designating additional areas of old growth.

National Forest Management Act/Kootenai Forest Plan

KFP direction is to "maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species,… in sufficient quality and quantity to maintain viable populations" (KFP Vol. 1, II-1 #7). All combined action alternatives may impact individual Townsend's big-eared bats or their habitat, but would not likely contribute to a trend toward federal listing. Townsend's big-eared bats have been observed in the analysis area, old growth and riparian habitats would be maintained, and openings in the canopy layer and resultant edge habitat would improve foraging opportunities. All action alternatives would be consistent with KFP direction to maintain a minimum of 10 percent old growth below 5,500 feet in elevation in each third order drainage or compartment, or a combination of compartments.

All alternatives are consistent with KFP direction for snags, snag replacement trees, and down wood (KFP Vol. 1, II-1 #8 and II-7; Vol. 2, Appendix 16). See section 3.25.2.2, *Snags and Woody Debris*.

Forest Service Sensitive Species Statement of Findings

The no action alternatives would not impact individual Townsend's big-eared bats or their habitat within the analysis area, and would not contribute to a trend toward federal listing or cause a loss of viability to the population or species. ***Implementation of the action alternatives result in a determination of may impact individuals or their habitat, but will not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species for Townsend's big-eared bats.*** This determination is based on: 1) none of the combined mine-transmission line alternatives would affect key roosting habitat or potential hibernacula such as caves, mines, or buildings, 2) timber harvest activities associated with the combined action alternatives would reduce potential summer roosting sites for the Townsend's big-eared bat, but impacts would be too small to change the existing PPI for pileated woodpecker, the MIS for cavity-nesting species; and 3) snag levels would continue to be greater than KFP-recommended levels and sufficient cavity habitat would remain in the Crazy and Silverfish PSUs and the KNF to provide roosting habitat for Townsend's big-eared bat populations; and 4) a forested environment suitable for foraging would remain well distributed across the Crazy and Silverfish PSUs and the KNF.

State Requirements

Alternatives 3 and 4 would comply with the MMRA regarding disturbed lands being reclaimed to a post-mining land use with stability and utility comparable to that of the pre-mining landscape. Draft findings regarding compliance with MFSA requirements are discussed in the Summary, beginning on p. S-53.

3.25.4.11 Western Toad

3.25.4.11.1 *Analysis Area and Methods*

Western toad ecology, biology, habitat use, status, and conservation are described and summarized in Maxell *et al*. (2009), Maxell (2000) and Reichel and Flath (1995). That information is incorporated by reference. Western toad occurrence data come from District wildlife observation records and KNF historical data (NRIS Wildlife) and other agencies (MNHP).

Criteria used to compare the alternative impacts on the western toad and its habitat includes impacts on known breeding/rearing habitat, potential breeding habitat, and potential upland foraging habitat. In the analysis area, potential breeding habitat is represented by wetlands and aquatic habitat, as described in sections 3.6, *Aquatic Life and Fisheries* and 3.23, *Wetlands and Other Waters of the U.S*.

Suitable aquatic breeding habitat for western toads was determined by selecting ponds, lakes, seeps and springs, and low gradient (less than 7 percent) perennial streams and rivers. All KNF wetlands and all project specific wetlands and streams were buffered by 2,000 meters. The KNF provided terrestrial habitat broken into “High Quality” and “Other Potential” habitat categories, which were analyzed within the aquatic habitat.

The analysis area for the western toad is described in section 3.25.1, *Introduction.* The area for determination of population trend and contribution toward population viability is the KNF.

3.25.4.11.2 *Affected Environment*

Western toads are largely terrestrial species that are found in a wide variety of habitats including wetlands, forests, woodlands, meadows, and floodplains in the mountains and mountain valleys. They are aquatic species only during the short breeding/rearing season. Western toads require over-wintering, breeding/rearing, and foraging habitat, and may also be dependent on habitats suitable for migration if the three required habitat types are isolated spatially. Over-wintering may take place in underground caverns or in rodent burrows, breeding/rearing takes place in aquatic sites such as shallow areas of large and small lakes or temporary ponds, and foraging habitat consists largely of terrestrial uplands (Maxell 2000). Research by Bartelt and Peterson (1994) showed that western toad movement in foraging areas was significantly influenced by the distribution of shrub cover and toads may have avoided macrohabitats (*e.g.*, forested stand, shrub fields, meadow) with little or no canopy or shrub cover. In Montana, the species has been documented to occur as high as 9,220 feet in elevation.

Quantitative data regarding the western toad’s use of upland and forested habitats are limited. Western toads are known to migrate between the aquatic breeding and terrestrial non-breeding habitats (NatureServe 2012). Movement of toads between breeding sites has been documented from 1.6 miles to greater than 3 miles (Corn *et al.* 1998; Bartelt and Peterson 1994). Movement in foraging areas may be influenced by the distribution of shrub cover, and toads may avoid habitats with low canopy closure and shrub cover, such as clearcuts. Down wood may be important in providing refugia for this species (Bartelt and Peterson 1994).

According to the KNF status summary of the western toad (Johnson 1999), the species has been found in seven of the eight planning units in the KNF. The population size is unknown and direct measures of population trend on the KNF are not available. About 35 breeding sites were verified in the KNF between 1995 and 1998 (Johnson 1999).

Results of annual District surveys have not identified any breeding sites in the Crazy or Silverfish PSUs (Johnson 1999). Observation from the late 1980s and early 1990s suggest that western toad breeding may be present in the Little Cherry Creek drainage (Westech 2005a). In 2007, one adult western toad was found in the Poorman Tailings Impoundment Site in the Crazy PSU (Geomatrix 2009b). Potential breeding habitat is present in the Crazy and Silverfish PSUs in aquatic and wetland habitats, including temporal ponds or road ditches. Upland terrestrial habitat providing relatively good shrub or forest cover within the Crazy and Silverfish PSUs is considered potential foraging habitat. About 62,751 and 66,467 acres of upland terrestrial western toad habitat occur in the Crazy and Silverfish PSUs, respectively.

The majority of the private and State lands in the analysis area have high road densities and have been logged in the past 20 to 30 years, resulting in fragmented coniferous. Vegetation communities in the analysis area, including private and State land, are shown on Figure 85.

3.25.4.11.3 *Environmental Consequences*

Alternative 1 – No Mine

Alternative 1 would not disturb the western toad or their habitat and would have no effect on this species. Natural successional processes would continue to occur within the upland habitat being used by western toads for foraging and over-wintering habitat. No impacts to riparian areas and breeding/rearing habitat would occur. In the short-term, the toad's use of these habitats would continue at current levels.

However, plant succession would continue on many of the sites and would result in an increasing canopy closure that may not be used as frequently by western toads. Greater fuel accumulations would result in a greater potential for a high severity fire throughout the analysis area, including streamside riparian habitats. Western toads have been reported to use burned areas in the year following fires in western Montana (Guscio 2007; Hossack and Corn 2007) even in high severity burn areas (Guscio 2007). This included colonization of wetlands for breeding use where they had not been documented before (Hossack and Corn 2007). Burned forests may improve thermal conditions (*e.g.,* warmer environment) that may result in physical benefits to the toad (Hossack *et al*. 2009). Although fire appears to provide habitats that benefit western toads there also seem to be some limitations. A high severity wildfire that reduces the overstory vegetation along aquatic breeding habitats could alter the wetland habitat and make it unsuitable for western toads (Hossack and Corn 2008). Additionally, greater exposure and warmer temperatures increases the risk for evaporative water loss. Western toads showed a changed in use from high severity to partially burned habitats during summer where more cover and greater moisture occurred, likely reducing the risk for water loss (Guscio *et al*. 2008, Hossack *et al*. 2009). Therefore, an extensive high severity fire in both riparian and upland terrestrial habitats could impact the suitability, at least seasonally, of large areas for western toads.

Alternative 2 – MMC's Proposed Mine

Threats to the western toad from the proposed mine include forest clearing for mine facilities, road construction and maintenance, vehicle use on roads, environmental contaminants, and isolation of populations through habitat fragmentation. Alternative 2 would disturb 2 acres of high quality western toad habitat (Table 223). The effects on streams that may provide potential western toad habitat are discussed in sections 3.6, *Aquatic Life and Fisheries* and 3.23, *Wetlands and Other Waters of the U.S.* The feasibility of MMC's proposed Wetland Mitigation Plan to replace the lost functions of all potentially affected wetlands that provide toad habitat is uncertain. MMC's plan is conceptual and would be refined during the 404 permitting process. MMC did not update its mitigation plan for Alternative 2 to reflect new wetland and stream mitigation regulations and procedures. Section 3.23, *Wetlands and Other Waters of the U.S.*, discusses proposed wetland mitigation in more detail. About 2,234 acres of other potential habitat, including upland foraging habitat, would be disturbed by Alternative 2, primarily in the tailings impoundment area (Table 223). Impacted potential habitat would represent about 4.9 percent of the total habitat available in the Crazy PSU. Some down wood and wintering habitat also would be lost as a result of Alternative 2. Relative to existing habitat and down wood, these losses would have minor impacts on the western toad.

Table 223. Available Western Toad Habitat and Potential Effects in the Analysis Area by Mine Alternative.

Measurement Criteria	[1] No Mine Existing Condition	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impound-ment	[4] Agency Mitigated Little Cherry Creek Impound-ment
Crazy PSU				
High quality habitat (acres)	6.970	6,968 (2/<0.1)	6,969 (1/<0.1)	6,969 (1/<0.1)
Other potential habitat (acres)	46,021	43,787 (2,234/4.9)	44,556 (1,465/3.2)	44,431 (1,590/3.5)
Silverfish PSU				
High quality habitat (acres)	2,308	2,308 (0/0)	2,308 (0/0)	2,308 (0/0)
Other potential habitat (acres)	53,950	53,950 (0/0)	53,950 (0/0)	53,950 (0/0)

Number in parentheses is the reduction in habitat acres/percentage compared to existing conditions.

The fragmentation of natural habitats from timber harvesting and road building may impede dispersal and decrease the probability of wetland recolonization by amphibians (Semlitsch 2000). Western toads are considered terrestrial habitat generalists (deMaynadier and Hunter 1998) and tend to be more tolerant than some amphibians of forest edges, tree harvests, and declining patch size (Renken *et al.* 2004).

About 10 miles of the Bear Creek Road (NFS road #278), from US 2 to the Bear Creek bridge, would be widened on its existing alignment and chip-sealed. The roadway width would be 20 to 29 feet wide and designed to handle speeds of 35 to 45 mph. The disturbed area, included ditches and cut-and-fill slopes, is expected to be up to 100 feet wide. Because the Bear Creek Road would be chip-sealed, use of mine or adit water and/or chemical stabilizers for dust suppression along the Bear Creek Road would be unlikely. Widening and improvement of the Bear Creek Road would affect 0.2 acres of wetlands along the road (see Table 184 in the *Wetlands and Other Waters of the U.S.* section) and may remove small area of potential western toad habitat. Some incidental mortality may occur due to forest clearing and increased traffic associated with Alternative 2.

MMC would store mine, adit, or tailings water at the Ramsey Plant Site, a surge pond at the LAD Areas, and the tailings impoundment. The metals in the tailings water would be similar to what is found at the Troy Mine decant ponds (see Table 120 in the *Water Quality* section), where adverse effects on wildlife have not been observed (USDA Forest Service and DEQ 2012). Concentrations of metals in mine and adit water, which would be stored in mine/yard pond at the Ramsey Plant Site and in a surge pond at the LAD Areas, would be lower than tailings water (see Table 120 in the *Water Quality* section).

Alternative 2 would disturb 266 acres within Riparian Habitat Conservation Areas (RHCAs) on National Forest System land; 152 acres of other riparian areas on private land would be disturbed (Table 74). Portions of LAD Area 2, the tailings impoundment, the Ramsey Plant Site, and the Libby Adit would be within RHCAs or riparian areas on private land under this alternative (Figure 53). Roads would be constructed or reconstructed within the RHCAs of Little Cherry, Libby, Bear, Poorman, and Ramsey creeks, as well as other unnamed tributaries. Adverse direct effects on toad habitat could occur where roads and facilities were constructed in RHCAs and particularly where roads crossed streams, but the design features and BMPs to be implemented In Alternative 2 would minimize such effects (MMI 2006). Most of the roads planned for reconstruction are existing roads that cross a RHCA only at a stream crossing, but segments of existing roads parallel the RHCAs along Ramsey and Libby creeks.

The KNF's analysis of sediment erosion from roads to streams (KNF 2013) indicates that 79 tons of sediment would be generated during the project in the combined Evaluation, Construction, and Operations Phases in Alternative 2 with BMPs (Table 125, p. 693). This would be a 52-percent decrease from the 163.5 tons of sediment estimated to be produced under existing conditions without the project over the same time frame. The highest percentage of reductions would occur in the Construction Phase. While substantially less sediment is predicted to be delivered overall to analysis area streams from roads under the alternatives than under existing conditions, temporary increases in sediment input would occur at some locations. Any sedimentation that were to occur from roads, sediment pond overflows, or other sources would have the potential to alter western toad habitat by decreasing pool depth and habitat complexity, changing substrate composition by filling in interstitial spaces, and increasing substrate embeddedness (Rieman and McIntyre 1993; Waters 1995). One of the fisheries mitigation projects proposed by MMC would be to conduct a sediment-source inventory in the watershed, and stabilize, recontour, and revegetate priority source areas, which are typically roadcuts in Libby, Hoodoo, Poorman, Midas, and Crazyman creeks. If implemented, this project would reduce the contribution of sediment from priority source areas to the Libby Creek watershed. Because specific priority source areas have not been identified, the effects of the mitigation were not quantified.

Increases in water temperature as a result of Alternative 2 are not anticipated. Mine inflows, discharges, and stream diversions projected for Alternative 2 may change lake levels and streamflows. Flow in Little Cherry Creek would be substantially less, reducing or eliminating western toad breeding may be present in the Little Cherry Creek drainage (Westech 2005a).

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Direct impacts on western toad from Alternative 3 would be less than Alternative 2, affecting less high quality habitat (1 acre) and less upland foraging habitat (1,465 acres) or about 3.2 percent of the habitat available (Table 223). Impacts on wetlands would be mitigated through implementation of the agencies' Wetland Mitigation Plan, which would have a greater likelihood of replacing lost functions than the Alternative 2 Wetland Mitigation Plan. The direct effect on the toad from increased traffic would be the same as Alternative 2.

As with Alternative 2, the Libby Creek watershed would be at risk due to short-term impacts from increased sediment. Potential sediment impacts would be reduced in Alternative 3 compared to Alternative 2, but would affect toad populations through the same mechanisms as discussed for that alternative. The locations and structures of the plant and impoundment site in Alternative 3 would decrease disturbance within RHCAs. Alternative 3 would affect 256 acres of RHCAs on National Forest System land and 9 acres of other riparian areas on private land, substantially less than Alternative 2 (Table 74). Because RHCAs are designed to act as a buffer to protect the streams from sediment as well as other impacts (Belt *et al.*1992), fewer disturbances within these areas would reduce the amount of sediment that would reach the streams, particularly during the Construction Phase when sediment impacts have the greatest probability of occurring. Based on the KNF's analysis (Table 125) (KNF 2013), 136.5 tons of sediment would be delivered to analysis area streams from roads over the 25-year period included in the Evaluation, Construction, and Operations Phases, which would be a reduction of 194.0 tons (59 percent) from what was estimated for existing conditions under the same time frame. The tons of sediment predicted to be delivered from roads to streams cannot be compared directly between alternatives as the roads proposed for use under each alternative would different but the percentage decrease from existing conditions is greater In Alternative 3 than Alternative 2 by 7 percent.

Water management in Alternatives 3 and 4 would reduce the risk to wildlife from contaminant uptake from storage of mine, adit, and tailings water. All mine and adit water would be treated and discharged at the Libby Adit Water Treatment Plant and not stored in ponds. The LAD Areas would not be used and the surge ponds would not pose a risk to white-tailed deer. Tailings water quality would have lower metal concentrations than in Alternative 2; the factors leading to lower metal concentrations in tailings water quality in Alternatives 3 and 4 are discussed in section 3.13, *Water Quality*, p. 674.

The flow in the four drainages below impoundment at the Poorman site would be substantially reduced, reducing or eliminating western toad habitat present in the Poorman Tailings Impoundment Site (Geomatrix 2009b). Flow in Little Cherry Creek also would be reduced (by an estimated 19 percent), reducing toad habitat in that stream. Other indirect effects on the toad from water temperature, mine inflows, discharges, and stream diversions would be the same as Alternative 2.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Impacts on potential western toad breeding habitat from Alternative 4 would be about the same as Alternative 2, but Alternative 4 would affect slightly more other potential habitat (1,590 acres) or 3.5 percent of the habitat available (Table 223). Impacts on wetlands would be mitigated through implementation of the agencies' Wetland Mitigation Plan, which would have a greater likelihood of replacing lost functions than the Alternative 2 Wetland Mitigation Plan.

In general, potential sediment impacts would be reduced in Alternative 4 compared to Alternative 2, but would be similar or greater than those predicted for Alternative 3. In Alternative 4, the permit and disturbance boundaries for the Little Cherry Creek Tailings Impoundment Site would be modified to reduce effects on RHCAs in this drainage in comparison to Alternative 2. Alternative 4 would affect 236 acres of RHCAs on National Forest System land and 147 acres of other riparian areas on private land (Table 74). Because RHCAs are designed to act as buffers to protect the streams from sediment as well as other impacts (Belt *et al.* 1992), fewer disturbances within these areas would reduce the amount of sediment that would reach the streams, particularly during the Construction Phase when the sedimentation impacts associated with the mine facilities are expected to be the most severe.

The mitigation plans for Alternative 4 regarding sediment reduction would be the same as Alternative 3. Proposed road BMPs, road closure mitigation, and implementation of sediment abatement and instream stabilization measures designed to reduce sediment contribution from the identified sediment sources would substantially reduce the contribution of sediment over the long-term to most analysis area streams within the Libby Creek watershed (KNF 2013). The estimated sediment delivery from roads to analysis area streams for the Evaluation, Construction, and Operations Phases would be 140.7 tons, compared to 335.3 tons under existing conditions, which would be a 58 percent decrease (Table 125, p. 693). The percentage decrease would be greater than that predicted to occur in Alternative 2 and similar to Alternative 3.

The Diversion Channel in Alternative 4 would be constructed to minimize erosion and effect on toad habitat in Drainages 5 and 10. Some periodic increases in sediment in the lower channels and Libby Creek would occur, particularly during storm events. These increases is expected to only persist in the short term because much of the sediment would likely be flushed out of the upper Libby Creek drainage by the high flows.

Alternative A – No Transmission Line

Alternative A would not affect the western toad and would have the same effect as Alternative 1.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

The clearing area for Alternative B would include about 11 total acres of western toad high quality habitat in the Crazy and Silverfish PSUs and no high quality western toad habitat on private land. About 175 acres of other potential western toad habitat in the Crazy and Silverfish PSUs and 26 acres of other potential habitat on private land would be disturbed by Alternative B, which represents less than 1 percent of the total foraging habitat available (Table 224). Construction of the Sedlak Park Substation and loop line would not affect the western toad due to lack of suitable habitat. The effects on streams that may provide potential western toad habitat are discussed in sections 3.6, *Aquatic Life and Fisheries* and 3.23, *Wetlands and Other Waters of the U.S.* Direct effects to wetlands are expected to be avoided by placement and location of transmission line facilities and roads outside of wetlands and streams. Less than 0.1 acre of wetlands and streams would be affected by new or upgraded road construction.

Alternative B would disturb 8.9 acres for new access roads or roads with high upgrade requirements on soils having severe erosion risk, the majority of which occur along Libby and Miller creeks and Fisher River (see Table 166, p. 855). Most soils with high sediment delivery potential disturbed by access roads occur along Ramsey, Libby, and Miller creeks and Fisher River (Figure 84). Clearing vegetation, constructing new roads, and upgrading roads in Alternative B would disturb 30 acres of RHCAs on National Forest System land and 35 acres of other riparian areas on private land (Table 78). Some sediment increases would occur, particularly during periods of high activity or large storm events, potentially affecting toad habitat. Transmission line maintenance may periodically result in short-term minor sediment increases to streams at locations where the transmission line was located adjacent to or crossed streams. Transmission line decommissioning also may result in a short-term sediment increases to streams that may temporarily affect toad habitat. Relative to existing habitat and availability of down

Table 224. Available Western Toad Habitat and Potential Effects in the Analysis Area by Transmission Line Alternative.

Measurement Criteria	[A] No Trans-mission Line	[B] North Miller Creek	[C-R] Modified North Miller Creek	[D-R] Miller Creek	[E-R] West Fisher Creek
Crazy PSU					
High quality habitat (acres/%)	6,970	6,966 (4/<0.1%)	6,970 (0/0%)	6,970 (0/0%)	6,970 (0/0%)
Other potential habitat (acres/%)	46,021	45,911 (110/0.2%)	45,948 (73/0.2%)	45,949 (72/0.2%)	45,949 (72/0.2%)
Silverfish PSU					
High quality habitat (acres/%)	2,308	2,301 (7/0.1%)	2,292 (16/0.2%)	2,288 (20/0.2%)	2,305 3/0.1%)
Other potential habitat (acres/%)	53,950	53.885 (65/0.1%)	53,826 (124/0.2%)	53,820 9130/0.2%)	53,823 (127/0.2%)
Private and State Land					
High quality habitat (acres/%)	206	206 (0/0%)	206 (0/0%)	206 (0/0%)	20 (0/0%)
Other potential habitat (acres/%)	13,328	13,302 (26/0.2%)	13,293 (35/0.3 0%)	13,293 (35/0.3 0%)	13,265 (63/0.5%)

Number in parentheses is the reduction in habitat acres/percentage compared to existing conditions.

wood in both high quality and other potential habitat, these losses would have minor impacts on the western toad.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

Impacts on the western toad from Alternative C-R would be less than Alternative B, affecting less high quality habitat. The clearing area for Alternative C-R would include about 16 acres of high quality habitat in the Crazy and Silverfish PSUs or less than 1 acre of the habitat available and no high quality habitat would be disturbed on private land. More other potential western toad habitat, including upland foraging habitat, would be disturbed by Alternative C-R than Alternative B in the Crazy and Silverfish PSUs (197 acres instead of 175 acres), as well as on private land (35 acres instead of 26 acres) (Table 224). Construction of the Sedlak Park Substation and loop line would not affect the western toad due to lack of suitable habitat. Fewer miles of new access roads would be constructed for Alternative C-R than Alternative B, and the potential for stream sedimentation would be lower. New access roads and closed roads with high upgrade requirements in Alternative C-R would disturb 3.1 acres of soils having severe erosion risk, and 0.5 acres of soils with high sediment delivery potential (see Table 166, p. 855). Most soils having severe erosion risk along access roads occur along Libby Creek in the extreme western portion of the transmission line, along Miller and West Fisher creeks, and near the Fisher River crossing (Figure 84). Soils having high sediment delivery potential along access roads occur along Libby and Miller creeks and along the Fisher River. Most soils having potential for slope failure along access roads occur just east of Libby Creek, along Miller Creek and east of Fisher River. Some sediment increases may occur, particularly during periods of high activity or large storm events.

Alternative C-R would disturb 24 acres of RHCAs on National Forest System land and 13 acres of other riparian areas on private land (Table 78). Based on a preliminary design, four structures would be in a RHCA on National Forest System land and three structures would be in a riparian area on private land. During final design, MMC would locate these structures outside riparian areas if alternative locations were technically and economically feasible. Minimizing structure locations in riparian areas, decommissioning new access roads on National Forest System land after construction and using a helicopter for line stringing, logging, and line decommissioning would reduce potential contributions of sediment to area streams and toad habitat.

Implementation of the agencies' Vegetation Removal and Disposition Plan and the Environmental Specifications (Appendix D) also would help minimize impacts on western toad breeding habitat. The effect of transmission line maintenance and decommissioning would be similar to Alternative B.

Alternative D-R – Miller Creek Transmission Line Alternative

Impacts of Alternative D-R on western toad would be the same as Alternative C-R, except that slightly more other potential habitat would be disturbed (202 acres instead of 197 acres) (Table 224). Construction of the Sedlak Park Substation and loop line would not affect the western toad due to lack of suitable habitat. Alternative D-R would require 5.1 miles of new roads (Table 77). This alignment also would cross less area with soils that are highly erosive and subject to high sediment delivery and slope failure than Alternative B (see Table 166, p. 855). New access roads and closed roads with high upgrade requirements would disturb 2.6 acres of soils having severe erosion risk, and 0.5 acres of soils with high sediment delivery potential. Most of the soils having severe erosion risk that would be crossed by access roads occur along West Fisher Creek and the Fisher River. The majority of soils with high sediment delivery potential along access roads occur along Libby Creek and the Fisher River (Figure 84).

Disturbance within riparian areas would be less than Alternative B, with 35 acres of RHCAs on National Forest System land and 13 acres of other riparian areas on private land (Table 78). Based on a preliminary design, six structures would be in a RHCA on National Forest System land and three structures would be in a riparian area on private or State land. During final design, MMC would locate these structures outside of riparian areas if alternative locations were technically and economically feasible. Minimizing structure locations in riparian areas, and using a helicopter for line stringing and site clearing would minimize contributions of sediment to area streams and toad habitat.

Implementation of the agencies' Vegetation Removal and Disposition Plan and the Environmental Specifications (Appendix D) also would help minimize impacts on western toad breeding habitat. The effect of transmission line maintenance and decommissioning would be similar to Alternative B.

Alternative E-R – West Fisher Creek Transmission Line Alternative

Impacts of Alternative E-R on western toad would be similar to the same as Alternative C-R, except that slightly more other potential habitat would be disturbed (199 acres instead of 197 acres) (Table 224). Construction of the Sedlak Park Substation and loop line would not affect the western toad due to lack of suitable habitat. Alternative E-R would require the construction of 3.2 miles of new roads (Table 77). New access roads and closed roads with high upgrade requirements would disturb 2.9 acres of soils having severe erosion risk (see Table 166, p. 855), which occur primarily along occur along West Fisher Creek and the Fisher River (Figure 84). This alternative would affect 0.5 acre of soil with high sediment delivery potential.

Disturbance within riparian areas would be slightly less than Alternative B, with 32 acres of RHCAs on National Forest System land and 28 acres of other riparian areas on private or State land (Table 78). Based on a preliminary design, eight structures would be in a RHCA on National Forest System land and nine structures would be in a riparian area on private or State land. During final design, MMC would locate these structures outside of riparian areas if alternative locations were technically and economically feasible. Minimizing structure locations in riparian areas and using a helicopter for line stringing and site clearing would help minimize the potential for sediment movement to area streams and toad habitat.

Implementation of the agencies' Vegetation Removal and Disposition Plan and the Environmental Specifications (Appendix D) also would help minimize impacts on western toad breeding habitat. The effect of transmission line maintenance and decommissioning would be similar to Alternative B.

Combined Mine-Transmission Line Effects

All alternatives would have similar effects to high quality western toad habitat in the Crazy and Silverfish PSUs, ranging from 4 to 21 acres. Potential effects would occur on less than 1 percent of the available high quality under all alternatives. No alternatives would affect high quality habitat on state and private land (Table 225). Construction of the Sedlak Park Substation and loop line would not affect the western toad due to lack of suitable habitat. Other potential western toad habitat in the Crazy and Silverfish PSUs would be affected the most by Alternative 2B, impacting 2, 329 acres or about 2.4 percent of the other habitat available. The agencies' alternatives would affect between 1,658 and 1.788 acres of other potential habitat or about 1.8 percent of habitat available. In the agencies' combined alternatives, implementation of Wetland Mitigation Plans and the Environmental Specifications (Appendix D) would help minimize impacts on western toad breeding habitat. Impacts on western toad habitat would be somewhat reduced through MMC's and the agencies' proposed land acquisition associated with grizzly bear mitigation. Acquired parcels would be managed for grizzly bear use in perpetuity and could improve or

Table 225. Available Western Toad Habitat and Potential Effects in the Analysis Area by Combined Mine-Transmission Line Alternative.

Measurement Criteria	[1] Existing Condi-tion	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Little Cherry Creek Impoundment Alternative		
		TL-B	TL-C-R	TL-D-R	TL-E-R	TL-C-R	TL-D-R	TL-E-R
Crazy PSU								
High quality habitat (acres)	6,970	6,964 (6/<0.1)	6,969 (1/<0.1)	6,969 (1/<0.1)	6,969 (1/<0.1)	6,969 (1/<0.1)	6,969 (1/<0.1)	6,969 (1/<0.1)
Other potential habitat (acres)	46,021	43,694 (2,327/5.1)	44,487 (1,534/3.3)	44,488 (1,533/3.3)	44,488 (1,533/3.3)	44,362 (1,659/3.6)	44,363 (1,658/3.6)	44,363 (1,658/3.6)
Silverfish PSU								
High quality habitat (acres)	2,308	2,301 (7/0.3)	2,292 (16/0.7)	2,288 (20/0.9)	2,305 (3/0.1)	2,292 (16/0.7	2,288 (20/0.9)	2,305 (3/0.1)
Other potential habitat (acres)	53,950	53,885 (65/0.1)	53,826 (124/0.2)	53,820 (130/0.2)	53,823 (127/0.2)	53,826 (124/0.2)	53,820 (130/0.2)	53,823 (127/0.2)

Number in parentheses is the reduction in habitat acres/percentage compared to existing conditions.
Source: GIS analysis by ERO Resources Corp. using KNF data.

contribute suitable western toad habitat if the acquired parcels provided appropriate habitat characteristics. The agencies' alternatives also would minimize impacts through implementation of the Vegetation Removal and Disposition Plan (section 2.5.2.5.2, *Vegetation Removal and Disposition Plan*).

The fragmentation of natural habitats from timber harvesting and road building may impede dispersal and decrease the probability of wetland recolonization by amphibians (Semlitsch 2000). Alternative 2B would include the most new road construction (about 12.7 miles). New road construction for the combined agencies' alternatives would be comparable, ranging from 4.2 miles for Alternatives 3C-R and 3E-R, to 7.5 miles for Alternative 3D-R. Western toads are considered terrestrial habitat generalists (deMaynadier and Hunter 1998), and tend to be more tolerant than some amphibians of forest edges, tree harvests, and declining patch size (Renken *et al.* 2004). New road construction, while it may affect individual western toads, would not affect the western toad population in the analysis area.

Cumulative Effects

Past actions, particularly timber harvest, road construction, and fire-suppression activities, have altered the old growth ecosystems and high quality western toad habitat in the analysis area, resulting in a reduction in early and late succession habitats; conditions favoring shade-tolerant, fire-intolerant species; loss of large snags and down wood; increases in tree density; and a shift to a largely mid-seral structural stage (USDA Forest Service 2003b). Continuing development of private lands, including timber harvest, home construction, and land clearing, would contribute to losses of western toad habitat in the analysis area.

Timber harvest has occurred in the analysis area since the 1950s and, up until the early 1990s, harvest occurred within riparian habitats resulting in alterations and reduction of riparian habitat. In some cases, past harvests provided habitat conditions favorable for western toad foraging and overwintering habitat; however, it would have also reduced vegetative cover and down woody materials. High levels of road construction to facilitate harvest occurred through the 1980s and resulted in sedimentation into streams. Detailed descriptions of previous vegetation and road management activities are found at the beginning of Chapter 3 and Appendix E lists all past actions considered in the cumulative effects analysis. Since the adoption of the KFP in 1986, application of KFP standards has resulted in the protection of riparian habitats, less road construction and road closures, and BMP work on existing roads to reduce sedimentation. In unharvested areas, natural disturbances such as wildfire would have contributed to this mosaic of habitats and forage conditions. In contrast, fire suppression since the early 1900s has altered stand structure resulting in more homogenous stands with greater canopy closure, reduced understory vegetation, greater fuels accumulations in some areas, and an increased potential for severe wildfire.

Alternative 1 would not have cumulative impacts on the western toad. The likelihood of mine alternatives directly or indirectly affecting the western toad is low. No other reasonably foreseeable actions would affect any known locations of western toad. All mine alternatives would have no cumulative impacts on this species.

Regulatory/Forest Plan Consistency

Organic Administration Act and Forest Service Locatable Minerals Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources and to take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations. Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8. In the proposed action, MMC did not propose to implement feasible measures to minimize effects on the toad or all practicable measures to maintain and protect wildlife habitat. The agencies' alternatives (Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R) would comply with 36 CFR 228.8. The agencies' alternatives would incorporate additional feasible and practicable measures to minimize adverse environmental impacts on wildlife habitat that benefit the toad, including reduced mine disturbance areas, implementation of a wetland mitigation plan more likely to provide high quality toad habitat, implementation of access and design changes that minimize sedimentation of toad habitat, revised water management that would reduce the potential for contaminant uptake and compliance with INFS standards and guidelines for any work in a RHCA along an access road.

National Forest Management Act/Kootenai Forest Plan

p. II-1 #6 – *Determine the status of sensitive species and provide for their environmental needs as necessary to prevent them from becoming threatened or endangered* and p. II-1 #7 – *Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species*: Less than 1 percent of the high quality habitat available would be impacted by the mine and transmission line alternatives and minimal other potential habitat would be impacted. The agencies' alternatives would include implementation of several measures that would further reduce any effects on the western toad, specifically: 1) reduced mine disturbance areas; 2) implementation of a wetland mitigation plan more likely to provide high-quality toad habitat; 3) implementation of access and design changes that minimize sedimentation of toad habitat; 4) revised water management that would reduce the potential for contaminant uptake; 5) and as described in section 3.6, *Aquatic Life and Fisheries*, compliance with INFS standards and guidelines for any work in a RHCA along an access road.

p.II-1 #7 – *Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species:* All action alternatives would maintain diverse age classes for viable populations of the western toad.

p.II-22, 23 – *Maintenance of viable populations of existing native and desirable non-native vertebrate species, as monitored through indicator species, attained through the maintenance of a diversity of plant communities and habitats:* See p.II-1 #7 above for habitat diversity.

KFP riparian standards and guidelines, KFP Vol. 1, II-28 thru 33, as amended by INFS: Compliance with INFS, including RHCA standards and guidelines, are discussed in detail in section 3.6, *Aquatic Life and Fisheries*.

Forest Service Sensitive Species Statement of Findings

The no action alternatives would not affect individual western toads or their habitat, and would not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species. ***All combined action alternatives may impact individuals or their habitat, but will not likely contribute to a trend toward federal listing or cause a loss of viability to the population or***

species for western toad. This determination is based on: 1) disturbed areas would be 5.1 percent or less of available habitat; 2) some incidental mortality could occur due to forest clearing and increased traffic associated with the mine alternatives; 3) the agencies' alternatives would include implementation of several measures that would further reduce the likelihood of any adverse effects on the western toad, including reduced mine disturbance areas, implementation of a wetland mitigation plan more likely to provide high quality toad habitat, implementation of access and design changes that minimize sedimentation of toad habitat, revised water management that would reduce the potential for contaminant uptake and compliance with INFS standards and guidelines for any work in a RHCA along an access road.

State Requirements

Alternatives 3 and 4 would comply with the MMRA regarding disturbed lands being reclaimed to a post-mining land use with stability and utility comparable to that of the pre-mining landscape. Draft findings regarding compliance with MFSA requirements are discussed in the Summary, beginning on p. S-53.

3.25.5 Threatened, Endangered, and Proposed Species

3.25.5.1 Regulatory Framework

Section 3.6*, Aquatic Life and Fisheries* discusses the regulatory framework for aquatic and terrestrial federally listed threatened, endangered, proposed, or candidate species. In addition, the MFSA directs the DEQ to approve a transmission line if, in conjunction with other findings, the DEQ finds and determines that the facility would minimize adverse environmental impacts, considering the state of available technology and the nature and economics of the various alternatives. An assessment of effects on federally listed threatened and endangered species is part of the transmission line certification process.

The Organic Administration Act authorizes the Forest Service to regulate the occupancy and use of National Forest System lands. The Forest Service's mineral regulations are promulgated at 36 CFR 228, Subpart A. The regulations apply to operations conducted under the U.S. mining laws as they affect surface resources on National Forest System lands under the jurisdiction of the Secretary of Agriculture. One of these regulations (36 CFR 228.8) requires that mining activity be conducted, where feasible, to minimize adverse environmental impacts on National Forest System surface resources. 36 CFR 228.8 also requires that mining operators take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations.

The species list for terrestrial threatened and endangered species known or suspected to occur on the KNF is supplied by the USFWS Montana Ecological Field Services Field Office, current as of June 6, 2013 (USFWS 2013d). Species distribution maps and resulting consultation areas on the KNF received prior concurrence from the USFWS (USFWS 2001). The status of federally listed threatened, endangered, and proposed wildlife species in the analysis area and the KNF's effect determination are shown in Table 226.

Table 226. Federally Listed Threatened, Endangered, and Candidate Species Potentially Affected by the Montanore Project.

Species	ESA Status	Determination	Status in Analysis Area and Comments
Grizzly Bear (*Ursus arctos*)	Threatened	May affect, likely to adversely affect[1]	Species documented to occur
Canada Lynx (*Lynx canadensis*)	Threatened	May affect, likely to adversely affect[2] or May affect, not likely to adversely affect[3]	Species documented to occur
Critical Habitat for Canada Lynx	NA	No effect	Analysis area not located within designated critical habitat in the Northern Rocky Mountains Critical Habitat Unit #3

[1]Determination of may affect, likely to adversely affect grizzly bear is for all action alternatives (2B, 3C-R, 3D-R, 3E-R, 4C-R, 4D-R, and 4E-R).
[2]Determination of may affect, likely to adversely affect the lynx is for Alternative 2B only.
[3]Determination of may affect, not likely to adversely affect the lynx is for all agency mitigated action alternatives (3C-R, 3D-R, 3E-R, 4C-R, 4D-R, and 4E-R).
Definition of terms are in Chapter 7, *Glossary*.

3.25.5.2 Grizzly Bear

3.25.5.2.1 Summary of Conclusions

Implementation of the action alternatives may affect and are likely to adversely affect the grizzly bear. Within Bear Management Unit (BMU) 5, all action alternatives would result in mine-related activities occurring continuously along the east Cabinet Mountain front during the grizzly bear spring use period (April 1 to June 15) for the life of the project.

Alternative 2B would physically remove 2,598 acres of grizzly bear habitat over the 30+ year life of the mine and no habitat compensation for long-term mine-associated displacement effects is proposed. Alternative 2B would cause additional decreases in core habitat in BMUs 5 and 6 where core standards are not met in the existing conditions, would increase total motorized route densities (TMRD) in BMU 6, and would have no trend toward meeting core or TMRD standards. Alternative 2B mitigation would compensate for habitat physically lost at a 2:1 ratio prior to activity. As a result of this land acquisition, baseline habitat parameters would improve, but as specific parcels are not yet acquired, improvements to core, open motorized route densities (OMRD), and TMRD could not be calculated for this analysis.

The agencies' alternatives would physically remove between 1,560 and 1,926 acres of grizzly bear habitat over the 30+ year life of the mine. Road access mitigation prior to the Evaluation and Construction Phases would bring the directly affected BMUs into compliance with habitat parameter standards of core, OMRD, and TMRD prior to activity. The agencies' alternatives mitigation would compensate for habitat physically removed (at a 2:1 ratio) and displacement effects (1:1 ratio) from the mine prior to activity. Additional improvements to baseline habitat parameters would result from land acquisition/purchase of conservation easement, but as specific parcels are not yet acquired, improvements could not be calculated for this analysis.

Depending on the combination of the proposed combined action alternatives and the acres required for the habitat compensation, this mitigation would result in improvements (Alternative 2B) or additional improvements (all agency combined alternatives) to the baseline habitat parameters of core, OMRD, and TMRD prior to activity within the south Cabinet Mountain portion of the CYE (see Table 234). Alternative 2B would result in the least improvement, while the agencies' combined action alternatives would result in the most improvement to the baseline parameters.

3.25.5.2.2 Data Sources, Methods, Assumptions, and Bounds of Analysis

Grizzly bear population ecology, biology, habitat description, and relationships identified by research are described in the Grizzly Bear Recovery Plan (USFWS 1993a); the Interagency Grizzly Bear Committee Guidelines (IGBC 1986); the annual progress report for the Cabinet-Yaak grizzly bear research (Kasworm *et al.* 2013c; Kasworm and Manley 1988; Westech 2005a); and the KFP Amendment for Motorized Access Management with the Selkirk and Cabinet-Yaak Grizzly Bear Recovery Zones (USDA Forest Service 2011a,b) and corresponding biological opinion (USFWS 2011c), herein referred to as the Access Amendment. These documents are incorporated herein by reference. A summary of these and more recent documents is provided in the *Affected Environment* section. The KNF's Wildlife BA (USDA Forest Service 2013b) and the USFWS' Grizzly Bear Biological Opinion (USFWS 2014a) and transmittal letter (USFWS 2014b) are incorporated herein by reference. Grizzly bear occurrence data come from recent District wildlife observation records, KNF historical data (NRIS Wildlife), other agencies (USFWS and FWP), and Westech (2005a). KNF GIS layers including boundaries for BMUs, the Cabinet Face bears outside the Recovery Zone (BORZ), approach or linkage areas, as well as road location and status, existing and past vegetation treatments, fire history, and others were used in the grizzly bear analysis, including existing conditions, core, OMRD, TMRD, and linear miles of road.

Grizzly Bear Habitat Bounds of Analysis

Cabinet Yaak Recovery Zone

The majority of the proposed activities are within the Cabinet-Yaak Recovery Zone (CYRZ) (USFWS 1993a). The CYRZ is in northwest Montana and northeast Idaho, directly south of Canada and encompassing 2,600 square miles (USFWS 1993a). The Kootenai River bisects the area with the Cabinet Mountains portion to the south and the Yaak River portion to the north. Within the CYRZ, 5.6 percent (94,272 acres) is designated Wilderness Area, with the Cabinet Mountains containing about 60 percent of the Recovery Zone. The extent to which grizzly bear movement occurs between the two portions is unknown but thought to be minimal (Kasworm *et al.* 2013c).

Recovery zones, including the CYE, contain the minimum seasonal habitat components needed to support a recovering grizzly population. Recovery zones are further divided into smaller BMUs, which afford greater resolution for purposes of habitat evaluation and population monitoring (USFWS 1993a). These BMUs approximate the size of annual home ranges of an adult female grizzly bear and are used for effects analysis (IGBC 1998). As these are only approximations, BMUs account for elevation and seasonal distribution of habitats (Ibid). Breaking the ecosystem down into BMUs allows for analysis to consider effects associated with the activity's area of influence and so that potential effects will not be diluted by considering too large an area (IGBC 1990). The BMUs are biologically meaningful to grizzly bears in that they 1) are based on the average size of a female bear's home range; 2) provide seasonal and elevational movement in response to needs (*e.g.*, food and denning habitat); and 3) provide contiguous, unobstructed habitat allowing for displacement (*i.e.*, core) (Christensen and Madel 1982, IGBC 1990). Delineating BMU boundaries using topographical features establishes a recognizable unit for management consistency, allowing for identification of management needs or concerns, activity planning, scheduling, coordination, and monitoring (Ibid) within and among adjacent ranger districts and forests.

Christensen and Madel (1982) in *Cumulative Effects Analysis Process* chose a 515,000-acre cumulative effects analysis area, which represented 56 percent of the CYRZ and was the focal point of mineral exploration and development on the KNF. In this analysis, it was assumed that if each smaller BMU within that analysis area is maintained in a viable condition, then all BMUs would remain a viable habitat. Based on that well-established premise, the BMU has been consistently identified as the analysis area for analyzing and monitoring effects to the grizzly bear (*e.g.*, USFWS 1995a, IGBC 1998).

The Grizzly Bear Recovery Plan (USFWS 1993a p. 22) outlines the process for considering cumulative effects and correlates that to the cumulative effects model (Christensen 1982). The cumulative effects model expressly provides for use of BMUs as the appropriate scale to consider cumulative impacts. The use of the BMU as the most appropriate scale to consider cumulative impacts is fully consistent with the recovery plan direction to assess impacts in a regional context (USFWS 1993a, p. 22).

Individual projects proposed on the KNF include activities to maintain or improve conditions in affected BMUs and move toward compliance with current standards where needed. Progress on this effort is documented by the KNF by BMU in the annual KFP "Monitoring and Evaluation Reports" (USDA Forest Service 2013g).

The Montanore Project analysis area consists of the Crazy and Silverfish PSUs, which are partially located within the CYE and the Cabinet Face BORZ and, consequently, the grizzly bear analysis area does not use the PSU boundaries. All three BMUs 2, 5, and 6 directly affected by physical ground disturbing activities are considered occupied (Kasworm *et al.* 2013c). Human activity and development in these BMUs is concentrated along the open roads found in the major drainages, with timber harvest activities and dispersed recreation occurring in those areas as well as over the remaining network of roads and trails. The proposed mine development and transmission line alternatives occur within the lower elevations of the BMUs and are largely concentrated in existing roaded areas. Some existing core along these areas would be lost by the proposed activities while additional core would be created by required mitigation prior to the Evaluation and Construction Phases of project activity. The proposed Rock Creek Project is a reasonably foreseeable action within BMU 4, located west of BMUs 5 and 6, and the potential for both mines to occur simultaneously could constrict the north-south movement corridor. The agencies' combined alternatives would require core creation (acres vary by combined-mine-transmission line alternative), which would reduce fragmentation, mortality risk, and displacement by improving the north-south corridor connectivity and mitigate for the cumulative effect of two mines. Habitat compensation for habitat physically lost (Alternative 2B and all agency combined alternatives) and habitat compensation for displacement and creation of core (only the agencies' combined alternatives) would improve or maintain the baseline habitat parameters of core, OMRD, and TMRD within the CYRZ. Habitat compensation for displacement effects also has potential to improve connectivity outside the Recovery Zone. Activity-free areas of core would be available both within and adjacent to the affected BMUs.

Large portions of core habitat within the affected BMUs are located outside of the project disturbance area. Activity-free areas of core are also found in adjacent BMUs to the north and south. Any bears potentially displaced during project activities would have large areas of core providing secure habitat, in both existing core areas and areas of core that would be created by required mitigation.

Displacement effects from transmission line construction activity related to the use of helicopters (effects of helicopters were analyzed within a 1-mile buffer extending from either side of the transmission line alternatives as described in ERO Resources Corp. (2015) and in the following *Methods* section). Small portions of these transmission line buffers would extend into BMU 7; however, displacement effects are expected to have such low potential to affect bears that this BMU was not considered in the detailed analysis for direct affects for the following reasons: 1) no ground-disturbing activities occur in BMU 7; 2) the area affected is adjacent to the outer edge of the buffers, furthest from the helicopter activity and no direct overflight would occur; 3) the area affected by the transmission line buffers is partially located in core, and if a bear was temporally displaced by helicopter noise, adjacent core habitat outside of the buffer is available; 4) Alternative 2B would restrict activity during the winter on big game winter ranges, which overlaps the helicopter zone of influence in BMU 7, and no spring range or denning habitat has been identified within the Alternative B zone of influence in BMU 7; 5) helicopter noise and any potential displacement effects within BMU 7 would not occur consistently during the activity period; 6) the agencies' alternatives would restrict transmission line construction and decommissioning-related activity outside of the grizzly bear spring use and denning periods, when use of the area in BMU 7 would likely occur; and 7) the likelihood of displacing a grizzly bear during the summer activity period is very low and secure summer habitat located in core would be adjacent and available to any grizzly bear potentially displaced by helicopter noise in BMU 7. Therefore, displacement tables for the transmission line displacement effects due to potential helicopter use during the Construction Phase do not include between 114 acres (Alternatives C-R and D-R) and 658 acres (Alternative B) of grizzly bear habitat in BMU 7 potentially affected by noise associated with helicopter activities.

Therefore, BMUs 2, 5, and 6 have been chosen as the appropriate scale for detailed analysis of direct, indirect, and cumulative effects within the Recovery Zone, and on a larger scale, the additional BMUs 1, 4, 7, 8, and 22 will also be considered for cumulative effects. The cumulative effects analysis for grizzly bears considered activities affecting grizzly bear habitat parameters in the Cabinet Mountain portion of the CYE, including the directly affected BMUs 2, 5, and 6, as well as BMUs 1, 4, 7, 8, and 22 for making the effects determination. The directly affected BMUs 5 and 6 comprise the main bulk of the north-south movement corridor and proposed activities could affect movement patterns in this corridor, which connects the BMUs to the south (7, 8, and 22) to BMUs to the west and north (1, 2, and 4). Cumulatively, due to the reasonably foreseeable Rock Creek Project, which would be located in BMU 4 to the west and adjacent to BMUs 2, 5, and 6, the high-intensity long-duration activities and resulting displacement associated with the two mines could affect grizzly bear security and movement by potentially constricting the north-south movement corridor between BMUs to the north and BMUs toward the south. Thus, for the grizzly bear analysis within the Recovery Zone, all of the National Forest System lands within the Cabinet Mountain portion of the CYRZ are considered the "action area" due to these potential cumulative effects of two concurrent mining development projects. As mentioned previously, this grizzly bear analysis area differs from the Montanore Project analysis area, which is comprised of the Crazy and Silverfish PSUs. Private landowners in the Cabinet Mountain portion of the CYRZ and the adjacent Cabinet Face BORZ (see below for discussion of outside the Recovery Zone) include large corporate land owners of Plum Creek and Stimson. Limiting the assessment of cumulative effects to the southern half of the CYRZ and the Cabinet Face BORZ is appropriate. The number of grizzly bears in the south Cabinet portion is not considered dense enough to create sufficient pressure to push bears north to the Yaak portion (W. Kasworm, pers. comm. 2010) and effects to bears in the Yaak portion would not be anticipated.

Bears Outside Recovery Zones

The current distribution of resident grizzly bears includes areas outside of the recovery zones identified in the Grizzly Bear Recovery Plan (USFWS 1993a). An analysis of potential effects to grizzly bears outside the recovery zones on the KNF was completed in the Access Amendment, FSEIS (USDA Forest Service 2011a, Allen 2011). Current grizzly bear distribution outside of the CYRZ has been delineated into four individual polygons, including the Cabinet Face BORZ. The action alternatives have project activities proposed within the Cabinet Face BORZ, which is adjacent to the east side of the Cabinet Mountains. The 2009 re-analysis of the KNF BORZs (as described in Allen 2011) resulted in boundary changes to the previously delineated Cabinet Face BORZ. These changes were based on all grizzly bear use information for the KNF broken down into sixth order Hydrologic Unit Code (HUC) polygons. Sixth order HUCs were selected because of their size (typically 10,000 to 40,000 acres) and their common use as cumulative effects boundaries for watershed, fisheries, and wildlife analysis in environmental documents by the Forest Service. Adjacent HUCs with enough grizzly bear use to be considered recurring use areas were combined to create contiguous areas of recurring use. Standards for determining recurring use include credible observations (see Kasworm *et al.* 2013c for definition of credible) of multiple individuals, females with cubs, multiple years of use, and radio-locations occurring within a timeframe of 15 years or less (Allen 2011). For the Cabinet Face BORZ, this boundary change reduced the number of acres within the total BORZ from 95,718 to 28,052 acres, and National Forest System acres from 53,612 to 27,093 acres. Allen (2011) is incorporated by reference and provides a complete description of the selection criteria and a list of all HUCs south and west of US 2, which were not included in the Cabinet Face BORZ area due to not meeting the selection criteria to be considered occupied.

To evaluate transmission line construction-related activities using helicopters, effects within the Cabinet Face BORZ on federal lands were considered within a corridor 1 mile on each side of the transmission line alignments, while effects to linear open and total miles of road were compared with the baseline standards established by the Access Amendment.

Within the CYRZ and Cabinet Face BORZ

For both the CYRZ and Cabinet Face BORZ, the analysis considers the present effects of past activities, as required in 36 CFR 220.4(f). These effects are reflected in existing conditions (baseline) and generally include the effects of past road building and vegetation management within the BMUs. In addition, the analysis considers the temporal effects of the activities; that is, how long would the effects of the action alternative last. For the grizzly bear analysis, temporal effects were considered to be short-term (2 to 5 years) or long-term (lasting for life of the mine (30 years) or longer).

The effects of a proposed activity on listed species depend largely on the duration of its effects. Three potential categories of effects are: (1) a short-term event whose effects are relaxed almost immediately (pulse effect), (2) a sustained, long-term, or chronic event whose effects are not relaxed (press effect), or (3) a permanent event that sets a new threshold for some feature of a species' environment (threshold effect) (USFWS and National Marine Fisheries Service 1998). These descriptions of short-term and long-term effects are generally not consistent with the definitions provided in section 3.1.1, *Direct, Indirect, and Cumulative Effects* (p. 267), but they are appropriate for analysis of the threatened grizzly bear. Although relatively long-lived (15-25 years in the wild), the grizzly bear has a low reproductive rate due to the late age of first reproduction (4-7 years), small litter size (typically two cubs), long intervals between litters (three years), and limited cub survival (less than 50 percent). Temporal effects also were used to determine what, if any, reasonably foreseeable activities overlap the activities, the project (geographic) area that could cause cumulative effects.

Direct, indirect, and cumulative effects are evaluated within the CYRZ and extended into the Cabinet Face BORZ, where criteria for documented recurring grizzly bear use has been met. See Figure 92 for the CYRZ and Cabinet Face BORZ boundary in relation to the Montanore Mine Project.

Basis for Grizzly Bear Habitat Analysis Framework Inside the Recovery Zone: The analysis incorporates standards and design elements from the 2011 Access Amendment (USDA Forest Service 2011a, b). Standards were set specific to each BMU to reflect the unique biological factors (*e.g.*, high-quality habitat, sightings of family groups, human-caused mortality, adjacency to BMUs having females with young, and ties to linkage areas), as well as other non-biological factors (highways, access to inholdings, and access to popular recreation areas).The corresponding Access Amendment Biological Opinion (USFWS 2011c, 2011d) established an incidental take statement defined by habitat parameters applicable within the recovery zones based upon the benchmark standards for core habitat, OMRD, and TMRD. Also addressed are management needs identified in Harms (1990). The effects analysis for the Montanore Project considers the recovery objectives, compliance with management direction, and best science. Table 227 describes the recovery objective, the habitat parameters evaluated, and the basis for the habitat parameters used in the effects analysis.

As noted in Table 227, the core area, OMRD, and TMRD parameters are based on direction in the Access Amendment, which uses the research recommendations found in Wakkinen and Kasworm (1997) as the benchmark standards for BMUs. Wakkinen and Kasworm (1997) applied research techniques from Mace and Manley (1993) and Mace and Waller (1997) to local bear populations in the Selkirk and Cabinet-Yaak Ecosystems (SCYE). The Wakkinen and Kasworm (1997) recommendations are 1) a minimum core habitat of 55 percent, 2) a maximum of 33 percent of a BMU with greater than 1 mi/mi^2 OMRD, and 3) a maximum of 26 percent of a BMU with greater than 2 mi/mi^2 of TMRD.

Table 227. Recovery Objectives, Parameters, and Basis Guiding Grizzly Bear Habitat Analysis.

Objective*	Parameter	Basis for Parameter
1) Provide adequate space to meet the spatial requirements of a recovered grizzly bear population.	a. Core areas b. OMRD c. TMRD d. Point Source disturbance	a. KFP Standard III-59 a., b., c., and d.: 2011 Access Amendment as an Addendum to Appendix 8
2) Manage for an adequate distribution of bears across the ecosystem.	a. Juxtaposition of foraging habitat and cover b. Movement corridor c. Seasonal components d. Road density and displacement (core)	a. and b. Forestwide goal to maintain vegetative diversity, p.II-1 #7; KFP standard (Appendix 8-10) b. Access Amendment Biological Opinion (USFWS 2011c) describes importance of habitat connectivity or linkage for the grizzly bear c. KFP standard (Appendix 8-10); and recommendations from USFWS and KNF meeting (Brooks 1992) d. See Objective 1
3) Manage for an acceptable level of mortality risk.	a. Juxtaposition of foraging habitat and cover b. Movement corridor c. Road density d. Displacement e. Attractants	a. See Objective 2 b. See Objective 2 c. See Objectives 1 and 6 d. See Objectives 1 and 6 e. KFP standard (Appendices 8-9, 11, 12, 14, and 16)
4) Maintain/improve habitat suitability with respect to bear food production.	Objectives 1 and 2 How does project improve food sources (especially huckleberries)	
5) Meet the management direction outlined in the Interagency Grizzly Bear Guidelines (51 Federal Register 42863) for management situations 1, 2, and 3.	Meeting Objectives 1-4 has been determined to meet the intent of the Interagency Grizzly Bear Guidelines (Buterbaugh 1991)	
6) Meet management direction specified in the October 18, 2011 incidental take statement (USFWS 2011c, 2011 d).	This objective is met by meeting core, OMRD, and TMRD standards addressed in Objective 1 as well as complying with 2011 Access Amendment design elements, including those for the BORZ areas	

*Objectives 1-5 were formulated to accomplish the KNF grizzly bear management goal to provide sufficient quantity and quality of habitat to facilitate grizzly bear recovery (Harms 1990).

Outside the CYRZ and BORZ

The analysis area for evaluating project impacts on individuals and their habitat also consists of private and State land potentially affected by the proposed action alternatives. To evaluate potential direct, indirect, and cumulative impacts of the transmission line and Sedlak Park Substation on private and State lands as required by the DEQ for MMC's MFSA evaluation, the analysis area includes all additional non-National Forest System land within a corridor 1 mile on each side of the alternative transmission line alignments (Figure 92) outside of the CYRZ and BORZ boundaries. The 1-mile buffer on either side of the transmission line was guided by DEQ circular 2, Section 3.7 Baseline Data and Impact Assessment Requirements for Electric Transmission Lines, item 12(a). To determine the adequate size of an analysis area to measure potential displacement effects from the transmission line on private lands, the 1-mile zone of influence for aircraft as determined by the Cumulative Effects Analysis Process for the Selkirk/Cabinet-Yaak grizzly bear ecosystems (USDA Forest Service *et al.* 1988, USDA Forest Service *et al.* 1990) was considered sufficient to measure potential disturbance to the grizzly bear outside of the CYRZ and BORZ boundaries. The effects of activities in this area are also considered in the context of linkage or approach areas, which extend outside of the transmission line analysis area for the MFSA evaluation.

Montana State Trust Lands

Two parcels of State trust land (section 36 T27N, R30W and section 16 T28N, R30W) are located within the Montanore Project analysis area, which is comprised of the Crazy and Silverfish PSUs. The Montana Department of Natural Resources and Conservation (DNRC) developed a voluntary multispecies Habitat Conservation Plan (State HCP) for forest management activities with technical assistance from the USFWS. The State HCP identified species-specific goals for the grizzly bear on State HCP covered lands that include promoting safety for humans and bears, minimizing displacement of grizzly bears from suitable habitat, providing for seasonal habitat use and security through access management, contributing to grizzly bear recovery where conservation of seasonally important grizzly bear habitat would complement federal efforts, promoting grizzly bear connectivity where the State HCP covered lands occur in important locations, and maintaining important habitat features including den sites, avalanche chutes, riparian zones, and other high forage producing areas. On the DNRC Libby Unit, which manages State lands located near the Libby, parcels near town and two other parcels were not included in the State HCP. All other State lands were identified as either in the CYRZ or in non-recovery occupied habitat. The two State trust parcels located in the Crazy and Silverfish PSUs were identified as being located in non-recovery occupied habitat (State HCP, Figure C-15). The State HCP covers forest management activities including timber harvest and associated activities, road construction and maintenance, and forest grazing. Construction, operations, and decommissioning of the proposed transmission line action alternatives are not covered activities under the State HCP. For this analysis, which will fulfill both the MEPA and NEPA requirements of the agencies, proposed activities on State trust land will be evaluated on the effects to grizzly bears and grizzly habitat, and mitigations will be applied consistent with those for affected federal lands. Measurement criteria will be information and education, firearm use, food storage and sanitation, new open road construction in riparian areas, active den site protection, retention of visual screening in riparian and wetland management zones, helicopter use, general open new road construction, spring management restrictions, and distance to visual screening.

Movement Corridor/Linkage Zone Area Outside the CYRZ and BORZ

Additional consideration was given to the area surrounding the transmission line and Sedlak Park Substation located outside of the CYRZ and the BORZ boundary. This portion of the transmission line and the Sedlak Park Substation are located within an area identified by several agencies and environmental organizations as important for wildlife as a movement corridor, including grizzly bears. An evaluation of existing and additional human-related development within this linkage movement area is provided in the movement corridor/linkage zone assessment sections.

Methods

Data sources used to calculate habitat parameters of core; TMRD; OMRD; miles of open, closed, and new access roads used by action alternatives; and acres were calculated using geographic information systems (ArcGIS) applications by the KNF. ERO Resources Corp. (2015) used ArcGIS to calculate habitat physically lost or cleared and habitat displacement acres using information about the project area and BMU and BORZ data as provided by the KNF. Acres and road lengths are in decimal format. Therefore, there may be slight differences in acres or mile totals as presented in the following analysis than elsewhere in the document. Differences in totals and acres presented in tables are due to rounding.

The analysis considered both long-term displacement effects (lasting for life of the mine or longer) due to mine development and associated 24-hour high-intensity use (during operations phase) and the shorter-duration (about two active bear seasons) helicopter use during transmission line construction/decommissioning. The effects of activities potentially resulting in the displacement of bears from their habitat is calculated by applying influence zones and disturbance coefficients for point source and linear disturbances established in Christensen and Madel (1982), USDA Forest Service (1988a), IGBC (1990), Summerfield (2007), and USDA Forest Service and USFWS (2009). For example, to specifically address effects of increased traffic on the access road, effects were considered within a corridor 0.5 mile on each side of the Bear Creek Road #278, which once leaving BMU 5, overlaps both the Cabinet Face BORZ on the east side and BMU 2 immediately adjacent to the west side of the road for 3.5 miles, before heading northeast toward US 2 passing through both BORZ and private lands. For determining displacement effects of a helicopter during transmission line construction, the acres calculated (such as shown in Table 229) do not include areas of overlap with influence zones for mine facilities and access roads or displacement from existing roads or activities. Alternative B helicopter use is at the discretion of the contractor. The helicopter may be used for four activities: structure placement, line stringing, timber harvest, and annual inspection and maintenance. Logging may take 1 to 2 months over the 2-year period. Structure placement and line stringing would take 1 or 2 weeks each. Annual inspections may take about a week. For analysis of Alternative B, the agencies assumed vegetation clearing, including timber harvest and structure placement, would not use a helicopter and helicopter use and displacement were analyzed for line stringing/annual maintenance only. Methods used to evaluate displacement effects from the Montanore Project are described in the *Revised FEIS Analysis of Grizzly Bear Displacement Effects* (ERO Resources Corp. 2015).

The analysis evaluates potential alternative impacts using a 2009 baseline (Bear Year 2009 road layer, modified and available in December 2010). The 2009 road layer for existing conditions was updated in December 2010 to account for those roads temporarily opened for harvest activity (on private or National Forest System lands) or for road repair or other activities during 2009; the access statuses of roads were changed back to their actual access status to better reflect the existing condition as a non-activity baseline. The core, OMRD, and TMRD analysis of the effects for Alternative 3D-R were updated in 2012 to reflect changes in the disturbance boundary since the Supplemental Draft EIS. This analysis incorporated the most recent data, including road status (through summer of 2012) where available. The projected impacts from Alternative 3D-R did not measurably change as a result of the updated analysis. Because disturbance boundaries for the other agency alternatives since the Supplemental Draft EIS had very similar and slight changes, their disturbance boundary changes would have also resulted in negligible changes to grizzly bear habitat parameters and, thus, their effects were not re-analyzed. In addition, a comparison done September 2012 (USDA Forest Service 2010, 2011m, 2012e) between a 2009 bear-year non-activity baseline and a 2011 non-activity baseline demonstrated that the baselines in BMUs 5 and 6 would remain the same, while the baseline in BMU 2 would slightly improve. This provided additional rationale for not re-calculating effects to grizzly bear habitat parameters as a result of the disturbance boundary changes in the other agency alternatives.

Evaluation of Effectiveness of Mitigation Plans: The analysis of effects includes an evaluation of the effectiveness of the mitigation plans described in Chapter 2. Analysis of proposed action alternatives effects on core, OMRD, and TMRD incorporated changes in road status associated with proposed road access changes and mitigation applicable to each alternative, but do not reflect additional potential improvements to baseline habitat parameters that could result from required land acquisition and subsequent motorized access changes that could occur associated with grizzly bear habitat compensation mitigation for each alternative.

Mitigation measures incorporated into MMC's (Alternative 2B) or the agencies' alternatives would include making road access changes, acquiring conservation easements or land, prohibiting employees from carrying firearms, removing road-killed big game animals, and busing employees to the work site. All action alternatives would include the funding of one law enforcement officer and one grizzly bear specialist. The agencies' alternatives would include funding of an additional grizzly bear specialist, identified as a habitat conservation specialist, if the Rock Creek Project and Montanore Mine operate concurrently, and monitoring of bear movements and status.

MMC's proposed combined Alternative 2B included access changes on NFS road #4724 from April 1 to June 30 and a yearlong access change in a segment of NFS road #4784 to mitigate for impacts on grizzly bears. The seasonal closure on NFS road #4724, although benefiting bears by restricting motorized access during the spring use period, would not change the open status of the road during the active bear year and, thus, would not result in changes to core, OMRD, or TMRD. NFS road #4784 was already proposed for an access change by the Rock Creek Project and, thus, was not considered as mitigation in the analysis for direct effects of Alternative 2B.

The access change on NFS road #4784 was not originally proposed as part of the agencies' combined action alternatives road access mitigation changes (see Table 28 and Table 29 in Chapter 2) to improve the baseline for grizzly bears. However, as shown in Table 28, the access change on NFS road #4784 would be implemented prior to the Evaluation Phase by any of the Montanore combined action alternatives if the road closure were not already implemented as part of the Rock Creek Project mitigation. The contribution to improvements in baseline core and habitat security that the closure of NFS road #4784 would provide was determined by the agencies and USFWS as necessary to mitigate for impacts prior to either mine becoming active and, thus, the act of closing the road was assigned to either mine. Therefore, the action is discussed as a potential direct action for the Montanore combined action alternatives but for analysis of direct effects to habitat parameter of core, OMRD, and TMRD, NFS road #4784 was considered open. The mitigation and created core resulting from the NFS road #4784 access change would remain attributable to the Rock Creek Project and, as such, improvements to core or decreases in TMRD and OMRD are only shown in the cumulative effects analysis for the agencies' combined action alternatives.

The agencies' alternatives would include additional yearlong access changes through the installation of barriers or gates in several roads to mitigate for the loss of big game security and impacts on grizzly bear. These road access changes specified in the agencies' mitigation plans are taken into account for determining direct and cumulative effects on core, OMRD, and TMRD calculations. Road access changes associated with mitigation were determined for the combined mine-transmission line alternatives only. It is not possible to attribute these road access changes to individual mine and transmission line alternatives independent of one another.

The analysis for all action alternatives provided does not reflect additional road access changes that would occur as a result of land acquisition for habitat compensation required for grizzly bear habitat physically lost or for displacement associated with the mine activities proposed by MMC or the agencies. Additional road access changes would occur on mitigation lands to further improve grizzly bear baseline habitat parameters, but as the exact locations of which parcels would be obtained and where access changes would actually occur remain unknown, it is not possible to reflect changes in core, OMRD, and TMRD calculations that could occur at this time.

3.25.5.2.3 Affected Environment

Inside Recovery Zone

Habitat conditions in the CYRZ have been improving steadily since 1987 as documented by Johnson (2002), Summerfield *et al.* (2004), Kasworm *et al.* 2013c, and the annual KFP monitoring reports on threatened and endangered species habitat (USDA Forest Service 2013e).

Population Status and Trend

Currently, the CYE grizzly bear population is estimated to have a minimum population of 50 grizzly bears, using a 10-year calculation, with a 57 percent probability of a downward population trend (Kasworm *et al.* 2013c). However, data from the last six years indicate an improving situation (Kasworm *et al.* 2013c). The observed rates of survival and reproduction are used to calculate a rate of change in the population (lambda). This calculation is essentially births - deaths = population change and is measured against a stable population depicted by lambda equaling 1.0. This calculation only involves female adult and sub-adult survival plus all yearling and cub survivals. Since calculations started, the lowest lamba (0.920) occurred in 2006. This meant an annual rate of decline of 8.3 percent. The point estimate of lambda for all data from 1983-2009 was 0.963 (Kasworm 2010a, 2010b). This equates to a declining population at an annual rate of -4.0 percent. The updated lambda for 1983-2012 is 0.992, which corresponds to a *negative* 0.8 percent annual rate of change (Kasworm *et al.* 2013c). Thus, lambda has improved and moved closer to stability (1.0), again an indication that the CYE grizzly bear population status is improving (USFWS 2014a). Improving survival by reducing human-caused mortality is crucial for recovery of this population (Proctor *et al.* 2004).

Preliminary results from the Cabinet-Yaak DNA study indicate a population of 45 to 49 bears within the CYE (IGBC 2013) and corroborate the estimate by Kasworm *et al.* (2013).

Forty-two credible sightings were reported to this study that rated 4 or 5 (most credible) during 2012. Eighteen of these sightings occurred in the Yaak portion of the CYRZ and 12 sightings occurred in the Cabinet Mountains portion of the Recovery Zone. Twelve sightings came from outside the CYRZ (Ibid). Five credible sightings of a female with cubs occurred during 2012 in BMUs 2 and 5, while eight credible sightings of a female with yearlings or 2-year-olds occurred in BMUs 5, 11, 16, and 17. Occupied BMUs were: 2, 3, 4, 5, 6, 7, 11, 13, 14, 15, 16, 17, and 18. Recovery plan criteria indicate the need for 18 of 22 BMUs to be occupied. Sightings of females with young in BMUs 2, 3, 4, 5, 6, 7, and 18 were indicative of recent reproduction in the Cabinet Mountains (Ibid).

Based on results of a 5-year radio-telemetry study conducted by FWP from 1983 to 1987, home ranges of three collared bears overlapped around the upper portions of Bear Creek, Cable Creek, Poorman Creek, and Ramsey Creek within BMU 5 (Kasworm and Manley 1988). Home ranges extended laterally from this area throughout BMUs 5 and 6. A large male grizzly bear captured in the Bull River drainage in 2005 spent considerable time in the upper Libby Creek drainage during the fall of 2005 and also the spring of 2006. This bear was located on numerous occasions less than 1 mile east of the Libby Adit Site. These drainages contain some of the highest quality grizzly bear habitat in the Cabinet Mountains and form the core area for home ranges of 11 known grizzly bears (see Figure 5 in Wildlife BA, USDA Forest Service 2013b) of the minimum estimated 21 bears from the Cabinet Mountains. Bear activity in the Snowshoe, St. Paul, and Wanless BMUs is summarized in Table 228.

Table 228. Credible Grizzly Bear Sightings, Credible Female with Young Sightings, and Known Human-Caused Mortality by BMU in 2012.

BMU #	Credible Grizzly Bear Sightings	Unduplicated Sightings of Females with Cubs	Sightings of Females with Yearlings or 2-Year-Olds	Human-Caused Mortality
Snowshoe (2)	5	1	0	0
St. Paul (5)	4	1	1	0
Wanless (6)	1	0	0	0

Source: Kasworm *et al.* 2013c.

Mortality

Humans have been identified as one of the main factors in mortality of grizzly bears in the CYE (Kasworm and Manley 1988). At least 38 known human-caused mortalities were documented within 10 miles of the CYRZ (including Canada) from 1982 to 2009 (Kasworm *et al.* 2010). Ten known or probable human-caused mortalities of native grizzly bears occurred in or within a 10-mile radius of the CYRZ in the U.S. between 2007 and 2012 (Kasworm *et al.* 2013c). Two additional mortalities of augmentation bears occurred south of the Clark Fork River within 10 miles of the CYRZ (Ibid.). Causes of grizzly bear mortality have generally been due to factors beyond Forest Service control (*i.e.*, mistaken identity by hunters, defense of life or management removal due to food attractant on private land, or illegal killing by humans). Kasworm *et al.* (2013) suggests that an increase in natural mortalities beginning in 1999 could be attributed to poor food production during 1998 through 2004, when huckleberry production was about half of the 20-year average. Point estimates for human-caused mortality occurring on public lands in the U.S. and British Columbia decreased from 1983–1998 to 1999–2012 (Kasworm *et al.* 2007, Kasworm *et al.* 2013c). This apparent decrease in mortality rates on public lands (from 6.1 to 4.0 percent) is particularly noteworthy given the increase in overall mortality rates (Ibid).Although the specific reason for this decline is unknown, the KNF's wheeled motorized access management over the last decade may play a factor in this trend toward meeting grizzly bear population recovery goals within the CYE by improving BMU parameters with some meeting or exceeding (better than) standards. Implementation of the 2011 Access Management design elements would continue that trend.

Because of the age structure and small size of the population, augmentation of the Cabinet grizzly bear population began in 1990. Fourteen bears have been added to the Cabinet Mountains population since 1990 (11 females and 3 males). Four bears (3 females and 1 male) left the target area and 4 bears are known to be dead, including 1 bear that survived for 16 years in the Cabinet Mountains and produced at least 9 offspring. Those offspring produced at least 8 young (Kasworm *et al.* 2013c). The augmentation effort appears to be the primary reason that grizzly bears remain in the Cabinet Mountains (Ibid). Simulations demonstrate that augmentation alone will not recover a small grizzly bear population when mortality is high (Kasworm *et al.* 2007).

An integral part of grizzly bear management on the KNF is to implement measures within the authority of the Forest Service to minimize human-caused grizzly bear mortalities. The KNF enacted a food storage order (USDA Forest Service 2011k) that includes the proper storage and transportation of food and other attractants on all Forest Service lands on the KNF. This food storage order applies to all KNF system lands, including those lands contained within the CYE. There has been an increase in bear-resistant garbage containers in developed campgrounds and a pack in/pack out policy for all other campgrounds and dispersed recreation sites. The KNF has also installed signs along popular roads to inform people that they are in grizzly bear habitat and they include grizzly bear identification information.

Other agency efforts include many county refuse sites being fenced to keep bears from attractants. The Lincoln County collection dumpsters located adjacent to US 2 at the eastern edge of the BORZ are a known attractant site. In 2012, the County moved this site several miles north to a more suitable location on National Forest System land along US 2 where it is now enclosed in an electric fence and locked nightly. Public education efforts are ongoing to encourage people to live in a way that is more compatible with the needs and behaviors of bears. This includes FWP assistance with the installation of new electric fencing of chicken and pigeon coops in the Yaak CYRZ to prevent future bear conflicts (Annis 2012). Montana FWP has also instituted a mandatory black bear hunter testing and certification program to help educate hunters in distinguishing bear species and reducing mistaken identity.

Existing Habitat Conditions: Portions of the directly affected BMUs (2, 5, and 6) are within the Crazy and Silverfish PSUs, which comprise the Montanore Project analysis area. Lower elevations of the Crazy PSU are heavily roaded with open, gated, impassable, and bermed roads, and this area overlaps lower elevations located in BMU 2 and BMU 5. Gated or open roads are also located in each of the main drainages in the Crazy PSU rising in elevation almost to the CMW boundary. The Crazy PSU overlaps 15,521 acres or 24 percent of BMU 2 and 32,544 acres or 46 percent of BMU 5. The Silverfish PSU is roaded in the Miller and West Fisher Creeks, has a gated road (Silver Butte Creek Road #594) that goes west toward Green Mountain and the Trout Creek area, and an open road (Silver Butte Pass #148) that passes through from US 2 down to the Vermilion East Fisher Road #154. The Silverfish PSU overlaps 32,879 acres or 51 percent of BMU 6. The Silverfish PSU also extends to the south and overlaps 28,850 acres or 46 percent of BMU 7.

Within BMUs 2, 5, and 6 (totaling 199,603 acres), the CMW provides large tracts of unroaded lands on 66,741 acres or 33 percent of the BMUs combined that provide excellent security and habitat that has not been actively managed, outside of fire suppression. Lands outside of the wilderness have been managed for multiple uses including timber production. Timber harvest methods included regeneration, salvage harvest, as well as pre-commercial thinning. Harvest activities began around 1949 and have continued to the present. Within the directly affected BMUs, when all ownership is considered, regeneration harvest has occurred on 3,028 acres in BMU 2 (5 percent of the total BMU); 1,350 acres of BMU 5 (2 percent of the total BMU); and

3,671 acres of BMU 6 (6 percent of the total BMU). Past harvest has provided a variety of vegetation successional stages across the BMUs and in favorable habitat types, and past harvest and prescribed burning for planting preparation provided conditions favorable for huckleberry production and other forage for grizzly bears and big game. The majority of this past timber harvest occurred prior to 1998 and the units currently have trees and shrubs in a density and size to provide cover. The more recent regeneration harvest units provide forage opportunities.

Stochastic natural events such as wildfire, insects, disease, and windthrow have also provided a variety of successional stages and habitat in unharvested areas. The last large-scale fires occurred between 1885 and 1939, with the 1910 fires affecting large areas within the CYRZ, including BMUs 2, 5, and 6. Fire suppression since the early 1900 has altered stand structure, resulting in more homogenous stands with greater canopy closure and poorly developed understories in some areas. In BMU 2, within the last 15 years, small fires have occurred on the south-facing slopes in Leigh and Big Cherry Creeks. Wildfires would reduce timber, promote understory shrub growth, and create additional age classes and species diversity. This would benefit some shrub species such as huckleberry, which provide an important fall food source for grizzly bears. Prescribed burns can also produce similar responses in shrub growth in the absence of wildfire.

Road construction to facilitate timber harvest or mining has occurred within the BMUs, resulting in the matrix of open, restricted with gates or berms, or impassable roads existing today. Open road densities within the CYRZ, including BMUs 2, 5, and 6, have reduced compared to levels in the 1970s and 1980s due to road access changes resulting from decisions that included management objectives to improve hydrological conditions and wildlife habitat, including to facilitate grizzly bear recovery. Past road access management has resulted in the existing conditions related to the habitat parameters of core habitat, OMRD, and TMRD in Table 230 below.

Management Objectives/Grizzly Bear Habitat Parameters

The goal for grizzly bear management on the KNF is to provide sufficient quantity and quality of habitat to facilitate grizzly bear recovery. As mentioned above, an integral part of the goal is to implement measures within the authority of the Forest Service to minimize human-caused grizzly bear mortalities. This goal is accomplished by achieving five objectives common to grizzly bear recovery as described by Harms (1990), and by a sixth objective specific to the KNF concerning acceptable incidental take (USFWS 2011c, 2011d).

Objective 1: Provide adequate space to meet the spatial requirements of a recovered grizzly bear population

Habitat parameters of core, OMRD, and TMRD are based on prudently drivable roads and are used to evaluate quality of grizzly bear habitat. Habitat parameters OMRD and TMRD directly measure road density, while core measures the amount of secure habitat within the BMUs located at least 0.31 mile from motorized roads and trails. Displacement calculations estimate the degree to which suitable habitat is used by grizzly bears and consider the effects of both linear features and point source disturbances. Point source disturbances typically pertain to a disturbance originating from a single point rather than a linear feature such as a road; however, roads with consistent 24-hour high-intensity use would be treated as a point source disturbance. Examples include a drill rig, a campground, a garbage collection site, a mine, or other site with concentrated human or mechanized activity.

A. *Disturbance and Displacement:* Displacement area means those acres where nearby human activity may result in underutilization of the available habitat by grizzly bears due to an avoidance behavior. The term displacement does not necessarily mean that grizzly bears would totally avoid an area, or be excluded in some way from ever using an area. Displacement is used in general terms to describe "underuse" of habitat. In research, "significant underuse" of habitat means that bears use habitat "less than expected" compared to its availability. Displacement of grizzly bears from an area can range from short-term or diurnal avoidance to more significant long-term underuse of habitat, depending upon the season, quality of habitat affected, and the age and sex of grizzly bears affected. The length of displacement time also depends on the nature of the disturbance and consequences experienced by grizzly bears. Displacement behavior in grizzly bears may be expressed through a change in diurnal habitat use or movement patterns, avoidance or underuse of otherwise preferred habitat, and/or other behaviors related to stress or fear (USFWS 2006 Rock Creek Biological Opinion p. A-38).

Grizzly bear displacement from disturbances other than roads (*e.g.,* such as mining, seismic activity, and aircraft) is usually related to distance from the activity. Individual bear behavior, the season of use, sex, habitat conditions, and a wide variety of other factors influence grizzly bear response to human presence and activities. Increases in human and or mechanical activities have a number of effects to bears that are well documented (McLellan and Shackleton 1988, 1989a, 1989b; USFWS 1993; Mace and Manley 1993; Wakkinen and Kasworm 1997; Mace *et al.* 1999). McLellan and Shackleton (1988) found that most bears used habitat less than expected within 100 meters of roads, and avoidance of roads was independent of traffic volume. McLellan and Shackleton (1989a) did not find significant displacement in terms of moving away from disturbance when radio-monitored bears were exposed to seismic activities, gas exploration, and timber harvest, although individual bears responded differently. McLellan and Shackleton (1989b) documented avoidance of roads and industrial sites, and that bears responded differently to modes of human transportation (on foot, moving vehicles, and to fixed-wing aircraft) in open habitat as opposed to closed timbered habitat. Grizzly bears can become conditioned to human activity and show tolerance, especially if the location and type of human use are predictable and do not result in outright negative impacts to bears (McLellan and Shackleton 1989a; Jope 1985; Cronin *et al.* 1999).

The analysis of habitat displacement estimates the extent of the displacement, or zone of influence, and the degree to which suitable grizzly bear habitat is used. The extent of a zone of influence is determined based on the type of activity, as recommended in the Cumulative Effects Analysis Process (USDA Forest Service 1988a; IGBC 1990). The degree of habitat use is estimated based on disturbance coefficients and compensation levels assigned to different human activities (Ibid). Methods used to estimate displacement effects from the action alternatives and corresponding required habitat compensation are described in greater detail in the *Revised FEIS Analysis of Grizzly Bear Displacement Effects* (ERO Resources Corp. 2015). Existing displacement within the directly affected BMUs is shown in Table 229. Existing displacement acres for point source disturbances and linear features were calculated by applying a 0.25-mile buffer to open roads, developments, and/or high levels of human activity (MS-3 lands, see Objective 5) during the active bear year. The area within this 0.25-mile influence zone is considered underutilized by grizzly bears.

Table 229. Existing Displacement Acres Due to Point Source Disturbances (MS-3 Lands) and Linear Features (Roads) within the Directly Affected BMUs.

BMU	Total Acres Within BMU	Overlap Acres of Displacement (MS-3 lands & buffer and existing roads & buffer overlap)	Point Source Disturbances (MS-3 lands & buffer with no overlap)	Linear Disturbances (linear open roads & buffer with no overlap)	Total Acres Currently Affected by Either Linear or Point Source Disturbances or Overlap and % of BMU Affected
2	65,241	4,665	1,734	6,854	13,253 (20%)
5	70,210	5,442	2,957	10,925	19,324 (28%)
6	64,148	7,932	2,925	8,057	18,914 (29%)

Wielgus and Vernier (2003) and Wielgus *et al.* (2002) found most female grizzlies avoided open roads and restricted (gated) roads. Mace *et al.* (1999) found female grizzlies avoided roads in all use classes. They divided road use into three categories: low = less than 1 vehicle a day, moderate = between 1 and 10 vehicles a day, and high = greater than 10 vehicles a day, with all three categories significantly and negatively associated with avoidance by female bears. Graham *et al.* 2010 found that female grizzly bear survival and reproductive output decreased as road densities increased. Proctor *et al.* 2008 also found that human development and highways were avoided by female bears, along with avoidance of spring and riparian habitats associated with roads. Roads in the south Cabinet portion of the CYE tend to occur in the lower elevations where grizzly bear spring habitat is concentrated and where human development and activities are situated. Approximately nine roads, including the roads accessing the Wayup and Fourth of July parcels, partially bisect the southern Cabinet Mountains from east to west in BMUs 5 and 6. Within BMU 5, portions of the East Fork Bull River (#407), Chicago Peak (#2741), East Fork Rock Creek (#150A), and the Rock Lake Trail 150A/#935, Upper Bear Creek (#4784), Upper Libby Creek (#2316) roads, and within BMU 6, portions of the Orr Gulch (#2285), Twin Peaks (#6746), Bramlet (#2332), Bramlet Spur Road #5111 to the Jumbo Mine, and Silver Dollar (#6748) roads enter the north-south corridor. Only the uppermost portion of Road #6746 and Road #5111 off the end of the Bramlet Road are gated to allow access only to landowners with inholdings; the remaining roads are open during the bear year. Open roads occurring within this corridor pose displacement and mortality risks to bears attempting to move north or south through the ecosystem. The displacement resulting from these roads is particularly disruptive to grizzly bears because they cross important spring habitat, which is limited in the ecosystem, and early-season huckleberries, also not abundant within the southern portion of the ecosystem (USFWS 2014a). A few of these roads run from the highways bordering the CYE up to the edges of the CMW, bringing people near secure bear habitat.

Existing habitat parameter levels in the Snowshoe, St. Paul, and Wanless BMUs are listed in Table 230 and are shown on Figure 92. (See project record for habitat parameter outputs.) 2011 Access Amendment standards for percent core, OMRD, and TMRD are specific to each BMU and are shown in Table 230.

Table 230. Existing Habitat Parameter Conditions Compared to Each BMU Standard.

BMU #	Percent Core Habitat	Percent OMRD >1 mi/mi^2	Percent TMRD >2 mi/mi^2
Snowshoe # 2	76 (≥75)	20 (≤20)	16 (≤18)
St. Paul # 5	**58** (≥60)	28 (≤30)	23 (≤23)
Wanless # 6	**54** (≥55)	29 (≤34)	**33** (≤32)

Values in parentheses represent Access Amendment grizzly bear habitat parameter standards.
Bolded values do not meet Access Amendment standards.
BMU = Bear Management Unit.
OMRD = open motorized route density.
TMRD = total motorized route density.

B. *Core area*. A core area or core habitat is an area of high-quality grizzly bear habitat within a BMU that is greater than or equal to 0.31 mile from any road (open or gated), motorized trail open, or high-use non-motorized trail during the active bear season. Blocks of core habitat function as displacement areas for grizzly bears. Core habitat may contain restricted-access roads, but such roads must be effectively closed to all motorized vehicles with a barrier device including, but not limited to, earthen berms/ditch, boulders, or other barriers, or be impassable due to vegetative growth. Core is calculated by buffering roads, motorized trails, and high-use non-motorized trails on all lands, regardless of ownership, in a BMU (IGBC 1998). Federal agencies will work toward attaining established core standards for each BMU, with a benchmark of 55 percent for most BMUs. No net loss of core area will occur on federal ownership within any BMU until all BMUs within the KNF jurisdiction in the CYRZ meet or are better than the standard.

Current core level for BMU 2 is better than its individual standard. BMU 5 does not meet its individual standard of 60 percent, but is above the research benchmark minimum of 55 percent. BMU 6 does not meet its individual core standard and is 1 percent below the 55-percent benchmark. Existing core block sizes are shown in Table 231 below as specified in the Access Amendment Biological Opinion (USFWS 2011c) design element (B).

Existing core blocks within the three BMUs range from 1 to 49,151 acres, with the largest blocks overlapping the CMW and providing secure habitat for connectivity between BMUs. For the CYE, no scientifically based minimum effective size polygon for core has been determined (Wakkinen and Kasworm 1997), though minimum blocks of 2 to 8 square miles were suggested.

A. *OMRD*: Open motorized route density is calculated on a BMU basis using moving window analysis. Any road or trail open to motorized use during the active bear year contributes to OMRD. Results are displayed as a percentage of the analysis area in relevant route density classes. OMRD is expressed as the percentage of the entire BMU, regardless of ownership, with open road density greater than 1 mile per square mile (mi/mi^2). In BMUs not meeting OMRD standards, actions affecting OMRD must result in post-project OMRD better than levels that existed before the action.

Table 231. Existing Core Block Acres in BMU 2, BMU 5, and BMU 6.

Core Block #	BMU 2 (acres)	BMU 5 (acres)	BMU 6 (acres)
1	2	8	1
2	3	24	1
3	29	56	3
4	54	67	8
5	327	239	15
6	49,151[4]	241	65
7		372[1]	959[1]
8		845	1,036
9		1,121	1,354[2]
10		11, 30, 33[3]	1,468
11		37,803[4]	1,636[3]
12			1, 1, 787, 27,067 (27,856)[4]
Total Acres (Total % Core)	49,566 (76% of BMU)	40,851 (58% of BMU)	34,402 (54% of BMU)

[1]Block #7 in BMUs 5 and 6 combine for a total core block of 1,331 acres.
[2]Block #9 in BMU 6 is adjacent to BMU 7 and combines with the main BMU 7 core block.
[3]The 11-, 30-, and 33-acre parcels in BMU 5 and 1,636-acre parcel in BMU 6 combine for a 1,710-acre block of core.
[4]The main 49,151-acre core block in BMU 2, the 37,803-acre block in BMU 5, and the total 27,856-acre block in BMU 6 all combine to form one large core block.

OMRDs within BMUs 2, 5, and 6 are near or lower (better) than levels reported in average female home range (Wakkinen and Kasworm 1997). The existing OMRD levels for BMUs 2, 5, and 6 (20, 28, and 29 percent, respectively) currently meet or are better than their respective standards of 20 percent for BMU 2, 30 percent for BMU 5, and 34 percent for BMU 6 (see Table 230).

B. TMRD: Total motorized route density is calculated for a BMU using moving window analysis. TMRD is expressed as the percentage of the entire BMU, regardless of ownership, with total route density greater than 2 mi/mi^2. Roads or trails open to motorized traffic and gated roads contribute to TMRD, whereas roads restricted with a barrier effectively restricting all motorized vehicles do not. For BMUs not meeting their TMRD standard, actions affecting TMRD must result in post-project TMRD better than levels that existed before the action.

TMRD in BMU 2 and BMU 5 are near or lower than the average reported being used by grizzlies in the CYE (26 percent) (Wakkinen and Kasworm 1997), providing more suitable habitat for a female grizzly bear. The existing TMRD level for BMU 2 at 16 percent is better than its standard of 18 percent, while BMU 5 existing TMRD and standard coincide at 23 percent.

BMU 6 at an existing 34-percent TMRD is higher or worse than the average total motorized access conditions of 26 percent found in the average female grizzly bear home ranges in the CYE (Wakkinen and Kasworm 1997) and 1 percent higher (worse) than the BMU standard of 32 percent (Table 230 and Table 234). BMU 6's numerical standard for TMRD of 32 percent is 6 percent above the Wakkinen and Kasworm (1997) research benchmark of no more than 26 percent TMRD within a BMU, but is an attainable goal based on private ownership within the BMU 6. BMU 6 has 15 percent of its land base in private or Montana State ownership (7 percent private, 1 percent State, 3 percent Stimson, and 4 percent Plum Creek), which has influenced the total number of roads. The density in BMU 6 is due in part to MT 200, which runs along its southwestern boundary and to private roads that access six sections of private corporate timber lands. Areas of higher TMRD could result in avoidance or underuse of the affected area by grizzly bears, potentially increasing mortality risk. The Access Amendment considered BMU 6 and the effect of its standard of 32 percent TMRD along with the other six BMUs set below the benchmark (USFWS 2011c; 2011d p. A-79, Table A-8, p. A-68) and determined that the negative effects would be moderated by conditions in the remaining BMUs. The level of incidental take associated with a baseline TMRD of 32 percent was considered within the Access Amendment Biological Opinion (USFWS 2011c).

Objective 2: Manage for an adequate distribution of bears across the ecosystem

A. *Juxtaposition of foraging habitat and cover/movement corridors*: The availability and proximity of cover may influence the use of foraging habitats by grizzly bears. Historical vegetative conditions and natural disturbance processes resulted in a mosaic of forage and cover habitats that bears evolved with. Consider the effect of actions on availability of bear foods, size and shape of openings, and movement corridors. The Access Amendment Biological Opinion (USFWS 2011c) describes the importance of habitat connectivity or linkage for the grizzly bear. Maintaining habitat linkage and connectivity can allow immigrant grizzly bears to bolster resident populations affected by catastrophic events or poor environmental conditions and reduces negative effects from inbreeding.

Past harvest units in the BMUs included regeneration units of various sizes. Those areas that were harvested 15 or more years ago in most cases now provide hiding cover and forage habitat for bears. Since implementation of the 1987 KFP, movement corridors for big game such as elk have been maintained and any harvests prior to 1987 that did not provide for movement corridors would now provide cover for movement within and between units due to time and vegetation succession.

On a larger scale, the CYE is a long, narrow ecosystem, bordering Canada and encompassing the Cabinet and Purcell Mountain ranges in northwestern Montana and northern Idaho, is 100 miles long north-south, and ranges from 15 to 35 miles east to west. The CMW is a smaller area with no motorized access in the higher elevations of the Cabinet Mountain portion of the ecosystem, is 34 miles long, and varies in width from 0.5 to 7 miles. The CMW consists of 93,709 acres of the 1,664,000 acres of the CYE (5.7 percent) and contains all or part of BMUs 1, 2, 4, 5, and 6. BMU 7 is adjacent to the southern tip of the CMW. BMU 8 is south of the CMW and contains the Cataract Roadless Area. These unroaded or wilderness areas provide a relatively high quantity of summer habitat, abundant throughout the CYE, but relatively limited important spring habitat. The CMW forms the central section of a north-south movement corridor, connecting the southern Cabinet Mountain BMUs (6, 7, 8, and 22) to the north Cabinet Mountain BMUs (1, 2, 3, 4, and 9) and overall linking the Cabinet Mountains to the Yaak River basin to the north. As described in section 3.9, *Geology and Geochemistry*, the Cabinet Mountains are a rugged, glaciated mountain range of high relief. Along this narrow northwest-trending corridor, the wilderness area is unroaded; however, it is impacted in places by open roads leading near or adjacent to its borders due to human development on the east and west sides. The influence of nearby roads is especially detrimental where the wilderness narrows as they constrict the width of effective grizzly bear habitat, or where habitat in the wilderness is not conducive to grizzly bear movement, such as open areas devoid of cover (USFWS 2014a). The characteristics and importance of the north-south movement corridor are described in detail in the Wildlife BA (USDA Forest Service 2013b).

B. *Seasonal Components*: Grizzly bear use seasons have been defined through grizzly bear research. Although there may be considerable variation between individuals, based on Kasworm *et al.* (2007) and Johnson *et al.* (2008), seasons are defined as: Denning: December 1 – March 31; Spring: April 1 – June 15; Summer: June 16 – September 15; Fall: September 16 – November 30; Non-denning season: same as active bear year; and active bear year: April 1 – November 30 (Johnson *et al.* 2008). In areas with important seasonal components such as spring range, the guideline (for timber harvest) is to schedule proposed activities to avoid spring habitats during the spring use period (April 1 – June 15). Activities close to known den sites should be avoided during the denning period (December 1 – March 31) (Summerfield 1991).

Excellent year-round habitat components are present in BMUs 5 and 6, with documented use by grizzly bears (Kasworm and Manley 1988). The yearly average elevational use occurs at 5,167 feet (1,574 meters, Kasworm *et al.* 2013c). Grizzly bear spring and denning habitat is shown on Figure 92. Roads, human development, and activity tend to be located in the lower elevations where the spring habitat is concentrated. Approximately nine roads, including the roads accessing the Wayup and Fourth of July parcels, partially bisect the southern Cabinet Mountains from east to west in BMUs 5 and 6. Additionally, roads just outside the corridor boundaries on the east side occur in or traverse through important spring habitat, including Libby and Miller Creek roads.

Spring grizzly bear habitat comprises 13,293 acres (20 percent) of BMU 2; 17,625 acres (25) percent of BMU 5; and 14,091 acres (22 percent) of BMU 6. Spring habitat is well distributed throughout all directly affected BMUs and is well represented in core areas (secure habitat) when compared to its availability within each BMU. The availability of spring and denning habitat and existing displacement effects are described in detail in the Wildlife BA (USDA Forest Service 2013b). In summary, of the 45,009 acres of spring range present within the directly affected BMUs 2, 5 and 6, about 3,843 acres or 8.5 percent are located within an existing open road buffer. Of that 3,843 acres, 654 acres (or 17 percent) are located on MS-3 lands. The majority of spring range is located outside of existing road buffers (41,167 acres or 91 percent), with 2,145 acres (or 5 percent) of that unaffected spring range located on MS-3 lands. Overall, 6 percent of spring range is located on MS-3 lands where grizzly use is not encouraged. Low-elevation spring habitat is thought to be less abundant than other seasonal habitats in this ecosystem (USFWS 2014a). Kasworm (1989) analyzed radio locations from three bears to determine the effects of roads on seasonal habitat use patterns, and found that grizzly use in the Cabinet Mountains was reduced 78 percent from that expected during the spring period in areas adjacent (up to 0.28 mile) to open roads. Existing seasonal habitat components are shown in Table 232.

Avalanche chutes, which total 8,140 acres, are also largely unaffected with 7,795 acres or 96 percent outside of existing road buffers (described in detail in the Wildlife BA, USDA Forest Service 2013b).

Grizzly bear den sites in the Cabinet Mountains are generally in remote areas above 5,000 feet that have well-developed soils for excavation and adequate snow accumulation. Mean elevation of den sites in the Cabinet Mountains from 1983 to 2009 was 6,151 feet (Kasworm *et al.* 2013c). The two closest known grizzly bear dens from the generalized location of all action alternatives mine disturbance areas were found 3 miles to the west in the upper Bear Creek and Cable Creek drainages. The majority of all denning habitat is located outside of existing road buffers (42,361 acres or 96 percent), and of that, 1,775 acres or 4 percent are located on MS-3 lands. Denning habitat affected by existing road buffers totals 1,694 acres or 4 percent. Overall, 2,321 acres or 5

Table 232. Existing Seasonal Habitat Components in BMUs 2, 5, and 6.

Habitat Component	BMU 2 (acres)	BMU 5 (acres)	BMU 6 (acres)	TOTAL (acres)
Size	65,241	70,210	64,148	199,599
Spring Habitat	13,293	17,625	14,091	45,009
Existing Road Effects[1]	533	1,915	1,395	3,843
Avalanche Chute	4,389	3,180	571	8,140
Existing Road Effects[1]	124	32	189	345
Denning Habitat	17,492	14,414	12,149	61,547
Existing Road Effects[1]	295	784	615	1,694

[1]Existing habitat affected by open roads (roads opened during active bear year) is located within a 0.25-mile buffer.
Source: Wildlife BA (USDA Forest Service 2013b).

percent of denning habitat is located on MS-3 lands. Existing denning habitat is well represented in secure (core) habitat across all three BMUs (described in detail in the Wildlife BA, USDA Forest Service 2013b).

The Bear Creek Road #278, which lies in a north-south alignment, cuts across most of the Libby Creek sub drainages that flow west to east, and divides higher elevation grizzly bear summer, fall, and den habitats to the west of the road from lower elevation spring habitats to the east (USFWS 2014a).

C. *Density, Displacement, and Core Areas*. Road density, displacement, and core areas are discussed in Objectives 1 and 6.

Objective 3: Manage for an acceptable level of mortality risk

During the 1980s, most documented grizzly mortalities in the CYE were the result of interactions between bears and big game hunters (Kasworm and Their 1990). The relatively small size of the Cabinet Mountains portion of the ecosystem, coupled with high accessibility, creates a strong potential for the illegal shooting of grizzly bears (Knick and Kasworm 1989). Grizzly bear vulnerability to human-caused mortality is partially a function of habitat security. Therefore, mortality risk can be assessed to some extent by the use of habitat components that maintain or enhance habitat security (see Objectives 1, 2, and 6). These include juxtaposition of cover and forage or movement corridors (see Objective 2), road densities, and displacement (core) areas (see Objectives 1 and 6).

Management removals due to habituated bears or those related to sanitation issues account for 8 percent of documented mortalities. In this regard, increased law enforcement along with better public education and awareness is of vital importance to grizzly bear recovery in the CYE.

The maximum human-caused mortality level that can be sustained by a grizzly bear population before resulting in population decline is 6 percent, when no more than 30 percent of mortalities are female bears (Harris 1984). The goal for the CYE is less than 4 percent human-caused mortality, with no more than 30 percent of total mortality consisting of female bears (USFWS 1993). Based on a calculated minimum population of 41 individuals (Kasworm *et al.* 2013c) and applying the 4 percent mortality limit resulted in a total mortality limit of 1.6 bears per year. The female limit is 0.5 females per year (30 percent of 1.6). Average annual human-caused mortality for 2007 through 2012 was 1.7 bears/year and 0.5 females/year (however, the sex of two bears was not known at the time) (Kasworm *et al.* 2013c). These preliminary mortality levels for total bears were in excess of calculated limits for 2007 through 2012 and female mortality was at the calculated limit (Ibid). However, it should be noted that the Grizzly Bear Recovery Plan established a human-caused mortality goal of zero for this CYRZ because grizzly bear numbers are so small in this ecosystem (USFWS 1993a).

Objective 3 also addresses attractants for grizzly bears that may result from proposed projects by developing methods to reduce the potential for human/grizzly conflict. Attraction of grizzly bears to improperly stored food and garbage is identified by the Recovery Plan as one of the principal causes of grizzly bear mortality (USFWS 1993a). Bears that lose their natural fear and avoidance of humans, usually as a result of food rewards, become habituated and may become food-conditioned. Current activity occurs on MMC-owned land at the Libby Adit where MMC has enacted sanitation protocols to reduce attractants. As mentioned previously, on KNF lands, bear-resistant garbage containers have been installed in developed campgrounds and dispersed recreation sites to reduce bear attractants. Other primary sources of existing attractants would be associated with private land development.

Objective 4: Maintain/improve habitat suitability with respect to bear food production

Within the Cabinet Mountains, the complex terrain creates steep biophysical and climatic gradients that foster diverse vegetation patterns (Holden *et al.* 2012). The Cabinet Mountains range in elevation from 2,000 to 8,750 feet and have a Pacific maritime climate characterized by short, warm summers and heavy, wet winter snowfalls. Mixed stands of coniferous and deciduous trees, riparian shrubfields, and wet meadows occur along the major drainages (Kasworm *et al.* 1998).

Identifying habitat components on the basis of bear food availability and delineating their specific season of importance helps provide a profile of important grizzly habitat. The process of identifying and mapping important bear foraging and denning habitat was completed for the Cabinet Mountains portion of the CYRZ in the early 1980s, and the process was described thoroughly by Madel (1982). Mapping indicated that the Libby Creek drainage had the highest spring, summer, and fall component acreage of any drainage in BMU 5, and the upper West Fisher Creek drainage had the highest spring and summer component acreage of any drainage in BMU 6. Excellent year-round habitat components are present within and adjacent to the project area with documented use by grizzly bears (Kasworm and Manley 1988; Christensen and Madel 1982). The process also recognizes that many high-value foraging components are generally non-forested and many sites may remain in a relatively stable vegetative state for many decades or even longer. Successional processes in wet meadows and marsh habitat are relatively slow, and avalanche chutes may retain their vegetative condition for centuries due to the continual disturbance associated with sliding snow. Other foraging sites that may have developed as a result of disturbance from wildfire or timber harvest may experience more rapid successional processes.

Kasworm *et al.* (2011) notes the importance of huckleberries as a major source of late summer food, along with serviceberries and mountain ash depending upon the year. Based on huckleberry life history, and fire occurrence and timber management within the Cabinet Mountains, huckleberry field production is likely decreasing. The last large-scale fires occurred between 1885 and 1939, with the 1910 fires affecting large areas of the CYE.

Objective 5. Meet the management direction outlined in the Interagency Grizzly Bear Guidelines (51 Federal Register 42863) for management situations 1, 2, and 3.

Within the Recovery Zone, meeting Objectives 1 through 4 has been determined to meet the intent of the Interagency Grizzly Bear Guidelines (IGBC 1986; Buterbaugh 1991) and the KFP direction found in Appendix 8, as amended by the 2011 Access Amendment. Habitat parameters within BMU 2 currently meet or are better than its individual standards. BMUs 5 at 58 percent does not meet its core standard of 60 percent, but is above the research benchmark minimum of 55 percent and either meets or is better (lower) than its OMRD and TMRD standard. BMU 6 at 54 percent does not meet its core standard of 55 percent or the research benchmark, but is better (lower) than its OMRD standard and is worse than (higher) than its TMRD standard. These existing conditions within BMU 6 are moderated by conditions in the remaining BMUs (USFWS 2011c, 2011d) in the south Cabinets. Those BMUs meeting or better than their standard would provide habitat for female grizzlies to be successful and survive to adulthood and reproduce and provide cubs, based on CYE research findings (Wakkinen and Kasworm 1997; Allen *et al.* 2011). As described previously, a north-south movement corridor exists through BMU 2, 5, and 6, connecting the southern BMUs (7, 8, and 22) to the northern Cabinet Mountain BMUs 1 and 2 and Yaak River basin portion of the ecosystem. The CMW forms the central section of this corridor. Seasonal habitat components are well distributed across BMUs 2, 5, and 6. Human-caused mortality has occurred as recently as 2011 within BMU 2 and BMU 5.

Objective 6: Meet the management direction specified in the October 18, 2011 Incidental Take Statement (USFWS 2011c, 2011d).

This objective is met by meeting core, OMRD, and TMRD standards addressed in Objective 1 as well as complying with 2011 Access Amendment features and design elements for the CYRZ and the Cabinet Face BORZ.

Outside Recovery Zone

National Forest System Lands

The 2011 Access Amendment Biological Opinion (USFWS 2011c, 2011d) concurred with the existing motorized access conditions for areas of bear occupancy outside the recovery zones. These conditions were determined and established by the 2010 Level One Team (Access Amendment). As discussed under the *Analysis Methods* section, the SCYE and BORZ were re-evaluated by a multiagency group of biologists in 2009 and linear miles of open and total road were used to document the existing motorized baseline because they are more easily communicated, monitored, and calculated than road densities (Allen 2011). The boundaries of these identified BORZ areas are not static and may be adjusted as grizzly bear use patterns are reevaluated in the future. The baseline conditions for National Forest System lands in the Cabinet Face BORZ polygon are displayed below in Table 233.

Table 233. Cumulative Baseline Condition of Cabinet Face BORZ.

Grizzly Bear Ecosystem	Total Size (acres)	National Forest System Lands		
		Size (acres)	Total Linear Miles of Roads 2013/Baseline	Total Linear Miles of Open Roads 2013/Baseline
Adjacent to Cabinet Mt portion of the CYE	28,052	27,093	164.6/(164.6)	129.5/(129.5)*

*- Differs from the 128.0 miles identified in the Access Amendment baseline (USDA Forest Service; KNF 2011a, 2011b) due to corrections in database; no changes occurred on the ground.

Grizzly bear sightings have occurred along the front of the Cabinet Mountains outside of the Recovery Zone. Credible sightings of grizzly bears documented for 15 years (1994-2010) within the Cabinet Face BORZ total 23 sightings with one female with cubs (1997) and one bear mortality (1997 poaching on private land) (Allen 2011; Kasworm *et al.* 2012). During 2012, no sightings of a female with cubs occurred in the Cabinet Face BORZ but a credible sighting of a grizzly bear did occur (Kasworm *et al.* 2013c).

Existing linear miles of road on National Forest System lands in the Cabinet Face BORZ (baseline corrected and updated since the 2011 Access Amendment) are 129.5 miles of open road and 164.6 miles of total road (USDA Forest Service 2012e). Road construction to facilitate timber harvest or mining has occurred within the Cabinet Face BORZ, resulting in the matrix of open, restricted with gates or berms, or impassable roads existing today. Timber harvest activities began about 1949 and have continued to the present. Within the Cabinet Face BORZ on National Forest System lands, 3,346 acres of regeneration harvest has occurred. Past harvest has provided a variety of vegetation successional stages across the BORZ.

Currently no active range allotments or food attractants (refuse collection sites) are on National Forest System lands in the Cabinet Face BORZ. The Lincoln County collection dumpster site, a known black bear attractant, was moved in 2012 to a location along US 2 about 0.6 mile north of the Libby Creek Road/US 2 intersection, is enclosed within an electrified fence, and is locked nightly. This site is 1.5 miles east of the current BORZ boundary. The Cabinet Face BORZ overlaps 14,058 acres of the Crazy PSU and 1,985 acres of the Silverfish PSU. Campgrounds and dispersed camping sites have the potential to provide attractants; however, these areas are managed or checked regularly so that potential attractants do not remain. Private lands within the Cabinet Face BORZ boundary or adjacent to the BORZ likely have both livestock and food attractants present. The 2011 Access Amendment and the management direction specified in the October 18, 2011 Incidental Take Statement (USFWS 2011c, 2011d) directs the KNF to comply with features and design elements for the Cabinet Face BORZ.

Private and State Trust Lands

Within the MFSA transmission line corridor analysis area, road densities on private land are generally high. Many private land parcels have housing and other human-related development. On corporate timberland, most previously harvested areas have well-established conifer regeneration primarily dominated by dry ponderosa pine/Douglas-fir communities. Small areas of cottonwood or spruce/fir riparian habitat provide potential feeding sites for grizzly bears in the Miller Creek, Fisher River, West Fisher Creek, and Hunter Creek riparian corridors.

The two State trust parcels (section 36 T27N, R30W and section 16 T28N, R30W) are located outside of the CYE. State section 36 T27N, R30W, located on the eastern edge of BMU 6 in the West Fisher Creek drainage, is crossed by the year-round open road #231 (Libby Creek/Fisher River Loop Road) through the southeast and southwest quarters. The KNF has mapped spring foraging habitat, which extends down in elevation from inside BMU 6 into the northwest quarter of this section. State section 36 is also partially located in the US 2 – Barren Peak/Hunter Creek approach area described below. The other State section (16 T28N, R30W) is located about 1 mile northeast of BMU 5 and has the Libby Creek Road #231 located through the northwest quarter. Both State trust sections were identified as being located in non-recovery occupied habitat (State HCP, Figure C-15) and are also located in HUCs (West Fisher Creek and upper Libby Creek), which are considered occupied by grizzly bears (Allen 2011).

Linkage/Movement Corridors

The KNF has identified three approach areas for crossing the US 2 fracture zone in the general vicinity of the Montanore Project area (Brundin and Johnson 2008). To the north of Poker Hill 7 miles, the US 2 –Deep Creek/McMillian approach area overlaps the northeastern tip of the Crazy PSU where Bear Creek Road #278 intersects US 2, the easternmost edge of BMU 2, and the Cabinet Face BORZ. Approximately 4 miles south of Poker Hill, the US 2 – Horse Mountain/Teepee Lake approach area is adjacent to BMU 5's eastern boundary and overlaps the Cabinet Face BORZ. The southernmost approach area identified, the US 2 – Barren Peak/Hunter Creek, extends from the Miller Creek area southward toward the Jumbo Peak and Fosseum Mountain Area. The Barren Peak/Hunter Creek and most of the Horse Mountain/Teepee Lake approach areas are located within the larger landscape scale Lost Trail – Kenelty linkage area identified by American Wildlands (2008), a regional non-profit organization. The Lost Trail – Kenelty linkage area was identified as an important movement area connecting the Northern Continental Divide Grizzly Bear Ecosystem and the CYE (Ibid). Servheen *et al.* (2003) examined grizzly bear habitat linkage between the Cabinet-Yaak and the Northern Continental Divide ecosystems and identified more site-specific linkage areas consisting of small scattered crossings between Libby and Sedlak Park. The linkage areas described by Servheen *et al.* (2003), Brunden and Johnson (2008), and American Wildlands (2008) are referred to collectively as the US 2 linkage zone. National Forest System land both inside and outside the BORZ boundary and private land occurs within the US 2 linkage zone area. Linkage areas between the Cabinet-Yaak and the Northern Continental Divide ecosystems are described in greater detail in the Wildlife BA (USDA Forest Service 2013b). The eastern part of the DEQ MFSA transmission line analysis area is comprised mainly of Plum Creek land, especially in the vicinity of US 2, and is situated within the US 2 linkage zone.

3.25.5.2.4 Environmental Consequences

The following subsections describe the effects of the transmission line alternatives and combined mine-transmission line alternatives on grizzly bears. Cumulative effects of the combined mine-transmission line alternatives and other past, present, and reasonably foreseeable actions on grizzly bears are described.

The effects on grizzly bear core habitat, OMRD, and TMRD in BMUs 2, 5, and 6 are shown for the combined mine-transmission line alternatives in Table 234. Mine development and associated facilities (evaluation adit, plant site, and associated aboveground conveyer belt system, pipe systems, impoundment and associated road construction and reconstruction, and Rock Lake Ventilation Adit) would be located in BMU 5. The transmission line would be located in both

BMU 5 and BMU 6. No proposed mine or associated facilities or transmission line locations would be located in BMU 2, only road access mitigation and the proposed access road would affect BMU 2. The access road for all combined action alternatives is the Bear Creek Road #278, which is located in or adjacent to BMU 2.

Transmission line impacts on core, road densities, and displacement may be inferred from impact calculations for the combined mine-transmission line alternatives. For example, for BMU 5 because core and road densities are similar for combined alternatives associated with Alternative 3 and combined alternatives associated with Alternative 4, the effects of the proposed project appear to be due primarily to the mine alternatives. In BMU 6, core and road densities would be primarily affected by the transmission line alternatives, and effects are similar for the combined alternatives associated with Alternatives C-R and D-R.

Transmission line displacement effects on grizzly bears would be short-term (about two active bear seasons) and, depending upon the combined alternative, are mitigated for by timing restrictions on transmission line construction-related activity on National Forest System land within the CYRZ and BORZ and also on State land (section 16 T27N, R30W) where applicable. Mine development-related effects (which would occur for the approximate 30-year life of the mine) are considered long-term for the grizzly bear, and to mitigate for these long-term displacement effects, the agencies' alternatives would require habitat compensation for displacement where Alternative 2B would not.

To illustrate the difference in transmission line and mine-related effects as required by Montana DEQ for MMC's MFSA evaluation, transmission line and mine alternative displacement effects are shown separately (Table 236 and Table 239). Corresponding habitat compensation for the mine alternatives' long-term displacement effects are shown in Table 239. Combined action alternative mitigation for grizzly bear habitat physically lost and for displacement effects is shown in Table 30 in Chapter 2.

No Action Alternatives

(Alternative A – No Transmission Line, Alternative 1 – No Mine, and Alternative 1A – No Combined Mine-Transmission Line)

No direct effects from federal actions would occur under the no action alternatives. No transmission line or mine would be constructed. Existing vegetative structure and current motorized road access would be maintained in BMUs 2, 5, and 6 and the CYE. The Access Amendment (USDA Forest Service 2011a, 2011b; USFWS 2011c) identified reasonably foreseeable federal actions as part of the strategies to bring BMUs into compliance with their individual BMU standards. The Montanore Project was identified as a potential reasonably foreseeable federal action to improve grizzly bear baseline habitat parameters and bring BMU 5 (currently not meeting core) and BMU 6 (currently not meeting TMRD or core) into compliance through road access mitigation. Access Amendment compliance within directly affected BMUs would have been achieved with implementation of any of the agencies' mitigated action alternatives and this would not occur. The agencies' mitigation plan would have required the KNF to manage at a level better than the baseline for the life of the mine once mitigation properties were acquired and this would not occur.

In those BMUs not currently meeting habitat parameter standards of core, OMRD, and TMRD, the KNF would be required to comply with Access Amendment standards within the specified timeframes (USDA Forest Service 2011a, 2011b) independent of the Montanore Project.

Access management on National Forest System lands within the Cabinet Face BORZ would be maintained at current levels. Human activity and associated human development on private land would continue, and motorized access would be expected to continue or expand. Any potential improvements to connectivity and movement corridors or road access changes outside of the CYRZ as identified in the agencies' mitigated combined action alternatives mitigation plan, which included the Cabinet Face BORZ area, would not occur.

Effects of Climate Change on Grizzly Bears

Grizzly bears are a more generalist species that have historically survived in many different climatic zones (Servheen and Cross 2010). Grizzly bears are opportunistic, omnivorous, and highly adaptable and climate change is unlikely to threaten populations due to ecological threats or constraints; however, climate change may play a role in driving grizzly bear/human interactions and conflicts.

Grizzly bear/human interactions are key factors that will affect grizzly bear persistence. Research is needed to understand how and where food sources will change and concerns over denning chronology. Timing of den entry and exit could be altered by warmer autumn temperatures, delayed snowfall, and earlier arrival of spring and could result in an increase in potential for bear/human conflicts in spring/fall (Servheen and Cross 2010). Management efforts to minimize fragmentation will offer benefits to the ability of grizzly bears and other wildlife to respond to climate change (Intergovernmental Panel on Climate Change (IPCC) 2007).

The north-south orientation of the major mountains in western North America provide natural movement areas where bears and other species can respond to climate change effects on preferred habitats and foods (Proctor *et al.* 2012). Grizzly bears currently inhabit much of the territory from their current southern extent in the northern U.S. to the Arctic Ocean, and movement in response to range shifts in vegetation and climate may not be critical (Ibid). As the historical range extends south to northern Mexico and continues to include a range of habitats that include hot dry regions (Servheen 1999), climate and habitat change alone may not be a threat to grizzly bears along the Canada-U.S. border unless their major foods do not adapt and shift in a timely manner (Proctor *et al.* 2003).

It is difficult to predict any species' response to climate change, thus it is prudent to manage for population and metapopulation resilience, thereby facilitating adaptation to change within and between geographic regions if possible (Anderson *et al.*2009). This management would be best accomplished by reconnecting smaller population units and maintaining larger, more resilient units.

Table 234. Direct Effects on Grizzly Bear Habitat Parameters by the Combined Mine-Transmission Line Alternative.

Habitat Parameter and Access Amendment Standard (%)	Existing Conditions	[Alt 2] MMC's Proposed Mine			Prior to Evaluation Agencies' Mitigation Incorporated	Prior to Construction Agencies' Mitigation Incorporated	[Alt 3] Agency Mitigated Poorman Impoundment Alternative									[Alt 4] Agency Mitigated Little Cherry Creek Impoundment Alternative								
		TL-B					TL-C-R			TL-D-R			TL-E-R			TL-C-R			TL-D-R			TL-E-R		
		C	O	R			C	O	R	C	O	R	C	O	R	C	O	R	C	O	R	C	O	R
BMU 2																								
Core (75%)	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76
OMRD (20%)	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
TMRD (18%)	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
BMU 5																								
Core (60%)	**58**	**57**	**57**	**58**	60	65	64	65	65	64	64	65	64	64	65	65	65	65	65	65	65	65	65	65
OMRD (30%)	28	**32**	30	27	27	27	28	28	27	28	28	27	28	28	27	28	28	26	28	28	26	28	28	26
TMRD (23%)	23	**26**	**26**	22	19	19	20	20	18	20	20	18	20	20	18	20	20	18	20	20	18	20	20	18
BMU 6																								
Core (55%)	**54**	**53**	**53**	**54**	55	57	55	57	57	57	57	57	57	57	57	55	57	57	57	57	57	57	57	57
OMRD (34%)	29	32	29	29	29	29	31	29	29	30	29	29	30	29	29	31	29	29	30	29	29	30	29	29
TMRD (32%)	**33**	**35**	**35**	**33**	**33**	32	**33**	32	32	**33**	32	32	32	32	32	**33**	32	32	**33**	32	32	32	32	32

Bolded values do not meet Access Amendment standards.
TL = Transmission Line Alternative.
C = Construction Phase – shown with mitigation in place as mitigation plan requires this before the start of the Construction Phase.
O = Operations Phase – includes all mitigation in place.
R = Closure Phase (post-project) –includes all mitigation in place. Effects to grizzly bear habitat as reclamation activities are implemented were considered the same as the Construction Phase, and are not displayed.
BMU = Bear Management Unit; OMRD = open motorized route density; TMRD = total motorized route density.

Table 235. Physical Loss and Clearing by Transmission Line Alternative.

Effect on Grizzly Bear Habitat	[A] No Trans-mission Line	[B] North Miller Creek	[C-R] Modified North Miller Creek	[D-R] Miller Creek	[E-R] West Fisher Creek
Bear Habitat Physically Removed in BMUs 5 and 6[1]	0	20	2	9	7
Bear Habitat Physically Removed in BORZ[1]	0	<1	2	2	0
Habitat Physically Removed Outside of CYRZ and BORZ[1, 2, 3]	0	14	9	9	8
Total Habitat Physically Removed	**0**	**34**	**13**	**20**	**15**
Clearing on National Forest System Land in BMUs 5 and 6[4]	0	159	154	174	229
Clearing on Land in the Cabinet Face BORZ[4]	0	8	51	45	0
Clearing Outside of CYRZ and BORZ[3,4]					
State Trust Land	0	0	10	10	28
Private Land	0	130	101	101	105
Total Habitat Cleared	**0**	**297**	**316**	**330**	**362**

All units are acres.
BORZ = Bears Outside Recovery Zone.
[1]Includes impacts of new roads constructed and existing road improved for the transmission line, based on a 25-foot right-of-way.
[2]Includes 4 acres of habitat physically removed for construction of the Sedlak Park Substation, access road, and loop line.
[3]Acres located outside of the CYRZ and BORZ but within the MFSA Transmission Line Analysis Area required by Montana DEQ.
[4]Potential habitat in transmission line corridor may be altered by tree clearing but is expected to remain usable for movement or foraging habitat due to small trees and low shrubs that would remain.

Table 236. Grizzly Bear Displacement Effects Due to Transmission Line Alternative.

Displacement Effect	[A] No Trans-mission Line	[B] North Miller Creek	[C-R] Modified North Miller Creek	[D-R] Miller Creek	[E-R] West Fisher Creek
In Recovery Zone					
New Displacement[1, 2]	0	5,232	4,268	4,377	4,929
Additional Displacement[2, 3] on Areas Currently Affected by Other Activities	0	2,938	3,096	4,604	6,489
Total Displacement	0	8,170	7,363	8,981	11,418
In the Cabinet Face BORZ					
New Displacement[1, 2]	0	730	868	794	769
Additional Displacement[2, 3] on Areas Currently Affected by Other Activities	0	1,636	1,336	588	217
Total Displacement	0	2,366	2,204	1,382	986

All units are acres.
BORZ = Bears Outside Recovery Zone.
[1] New displacement is the effect of project activities in grizzly bear habitat not currently disturbed by human activity.
[2] In Alternative B, the use of helicopters during line construction would be at the discretion of MMC. The agencies assumed that helicopters would not be used for logging or structure placement in Alternative B. Helicopter use was assumed for line stringing, maintenance, and annual inspections only.
[3] Additional displacement is the additional effect of project activities in grizzly bear habitat currently affected by other activities, such as existing road use or activities on private land.

Table 237. Miles of Open, Closed, and New Access Roads for Transmission Line Construction.

Road Type	Alt. B – North Miller Creek	Alt. C-R – Modified North Miller Creek	Alt. D-R – Miller Creek	Alt. E-R – West Fisher Creek
Existing Open Road Used				
Within a BMU	9.1	7.6	7.4	3.3
Within Cabinet Face BORZ	1.4	2.3	0.0	0.0
Private Land	10.1	12.0	9.4	8.3
State Trust Land	0	0.0	0.0	1.2
Subtotal	20.6	21.9	16.8	12.8
Existing Closed (includes gated or barriered) Road Opened				
Within a BMU	11.1	5.8	1.9	8.4
Within Core Habitat*	0.2	0.0	0.0	0.0
Within Cabinet Face BORZ	0.0	2.7	2.7	0.0
Private Land	0.0	5.7	5.8	5.0
State Trust Land	0.0	0.0	0.0	0.0
Subtotal	11.1	14.2	10.4	13.4
New Road Constructed				
Within a BMU	6.5	0.7	2.7	1.8
Within Core Habitat*	0.8	0.0	0.0	0.0
Within Cabinet Face BORZ	0.1	0.7	0.8	0.0
Private Land	3.3	1.5	1.4	1.3
State Trust Land	0.0	0.2	0.2	0.1
Subtotal	9.9	3.1	5.2	3.2
Total	41.6	39.2	32.3	29.3

All units are miles. Totals may vary due to rounding.
*Core habitat mileage is also included with the mileage of the "Within a BMU" category.
BMU = Bear Management Unit.
BORZ = Bears Outside Recovery Zone.

Action Alternatives

Effectiveness of Mitigation Plans: Habitat Compensation and Improving Habitat Parameters

Effects Common to All Action Alternatives

Although specific acreages would vary by combined alternative, mitigation habitat required in BMUs 5 and 6 would specifically reduce or mitigate for the potential fragmentation of the north-south movement corridor that would result from impacts of the proposed mine development. Mitigation properties would be managed for bear recovery. Depending on the access management changes that could occur and the development potential of the land, connectivity within the north-south corridor would improve, core would increase reducing risk of displacement and poaching, and grizzly bears would benefit throughout the larger area. Acquired land or conservation easements in perpetuity for grizzly bear mitigation would ensure lands that might otherwise be developed in a manner inconsistent with bear needs would be managed for grizzly bear use in perpetuity. Perpetual conservation easements would ensure long-term protection of security habitat for bears currently using these areas and mitigation habitat would preclude development that might occur.

Effects Common to Agencies' Action Alternatives

The agencies anticipate additional land acquisition beyond that proposed by MMC in Alternative 2B would be necessary to mitigate for effects of both habitat physically lost and long-term displacement from the mine and associated facility disturbance. The parcels identified for potential mitigation occur both within the CYE and outside in areas identified as important for linkage and movement. Priority areas are in (or adjacent) to the Cabinet Mountain portion of the CYE. High-priority lands within the north-south constricted corridor area are also ranked with a mitigation credit process for the agencies' alternatives. Any lands within the linkage area east of the CYE would contribute to reducing fracture zones and providing a more secure movement area between the CYE and the NCDE (Northern Continental Divide Ecosystem) located to the east. Management objectives of mitigation lands would be to improve grizzly bear habitat, including the reduction of sources of grizzly bear disturbances and where in the CYRZ to improve baseline habitat parameters by increasing core, and decreasing open and total road densities. Thus, additional increases in core and additional reductions in OMRD and TMRD would likely occur as a result of the mitigation lands. Any changes that may occur however are dependent on where the individual mitigation lands were located and any potential motorized access changes. As described in the *Methods* section, improvements to core, OMRD, and TMRD as a result of mitigation lands are not reflected in the following analysis because the exact location of the lands and which road access changes may occur on the mitigation lands are not known and, thus, improvements cannot be calculated.

The mitigation plan would require the KNF to manage at a level better than the baseline conditions for the life of the mine once mitigation properties are acquired and access management opportunities occur on National Forest System lands. This level of access management would contribute to reducing or mitigating for displacement and fragmentation effects of the mine on grizzly bears (USFWS 2014a). The mitigation plan also considered the effectiveness of the mitigation lands to protect seasonally important habitat, with an emphasis on spring and secondarily on fall habitats. The Comprehensive Grizzly Bear Management Plan would include provisions for adaptive management to ensure that human access to grizzly bear habitat, grizzly bear mortality, and habitat fragmentation would be minimized and that grizzly bear habitat would be maintained and improved, and would allow for development of recommendations for modifications of the mitigation plan based on data collected and new information.

Habitat Physically Removed: To mitigate for habitat physically lost due to mine-related development such as facilities, roads, tailings impoundment, and other features, the agencies' alternatives require habitat compensation at a 2:1 ratio (Table 30 and Table 238).

Habitat Displacement: In addition to habitat replacement for habitat physically lost, the agencies' alternatives would require land acquisition or purchase of a conservation easement in perpetuity for long-term displacement effects associated with the mine development at a 1:1 ratio (Table 30 and Table 239).

The agencies' alternatives mitigation plan would also require MMC to contribute funding to support monitoring of bear movements and population status in the Cabinet Mountains to confirm the effectiveness of habitat acquisition in mitigating the impacts of habitat loss and displacement on grizzly bears. If monitoring indicated that proposed habitat compensation was not adequate, the adaptive management features of the mitigation plan would allow for additional mitigation measures to be developed to address issues identified through monitoring.

In the agencies' alternatives, transmission line displacement effects would be minimized through implementation of helicopter construction timing restrictions. This mitigation would meet Objective 1. The agencies' mitigation plan would require that all transmission line construction, decommissioning, and removal in the CYRZ and Cabinet Face BORZ occur between June 16 and October 14. This timeline would prevent construction and decommissioning-related activity associated with the transmission line during the denning and spring use periods.

In addition to habitat compensation, mitigation designed to offset cumulative effects by changing motorized access conditions to create grizzly bear core habitat would also a) contribute to reducing risk of human-caused bear mortality; b) provide undisturbed habitat area for displaced bears; c) improve habitat conditions in the north-south movement corridor; and d) help meet KFP standards for grizzly bear habitat conditions established by the Access Amendment. Access changes such as the installation of barriers or gates on several roads would also reduce sources of grizzly bear disturbance within the BORZ.

Additional detail of mitigation plans is discussed below under the alternatives discussion.

Effects within Recovery Zone

The environmental consequences analyzes the potential direct, indirect, and cumulative effects of the proposed transmission line alternatives and the combined mine-transmission line alternatives, which consider measures included in mitigation plans. The effects of the action alternatives will be discussed relative to the five objectives common to grizzly bear recovery (Harms 1990) and the sixth objective concerning acceptable incidental take (USFWS 2011c, 2011d). The following analysis examines how these measures are implemented and, thus, how the objectives relating to grizzly bear recovery are met by each alternative. Included within this analysis are the effects of direct physical loss of or displacement from grizzly bear habitat resulting from 1) increased human activity and disturbances associated with roads or activities, including changes to OMRD and TMRD, loss of core area, impacts to seasonal habitats, opening size, and corridor width; 2) an increase in mortality risk to grizzly bears resulting from human impacts, including food attractants, recreation, access into grizzly bear habitat, and human settlement; and 3) fragmentation of grizzly bear habitat or narrowing of the relatively narrow north-south corridor connecting the southern Cabinet Mountain BMUs to those habitats to the north.

Grizzly Bear Recovery Objectives: The 2011 Access Amendment provides the habitat parameter standards by BMU for core, OMRD, and TMRD analyzed below and considers the best available science (Allen *et al.* 2011) for the CYE. The estimated grizzly bear population has increased since 1999 (20 bears) through the early 2000s (30 to 40 bears) to a current estimate of 50 bears (Kasworm *et al.* 2000, 2003, 2004, 2013). Although an improvement in the probability of decline does not directly indicate the grizzly bear population is increasing, it means that the calculated growth rate is getting closer to 1.0 (stable population). Even when the growth rate becomes just greater than 1.0 (increasing population), there would still be some probability that the population is in decline due to portions of the bell curve still falling below 1.0. Similarly, an improvement in the percent probability of decline has been observed since 2006, decreasing from 94 to 57 percent (Kasworm *et al.* 2007, 2013). This would suggest the KNF's wheeled motorized access management policy over the last decade has contributed to improving the grizzly population toward recovery goals within the CYE by improving BMU parameters with some meeting and exceeding standards. Implementation of the 2011 Access Amendment design elements would continue this trend.

Objective 1: Provide adequate space to meet the spatial requirements of a recovered grizzly bear population.

All action alternatives have the potential to remove habitat or displace bears and impact core, OMRD, and TMRD through road construction and use. The level of impacts to the habitat parameters of core, OMRD, and TMRD depend on the current and during project activity access status of the roads being used, length of the road, and proximity of the roads with other roads on the landscape. Impacts resulting from displacement were calculated based on the CEM model (as described in the *Methods* section and in ERO Resources Corp. (2015), which considers intensity, frequency, and duration of the disturbance. Proposed activities with potential to increase or decrease displacement occurring within the BMUs and/or impact the habitat parameters include road access mitigation prior to activity; transmission line and mine development (construction of the plant site and associated conveyor belt, aboveground pipelines, adits, impoundment); and all associated road reconstruction and new construction.

Physical Habitat Removal and Displacement

Alternative B – MMC's Proposed Transmission Line (North Miller Creek)

*Physical habitat removal and clearing***:** Within BMUs 5 and 6, Alternative B would require clearing on 159 acres and the physical removal of 20 acres of potential grizzly bear habitat as a result of new road construction (Table 235). In Alternative B, the new road prism would remain during transmission line operations, but roads opened or constructed for transmission line access would be gated or barriered on National Forest System land after transmission line construction. All disturbed areas, such as access roads, pulling and tensioning sites, and transmission line clearing areas, would be seeded with grass and shrub species after transmission line construction. Areas where trees were trimmed, but were otherwise not disturbed, would be allowed to establish naturally as grassland or shrubland. In areas where vegetation re-established, disturbed areas would provide forage habitat during the Operations Phase.

The physical removal of habitat on 20 acres would be for the life of the mine. Alternative 2B habitat compensation would offset the loss of these 20 acres. Suitable habitat is widely available and would remain in BMUs 5 and 6 for grizzly bear use, and land acquisition mitigation for habitat physically lost would increase the amount of secure habitat. Low shrubs or trees are expected to remain in the 159 acres of cleared area, although vegetation could be removed at the contractor's discretion.

Roads built for the installation of the transmission line would be re-disturbed during line decommissioning. After the transmission line was removed, all newly constructed roads would be bladed, contoured, and seeded on National Forest System lands. Once vegetation re-established, these areas would provide forage habitat.

*Displacement effects***:** Helicopter use and other construction activities would increase short-term displacement effects to bears inside the Recovery Zone. The 1 mile on either side of the transmission line zone of influence for helicopter-associated activities would include currently undisturbed areas as well as areas currently affected by human activities such as road use or activities on both National Forest System and private land. Within the Recovery Zone, Alternative B would create short-term displacement effects on 5,232 acres of undisturbed grizzly bear habitat and short-term additional displacement effects on 2,938 acres of currently affected grizzly bear habitat (Table 236). Additional and new short-term displacement effects would also occur on 658 acres of habitat in BMU 7.

Situations involving impacts to grizzly bears caused by aerial flights have not been extensively studied (USDA Forest Service and USFWS 2009); however, there is general agreement that helicopters create audible temporary disturbance that can influence bears, but without the longer lasting effects associated with roads (Parametrix 2005, revised 09/2010). Thus, disturbance to grizzly bears caused by helicopters does not typically result in the same extent of impact as permanent roads or other developments (USDA Forest Service and USFWS 2009). The use of a helicopter could have displacement effects to any grizzly bears that may be in the zone of influence (USDA Forest Service and USFWS 2009). Studies suggest that high frequency helicopter use, particularly at low altitudes, in grizzly bear habitat can adversely affect grizzly bears (USDA Forest Service and USFWS 2009; Summerfield 2007). Disturbance from helicopters may cause flight responses and other behavioral changes, increased heart rate and other physiological changes, displacement to lower quality habitat, and increased energetic demands (Ibid, Harding and Nagy 1980; Reynolds *et al.* 1986).

Alternative B would include mitigation for grizzly bears to lower potential for displacement effects associated with the helicopter use. Alternative B would require a timing restriction for restricting motorized activity associated with the transmission line construction from April 1 to June 15 within spring bear habitat in the Miller Creek (BMU 6) and Midas Creek (BMU 5) drainages. In addition, Alternative B construction would not occur during the winter in big game winter ranges (December 1 to April 30) and this would apply to National Forest System and private lands. Alternative B would be located entirely on big game winter range in BMU 6 and therefore construction may not occur from December 1 to April 30, which would extend the timeframe on either side of the grizzly bear spring range displacement mitigation. BMU 5 activity would be mainly restricted in Midas Creek due to the grizzly mitigation, as minimal big range winter range would be affected by Alternative B. For Alternative B, use of helicopters for structure placement, vegetation clearing, and line stringing is at the contractor's discretion, but for this analysis, the agencies assumed for Alternative B that helicopters would not be used for structure placement or for timber harvest and vegetation clearing. Therefore the analysis limited potential displacement effects related to helicopter use for Alternative B to line stringing (approximately 10 days) during construction and inspection and maintenance (approximately 10 days a year) during operations. Potential displacement effects associated with these activities during construction would be short-term with reduced potential to disturb grizzly bears due to most of the activity being expected to occur outside of the spring and denning season, Construction-related activity would not occur during the denning season or during the spring period in Miller and Midas Creek drainages. Use of helicopters for maintenance during operations would result in infrequent disturbance to grizzly bears.

Disturbance effects could occur from other transmission line construction activities in areas where helicopters were not used, and would be more extensive for Alternative B than the agencies' alternatives. After construction, displacement effects would diminish through the Operations Phase as roads opened or constructed for transmission line access would be gated or barriered.

During decommissioning when removing the transmission line, helicopter use and other activities would cause similar disturbances with similar durations as during construction. Access roads would be reopened, the transmission line would be removed, roads would be reclaimed, trees along the line would be allowed to grow, and all disturbed areas would be revegetated.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

Effects to grizzly bears due to habitat physically removed due to the transmission line construction and habitat compensation mitigation for those effects from Alternative C-R would be as described in "*Effects common to all action alternatives*," "*Effects common to agency alternatives*," or as described under Alternative B with the exception of the following:

Physical habitat removal and clearing: Alternative C-R would require a total of 154 acres of clearing within BMUs 5 and 6 and the physical removal of 2 acres of potential grizzly bear habitat due to new roads (Table 235). Habitat compensation would be required for the 2 acres of habitat physically lost. More low shrubs or trees would be expected to remain in the 154 acres of cleared area compared to Alternative B due to the agencies' requirement for preparation and implementation of a Vegetation Removal and Disposition Plan to minimize vegetation removal and minimize use of heavy equipment in riparian areas. After the transmission line was constructed, all roads on National Forest System lands would be placed in intermittent stored service. Intermittent stored service roads would be closed to traffic and would be treated so they would cause little resource risk if maintenance were not performed on them during the operation period of the mine and before their future need during reclamation. New transmission line roads on National Forest System lands would be decommissioned after closure of the mine and removal of the transmission line. Decommissioned roads would be removed from service and would receive a variety of treatments to minimize the effects on other resources. Once vegetation re-established, re-disturbed areas would provide forage habitat. Reclamation of all disturbed areas where habitat was physically removed would be similar to Alternative B; however, native species would be specified and a more rigorous reclamation program is required.

Displacement effects: In Alternative C-R, helicopters would be used for logging, structure placement, line stringing, annual inspections and maintenance, and line decommissioning. Displacement effects from helicopter use and other construction activities related to Alternative C-R would have the greatest impact in BMU 6. The 1-mile zone of influence of helicopter activity on either side of the centerline would include currently undisturbed areas as well as areas currently affected by human activities such as road use or activities on private land. Within the Recovery Zone, Alternative C-R would cause new short-term displacement effects to 4,268 acres of grizzly bear habitat due to helicopter use (Table 236) for up to 2 months over a 2-year period. Vegetation clearing and structure placement where helicopters were not used outside of core habitat could also contribute to short-term displacement effects due to wheeled motorized access and concentrated human activity. Alternative C-R would cause short-term additional displacement effects to 3,096 acres of currently affected grizzly bear habitat in the Recovery Zone. Additional and new short-term displacement effects would potentially occur on 114 acres of habitat in BMU 7. Alternative C-R would increase short-term helicopter displacement effects during construction but would require less use of new or formerly closed (gated or barriered) roads relative to Alternative B (Table 237). Noise associated with transmission line construction would cease after 2 to 3 years when the transmission line was completed. Except for annual inspection and infrequent maintenance operations, helicopter use and other transmission line construction activities would cease after transmission line construction until decommissioning.

No habitat compensation was required for transmission line displacement effects due to incorporated timing mitigation. Alternative C-R potential transmission line displacement effects would be more effectively minimized than Alternative B through implementation of mitigation. According to the agencies' alternatives transmission line construction schedule, helicopter use would be limited to two active bear seasons. In addition, the agencies' alternatives mitigation plan for transmission lines, including Alternative C-R, would limit construction and decommissioning activity to the period between June 16 and October 14 and outside of the grizzly bear spring (April 1 to June 15) and den (December 1 to March 31) seasons, resulting in a very low likelihood of actual displacement of grizzly bears. Alternative C-R would defer access change on North Fork Miller Creek Road (NFS road #4725) and would delay the creation of 1,053 acres of core to after transmission line construction (Figure 94). Consequently, BMU 6 core would remain at 55 percent during construction (meeting the core standard) and TMRD would remain at the existing 33 percent, 1 percent above the standard. As a result of Alternative C-R, less available secure habitat would be available for displacement during the Construction Phase compared to Alternatives D-R and E-R. After construction of Alternative C-R, the road access change on North Fork Miller Creek Road would be implemented and BMU 6 core would increase to 57 percent, and TMRD would decrease to the standard, therefore providing all habitat parameters suitable for a female grizzly bear's successful survival and reproduction based on research (Wakkinen and Kasworm 1997). During the Operations Phase of Alternative C-R, maintenance of the transmission line corridor could result in an increased potential for displacement of grizzly bears within the two separate blocks of core where the line would be located due to helicopter noise and any associated human activity compared to Alternatives D-R and E-R, which are not located within core.

Alternative D-R – Miller Creek Transmission Line Alternative

Effects to grizzly bears due to habitat removal and displacement and mitigation for those effects from Alternative D-R would be as described in Alternative C-R with the exception of the following:

Physical habitat removal and clearing: Alternative D-R would clear 174 acres of grizzly bear habitat within BMUs 5 and 6 and physically remove 9 acres of grizzly bear habitat (Table 235).

Displacement effects: Effects from Alternative D-R would be the same as described for Alternative C-R, except that in Alternative D-R, the extent of short-term displacement effects from helicopter construction and line stringing would be slightly greater due to the length of the alignment. The timing of helicopter activities would be the same as Alternative C-R. Potential new short-term displacement effects would occur on 4,377 acres of grizzly bear habitat and additional short-term displacement effects would occur on 4,604 acres in the CYRZ (Table 236). As a result of the mitigation limiting construction and decommissioning activities to certain times of year described under Alternative C-R, Alternative D-R displacement effects would be minimized as 1) the transmission line is primarily in spring habitat; 2) grizzly bears are highly unlikely to use the area outside the spring period; 3) no activities are allowed on National Forest System land within the CYRZ or BORZ during the spring period; 4) other undisturbed areas of quality spring habitat would be available should a bear be disturbed; and 5) the availability of secure summer habitat would be improved with road access mitigation and habitat compensation associated with the agencies' combined alternatives prior to activity and any bear potentially displaced would have ample secure summer habitat within proximity of the activity for displacement. In addition, Alternative D-R would implement an access change on NFS road

#4725 prior to the Construction Phase (Figure 94). As a result, OMRD and TMRD road densities and security core habitat would either meet or be better than the affected BMU standards prior to construction activity. Within BMU 6, the baseline habitat parameter of core would improve to 57 percent prior to activity and would allow for more available secure habitat for a grizzly bear to utilize if a bear was temporarily displaced during the Construction Phase compared to Alternative C-R. By not deferring the road access change on NFS road #4725, Alternative D-R would also result in BMU 6 TMRD meeting the standard prior to the Construction Phase. Thus, prior to Alternative D-R construction activity, road densities and security core habitat would either meet or be better than the BMU standards in both BMU 5 and BMU 6 and would provide improved baseline habitat parameters suitable for a female grizzly bear's successful survival and reproduction based on research (Wakkinen and Kasworm 1997).

Alternative E-R – West Fisher Creek Transmission Line Alternative

Effects to grizzly bears due to habitat removal and displacement and mitigation for those effects from Alternative E-R would be as described in Alternative D-R with the exception of the following:

Physical habitat removal and clearing: Physical habitat disturbance resulting from Alternative E-R would be similar to Alternatives C-R and D-R, except that Alternative E-R would clear 229 acres within BMUs 5 and 6 and physically remove 7 acres of grizzly bear habitat (Table 235).

Displacement effects: Displacement effects from Alternative E-R would be the same as Alternative D-R, except that the extent of short-term displacement effects from helicopter construction and line stringing would be greater due to the greatest number of structures being placed by helicopter. The duration of helicopter activities would be the same as Alternatives C-R and D-R. New short-term displacement effects would occur on 4,929 acres of grizzly bear habitat and additional short-term displacement effects would occur on 6,489 acres of currently affected habitat in the CYRZ (Table 236). Additional and new short-term displacement effects would potentially occur on 268 acres of habitat in BMU 7.

Combined Mine-Transmission Line Alternatives

As described previously, mine and transmission line development would occur within BMU 5. BMU 2 would be affected only by the access road and BMU 6 would be affected only by the transmission line alternatives. The mitigation plan for the agencies' combined action alternatives required more habitat compensation for habitat physically lost and displacement as a result of the mine development than Alternative 2B, which compensated for habitat physically lost at an approximate 1:1 ratio.

*Physical habitat removal and clearing***:** All combined action alternatives would result in the direct loss of grizzly bear habitat due to the construction of mine facilities and new or upgraded roads (Table 238). Alternative 2B would remove the most grizzly bear habitat, while Alternatives 3C-R, 3D-R, and 3E-R would remove the least. Grizzly bear habitat physically removed by the combined alternatives mine facilities and associated new/upgraded roads would not be available for the life of the mine. Some level of forage or cover would be expected to remain in the transmission line clearings, with greater amounts retained for the agencies' alternatives.

Table 238. Physical Loss of Grizzly Bear Habitat by Combined Mine-Transmission Line Alternative.

Project Component	[1] No Action	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Little Cherry Creek Impoundment Alternative		
		TL-B	TL-C-R	TL-D-R	TL-E-R	TL-C-R	TL-D-R	TL-E-R
Mine components in BMU 5	0	2,564	1,547	1,547	1,547	1,906	1,906	1,906
Transmission line in BMUs 5 and 6[1]	0	20	2	9	7	2	9	7
Transmission line in BORZ[1]	0	<1	2	2	0	2	2	0
Transmission line outside of CYRZ and BORZ[1, 2]	0	14	9	9	8	9	9	8
Mine and transmission line	0	2,598	1,560	1,567	1,562	1,919	1,926	1,921
Proposed habitat replacement	0	2,826	3,120	3,134	3,124	3,838	3,852	3,842

All units are acres.
[1] Includes impacts of new roads constructed and existing roads upgraded for the transmission line, based on a 25-foot right-of-way.
[2]Includes 4 acres of habitat physically removed for construction of the Sedlak Park Substation, access road, and loop line.

For all combined action alternatives, construction and improvement of access roads during transmission line construction would temporarily remove habitat. All areas physically disturbed for transmission line construction, such as access roads, pulling and tensioning sites, and transmission line clearing areas, would be seeded with grass and shrub species after transmission line construction. Areas where trees were trimmed, but otherwise were not disturbed, would be allowed to establish naturally as grassland or shrubland. After revegetation, disturbed areas of the transmission line would provide forage habitat as forage species become established. Habitat in the disturbance footprint for temporary access roads would be disturbed for a short time when the transmission line was removed.

For all combined action alternatives, all physically disturbed areas would be reclaimed after mine closure. New transmission line roads on National Forest System lands would be decommissioned after closure of the mine and removal of the transmission line. Decommissioned roads would be removed from service and would receive a variety of treatments to minimize the effects on other resources. Once vegetation re-established, reclaimed areas would provide forage habitat, but forest habitat would not re-establish for several decades.

In all combined action alternatives, the impacts of physical habitat loss associated with mine development or transmission line construction would be offset by MMC's and agencies' land acquisition or conservation easement in perpetuity requirements. In Alternative 2B, to mitigate for habitat physically lost, MMC would acquire 2,826 acres (an approximate 1:1 ratio of habitat lost to replacement) and if MMC transferred mitigation lands to the KNF, the lands would be managed as MS-1 grizzly bear habitat.

In the agencies' alternatives, 2 acres of habitat would be acquired for every 1 acre of grizzly bear habitat physically lost, and either acquisition or conservation easement in perpetuity could occur (Table 238).

*Displacement effects***:** Underuse or displacement of grizzly bears may already occur in existing influence zones around roads and point source disturbances, such as the Libby Creek or Bear Creek Road, Libby Adit, or other developed private lands**.** In all combined action alternatives, mine construction and operations, road construction and use, and helicopter use would increase displacement effects to bears inside the Recovery Zone. The agencies would require 1 acre of habitat for every 1 acre of grizzly bear habitat affected by long-term mine displacement.

Transmission Line: The extent of displacement would be greater for transmission line construction activities than for mine activities (Table 239) due to the length of the line and helicopter use, but would be of shorter duration compared to the mine associated activities. The detailed effects are discussed under the individual transmission line alternatives sections. Except for Alternative 2B, transmission line displacement effects would be generally proportional to the length of the transmission line component of the combined alternative (Table 236). The analysis of transmission line displacement effects does not include areas where mine displacement effects and transmission line displacement effects overlap. The areas of overlap between transmission line and mine displacement would be greatest for Alternative 2B; therefore, a larger proportion of the displacement effects are attributed to long-term mine disturbance effects. Transmission line displacement effects in the CYRZ would be the greatest for Alternatives 3E-R and 4E-R (11,418 acres), followed by Alternatives 3D-R and 4D-R (8,981 acres), Alternative 2B (8,170 acres), and Alternatives 3C-R and 4C-R (7,363acres) (Table 236 and Table 239). Alternative 2B, as described under Alternative B, would restrict helicopter use during construction and decommissioning outside of the spring use period for bears in the Midas Creek and Miller Creek drainages and would restrict winter activity to outside of December 1 through April 30 on big game winter ranges, providing for lower levels of disturbance in denning habitat. In the agencies' alternatives, transmission line displacement effects would be minimized through implementation of construction timing restrictions described in section 2.5.7, *Mitigation Plans* and under the transmission line alternatives. As described under Alternative C-R, the agencies' alternatives mitigation plan would limit construction and decommissioning activity to the period between June 16 and October 14, outside of the spring use and denning periods, resulting in a very low likelihood of actual displacement of a grizzly bear. Undisturbed summer habitat is widely available within the BMUs should a grizzly bear be displaced by construction activity during the summer. Alternative C-R would defer access change on NFS road #4725 and core creation in BMU 6 to post-construction, resulting in less available secure habitat available for displacement during construction compared to Alternatives D-R and E-R, which would not delay the road access change (Figure 94).

Mine Facilities and Associated Roads: Displacement effects during mine construction and operations are not as widespread as those related to the short-term effects of the transmission line construction, but would affect grizzly bears more because the effects would be long-term and last for the life of the mine, or possibly longer. As discussed previously, displacement can, but does not always, mean that grizzly bears totally avoid areas. Those areas affected by the mine impoundment and facilities and associated roads, and the access road with high-intensity 24-hour point activity may be underutilized or avoided.

Table 239. Grizzly Bear Displacement Effects of Mine Alternatives in BMU 2, BMU 5, and the Cabinet Face BORZ.

Displacement Effect	[1] No Action	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative	[4] Agency Mitigated Little Cherry Creek Impoundment Alternative
Displacement in Recovery Zone[1] BMU 2 and BMU 5				
In North-South Corridor				
New Displacement[2]	0	2,639	1,154	1,075
Additional Displacement[3]	0	926	728	732
Total Displacement	0	3,565	1,882	1,807
Outside of North-South Corridor				
New Displacement[2, 3]	0	346	397	367
Additional Displacement[3]	0	2,392	2,215	2,590
Total Displacement	0	2,738	2,612	2,958
Total Inside and Outside of North-South Corridor				
Total New Displacement	0	2,985	1,551	1,442
Total Additional Displacement	0	3,916	3,536	3,920
Total New and Additional Displacement	0	6,901	5,087	5,362
Corresponding Habitat Compensation[4]	0	0	2,293	2,339
In the Cabinet Face BORZ				
New Displacement[2]	0	55	0	40
Additional Displacement[3]	0	2,800	2,577	2,799
Total Displacement	0	2,855	2,577	2,838

All units are acres. Totals may not match due to rounding.
[1] No displacement effects from mine-related activities would occur in BMU 6.
[2] New displacement is the effect of project activities in grizzly bear habitat not currently disturbed by human activity.
[3] Additional displacement is the additional effect of project activities in grizzly bear habitat currently affected by other activities, such as road use or activities on private land.
[4] Corresponding habitat compensation based on displacement effects only, as determined using the CEM model.

Initial access to the mine site would be NFS roads #231 and #2316. Since November 2007, the KNF has authorized MMC to plow snow on NFS roads #231 and #2316 for access to the Libby Adit for maintenance. As part of this authorization, the KNF implemented seasonal restrictions on these two roads from April 1 to May 15 so that only mine traffic is allowed access behind the gate. In addition, seasonal restrictions on NFS roads #4778, #4778E, #5192, and #5219A were implemented as part of this authorization. These restrictions were implemented to reduce displacement and mortality risk to grizzly bears on spring range. With Forest Service authorization of the Evaluation Phase, MMC would continue to snowplow NFS roads #231 and #2316 to allow access during winter. These segments would continue to be plowed during the Evaluation Phase and for the first year of reconstruction of NFS road #278 during the Construction Phase.

Long-term displacement would be greatest for Alternative 2B, mostly because the Ramsey Plant Site would be in a separate drainage than other mine components (Table 239). Alternatives 3C-R and 3D-R would result in the least displacement effects. The zone of influence for combined action alternative activities would include currently undisturbed areas as well as areas currently being affected by human activities such as road use or activities on private land. Within the Recovery Zone, new displacement effects of mine activities to undisturbed grizzly bear habitat would range from 1,442 acres in Alternatives 4C-R, 4D-R, and 4E-R to 2,985 acres in Alternative 2B (Table 239). Additional displacement effects of mine activities to currently affected grizzly bear habitat would range from 3,536 acres in Alternatives 3C-R, 3D-R, and 3E-R to 3,920 acres in Alternative 4E-R.

In all combined action alternatives, the Bear Creek Road (NFS road #278) access road would extend 18 miles between the potential mine sites and US 2. Of the 18 miles, approximately 14.2 miles cross through or are adjacent to BMU 5 and BMU 2 and in MS-1 habitat. The Bear Creek Road (NFS road #278) is considered a high-use road based on the CEM model (greater than 10 vehicles per day) in the existing condition and is usually impassible from mid to late November through spring break-up in May. Widening, improvement, and yearlong access of the Bear Creek Road would lead to increased vehicle volumes and speed. Overall, improved road conditions that allow higher vehicle speeds and increased traffic could increase the risk of grizzly bear mortality due to vehicle collisions.

Estimates of increased annual traffic volume range from 187 percent to 234 percent, about three times existing levels throughout the life of the mine (Table 172 in section 3.21, Transportation). The Wildlife BA (USDA Forest Service 2013b) and USFWS' Grizzly Bear Biological Opinion (USFWS 2014a) considered an estimated 255 percent increase in traffic volume over the existing condition. Traffic volume estimates for percent increases in Table 172 differ from the Wildlife BA and Biological Opinion due to several reasons, one being an error (years of increase) in Johnson's (2013) calculations used in both the BA and the Biological Opinion. The KNF revised Johnson's calculations (2013) due to this error, and the revision is available in the project record. Estimated future traffic volumes based on a 1.2% increase shown in (Table 172 in section 3.21, Transportation) are the same as obtained from the revised KNF calculations, except that the revised KNF calculations considered these estimates to be over a 7-month period, not a 12-month period. Johnson (2013) calculations were based on the likelihood the baseline traffic data shown in Table 171 were not collected during the January 1 to May 31 time period as the Bear Creek Road is usually impassible mid to late November through spring break-up in May. In addition, unlike Table 171, estimated percent increases in traffic began in 2013, an appropriate environmental baseline (a "snapshot" of a species' health at a specified point in time) for the USFWS Grizzly Bear Biological Opinion analysis (USFWS 2014a).

The KNF revised Johnson (2013) calculations used 212 days (a 7-month period) to divide the estimated average future traffic volumes to estimate the increase in daily traffic, and to estimate future traffic. The revised Johnson (2013) estimates daily future traffic over a 7-month period ranging from 232 to 253 vehicles a day, and a 109 percent to 132 percent increase in traffic during this same 7-month period. Estimating daily traffic and percent increase in traffic over this 7-month period coincides with the active bear year. In comparison, Table 172 in section 3.21 *Transportation*) percent increases are based on a 12-month period (365 days) and this would result in an estimate of daily future traffic ranging from 188 to 203 vehicles a day, and a 187 to 234 percent increase in traffic during this same 1- month period. Although the Transportation Section 3.21,Johnson (2013), and the revised KNF Johnson (2013) calculations differ, all reflect a substantial increase in traffic volume.

In all combined action alternatives, the mine would generate an estimated additional 132 vehicles per day (an additional 66 trips) on the Bear Creek Road. At peak production about 420 tons of concentrate, or 21 trucks per day, would be trucked daily via NFS road #278 Bear Creek Road and US 2 to the loading site in Libby. The speeds on the Bear Creek Road would increase from the existing 15 to 25 mph to 35 to 45 mph, equating to a 40-percent to 80-percent increase in potential traffic speeds over the existing conditions. MMC would limit concentrate haulage to daylight hours during the day shift (0800 to 1600), which would minimize traffic and the potential for vehicular-grizzly collisions outside of this time period. MMC would provide transportation to employees using buses, vans, and pickup trucks, thereby limiting the use of personal vehicles. MMC would report road-killed animals to the FWP as soon as road-killed animals were observed. The FWP would either remove road-killed animals or direct MMC on how to dispose of them.

Ruediger *et al.* (1999) summarized that traffic volume more than 4,000 vehicles per day would create significant habitat fragmentation and wildlife mortality. Chruszcz *et al.* (2003) study in Banff National Park in Alberta, Canada defined high-volume roads as annual daily traffic volume of 14,600 to 21,500 vehicles per day, whereas low-volume roads ranged from 2,000 to 3,000 vehicles per day. Traffic volume was found to be the single greatest determinate of road crossings and that grizzly bears were reluctant to cross roads with high traffic volume (Ibid). Waller and Servheen (2005) studied the area along US 2 separating Glacier National Park from the Bob Marshall Wilderness Complex to the south. During their study, traffic volume between the east and west counters ranged from 77 to 87 vehicles per hour and mean daily traffic from 1,806 to 2,066 vehicles per day. Traffic levels on US 2 are already near this range with average annual daily traffic volume along US 2 near the intersection of US 2 and NFS road #278 (Bear Creek Road) from 2002 through 2011 ranging from 1,740 vehicles per day in 2002 to 1,940 vehicles per day in 2010 (MDT 2012) (see *Transportation* section 3.21.3.1*)*. Waller and Servheen (2005) found most wildlife crossings of US 2 occurred at night and when highway traffic volume could be expected to be low. Hourly mean traffic during crossings averaging 10 vehicles per hour was half that of normal daytime traffic levels. Waller and Servheen (2005) hypothesized that the threshold traffic volume beyond which highways become significant barriers to grizzly bear movement occurs near 100 vehicles per hour. The projected increase in traffic volume on the Bear Creek Road #278 would not approach levels that are likely to result in a complete barrier to movement of grizzly bears based on existing research (Waller and Servheen 2005; Chruszcz *et al.* 2003; Ruediger *et al.* 1999).

Existing roads already result in displacement effects to grizzly bears within the influence zones surrounding the roads. According to the CEM, the influence zone extends 0.25 mile from roads considered to have “low linear motorized use.” The significant increase in daily traffic (in both numbers of vehicles and 24-hour activity period) on the Bear Creek Road #278 would result in additional displacement effects so that the road was categorized as a motorized point 24-hour disturbance and the ability of the influence zone was reduced to about 10 percent of its potential to support grizzly bears. Where these significant increases in vehicle traffic were projected, additional reduction in grizzly bear use was expected and corresponding replacement habitat was required.

Mitigation for the estimated projected increase in traffic volume, duration, and intensity is addressed in the grizzly bear mitigation plan and was based on the estimate of 255-percent increase in traffic volume over the existing condition. Thus, the proposed mitigation plan would mitigate for potential effects from the revised estimated increases in traffic volume. It should also be noted that the estimated projected traffic levels may be substantially less than shown in Table 172 in section 3.21, *Transportation*, based on the assumption that logging or other traffic would remain at a substantial decrease compared to the 1986-1991 timeframe used to develop the estimated baseline traffic volume. Long-term displacement from, or underuse of MS-1 habitat within portions of the affected drainages by some grizzly bears could occur for the life of the mine, or longer, as an indirect effect from increased mine-related high-intensity motorized traffic on the Bear Creek Road. Females may teach avoidance of disturbed area to cubs, extending the displacement for an unknown period of time after the mine is reclaimed. In addition, Bear Creek Road, which lies in a north-south alignment, cuts across most of the Libby Creek sub-drainages that flow west to east. The increased traffic levels would contribute to fracturing habitat connectivity between summer, fall, and den habitats west of the road from spring habitats to the east. Long-term high-intensity 24-hour use on Bear Creek Road may also affect grizzly bear movements toward the east where linkage areas across US 2 connect to the NCDE. Traffic along US 2 also would increase by about 4 percent from the Bear Creek Road intersection to the Libby loadout site. This intersection is located in the US 2-Deep Creek/McMillan Approach area identified by Brundin and Johnson (2008), where grizzly bears have been documented outside of the Recovery Zone. Future traffic volume on the Bear Creek Road when all activities at the mine were completed in the Post-Closure Phase would be higher than the No Action Alternative (Alternative 1) because of the reconstruction of Bear Creek Road and loss of the Little Cherry Loop Road beneath the impoundment. Mine traffic would be substantially less in the Closure Phase, and traffic volume would return to estimated future volumes when all mine activities were completed in the Post-Closure Phase. In the Post-Closure Phase, mortality risk to grizzly bears would decrease on the Bear Creek Road compared to Operations, but the permanently improved road conditions (increased road width, improved sight distance, and paving) and higher traffic speeds would result in an increased grizzly bear mortality risk compared to pre-mine conditions.

Noise levels could be a factor contributing to the displacement of grizzly bears. Construction, operations, and reclamation or decommissioning would raise background noise levels substantially during the life of the operation (see section 3.20.4.1 in *Sound, Electrical and Magnetic Fields, and Radio and TV Effects*). Equipment noise can vary considerably depending on age, condition, manufacturer, use during a time period, and a changing distance from the equipment to a listener location. Noise generated by construction and blasting for adits would occur sporadically for about two weeks. Blasting would then mostly occur underground. The noise generated by the adit blasting would be short and sporadic and likely not audible to degrees that would significantly impact grizzly bear behavior. Generators would be used to supply power as the adits were developed, and ventilation fans would be located outside of the portals during construction. Noise from the generators and fans would extend into the CMW, at slightly higher levels than existing conditions. Noise from generators would cease after the transmission line was constructed. Highest noise levels would be associated with blasting, would be greatest during initial adit construction, and would decrease as the adits increased in depth. Very short-term blasting noise would be associated with the Rock Lake Ventilation Adit when it hit the surface on private land. Noise would also be associated with the excavation of the impoundment, hauling of waste rock to the impoundment, and construction of the dam, and would be experienced in areas within 2.5 miles of the source. Traffic noise would be the highest during construction on the Bear Creek Road and use of Libby Creek during that time. During operations, increased noise and increased night lighting within and adjacent to the mine facilities would occur. The conveyor, crushing plant, and ball mill would be the loudest continual disturbances. As described for the Ramsey Plant Site, during operations noise levels between 30 and 55 dBA would extend into the

CMW to Elephant Peak and down the Ramsey Creek drainage to about the LAD Area 1 (Big Sky Acoustics 2006) (see section 3.20.4.1 in *Sound, Electrical and Magnetic Fields, and Radio and TV Effects*), equating to about 2 air miles in either direction from the mill site. Noise sources and general magnitude of effects during all phases of operations in the agencies' alternatives would be similar to Alternative 2. For the agencies' alternatives, mitigation required prior to initiation of the Operations Phase would limit potential sound effects. This includes limiting sound levels of all surface and mill equipment, vehicle backup beepers, and intake and exhaust ventilation fans (acceptable sound levels are detailed in the agencies' mitigation plan).

It is not expected that the construction and operation of evaluation adits would result in similar levels of displacement as mine facility construction and operation. Disturbance effects of the evaluation adit would not approach levels associated with the construction and operation of the combined mine transmission line alternatives, considering the habitat condition (moderate motorized route densities and abundant core), number of employees, level of road use along an existing open road, and disturbances generated by construction and operation of the adit (see project description). Given the existing road management in the action area, effects would be moderate. The number of employees working on the evaluation adit would be 30 to 35, as compared to more than 300 during construction and up to 450 during the Operations Phase of the mine. Crews would assemble at an area designated by MMC and from there would be bused to the adit site. Busing employees would minimize traffic on NFS road #278, which is already an existing open road.

Unmitigated long-term displacement effects from mine activities could reduce grizzly bear movement in the north-south movement corridor in the Cabinet Mountains. Near the proposed combined alternatives, the CYE narrows to 15 miles, its' narrowest portion. Human development on the east and west slopes impacts the north-south movement corridor for grizzly bears in BMUs 2, 5, and 6. Figures 9 through 12 of the Wildlife BA (USDA Forest Service 2013b) provide a detailed description of this north-south movement corridor and existing and potential sites that, if developed, may constrict the corridor and impair movement of bears through the area. Distances between existing or potential sites of high human use could be less than 2 miles in some cases and when displacement distances are considered, it could be less than 1 mile. This corridor is critical as it links grizzly bear habitat in the southern Cabinet Mountains, specifically BMUs 7, 8, and 22, with habitat in the Cabinet Mountains BMUs to the north.

Unmitigated, the disturbance and displacement of grizzly bears from the proposed mine activities and existing roads on the east side could affect movement of bears traveling north and south along the Cabinet Mountains. Alternative 2B would have the greatest displacement effects in the north-south movement corridor, affecting 3,565 acres (Table 239). These displacement effects would not be offset by MMC's proposed road access changes (NFS road #4784 was proposed under Alternative 2B but this mitigation was already included in the Rock Creek Project mitigation, and would not be considered for direct effects of Alternative 2B, and the seasonal change on NFS road #4724 South Fork Miller Creek would not contribute to core). Alternative 2B would not include any other habitat replacement or compensation for long-term displacement effects associated with the mine activity.

Displacement effects in the north-south movement corridor would be less in the agencies' alternatives, with displacement effects in the north-south movement corridor occurring on 1,882 acres in Alternatives 3C-R, 3D-R and 3E-R and 1,807 acres in Alternatives 4C-R, 4D-R and 4E-R (Table 239). Compared to Alternative 2B, which would not mitigate for displacement effects, the agencies' alternatives would mitigate long-term displacement effects from mine activities by acquisition or conservation easement of grizzly bear habitat at a 1:1 ratio, as described in section 2.5.7, *Mitigation Plans*. The agencies' alternatives habitat compensation for displacement effects was based on existing effects and types of proposed activities, and reflects the degree to which habitat within the zone of influence of the alternative activities is anticipated to remain effectively useable by bears (ERO Resources Corp. 2015).

The habitat compensation for long-term mine displacement effects in the agencies' alternatives would be between 2,293 acres and 2,339 acres (Table 239). Habitat compensation for displacement effects differ from those in the Wildlife BA (USDA Forest Service 2013a) and the USFWS' Grizzly Bear Biological Opinion (USFWS 2014a) due to revisions in the displacement and habitat compensation analysis used in the Wildlife BA and Biological Opinion. Compensation requirements for displacement were recalculated for the FEIS (ERO Resources Corp. 2015). In the combined agencies' alternatives, to maintain grizzly bear movement in the Cabinet Mountains, long-term displacement effects in the north-south movement corridor would be mitigated through acquisition or easement of an equal amount of grizzly bear habitat in the north-south movement corridor, where possible. To mitigate for displacement effects due to evaluation adit activities, the first 500 acres acquired or put into conservation easement would be within the north-south corridor in BMU 2, 5, or 6. In addition to the agencies' alternatives habitat compensation for long-term mine displacement effects, additional conservation measures in the agencies' mitigation plan would offset impacts to grizzly bears. These include the increased and substantial core areas and moderated road densities due to road access changes that would provide alternative habitat for grizzly bears potentially displaced from using habitat near the mine and related facilities, including the evaluation and ventilation adits, plant site, impoundments, and access roads.

Alternative 2B effects from long-term mine, facility, and road disturbance would displace grizzly bears on 9,756 acres in both the CYRZ and BORZ or 6 percent of the average home range, with 6,716 acres of this total currently affected by existing disturbances. The area affected by long-term mine, facility, and road disturbance in both the CYRZ and BORZ in the agencies' alternatives (7,664 acres for Alternative 3 and 8,200 acres for Alternative 4) would be small compared to the size of an average grizzly bear home range, approximately 5 percent. Native adult female life ranges in the CYE averaged 165,000 acres (258 square miles) (Kasworm *et al.* 2013c). The acres from which grizzly bears would be displaced over the life of the mine, and long-term is small compared to the size of an average grizzly bear home range. Of these total acres of displacement, 6,113 to 6,719 acres are already impacted by existing disturbances associated with roads and private land development.

In summary, compared to Alternative 2B, the agencies' combined alternatives mitigation plan includes the following measures to reduce and avoid displacement of grizzly bears from suitable habitat areas due to long-term mine displacement: 1) design road access changes to offset cumulative effects by creating grizzly bear core habitat, which would provide undisturbed habitat area for displaced bears; 2) acquire additional grizzly bear habitat (acres depending upon the agencies' combined alternative (Table 30)) that is at risk of development in or near the CYE and requiring those lands be managed to benefit grizzly bear in perpetuity and increase core and improve OMRD and TMRD to further improve BMU standards for the life of the mine especially in BMUs 2, 5, and 6; 3) effectively control the time when transmission line construction and decommissioning work may be conducted (outside the spring grizzly bear use period and denning period) resulting in very low potential to displace a grizzly bear; and 4) MMC would contribute funding to support monitoring of bear movements and population status in the Cabinet Mountains to confirm the effectiveness of habitat acquisition in mitigating displacement effects. If monitoring indicated that proposed habitat acquisition was not adequate, mitigation measures would be developed to address issues identified through monitoring. Alternative 2B would not include grizzly bear monitoring.

Core

The transmission line action alternatives' detailed effects to core blocks are available in the Project record (*Wildlife Resources* section, Bear Management Unit Core Block Analysis Summary Tables for Grizzly Bear Analysis, Revised 26 July 2014 and associated maps) and are summarized here. Within the Recovery Zone, the transmission line action alternatives are located within BMUs 5 and 6 and would have no effect to BMU 2.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek)
The effects of Alternative B on core habitat can be inferred from Table 234 and is shown on Figure 93. Newly constructed roads and some previously barriered roads that would be opened would contribute to a decrease in core habitat. Small isolated blocks of core habitat may provide lower quality habitat than large interconnected blocks. Research suggests that grizzly bears prefer larger blocks of core habitat, although a minimum block size was not determined due to small sample sizes (Wakkinen and Kasworm 1997).

BMU 5: Alternative B would remove 356 acres of core habitat in the southern half of an existing 845-acre block of core in the upper Midas Creek drainage as a result of opening an existing barriered road and construction of new roads, reducing the core block to 489 acres for the Construction and Operations Phases. The main BMU 5 core block of 37,803 acres would be reduced by approximately 54 acres adjacent to the Alternative B transmission line in Ramsey Creek, leaving 37,749 acres of core. Construction of Alternative B would contribute to approximately 70 percent (463 acres) toward the 1-percent reduction in existing core from 58 percent down to 57 percent. This would further decrease core to 3 percent lower than the BMU's 60-percent standard and would maintain this level of core for the Construction and Operations Phases. After reclamation and removal of the transmission line, BMU 5 core would return to 58 percent and would still not meet its standard.

BMU 6**:** One core block in BMU 6 largely located in an unnamed tributary of Miller Creek slightly crosses over into BMU 5, and totals 1,710 acres between BMU 6 and BMU 5. During transmission line construction, new road construction in Alternative B would divide and reduce the existing 1,710-acre block (1,636 acres in BMU 6) into three smaller habitat blocks of 26, 58 (46 acres in BMU 6 and 12 acres in BMU 5), and 1,254 acres (1,237 acres in BMU 6 and 17 acres in BMU 5) (Figure 93). Overall, this block would lose a total of 327 acres of core, due entirely to Alternative B. Construction of Alternative B would decrease the existing 54 percent of core habitat to 53 percent in BMU 6 during the Construction and Operations Phases, a total of 2 percent below the standard. After reclamation, road closures with barriers and decommissioning would re-create core and would return the BMU to the existing condition of 54 percent, still 1 percent below the BMU standard.

BMU 5 and BMU 6 Summary**:** The Access Amendment requires in-kind replacement of core either prior to activity or concurrent. The decrease in core from opening barriered roads and constructing new roads during the Construction Phase and the potential for use of those newly constructed roads for maintenance would prevent those areas previously providing core from returning to core in the Operations Phase. Displacement effects from helicopter activity associated with the 10 days of line stringing during construction and infrequent annual (no more than 10 days of maintenance) would be short-term and would not occur over the entire length of the line at any one time. Effectiveness of core remaining within the 1-mile helicopter influence zone on either side of the transmission line may be reduced during helicopter activity, but the area would remain core if no barriered road was accessed by motorized vehicles. During construction, transmission line clearing in habitat previously providing core habitat would convert 3 acres and 7 acres, respectively, of forested core habitat in BMUs 5 and 6 to grass-shrub habitat. Alternative B clearing during construction and maintenance of the line and right-of-way clearing is expected to occur by motorized wheeled access and core would not be provided in these impacted core areas during the Construction, Operations, or Closure Phase. Forest cover would return slowly after the line was decommissioned.

Reductions in core habitat were analyzed as remaining for the duration of the project for a worst-case scenario. Alternative B would not create core habitat prior to the Evaluation Phase, prior to construction, or during operations by road access changes. With the known effects on core considered, Alternative B would not comply with the Access Amendment Design Elements due to the following: 1) core levels in BMU 5 and BMU 6 are currently below their individual core standard and Alternative B would reduce or contribute to an additional reduction in core for the life of the mine; 2) Alternative B would not compensate for the loss of core with in-kind replacement as required by the Access Amendment, either concurrently or prior to incurring the loss in core; and 3) as analyzed, post-project, Alternative B would not contribute to an increase in core or trend toward the standard.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

The effects of Alternative C-R on core habitat can be inferred from Table 234 and Table 240. If Alternative C-R was selected, the agencies' combined alternatives 3C-R or 4C-R pre-construction road access mitigation in BMU 6 on North Fork Miller Creek road #4725, creating 1,053 acres of core habitat, would not occur until after construction of the transmission line was completed (Table 234, Figure 94). The remaining road access mitigation associated with the combined agencies' alternatives (3C-R and 4C-R) would be implemented prior to the Evaluation Phase and prior to the Construction Phase and would increase the existing acreage of core in BMU 2, BMU 5, and BMU 6 prior to activity. BMU 6 would reach the access amendment standard of 55 percent prior to the Construction Phase.

No core habitat would be physically removed by Alternative C-R. Transmission line structures for Alternative C-R would be placed by helicopter in or adjacent to grizzly bear core habitat and no new access roads in existing core habitat would be needed (Table 240). Because core is determined by the amount and location of open or gated roads, using a helicopter in these areas would avoid decreases to core habitat. Core has no motorized road or trail access by definition and utilizing a helicopter would allow the activity to meet the criteria. However, two separate blocks of existing core habitat would be crossed by the transmission line in Alternative C-R (Figure 94), with one block increasing in size after construction with the access change on the NFS road #4725.

Table 240. Effects on Core Habitat During Construction and Operations by Combined Mine-Transmission Line Alternative.

Effect on Core Habitat	[1A] No Action	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Little Cherry Creek Impoundment Alternative		
		TL-B	TL-C-R	TL-D-R	TL-E-R	TL-C-R	TL-D-R	TL-E-R
BMU 5								
Physical Habitat Loss in Core [1]	0	130	11	11	11	3	3	3
Core Lost Due to Road Disturbance [2]	0	572	242	237	242	70	70	70
Miles of Transmission Line Located in Existing Core	0	0.4[4]	0.4[5]	0	0	0.4	0	0
Vegetation Removal in Core [3]	0	8	16	0	0	16	0	0
Core Created by Road Access Changes Prior to Activity	0	0	4,587	4,587	4,587	4,587	4,587	4,587
BMU 6								
Physical Habitat Loss in Core [1]	0	1	0	0	0	0	0	0
Core Lost Due to Road Disturbance [2]	0	319[4]	0	0	0	0	0	0
Core Lost Temporarily Due to Road Disturbance[6]	0	0	0	18	18	0	18	18
Miles of Transmission Line in Existing Core	0	0.5[4]	0.5[5]	0	0	0.5[5]	0	0
Miles of Transmission Line in Created Core	0	0[4]	2.1[5]	0	0	2.1[5]	0	0
Vegetation Removal in Core [3]	0	7	12	0	0	14	0	0
Core Created by Road Access Changes Prior to Evaluation and Construction [7]	0	0	1,092	2,145	2,145	1,092	2,145	2,145
Core Created by Road Access Changes Post-Construction [8]	0	0	1,053	0	0	1,053	0	0

Units are acres unless specified as miles.
Acres of core created are shown for alternatives without implementation of any road access changes associated with land acquisition mitigation.
[1]Core habitat physically lost as a result of impoundments, plant sites, other mine facilities (facility disturbance areas), or new road construction in Alternative B.
[2]Core habitat lost due to being within 0.31 mile of new or opened roads, not already accounted for in facility disturbance areas.
[3]Vegetation removed in transmission line clearing area but not already accounted for in facility disturbance areas. Vegetation removal within the clearing would occur for life of the mine, although in areas some cover may remain.
[4]Alternative 2B existing core lost would occur at start of construction and continue for life of mine. Affected core would not remain during operations, and vegetation removal would occur in an area no longer core.
[5]Alternative C-R would maintain existing and created core by use of helicopters and no wheeled motorized access.
[6]Alternatives 3D-R, 4D-R, 3E-R, and 4E-R core lost in BMU 6 of 18 acres would be temporary and would occur during Construction Phase up to two summers as a result of opening a 0.2-mile segment of NFS road #4724. These effects may also occur during decommissioning of the transmission line. The 18-acre loss of core would be mitigated at a 2:1 ratio prior to activity.
[7]Agency Alternatives D-R and E-R would create all 2,145 acres of core prior to activity in BMU 6.
[8]Agency Alternative C-R would not create 1,053 acres of core in BMU 6 until after transmission line construction was completed.

BMU 2: Alternative C-R would not located in BMU 2 and would not affect BMU 2 core.

BMU 5: The percentage of core in BMU 5 would increase to 60 percent prior to the Evaluation Phase and would increase to 65 percent prior to the Construction Phase due to implementation of road access mitigation. This would result in a 7-percent increase over the existing condition, which did not meet the core standard and, as a result of mitigation, the BMU would be 5 percent better (above) than the core standard for BMU 5.

Prior to the Evaluation Phase: Agencies' combined alternative road access mitigation implemented prior to the Evaluation Phase would result in an increase in core (Table 234). Existing small blocks of 24 acres and 241 acres would be combined with newly created core connecting to the main core block for a total of 1,436 acres added to the existing main core block and increasing that to 39,239 acres. Additional road access changes would increase an existing 239-acre core block to 463 acres, and another existing 845-acre core block to 1,067 acres. Total core within BMU 5 prior to the Evaluation Phase would increase from 40,851 acres of core to 42,468 acres of core. Effects on core blocks in BMU 5 are available in the Project record.

Prior to the Construction Phase: Road access mitigation implemented prior to the Construction Phase would result in additional increases in core. The main core block of 39,239 acres would increase by 2,972 acres to a total of 42,210 acres. Total core within BMU 5 prior to the Construction Phase would increase from 42,468 acres of core to 45,439 acres of core.

During Construction/Operations/Reclamation: No removal of core habitat would occur in BMU 5 as a result of Alternative C-R because transmission line structures would be placed by helicopter in or adjacent to grizzly bear core and no new access roads in core habitat would be needed. During construction and operations, where the transmission line was located in core habitat, an increased risk of displacement to grizzly bears may occur within this core block due to the helicopter noise and any associated human activity.

BMU 6: The percentage of core in BMU 6 would increase to 55 percent prior to the Evaluation Phase. Core would not increase to 57 percent until after the Construction Phase due to deferring the implementation of road access mitigation on NFS road #4725. This would result in BMU 6 meeting its 55-percent core standard prior to the Evaluation Phase and during construction. Less secure core habitat would be available during the Construction Phase compared to Alternatives D-R and E-R due to deferring the creation of 1,053 acres of core. BMU 6 would not improve over the standard by an additional 2 percent until the Post-Construction Phase (Table 234).

Prior to the Evaluation Phase: Prior to the Evaluation Phase, core created by road access changes would combine two existing discontiguous core blocks of 787 and 1,036 acres to create a larger 2,915-acre block, which would connect to the main BMU 5 core block. Total core within BMU 6 prior to the Evaluation Phase would increase by 1,091 acres from 34,402 acres to 35,493 acres. Effects on core blocks in BMU 5 are available in the Project record.

Prior to the Construction Phase: Road access changes identified in the mitigation plan and specific changes for Alternative C-R would be implemented. Alternative C-R would defer the access change on NFS road #4725 until after construction.

Prior to Operations: For Alternative C-R, once construction was completed, additional core would be created by installing a berm on North Fork Miller Creek Road #4725 (Figure 94). The access change would occur on the entire length of the NFS road #4725. This would increase the existing 1,710-acre core block to 2,763 acres. Total core within BMU 6 would then increase by an additional 1,053 acres from 35,493 acres to 36,546 acres, resulting in 57 percent core.

During Construction/Operations/Reclamation: If the core in BMU 6 was created prior to the Construction Phase, it would only be in place for at the most 2 years and would not meet the definition of core, thus no in-kind replacement as specified by the Access Amendment would be required. No existing core would be reduced. Core would meet the Access Amendment standard of 55 percent during the Construction Phase due to core created prior to the Evaluation Phase. During the Construction Phase, Alternative C-R would result in core habitat provided in BMU 6 at the minimum core recommended for a female grizzly bear's successful survival and reproduction based on research (Wakkinen and Kasworm 1997). Prior to operations, core would increase to 57 percent and would remain better than the core standard during operations and reclamation.

Displacement or Clearing Effects to Core in BMUs 5 and 6: Displacement effects from helicopter activity during construction, annual maintenance throughout the project, and transmission line decommissioning in Alternative C-R could reduce effectiveness of two core habitat blocks. However, potential to displace grizzly bears is considered low due to timing mitigation that restricts transmission line construction and decommissioning activity to the period between June 16 and October 14 (see Objective 1.a).

During Operations: Alternative C-R would result in a total of 3 miles of transmission line being located within two blocks of core habitat during the Operations Phase. Alternative C-R would maintain the corridor clearing for the life of the project and would provide for easier recreation and hunting access within these core blocks. This would result in a potential higher risk of mortality and displacement of grizzly bears within these core blocks compared to Alternatives D-R and E-R.

Transmission line clearing in the unnamed tributary of Miller Creek would convert 23 acres of forested core habitat within this block to grass-shrub habitat. In the upper Midas Creek drainage, transmission line clearing would convert 10 acres of forested core habitat within this block to grass-shrub habitat. Maintenance of this shrub habitat located in core in the transmission line right-of-way during the Operations Phase would be required to occur by non-wheeled motorized access to maintain this core. By definition, any motorized wheeled access into core would remove that area as core for 10 years. By requiring use of helicopters in core for construction and maintenance within the right-of-way to not use wheeled motorized vehicles, no in-kind core replacement for losses of core would be required prior to the Evaluation or Construction Phases.

Alternative D-R – Miller Creek Transmission Line Alternative

Effects to core habitat and grizzly bears and mitigation for those effects from Alternative D-R would be as described in Alternative C-R with exceptions as follows. Alternative D-R differs from Alternative C-R in that the transmission line would not be located in existing core or in any core created for mitigation. The effects of Alternative D-R on core habitat can be inferred from Table 234 and Table 240. All road access changes in the agencies' alternatives resulting in improvements to core habitat would occur before the Evaluation Phase and before the Construction Phase. Transmission line structures would be placed by helicopter in or adjacent to core habitat and no new access roads would be constructed in core habitat.

BMU 6:

Prior to the Construction Phase: Alternative D-R differs from Alternative C-R in that the road access change in BMU 6 on NFS road #4725 would occur prior to the Construction Phase. Creation of the 1,053 acres of additional core resulting from this road access change would be created prior to construction activity. By not delaying this road access change, Alternative D-R allows BMU 6 to reach 57 percent core prior to the Construction Phase, allowing for more available secure core habitat for any grizzly bear potentially displaced during the Construction Phase compared to Alternative C-R.

During Construction: Alternative D-R would result in the short-term temporary loss of existing core during the Construction Phase. In BMU 6, a short segment of the currently bermed segment of NFS road #4724 would be opened and used for helicopter landing access. Motorized access would occur by the fuel truck, log loading equipment or trucks, removing 18 acres from functioning as core. Prior to construction activity, the loss of these 18 acres of core would be replaced at a 2:1 ratio, for a total of 36 acres, meeting (and better than) the Access Amendment requirement of in-kind (1:1) replacement. A total of 2,145 acres of core would be created in BMU 6 as mitigation prior to the Evaluation and Construction Phases. Of that, 36 acres is 2:1 replacement core, leaving a net core increase of 2,109 acres. Any potential short-term displacement effects resulting from the temporary loss of the 18 acres of core are mitigated for by core creation prior to activity. The affected core block within BMU 6 would increase by 1,053 acres from 1,710 acres to a total of 2,763 acres prior to the temporary 18-acre loss. Prior to the Construction Phase, Alternative D-R would maintain BMU 6 core at 57 percent, better and higher than the BMU standard.

In both BMU 5 and BMU 6, Alternative D-R road access mitigation would increase core to meet the individual BMU standard prior to the Evaluation Phase, and would increase it to 5 percent (BMU 5) and 2 percent (BMU 6) above the BMUs' standard prior to the Construction Phase. Core habitat provided in these BMUs during all phases would provide more than the minimum core suitable for a female grizzly bear's successful survival and reproduction based on research (Wakkinen and Kasworm 1997).

Alternative E-R – West Fisher Creek Transmission Line Alternative

The effects of Alternative E-R on core habitat can be inferred from Table 234 and Table 240. Effects to core habitat and grizzly bears and mitigation for those effects from Alternative E-R would be as described in Alternative D-R.

Combined Mine-Transmission Line Alternatives

Alternative 2B proposed mitigation on the Upper Bear Creek Road, which would have improved core, was already included in the Rock Creek Project and therefore was not considered as mitigation for Alternative 2B. This road closure and effects to core are addressed in cumulative effects as a reasonably foreseeable action. As previously discussed under Alternative B, the Alternative 2B mitigation plan for land acquisition and the potential to increase core prior to activity, is expected to result in Alternative 2B meeting the Access Amendment standard.

In the agencies' alternatives, road access changes associated with mitigation would be implemented before project activities affecting core habitat, with an exception for one road in Alternatives 3C-R and 4C-R, which would be deferred. Mitigation implemented before the Evaluation Phase would improve existing core habitat conditions in BMUs 5 and 6 to meet Access Amendment standards. Similarly, mitigation implemented before the Construction Phase would further improve core habitat conditions in BMUs 5 and 6. Alternatives 3C-R and 4C-R would defer the road access change on NFS road #4725 and core creation until after construction of the transmission line was completed. The agencies' combined alternatives 2:1 replacement for the loss of core habitat prior to the Evaluation and Construction Phases would create more core habitat than the in-kind (1:1) replacement required for core habitat loss by the Access Amendment. The agencies' core habitat mitigation achieved through road management access changes would provide core at levels higher and better than the individual Access Management standards and the minimum 55 percent core recommended by Wakkinen and Kasworm (1997) for the life of the mine. Providing BMUs with better habitat parameters (including core) than the minimum known to provide for a female grizzly bear to successfully survive, reproduce, and provide for cubs for the life of the mine, was designed to offset cumulative effects of two mines. Reducing motorized access conditions would contribute to reducing risk of human-caused bear mortality, provide undisturbed habitat for bears potentially displaced, improve habitat conditions in the north-south movement corridor, and help meet KFP standards for grizzly bear habitat conditions.

BMU 2: Core habitat in BMU 2 would not be removed by any of the combined action alternatives. Alternative 2B would not affect core in BMU 2 and no road access changes are proposed in BMU 2. Road access changes associated with the agencies' combined alternatives implemented prior to the Evaluation Phase would result in an additional 274 acres of core, increasing the main existing core block of 49,151 acres to 49,425 acres. Total core within BMU 2 would increase from 49,566 acres to 49,840 acres. The percentage of core would remain at 76 percent, 1 percent better than the BMU's standard.

BMU 5**:**

All Combined Action Alternatives: The access change on NFS road #4784 would be implemented for all action alternatives only if it was not already implemented as part of the Rock Creek Project mitigation. Core created would be attributable to the Rock Creek Project and is accounted for under cumulative effects as a reasonably foreseeable action.

Alternative 2B: Relative to other combined action alternatives, Alternative 2B would have the greatest impact on core habitat in BMU 5 (Table 234 and Table 240).

Physical Removal: Alternative 2B would remove existing core, with 2 acres of a 24-acre block, a small 8-acre block, and 117 acres of core of a 241-acre block physically removed by the impoundment (total of about 130 acres). Tables displaying the effects to individual core blocks are available in the project record (*Wildlife Resources* section, Bear Management Unit Core Block Analysis Summary Tables for Grizzly Bear Analysis, Revised 26 July 2014 and associated maps).

Disturbance: An additional 92 acres of the 241-acre existing block of core would be removed due to road disturbance, leaving approximately 30 acres. An additional 490 acres of core would be lost due to open road influences from the transmission line or LAD Areas and associated new road construction and the use of new or previously bermed roads. As these roads could be used for maintenance of the transmission line, loss of this core due to open and gated road buffers was assumed for the life of the mine. Core areas must be managed undisturbed for 10 years, and it could not be assumed this would occur. After reclamation, barriering of roads in some areas would return areas to core, while other areas would not return to core. A newly created core block of 250 acres due to Alternative 2B road removal or barriering in the impoundment area would offset some of the existing core loss and contribute to the return of core to pre-activity levels of 58 percent.

As previously described, Alternative 2B proposed an access change on NFS road #4784 but this action was already included as Rock Creek Project mitigation and was not considered in the analysis of direct effects. Core habitat would not be created by the seasonal access change (April 1 to June 30) proposed by MMC for NFS road #4724 because it would not be in effect for the entire active bear year. Potential improvement to core as a result of mitigation lands is described above in "*Effects common to all action alternatives*." Without considering the effects of land acquisition, Alternative 2B would not meet the Access Amendment design element for core as described under Alternative B.

As a result of mitigation land acquisition, it is expected that Alternative 2B would meet core standards, but as the location of which lands would actually be acquired is not known at this time, improvements to core cannot be calculated. Alternative 2B would not monitor to determine effectiveness of the habitat acquisition, or the road access change.

Agency Alternatives: During construction and through the Operations Phase, use of newly constructed or opened roads previously bermed or impassable would result in the loss of core.

Physical Removal: Of an existing 241-acre block of core, 9 to 11 acres would be physically lost due to Alternatives 3C-R, 3D-R, and 3E-R and 3 acres would be lost due to Alternatives 4C-R, 4D-R, and 4E-R, primarily from construction of the tailings impoundment. Tables displaying effects to core blocks are available in the project record (*Wildlife Resources* section, Bear Management Unit Core Block Analysis Summary Tables for Grizzly Bear Analysis, Revised 26 July 2014 and associated maps).

Disturbance: For Alternatives 3C-R, 3D-R, and 3E-R, the remaining 232 acres of the existing 241-acre block would be lost to open or gated road disturbance, while about 25 acres of the main core block would be lost due to open roads within the Libby Creek Plant site. For all agency alternatives, an approximate 20 to 37 acres of road access mitigation created core would also be removed in BMU 5 due to the impoundment and other mine related development or roads. These small decreases in the core areas created by road access mitigation prior to the Evaluation or Construction Phases under Alternatives 3C-R, 3D-R, 3E-R, 4C-R, 4D-R, and 4E-R (Table 240) in BMU 5 would occur during the Construction phase due to construction of the impoundment and mine facilities, newly constructed roads and some previously barriered roads that would be opened. These small decreases do not technically impact core habitat as core must be in place for 10 years, and more importantly the areas only resulted from the creation of larger areas of core in BMU 5 that were meant to function as core or core replacement for the life of the mine. However, for this analysis, a worst-case scenario was used and the loss of core displayed in the tables includes both existing core and mitigation-created core lost during construction of the impoundment and mine related facilities and roads

BMU 6: Within BMU 6, the principal activity for the combined action alternatives would be construction and operation of the transmission line, and the effects are described in detail under the individual transmission line alternatives.

Alternative 2B Effects in BMU 6: Alternative 2B would decrease core habitat to 53 percent during all phases of the project. In BMU 6, only 1 acre of core habitat would be physically removed by Alternative 2B due to new road construction; however, use of new or opened access roads during transmission line construction would remove 326 acres of core habitat located in the northeast portion of BMU 6, mostly located along and adjacent to the ridges between Miller and Midas Creek, and Miller and Schreiber Creek. This loss is largely due to new roads built off of or opening of spurs associated with either the Midas Howard Creek Road NFS #4778 or the North Fork of Miller Creek Road NFS #4725.. These effects are described in detail under the transmission line Alternative B.

Agency Alternatives: The agencies Alternatives 3D-R, 3E-R, 4D-R, and 4E-R would create all core habitat resulting from road access change mitigation by initiation of the Construction phase, while Alternatives 3C-R and 4C-R would defer 1,053 acres of the total core created to after the Construction Phase..

The transmission line alignments in the agencies' alternatives 3C-R and 4C-R would cross the same narrow band of existing core habitat in located along the ridge between Miller and Midas Creek as Alternative 2B (Figure 94), but due to the use of helicopters for construction activities of tree removal, structure placement, and line stringing, no roaded access would be needed in any existing core, and no reduction to core habitat would occur. All combined agencies' alternatives would improve core habitat by 1 to 3 percent in BMU 6 during all phases of the project as a result of road access changes and less new road construction along the transmission line corridors. All of the combined agencies' alternatives would include an access change on the entire length of NFS road #4725 that would create the same amount of core in the North Fork Miller Creek (BMU 6), only the timing of implementation would differ. For Alternatives 3D-R, 4D-R, 3E-R, and 4E-R, the access change would be implemented prior to transmission line construction. As a result, percent core in BMU 6 would be better than the standard and more secure core habitat would be available for displacement during the Construction Phase for these alternatives compared to Alternatives 3C-R and 4C-R, which defer this core creation. The entire length of NFS road #4725 would be used during construction of Alternatives 3C-R and 4C-R, and the access change would occur after it was no longer needed for transmission line construction and prior to operations. As a result, less secure core habitat would be available for displacement during the Construction Phase for Alternatives 3C-R and 4C-R. Alternatives 3C-R and 4C-R would result in a total of 3 miles of transmission line being located within two blocks of core habitat throughout the Operations Phase. This would result in a potential increase in displacement and mortality risk to grizzly bears within these two core blocks due to the maintenance of the corridor allowing for easier human access compared to the other agency alternatives.

Displacement effects to core habitat blocks are described above for the individual transmission line Alternatives C-R and D-R. During construction of Alternatives 3D-R, 3E-R, 4D-R, and 4E-R, a short segment of the currently bermed segment of NFS road #4724 would be used for helicopter landing access, including fuel or logging trucks, resulting in a short-term loss of 18 acres of core during construction (Table 240). This short segment of NFS road #4724 may also be accessed during removal of the transmission line for decommissioning, which would result in the same short-term loss of the 18 acres of core. The effects and mitigation for the loss of these 18 acres of core is described in detail under the transmission line Alternative D-R and Alternative E-R and is applicable to these combined alternatives.

Other effects to core habitat from the transmission line component of the combined action alternatives would be as previously described for individual transmission line alternatives.

BMU 5 and BMU 6 Summary:
Alternative 2B: Alternative 2B would result in both physical removal and loss of core due to the mine and associated facilities and transmission line development and associated opening of existing bermed or impassable roads and constructing new roads. Both BMU 5 and BMU 6 do not meet their individual core standards in the existing condition and Alternative 2B would decrease core during construction and for the life of the mine, would not create core prior to incurring the losses, and would not improve core post-project. Without knowing what mitigation lands would be acquired and what improvements to the baseline core habitat parameter would occur, and based on known calculable effects, Alternative 2B would not comply with the Access Amendment Design Elements for the same reasons described for the individual transmission line Alternative B.

Agencies Mitigated Combined Alternatives: Prior to the Evaluation Phase and prior to the Construction Phase, the combined agencies' alternatives would compensate for any loss of existing core within both BMU 5 and BMU 6 at a 2:1 ratio, better than the Access Amendment standard, which requires 1:1 in-kind replacement of core concurrently or prior to incurring the losses. To achieve this, the agencies' alternatives would implement road access changes associated with mitigation to create new core and would require fewer new temporary access roads and open fewer bermed roads along the transmission line corridors to maintain existing core. The agencies' combined alternatives mitigation plan would require yearlong road access changes prior to either Evaluation or Construction Phase activity, (or post Construction for Alternative 3C-R and 4C-R) which would create 4,534 acres of core habitat in BMU 5 and 2,145 acres of core habitat in BMU 6 (Table 240). This created core includes both the core acres required for compensation for loss of core, as well as additional core created to improve the core habitat parameter baseline for grizzly bears, provide additional security, reduce fragmentation in the north-south corridor, improve the baseline grizzly bear habitat conditions to assist in reversing the downward population trend, and provide mitigation for cumulative effects of both the Rock Creek Project and the agencies' action alternatives (see *Cumulative Effects* section for additional detail on the Rock Creek Project). Remaining effects to percentage core within the BMUs are described under the agencies individual transmission line Alternatives C-R, D-R, and E-R.

As discussed previously, additional improvements to the baseline core as a result of land acquisition or conservation easements in perpetuity and any additional road access changes are not quantified in this analysis. In the agencies' alternatives, MMC would contribute funding to support monitoring of bear movements and population status in the Cabinet Mountains to confirm the effectiveness of habitat acquisition and road access changes in mitigating impacts on grizzly bears. If monitoring indicated that proposed habitat acquisition and road access changes were not adequate, mitigation measures would be developed to address identified issues.

OMRD

For all action alternatives, additional improvements to baseline OMRDs in BMU 2, BMU 5, and BMU 6 are likely to occur as a result of the habitat compensation mitigation. This has been previously summarized in "*Effects common to all action alternatives*" and in "*Effects common to agency alternatives*." Any decreases and improvement to baseline OMRD in the affected BMUs may result in lower OMRD during activity than displayed in Table 234.

Within BMU 2, the transmission line or combined mine-transmission line action alternatives mitigation plans do not propose any road access changes that would affect existing OMRD.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Of all of the transmission line alternatives, Alternative B would require the most construction of new roads (Table 237). The effects of Alternative B on road densities can be inferred for BMU 5 and are displayed for BMU 6 in Table 234. Newly constructed roads and some previously gated or barriered roads that would be opened would contribute to increases in OMRD. Areas of OMRD higher than a BMU standard could result in avoidance or underuse of the affected area, potentially increasing mortality risk to grizzly bears.

BMU 5: Alternative B would contribute to the increase in existing OMRD by 4 percent and expansion in the existing spatial distribution of roads in the BMU to levels higher (worse) than levels reported in average female home range (Wakkinen and Kasworm 1997) and 2 percent above (worse) the Access Amendment standard for the BMU. During operations, OMRD would decrease by 2 percent, meeting the BMU standard of no more than 30 percent OMRD, but would remain 2 percent above the existing condition during the Operations Phase. Post-project OMRD due to road closures (removal or barrier) associated with the combined Alternative 2B in the impoundment area would decrease by another 2 percent, further reducing OMRD to 27 percent, lower and better than the existing condition by 1 percent.

BMU 6: The greatest effects of Alternative B on OMRD would be in BMU 6 where the majority of the line would be built. BMU 6 OMRD is currently 29 percent, 5 percent below and better than the BMU standard of no more than 34 percent. Alternative B would increase OMRD by 3 percent to 32 percent during the 2-year Construction Phase, and OMRD would return to existing condition levels during operations and post-reclamation. Within BMU 6, Alternative B would be within Access Amendment standards in all phases.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

More closed roads (currently gated and barriered roads) would be opened for Alternative C-R than for the other alternatives, but fewer new roads would be constructed (Table 237). Road access changes affecting OMRD associated with mitigation would be implemented before project activities affecting OMRD. The effects of Alternative C-R on OMRD can be inferred for BMU 5 and are displayed for BMU 6 in Table 234. During construction, grizzly bears would likely avoid the areas of increased activity; however, the potential to displace grizzly bears as a result of increased OMRD is low due to the agencies' transmission line timing mitigation as described under Part A, Displacement.

BMU 5: Road access mitigation prior to the Evaluation Phase decreases the existing 28-percent OMRD to 27 percent and 3 percent better (lower) than the BMU standard of 30 percent. As a result of this mitigation, the 1-percent increase during the Construction/ Operations/Decommissioning Phases would result in a return to the existing condition of 28 percent. Post-reclamation OMRD would return to the 27 percent attained due to mitigation prior to the Evaluation Phase, thus improving OMRD over the existing condition post-project.

BMU 6**:** The greatest effects of Alternative C-R on OMRD would be in BMU 6 where the majority of the transmission line would be built. Within BMU 6, all construction, operations, decommissioning, and reclamation effects to OMRD shown in Table 234 are due to the transmission line. BMU 6 OMRD is currently 29 percent, 5 percent below and better than the BMU standard of no more than 34 percent. Alternative C-R would increase OMRD to 31 percent during the Construction and Decommissioning Phases, staying below and better than the BMU standard by 3 percent. OMRD would return to the existing 29 percent during operations and post-reclamation.

Alternative D-R – Miller Creek Transmission Line Alternative

Effects to OMRD and grizzly bears and mitigation for those effects from Alternative D-R would be as described for Alternative C-R except for as follows: Alternative D-R would require fewer new roads than Alternative B, but slightly more than Alternatives C-R and E-R. The least amount of closed roads (gated or barriered) would need to be opened for access during construction of Alternative D-R than for the other alternatives (Table 237). The effects of Alternative D-R on OMRD can be inferred for BMU 5 and are displayed for BMU 6 in Table 234.

BMU 6: As displayed in Table 234, Alternative D-R would result in a 1-percent increase in OMRD to 30 percent during construction (and decommissioning). OMRD would return to the existing OMRD of 29 percent for the Operations Phase and post-reclamation. In Alternative D-R, a short segment of the currently bermed segment of NFS road #4724 would be used for helicopter landing access during construction, resulting in a short-term increase in linear miles of open road, but no change in percent OMRD would occur. These effects could also occur during decommissioning of the transmission line.

Alternative E-R – West Fisher Creek Transmission Line Alternative

The effects of Alternative E-R on OMRD can be inferred for BMU 5 and are displayed for BMU 6 in Table 234. More roads would be opened for the construction of Alternative E-R than for the other alternatives (Table 237). However, this would not result in a different OMRD percentage than Alternative D-R. The effects of Alternative E-R on percent OMRD would be as described for Alternative D-R.

Combined Mine-Transmission Line Alternatives

OMRD within BMUs 2, 5, and 6 are near or lower (better) than levels reported in average female grizzly bear home range (Wakkinen and Kasworm 1997). Newly constructed roads and previously barriered or gated roads that would be opened would contribute to an increase in OMRD. All combined action alternatives would increase OMRD in BMUs 5 and 6 during construction and operations (Table 234).

***BMU 5*:**

Alternative 2B: Alternative 2B would have the greatest effect on OMRD compared to the agencies' alternatives. Alternative 2B would increase OMRD to 32 percent during construction (4 percent over the existing condition of 28 percent and 2 percent over the BMU standard). During operations, OMRD would decrease to 30 percent, meeting the BMU standard, but 2 percent worse than the existing condition. Post-reclamation and decommissioning, OMRD would drop to 27 percent, better than the BMU standard.

Agencies' Alternatives: In the agencies' alternatives, road access changes in BMU 5 associated with mitigation would be implemented before project activities affecting OMRD. Agency mitigation implemented before the Evaluation Phase would improve BMU 5 existing 28-percent OMRD by reducing it 1 percent to 27 percent or 3 percent better than the 30 percent standard. During construction and operations, OMRD would return to the existing 28 percent. OMRD in BMU 5 would improve compared to existing densities after reclamation in all combined action alternatives, decreasing by 2 percent for Alternatives 4C-R, 4D-R, and 4E-R and 1 percent for

Alternatives 2B, 3C-R, 3D-R, and 3E-R, with all resulting decreases either better than or meeting the OMRD standard for BMU 5.

***BMU 6*:** In the agencies' alternatives, road access changes in BMU 6 associated with mitigation would be implemented before project activities, except where previously described for Alternatives 3C-R and 4C-R. Existing OMRD is 5 percent better than the standard. OMRD in BMU 6 during construction and decommissioning would be worse than existing densities for all combined action alternatives, and would increase the most in Alternative 2B, but all action alternatives would be lower (better) than the BMU standard during construction, operations, and decommissioning. After the transmission line was built, OMRD in BMU 6 would return to existing densities during operations and after reclamation in all combined action alternatives.

Summary: For all combined action alternatives, habitat compensation/land acquisition mitigation may lower the baseline OMRDs in the affected BMUs, which in turn would result in lower OMRDs than displayed in Table 234 during activity. As analyzed, Alternative 2B would increase OMRD above BMU 5's standard during construction/reclamation and decommissioning, and meet the standard during operations. Increases in OMRD above the standard may displace bears, and Alternative 2B would also not meet core standards in either BMU 5 or 6, or provide the 55-percent minimum recommended by research. Any additional core that would result from the mitigation land habitat compensation would contribute to secure areas for grizzly bears displaced from areas affected by increased OMRD. The agencies' alternatives would be more effective in providing secure areas for displacement of grizzly bears as a result of both the road access changes prior to activity creating core and the habitat compensation that is expected to result in additional decreases in OMRD and increases in core. In addition to road access changes, the agencies' alternatives would include monitoring the effectiveness of closure devices at least twice annually. In the agencies' alternatives, MMC would contribute funding to support monitoring of bear movement and population status in the Cabinet Mountains to confirm the effectiveness of road access changes in mitigating the effects to grizzly bears. If monitoring indicated that proposed access changes were not adequate, mitigation measures would be developed by the Oversight Committee and implemented by MMC, as described in Chapter 2, to address identified issues.

TMRD

Alternative 2B proposes no access changes in BMU 2 and would have no effect to the existing TMRD. The agencies' combined action alternatives mitigation plan would include access changes in BMU 2, installing barriers (rendering the roads impassable to motorized vehicles) on existing gated roads in BMU 2, resulting in a slightly lower linear miles of total road, but no change to the existing percentage of TMRD would occur.

For all action alternatives, additional improvements to baseline TMRDs in BMU 2, BMU 5, and BMU 6 may occur as result of the habitat compensation mitigation. This has been previously summarized in "*Effects common to all action alternatives*" and in "*Effects common to agency alternatives.*" Any decreases and improvements to baseline TMRDS in the affected BMUs may result in lower TMRD during activity than displayed in Table 234.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Of all of the transmission line alternatives, Alternative B would require the most construction of new roads (Table 237). The effects of Alternative B on road densities are displayed for BMU 6 and can be inferred for BMU 5 from Table 234. Newly constructed roads and some previously barriered roads that would be opened during construction and operations would increase TMRD.

BMU 5**:** Alternative B would contribute to a 3 percent increase in TMRD during construction that would result from both the transmission line and mine development.

BMU 6: The greatest effects of Alternative B on road densities would be in BMU 6 where the majority of the transmission line would be built. Alternative B would increase TMRD in BMU 6 during construction and operations 2 percent over the existing 33 percent and 3 percent above the standard of 32 percent. This increase would be maintained for the life of the mine. Post-reclamation, after decommissioning of all new roads built for access, and re-barriering of previously barriered roads, TMRD would return to the existing level. However, it should be noted, under the Access Amendment, the KNF is required to comply with the BMU standard within a specified timeframe, and this would occur independent of Alternative B.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

The effects of Alternative C-R on TMRD are displayed for BMU 6 and can be inferred for BMU 5 from Table 234. Alternative C-R would defer an access change on NFS road #4725 until after construction, but implements all others prior to project activities affecting road densities. During construction and operations, newly constructed roads and some previously barriered roads that would be opened would contribute to an increase in TMRD. More closed roads (gated or barriered) would be opened for Alternative C-R than for the other alternatives, but fewer new roads would be constructed (Table 237).

BMU 2: Road access change mitigation would berm existing gated roads in BMU 2 and slightly decrease the total linear miles of road, but no change to the existing percent of TMRD would occur.

BMU 5**:** Road access change mitigation associated with the agencies' combined alternatives in BMU 5 prior to activities would reduce TMRD to 19 percent, 4 percent better (lower) than the existing condition and BMU standard of 23 percent. During construction and operations, TMRD would increase to 20 percent, remaining 3 percent better than the standard. Alternative C-R would contribute to the increase in TMRD due to opening of closed roads and construction of new roads associated with the transmission line.

BMU 6**:** The greatest effects of Alternative C-R on road densities would be in BMU 6 where the majority of the transmission line would be built. Construction Phase TMRD for Alternative C-R would not increase over the existing condition of 33 percent (Table 234), which does not meet the BMU standard because unlike the other agencies' mitigated transmission line alternatives, Alternative C-R would defer the access change on NFS road #4725 that would decrease TMRD in BMU 6 until after the road was no longer needed for transmission line construction. After construction was completed, the access change on NFS road #4725 would decrease TMRD by 1 percent to meet the BMU standard. During operations, due to the access change, TMRD in BMU 6 would meet the BMU standard of 32 percent. During line decommissioning, TMRD would again briefly increase to 33 percent, but would return to the standard of 32 percent after reclamation.

Alternative D-R – Miller Creek Transmission Line Alternative

Effects to TMRD from Alternative D-R would be as described for Alternative C-R, except for as follows: The effects of Alternative D-R on TMRD are displayed for BMU 6 and can be inferred for BMU 5 from Table 234. Alternative D-R implements all of the road access changes proposed by the agencies' alternatives prior to project activities affecting linear miles of road and/or road densities. Alternative D-R would require fewer new roads than Alternative B, but slightly more than Alternatives C-R and E-R.

BMU 6**:** As previously mentioned, Alternative D-R differs from Alternative C-R in that the road access change in BMU 6 on the North Fork Miller Creek Road #4725 would occur prior to the Construction Phase and thus the 1-percent decrease in TMRD, bringing BMU 6 into compliance with its TMRD standard, would occur prior to activity.

Alternative E-R – West Fisher Creek Transmission Line Alternative

Effects to TMRD and grizzly bears and mitigation for those effects from Alternative E-R would be as described under Alternative D-R, except for as follows: The effects of Alternative E-R on TMRD are displayed for BMU 6 and can be inferred for BMU 5 from Table 234.

BMU 6: Differences in road access used for Alternative E-R compared to the other agency alternatives would result in TMRD remaining at the 32-percent level achieved by road access mitigation prior to activity. TMRD would meet the BMU standard in all phases.

Combined Mine-Transmission Line Alternatives

Effects to TMRD are as described for the individual transmission line alternatives and as summarized here for the combined mine-transmission line alternatives.

Newly constructed roads and previously barriered roads that would be opened would contribute to an increase in TMRD. All combined action alternatives would increase TMRD (Table 234). As previously described, in the agencies' alternatives, most road access changes associated with mitigation would be implemented before project activities affecting TMRD, except for implementation of the access change on NFS road #4725 in BMU 6, which would be deferred until after construction for Alternatives 3C-R and 4C-R.

BMU 5**:**
Alternative 2B: In BMU 5, TMRD would increase the most during construction and operations of Alternative 2B to 26 percent and would not meet the BMU standard. After reclamation, BMU 5 TMRD would drop to 22 percent, 1 percent better than the existing condition and standard of 23 percent.

Agencies' Alternatives: Mitigation implemented before the Evaluation Phase would decrease existing TMRD in BMU 5 to 19 percent, better than the existing condition and BMU standard of 23 percent. This reduction in TMRD prior to activity would allow the 1-percent increase resulting from the agencies' combined alternatives during construction, operations, and decommissioning and reclamation activities to be 3 percent less than the standard. TMRD would increase to 20 percent during construction, operations, and reclamation. Post-reclamation TMRD would decrease to 18 percent (a 5-percent improvement over the existing condition) (Table 234).

***BMU 6*:**
Alternative 2B: In BMU 6, TMRD would increase over the existing condition, which does not meet the standard. Of all the action alternatives, Alternative 2B would increase TMRD the greatest during Construction and Operations (to 35 percent) and would not meet the BMU standard during these phases. Post-reclamation, TMRD would return to 33 percent and would not meet the standard.

Agencies' Alternatives: Mitigation implemented before the Construction Phase would decrease TMRD in BMU 6 to 32 percent to meet Access Amendment standards. The 32-percent TMRD achieved through mitigation prior to the Construction Phase would be maintained during construction and operations for Alternatives 3E-R, and 4E-R. During construction of Alternatives 3C-R, 3D-R, 4C-R, and 4D-R, TMRD would be the same as existing levels (33 percent) and would not meet the standard. During operations, all agency alternatives would meet the standard of 32 percent. The effects to TMRD during decommissioning would be the same as during construction. Post-reclamation TMRD would remain at 32 percent and would meet the Access Amendment standards. Mitigation and monitoring related to TMRD would be the same as discussed above for OMRD.

Objective 2. Manage for an adequate distribution of bears across the ecosystem

Juxtaposition of foraging habitat and cover/movement corridors

The availability and proximity of cover may influence the use of foraging habitat by grizzly bears. This sub-element of Objective 2 was developed to address concerns regarding availability of cover in relation to foraging habitat. Historical openings would have varied in shape and size depending upon the disturbance process (*e.g.,* wildfire and windthrow). Large stand-replacing fires occurred over tens of thousands of acres (*e.g.,* 1910 era) whereas more frequent mixed-severity fries resulted in smaller patches in the range of 1 to 1,000 acres. These smaller disturbance patches resulted in a diversity of stand age, tree size, species composition, and edge habitats. This mix of ecological conditions provided the habitat conditions necessary to maintain a grizzly bear population.

The KFP addresses movement corridors between timber harvest openings. Guidelines in the KFP for timber harvest and grizzly bears include retaining movement corridors (MA 14, 600 feet between openings (KFP III-59, Timber #5) and as needed in project design (Timber/Fire Management Standard 2.b, Forest Service App. 8, pg. 8-10). All action alternatives remove vegetation, including timber for mine or transmission line construction. The Access Amendment Biological Opinion (USFWS 2011c) describes the importance of habitat connectivity or linkage for wildlife including the grizzly bear at a landscape scale.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

One linear opening in forest cover greater than 40 acres would be created by Alternative B. No location in the transmission line clearing area would be greater than 600 feet from cover. Alternative B does not specify that vegetation cover would be maintained in the transmission line clearing during construction or operations, but low shrubs and trees may remain or re-establish in portions of the clearing and would provide some cover for movement. Alternative B construction or decommissioning activity could deter grizzly bears from moving along the Miller Creek, Howard Creek, and Ramsey Creek drainages. The effects to grizzly bears include the disturbance and potential avoidance of the activity. Areas of cover would remain adjacent to the transmission line clearing, and although grizzly bears may change their pattern of use, the clearing area would continue to provide for movement between more secure habitat.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

Alternative C-R mitigation requires a Vegetation Removal and Disposition Plan that would minimize vegetation removal in the transmission line clearing. Alternative C-R would retain a greater amount of cover in the form of low trees and shrubs than Alternative B. Alternative C-R construction or decommissioning activity could deter grizzly bears from moving along the West Fisher Creek, Miller Creek, Howard Creek, and Libby Creek drainages, but due to timing, mitigation potential displacement resulting from construction or decommissioning activity would not occur during the grizzly bear denning or spring activity periods.

Alternative D-R – Miller Creek Transmission Line Alternative

Alternative D-R effects to juxtaposition of forage habitat and cover and movement across the transmission line clearing would be as described for Alternative C-R.

Alternative E-R – West Fisher Creek Transmission Line Alternative

Alternative E-R effects to juxtaposition of forage habitat and cover and movement across the transmission line clearing would be as described for Alternative D-R.

Combined Mine-Transmission Line Alternatives

All combined action alternatives would create one linear opening in forest cover greater than 40 acres as a result of transmission line clearing. The maximum transmission line clearing, estimated at 200 feet wide, would total approximately 330 acres but would be linear, and would provide some level of forage for grizzly bears, and no point in the clearing area would be more than 600 feet from cover. In all combined action alternatives, surface disturbance from the impoundments would consolidate two smaller forest cover openings into one large opening. These openings are associated with mine development, including the impoundment, facilities, and evaluation adits, not timber harvest, and grizzly bear use in these disturbance areas would not be encouraged. It would not be desirable to provide cover within 600 feet of these facilities due to the high level of human use.

Alternative 2B would create three additional openings due to mine facility development with locations in the opening more than 600 feet from cover. The mine components of the agencies' alternatives would create two additional openings with locations in the opening more than 600 feet from cover.

In all combined action alternatives, except for removal of vegetation for the impoundment disturbance, unharvested corridors greater than 600 feet would continue to be maintained between the proposed activity and unrecovered existing harvest units.

Between and within BMUs 5 and 6, movement corridors consisting of blocks of vegetative cover and core habitat are available. As discussed for displacement effects, mine activities could affect grizzly bear movement in the north-south movement corridor. All combined action alternatives due to the high-intensity level and duration (24-hour) activities associated with the mine facilities may result in underutilization of habitat within the zone of influence. This includes movement along the upper portions of the Libby Creek corridor. Alternatives 2B, 4C-R, 4D-R, and 4E-R could also disrupt grizzly bear movement in the Little Cherry Creek riparian area. Alternative 2B would have additional effects on grizzly bear movement in the Ramsey Creek corridor. These displacement effects would potentially last until mine closure. Displacement effects over time may be minimized in part because over the life of the mine, activities would be temporarily and spatially predictable and people associated with the work would be regulated against carrying firearms or having attractants available to grizzly bears (USFWS 2014a).

Due to disturbance associated with transmission line construction, all combined action alternatives could temporarily displace grizzly bears from moving along the Howard Creek and Libby Creek corridor. Grizzly bear movement along the Miller Creek corridor could be affected by Alternatives 2B, 3C-R, 3D-R, 4C-R, and 4D-R; and movement along the West Fisher Creek corridor could be affected by Alternatives 3D-R, 3E-R, 4D-R, and 4E-R. Potential disruption of grizzly bear movement during transmission line construction would be short-term, would subside during operations, and would not occur during the grizzly bear denning or spring activity periods.

In all combined action alternatives, mine-related activities in Libby Creek also would occur in proximity of the CMW and core grizzly bear habitat, and would potentially affect grizzly bear movement in the north-south movement corridor. For all combined action alternatives due to habitat compensation mitigation, an improvement in connectivity and reduction of fragmentation in the north-south corridor would occur. Mitigation for displacement effects in the north-south movement corridor are described under the *Displacement* discussion. Mitigation lands acquired within the north-south movement corridor would mitigate for the narrowing of the north-south corridor and reduce the risk of continued human development within the corridor. The agencies' combined alternatives mitigation designed to offset cumulative effects by changing access conditions to create grizzly bear core habitat will improve habitat conditions in the north-south movement corridor. The access change of NFS road #150A/Trail #935 from motorized access to restricted with a berm would increase the east to west undisturbed distance between existing disturbances (end of the Trail #935 below Rock Lake to the Wayup Mine) from 0.9 mile to 3.4 miles. This access change would create more than 1,000 acres of new core and specifically mitigate for the Libby Adit effects in the north-south corridor. This access change and others within the north-south movement corridor would create additional core; reduce displacement, mortality risk, and fragmentation; and improve connectivity in the South Cabinet portion of the CYE. The effects of the road access mitigation within the north-south corridor on the constricted area would result in increasing distances (widths) of secure (core) habitat between existing disturbances, and also between existing disturbances and proposed combined action alternatives related project disturbances, improving secure habitat for movement, and further reducing the mortality risk to grizzly bears. Blasting associated with the Rock Lake Ventilation Adit would be short-term and necessary when the adit daylighted on private land east of and above Rock Lake. During operations, the noise level of the fans due to mitigation would not be audible over ambient noise levels as described under *Displacement*. Grizzly bears may temporarily avoid the area during the short duration of blasting, but otherwise, bear movement would continue. Additional detail and analysis of the north-south corridor is provided in the Wildlife BA (USDA Forest Service 2013b).

In the agencies' alternatives, mitigation measures that would reduce disturbance from increased motorized activity along roads in forested corridors between mine components include a transportation plan to reduce traffic levels that would require busing employees to the mine facilities and limiting private vehicles (Mitigation Plan item A.1.b). The Bear Creek Road (NFS road #278) is considered a high-use road for the bear analysis (greater than 10 vehicles per day) in the existing condition, and the mine would add traffic volume, increase speeds, and result in yearlong access of the Bear Creek Road. Effects from increased traffic volume are discussed previously (p. 1252). The projected increased traffic volume would contribute to fracturing habitat connectivity between summer, fall, and den habitats west of the road from spring habitats to the east, and use on the Bear Creek Road may affect grizzly movement toward the east where linkage areas cross US 2. Effective cover along the Bear Creek Road would also be compromised by the estimated percent increase in traffic volume. Existing cover areas may also be impacted by the increased recreational use anticipated with the increase in human population. As discussed in the *Displacement* analysis, combined mine-transmission line alternatives, the increase in traffic volume on NFS road #278 would not approach levels that are likely to result in a complete barrier to movement of grizzly bears, based on existing research (Waller and Servheen 2005; Chruszcz *et al.* 2003; Ruediger *et al.* 1999).

MMC would contribute funding to support monitoring of bear movements in the Cabinet Mountains. In addition, MMC would provide funding to monitor bear movement along US 2 between the Cabinet Mountains and the Yaak River and/or the area between the CYE and NCDE. If monitoring indicated that proposed habitat acquisition and access changes were not adequate, mitigation measures would be developed to address any identified issues. Alternative 2B would not include grizzly bear monitoring.

Seasonal Components

Kasworm (1989) analyzed radio locations from three bears to determine the effects of roads on seasonal habitat use patterns, and found that grizzly use in the Cabinet Mountains was reduced 78 percent from that expected during the spring period in areas adjacent (up to 0.28 mile) to open roads. Research has indicated that loss of a single denning area following human disturbance will not always lead to adverse effects, if alternative denning areas are available within the home range (Linnell *et al.* 2000).

Alternative B – MMC's Proposed Transmission Line (North Miller Creek)

There are 4,140 acres of seasonally important habitat located within the influence zone of Alternative B (Table 241). MMC's transmission line is constructed directly across grizzly bear spring and denning habitat in the Miller Creek and Midas Creek drainages (Figure 92). In Alternative B, no motorized activity associated with transmission line construction would occur during the grizzly bear spring use period from April 1 to June 15 within spring bear habitat in the Miller Creek and Midas Creek drainages, minimizing potential for grizzly bear displacement on 787 acres in Midas Creek (out of the 2,103 acres total) within the influence zone in BMU 5, and on 341 acres (in Miller Creek) in BMU 6 Table 241). This restriction would also minimize disturbance on 92 acres of denning habitat (out of the 1,062 acres total) in BMU 5. In addition, the South Fork Miller Creek Road would be closed seasonally for spring range from April 1 to June 30 for the life of the mine.

A timing restriction on transmission line construction activity on big game winter ranges from December 1 to April 30 is proposed and would also provide some benefit to grizzly bears where spring range or denning habitat was also located within big game winter ranges. Seasonal habitat where displacement effects would be minimized to a very low potential as a result of the big game timing restriction would include the 311 acres of denning habitat in BMU 6. The likelihood for grizzly bear displacement on the 341 acres of spring habitat in BMU 6 is also very low as the area is covered by both the grizzly and big game timing restrictions (Table 241).

Avalanche chute habitat is located in the Ramsey Creek drainage and would be within the 1-mile buffer on either side of the transmission line. Outside of the 0.5-mile influence zone of the mine facilities in Ramsey Creek, about 323 acres of avalanche chutes exist within the Alternative B transmission line buffer. No timing restriction for activity would occur within the Ramsey Creek drainage due to the proximity of the mine-related development

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

Alternative C-R would potentially have the greatest short-term displacement effects on seasonally important habitat over the two year construction phase and helicopter use, with 2,586 acres (Table 241) located within the transmission line influence zone. However, the agencies' mitigation plan would require that all transmission line construction, reclamation, and removal on National Forest System land in the CYRZ and Cabinet Face BORZ occur between June 16 and October 14 and, as a result, disturbance to grizzly bears due to noise and the presence of humans and machinery would be minimized during the spring (April 1 to June 15) and denning (December 1 to March

Table 241. Displacement Effects on Grizzly Bear Seasonal Habitat in the Directly Affected BMU 5 and BMU 6 by Combined Mine-Transmission Line Alternative.

Seasonal Habitat and Displacement Effect	[1A] No Action	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Little Cherry Creek Impoundment Alternative		
		TL-B	TL-C-R	TL-D-R	TL-E-R	TL-C-R	TL-D-R	TL-E-R
BMU 5 (Mine and Transmission Line Effects)								
Spring Habitat	17,625							
Existing road effects	1,915[1]							
Mine effects	0	1,410	716	716	716	716	716	716
Transmisson line effects	0	2,103[2]	1,359[3]	922[3]	922[3]	1,359[3]	922[3]	922[3]
Avalanche Chute	3,180							
Existing road effects	32[1]							
Mine effects		397	53	53	53	53	53	53
Transmission line effects		323[2]	54[3]	54[3]	54[3]	54[3]	54[3]	54[3]
Denning Habitat	14,414							
Existing road effects	784[1]							
Mine effects	0	896	453	453	453	453	453	453
Transmisson line effects	0	1,062[2]	236[3]	180[3]	180[3]	236[3]	180[3]	180[3]
BMU 6 (Transmission Line Effects Only)								
Spring Habitat	14,091							
Existing road effects	1,395[1]							
Transmission line effects	0	341[2]	599[3]	1,171[3]	765[3]	599[3]	1,171[3]	765[3]
Denning Habitat	12,149							
Existing road effects	615[1]							
Transmission line effects	0	311[2]	338[3]	23[3]	150[3]	338[3]	234[3]	150[3]

All units are acres,

Mine related displacement effects are long-term: persist for life of mine (30 years) or longer; Transmission line construction and reclamation effects are short-term – 2 active bear seasons

[1]Existing habitat affected by open roads (roads opened during active bear year) is located within a 0.25-mile buffer, and existing data are taken from the Wildlife BA (USDA Forest Service 2013b).

[2]Alternative 2B would mitigate for displacement effects on 787 acres of spring habitat by not allowing motorized activity associated with transmission line construction to occur during the spring use period within bear habitat in the Miller and Midas Creek drainages; and would avoid transmission line construction in big game winter ranges.

[3]All agency alternatives would restrict transmission line construction and decommissioning to between June 16 and October 14, outside of the spring and denning seasons and resulting in very low likelihood of actual displacement.

Source: Avalanche habitat GIS analysis by KNF, other GIS analysis by ERO Resources Corp. using KNF data.

31) seasons. The timing of activity outside of spring and denning periods makes the likelihood of displacement very low, and the grizzly bear timing restriction mitigates for the very low potential displacement effect. The agencies' alternatives would include a big game winter range restriction with no transmission line construction or decommissioning in elk, white-tailed deer, goat, or moose winter range (December 1 through April 30) unless a waiver was approved by the agencies. This waiver would not apply on National Forest System lands in the CYRZ or BORZ, or on State trust lands. Alternative C-R would be located within existing core during construction and in both existing and created core during the remaining phases. An increased risk for displacement and mortality risk to grizzly bears would occur in spring and denning habitat located within the two affected core blocks where it would be impacted by the transmission line corridor compared to Alternatives D-R and E-R, which would not located within core.

Alternative D-R – Miller Creek Transmission Line Alternative

Alternative D-R would potentially result in displacement effects on 2,350 acres of seasonally important habitat located with the transmission line influence zone, however as described under Alternative C-R, the agencies mitigation plan restricts construction and reclamation activity to outside the spring and den use periods would result in very low potential for grizzly bear displacement. Effects of Alternative D-R would be less than Alternative C-R because no spring or denning habitat located within existing or created core would be affected by the transmission line corridor clearing as Alternative D-R would not be located within core.

Alternative E-R – West Fisher Creek Transmission Line Alternative

Due to the agencies mitigation plan timing requirement for transmission line construction and reclamation activity to outside the spring and denning use periods, displacement effects to grizzly bears from the 2,071 acres of seasonally important habitat located within the influence zone of Alternative E-R would be the same as Alternative D-R.

Combined Mine-Transmission Line Alternatives

The following sections discuss the combined mine-transmission line alternatives disturbance and displacement effects on the seasonal components of spring, avalanche and denning habitats.

Physical loss of Seasonal Habitat

No physical loss of avalanche habitat would occur. The physical loss of grizzly bear spring habitat would be minimal. Alternative 2B would remove 15 acres of grizzly bear spring habitat and Alternatives 3D-R and 4D-R would remove 2 acres. Alternatives 3C-R, 3E-R, 4C-R, and 4E-R would not directly remove spring habitat. Only Alternative 2B would directly impact denning habitat, removing 17 acres within BMU 5.

Long-term Displacement Effects on Seasonal Habitat

Effects common to all Combined Mine-Transmission Line Alternatives

All combined alternatives would use the Bear Creek Road (#278) as the main access haul route, which extends up to 18 miles between the combined alternatives mine location sites and US 2. No mapped seasonal habitat (spring, denning, or avalanche) is located within the 0.25-mile influence zone of the Bear Creek Road #278 haul route located from the impoundment areas northward to US 2 in either BMU 2 or BMU 5. About 14 miles of NFS road #278 cross through or are adjacent to BMU 2 and BMU 5 and in MS-1 habitat. Widening, improvement, and yearlong access of the Bear Creek Road would lead to increased vehicle volumes and speed. The effects of estimated projected traffic volume increases are described in the grizzly bear displacement analysis on p. 1248. The decrease in traffic volumes Post Closure and effects to bears and their habitat are also discussed in the grizzly bear displacement analysis. Long-term displacement or underuse of MS-1 habitat (lasting for the life of the mine or longer) within portions of the affected drainages by some grizzly bears could occur as an indirect effect from increased high-intensity 24-hour use associated with the mine facilities and associated increases in motorized traffic. Females may teach avoidance of disturbed areas to cubs, extending the displacement for an unknown period of time after the mine was reclaimed. In addition, NFS road #278, which lies in a north-south alignment, cuts across most of the Libby Creek sub-drainages that flow west to east. The increase in mine-related 24-hour traffic would contribute to fracturing habitat connectivity between summer, fall, and denning habitats west of the road from spring habitats east of the road. Due to the increased magnitude and duration of the disturbances associated with the mine development (impoundment, plant site, Libby Adit, and, in Alternative 2B, the LADs), and year-round open Bear Creek Road #278 and Libby Creek Road #231, all of which would be affected by the increased traffic volume and significant human activity, spring or denning habitat within these zone of influences would be underused by grizzly bears.

In BMU 5 all combined action alternatives mine-related activities associated with the facilities (*e.g.*, impoundment, mill site, conveyer system, adits, and associated roads) would occur continuously along the east Cabinet front during spring (April 1 to June 15) throughout the life of the project. Due to the nature of construction, operations, and reclamation within the influence zone of the mine facilities in BMU 5, no timing restrictions are feasible on spring range and are not proposed. The mine associated activities would result in long-term displacement effects lasting for at least the life of the mine, and would increase the amount of spring range (and other seasonal habitat) affected by human development and noise. Disturbance from mine activities would reduce the effectiveness of adjacent grizzly bear spring range. Bears that may have traditionally used the impacted areas during the spring would likely change their normal behavior patterns, possibly seeking foraging sites in less productive areas or areas closer to human disturbance.

Alternative 2B

Alternative 2B would cause additional long-term disturbance and displacement on spring, denning, and avalanche habitat compared to the agency combined alternatives due to the plant site and other facilities being located in the upper Ramsey Creek drainage, which is directly adjacent to the CMW and core grizzly bear habitat. Within BMU 5, Alternative 2B mine-related long term displacement effects on spring habitat would occur on 1,410 acres, while short-term displacement effects associated with the transmission line construction would affect 1,316 acres out of the 2,103 acres located within the influence zone (Table 241). The 2,726 acres of spring habitat affected would increase the amount of spring habitat within a disturbance influence zone by 16 percent in BMU 5, and by 6 percent in all of BMUs 2, 5, and 6 combined.

Within BMU 5, long-term displacement effects associated with the mine would occur on 896 acres of denning habitat, while short-term transmission line construction displacement effects would occur on 970 acres out of the 1,062 acres located within the influence zone (Table 241). Total physical disturbance (17 acres) and displacement (1,866 acres) would increase the amount of denning habitat within a disturbance influence zone by 13 percent in BMU 5, and 4 percent in all of BMUs 2, 5, and 6 combined.

As described under Alternative B, Alternative 2B would include two timing restrictions to reduce effects on spring and denning habitat; no transmission line construction in the Miller Creek and Midas Creek drainages during the grizzly bear spring use period of April 1 to June 15; and no transmission line construction in big game winter range from December 1 to April 30. The big-game timing restriction would mitigate for displacement effects where big-game habitat overlaps with spring and denning habitat, primarily in BMU 6.

Within Alternative 2B's transmission line influence zone, no avalanche habitat is located in BMU 6 or in the Midas Creek area in BMU 5, and the timing restrictions would not reduce displacement effects on avalanche habitat. Alternative 2B displacement effects on avalanche habitat would occur in BMU 5 with 720 acres affected. Of that total, long-term displacement effects associated with the mine would occur on 397 acres, while short-term effects associated with transmission line construction would occur on 323 acres (Table 241). Alternative 2B would increase the amount of avalanche habitat within a disturbance influence zone by 23 percent in BMU 5, and by 9 percent in all of BMUs 2, 5, and 6 combined.

Agency mitigated Combined Mine-Transmission Line Alternatives

The effects of the agencies' combined alternatives would be less than combined Alternative 2B because of alternative mine facility locations and transmission line construction and decommissioning timing restrictions. In the agencies' combined alternatives, transmission line construction and decommissioning would be limited to June 16 to October 14, avoiding spring and denning habitat use periods. The transmission line construction activity would result in short-term disturbance (about two active bear seasons) by aircraft during the construction phase (and decommissioning phase) within the transmission line influence zone. Restricting construction and decommissioning of the transmission line to outside the grizzly bear spring (April 1 to June 15) and den (December 1 – March 31) seasons make the likelihood of actual displacement very low. Displacement effects are so highly unlikely to occur that they are discountable or if the effect would occur it would not be measurable or detectable and so would be insignificant due to 1) the lines primarily are located in lower elevations used for spring habitat; 2) grizzly bears are highly unlikely to use the areas within the transmission lines influence zones outside the spring period; 3) no activities are allowed during the spring or denning periods; and 4) other undisturbed areas of quality spring, denning and avalanche habitat would be available should a bear be disturbed. The very low potential for displacement effects on spring, denning, and avalanche habitat associated with construction of the transmission lines in the agencies combined mine-transmission line alternatives are mitigated through timing of the activities (see Table 241 for acres of seasonal habitat within transmission line influence zones where short-term displacement effects have been minimized).

Alternatives 3C-R and 4C-R would differ from the other agency combined alternatives in effect on seasonal habitat. After the construction phase when an access change would be implemented on NFS road #4725, approximately 3 miles of the C-R transmission line route would cross two blocks of core which contain spring and denning habitat (Figure 93). Due to continued maintenance of the transmission line corridor for the life of the project, the mortality risk and displacement effects on the spring and denning habitat located within these two core blocks would be higher compared to the other agency combined mine-transmission line alternatives, which would not have transmission lines located within core.

The agencies combined alternatives long-term displacement effects associated with mine-related development would only occur in BMU 5, and would affect 716 acres of spring range, 53 acres of avalanche habitat, and 453 acres of denning habitat (Table 241). The displacement of 716 acres of spring range in the agencies' combined alternatives, plus the 2 acres of physical loss in combined

Alternatives 3D-R and 4D-R would increase the amount of spring habitat within a disturbance influence zone by 4 percent in BMU 5 and by 2 percent in all of BMUs 2, 5, and 6 combined.

The combined agencies' alternatives would have lower potential to displace bears from avalanche habitat compared to Alternative 2B. The relocation of the plant site to Libby Creek would reduce long-term displacement effects on avalanche habitat to 53 acres (Table 241). The amount of avalanche habitat within a disturbance influence zone in the agencies' combined alternatives would increase by 2 percent in BMU 5, and by less than 1 percent in all of BMUs 2, 5, and 6 combined.

The combined agencies' alternatives long-term mine-related displacement effects on 453 acres of denning habitat would increase the amount of denning habitat within a disturbance influence zone by 3 percent in BMU 5 and 1 percent in all of BMUs 2, 5, and 6 combined.

Summary of effects to seasonal habitat

Low-elevation spring habitat is thought to be less abundant than other seasonal habitats in the Cabinet-Yaak Ecosystem (USFWS 2014a). A total of about 45,000 acres of spring habitat components are present in the three BMUs directly affected by the combined alternatives (Table 232). Spring habitat is well distributed throughout all directly affected BMUs and is well represented in core areas (secure habitat) when compared to its availability within each BMU (USDA Forest Service 2013b). Approximately 3,843 acres or 8.5 percent of the 45,000 acres are already affected by use on existing roads, especially the existing high use forest roads #278 and #231 (Table 232). Due to the increased traffic volumes and significant human activity along these forest roads and at the mine site, the spring habitat within the influence zones would be under-used by grizzly bears. No seasonal avoidance of important spring habitats can be incorporated into the mine facility activities since the mine would operate full-time and year-round. In BMU 5, approximately 716 acres (agencies combined alternatives) to 1,410 acres (Alternative 2B) would be impacted by long-term displacement effects from the proposed mine sites and associated roads. In addition, Alternative 2B construction of the transmission line in BMU 5 would result in short-term displacement effects on 1,316 acres of spring range where no timing restriction is proposed.

The majority of spring range within the affected BMUs would remain outside of existing and new disturbance influence zones, approximately 84 to 85 percent for Alternative 2B (2B would affect 3,513 acres with no transmission line timing restrictions, and 2,741 acres of spring habitat with restrictions).

Displacement effects of the agencies combined alternatives transmission line are mitigated by implementing a timing restriction. All construction and reclamation activities associated with the transmission line would occur outside the grizzly bear spring and den seasons as discussed previously. Eighty-five to 90 percent of spring range would remain outside of disturbance influence zones in the agencies alternatives (agencies combined alternatives influence zones would include 2,674 to 2,809 acres of spring habitat with no transmission line timing restriction, and only 716 acres of spring habitat would remain due to mine-related displacement with the timing restriction). The agencies combined alternatives transmission line timing restrictions would mitigate for displacement effects more effectively than Alternative 2B as the agencies mitigation would restrict activity to outside the spring and den use periods along the entire length of the transmission line on NFS and State lands within the Recovery Zone and the Cabinet Face BORZ. The agencies' alternatives 3D-R, 3E-R, 4D-R and 4E-R would implement all road access mitigation prior to construction activity effects and would provide greater compensation for increased displacement on spring range prior to construction activity compared to 3C-R and 4C-R which would defer an access change to after construction. All agencies alternatives decrease existing road displacement effects on spring range compared to Alternative 2B. The core created by the agencies' alternatives road access mitigation would decrease the amount of spring range within the influence zone of gated or open roads and would ensure that more acres of spring habitat would be protected from major disturbances throughout the life of the mine, than the amount of spring habitat lost to the mine. The agencies combined alternatives road access changes would secure a total of 2,291 acres of spring habitat within BMUs 2, 5, and 6 combined (USDA Forest Service 2013b), and would reduce the mortality risk and displacement effects to grizzly bears using this habitat.

Although no known grizzly bear dens occur within several miles of the combined alternative facilities, affected potential denning habitat, especially on the slopes above Ramsey Creek (Alternative 2B),on Shaw Mountain above the Libby Adit Site (all alternatives), and near the Libby Plant Site (agencies' alternatives), may be underutilized. Denning habitat within the mine development influence zones totals 896 acres for Alternative 2B, and 453 acres for the agency combined alternatives. Disturbance levels that would cause a female to prematurely leave the den in spring or move from the den area prior to cub mobility would impair the fitness of the female and safety of the cubs (USFWS 2014a).

Denning habitat in the Cabinet Mountains is readily available and grizzly bears that might avoid habitat affected by mine activities would find ample denning sites in less disturbed locations. Existing denning habitat is well represented in secure (core) habitat across all three directly affected BMUs. The effects of the combined action alternatives on grizzly bear denning are anticipated to be minimal. BMUs 2, 5, and 6 currently provide den habitat in designated roadless areas in high elevation grizzly bear habitat within the Cabinet Mountain Wilderness Area. Core habitat created by the agencies' alternatives road access mitigation would remove gated and open road access and secure more potential denning habitat than what currently occurs within the directly affected BMUs.

For all combined action alternatives during operations, transmission line maintenance needs could arise during the spring or den use period, but disturbance associated with maintenance activities is expected to be very short-term.

As discussed under the agencies' transmission line alternatives, displacement effects on grizzly bear spring range and denning habitat would be minimized through implementation of helicopter construction and decommissioning timing restrictions. Potential to displace grizzly bears from denning and spring habitat from transmission line activity would be very low as the transmission lines would be largely located in spring habitat within the BMUs and the likelihood of displacing a grizzly bear during the summer construction or reclamation phase activity period from June 16 to October 14 is low. Summer habitat is widely available in the BMUs and any grizzly bear potentially displaced would have ample adjacent and secure areas providing similar habitat conditions. Displacement effects on grizzly bear seasonal habitat in the directly affected BMU 5 and BMU 6 by combined mine-transmission line alternative are displayed in Table 241 below. Transmission line effects to seasonal habitat are evaluated within a 1-mile zone of influence either side of the line. Acres displayed in Table 241 are total acres which combine areas with existing displacement effects receiving additional activity and acres receiving new displacement. New displacement is the effect of project activities in grizzly bear habitat not currently disturbed by human activity. Additional displacement is the additional effect of project activities in grizzly bear habitat currently affected by other activities, such as road use or activities on private land. Both new and additional acres displayed for the transmission line effects do not include overlap with mine disturbance footprint.

In all combined action alternatives, impacts from mining activities on seasonal habitat of grizzly bears would also be compensated through MMC's and agencies' land acquisition and conservation easement in perpetuity requirements. Alternative 2B would result in the least amount of spring, avalanche, or denning habitat protected by proposed mitigation because the acres required are far less than the agencies' alternatives. Effects of habitat compensation mitigation on grizzly bears are discussed under "*Effects common to all action alternatives*" and "*Effects common to the agencies' alternatives.*" Depending upon the alternative, acres required are related to habitat loss and the intensity and duration of the disturbance associated with each phase of the mine. Acquired/easement parcels could improve conditions on additional spring, denning, or avalanche habitat if mitigation parcels contained these habitats, were in proximity to these habitats, or had motorized access through these important seasonal habitats that could be reduced.

Road Density and Displacement and Core Areas

These are discussed under Objective 1 and Objective 6.

Objective 3. Manage for an acceptable level of mortality risk

Most human-caused grizzly bear mortality on the KNF have resulted from interactions between bears and big-game hunters (Kasworm and Manley 1988). Grizzly bear vulnerability to human-caused mortality is partially a function of habitat security. Therefore, mortality risk can be assessed to some extent by the use of habitat components that maintain or enhance habitat security. For juxtaposition of foraging habitat and cover see Objective 2, for road density see Objectives 1 and 6, and for displacement see Objectives 1 and 6.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek)

Alternative B would result in the greatest amount of new access roads (9.9 miles) for the construction and maintenance of the transmission line. Although these roads would be closed to public motorized use, the new roads would benefit non-motorized access. All contracts would require contractors or subcontractors or MMC employees to comply with the KNF mandatory food storage order on National Forest System lands.

In Alternative B, food attractants would be minimized through the use of bear-resistant garbage containers, prohibiting the feeding of bears by mine employees, and the prompt removal of roadkill. Although new transmission line access roads would be gated or barriered after transmission line construction, mortality risks could increase due to improved access for forest users. Mortality risks due to improved hunter or poacher access would increase more for Alternative B than for the other transmission line alternatives because more new roads would be built. Clearing of the transmission line corridor in three blocks of core grizzly bear habitat may improve access for forest users on foot or horseback, increasing mortality risk. Some of the Alternative B corridor that crossed core habitat would not be cleared because it would be in a valley, or is currently fairly open habitat due to past regeneration harvest. Clearing of 0.5 mile (9 acres) of corridor would create improved access for forest users to the ridgeline between the

Miller Creek and Midas Creek drainages, and could increase mortality risk in this area for the duration of the project. Forest cover would return slowly after the line was decommissioned.

Under MMC's proposed combined Alternative 2B, MMC would fund two new FWP wildlife positions—a bear specialist and a law enforcement officer. Public education about grizzly bears and enforcement of laws protecting grizzly bears would minimize mortality risks.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

In Alternative C-R, additional actions identified in the agencies' mitigation plan would more effectively minimize food attractants within the CYRZ compared to Alternative B. Potential for increase mortality risk due to improved hunter or poacher access would be less for Alternative C-R than Alternative B because fewer new roads would be built. Similar to Alternative B, clearing in 0.5 mile (12 acres) of existing core habitat in the transmission line corridor would provide improved access for forest users to the ridgeline between the Miller Creek and Midas Creek drainages, increasing mortality risk in this area. Throughout the Operations Phase, the transmission line corridor for Alternative C-R, which would total 3 miles through core habitat, would provide for easier recreation or hunter access in the two affected core blocks, resulting in an increased potential for mortality risk for grizzly bears within these core blocks compared to Alternatives D-R and E-R, which are not located within core habitat.

The potential increase in risk from human-caused mortality would be minimized by specific actions detailed in the agencies' combined alternatives mitigation plan. These include road access changes and informing and educating mine employees and the public about living in grizzly bear country with the goal to improve public support for recovery of the grizzly bear. Major items included in the mitigation plan include 1) development of a detailed and enhanced information and education program; 2) hiring a grizzly bear specialist to work specifically in the CYE; 3) hiring a law enforcement officer to work specifically in the CYE; 4) ensuring all garbage collection sites and Forest campgrounds in the CYE are bear resistant through fencing and bear-resistant garbage containers; and 5) providing the public with temporary electric fencing kits as needed to deter grizzly bear activity near residences and avoid bears becoming conditioned to attractants such as chickens, pigs, and fruit orchards.

In addition to the bear specialist and law enforcement positions funded by MMC in Alternative B, Alternative C-R would include MMC funding of a habitat conservation specialist if both the Rock Creek and Montanore projects are concurrent. The detailed public education and information program about grizzly bears required in the agencies' alternatives, enforcement of laws protecting grizzly bears, and management of mitigation lands to improve the baseline habitat parameters of OMRD, TMRD, and core and to benefit the grizzly bear would minimize mortality risks.

Alternative D-R – Miller Creek Transmission Line Alternative

In Alternative D-R, food attractants would be minimized within the Recovery Zone, the same as Alternatives B and C-R. Alternative D-R would result in less displacement effects within core habitat as the transmission line would not cross core habitat and would have a smaller potential to increase mortality risk than Alternatives B and C-R. The short-term temporary decrease in 18 acres of core during construction would be mitigated for prior to activity at a 2:1 ratio creation of core. Measures to reduce mortality risk would be the same as Alternative C-R.

Alternative E-R – West Fisher Creek Transmission Line Alternative

Under Alternative E-R, mortality risk would be less than Alternatives B and C-R during the Construction, Operations, and Closure Phases because Alternative E-R, like Alternative D-R, would not be located within core habitat and no core habitat would be cleared by the corridor. Other effects on mortality risk from Alternative E-R would be similar to Alternatives C-R and D-R.

Combined Mine-Transmission Line Alternatives

The effects are as described for the transmission line alternatives except for the following: Unmitigated, the large influx of mine employees into the county could increase mortality risk. It is assumed in all combined action alternatives that temporary housing facilities would be developed near the project site on private lands, increasing the potential for grizzly bear mortality due to human/grizzly bear interactions. All combined action alternatives would increase recreational use of the analysis area in the long term. Increased recreational activity in bear habitat may increase human/grizzly conflicts and grizzly bear mortality. Traffic-related mortality may also increase due to increased traffic on the access road and US 2. As a result of mine activity at the Ramsey Plant Site (Alternative 2B) and Libby Plant Site (agencies' alternatives), bears may be displaced from important seasonal foraging areas and may need to seek foraging sites in areas closer to human disturbance. Displacement into habitat less secure from humans can cause increased mortality for bears (USFWS 1993a).

All combined action alternatives would restrict public motorized and non-motorized access to mine and agency personnel in all permit areas, which would reduce the amount of area available for hunting and other dispersed recreation activities, which would minimize human/bear interactions. All combined alternatives restrict public motorized access on newly constructed roads and barriered roads opened for transmission line access during and after the Construction Phase.

In all combined action alternatives, food attractants would be minimized through the use of bear-resistant garbage containers, prohibiting the feeding of bears by mine employees, and the prompt removal of roadkill. All combined action alternatives would include the funding by MMC of two new wildlife positions – a bear specialist and a law enforcement officer (see Chapter 2). The new bear specialist would increase public awareness of grizzly bear biology and behavior and help increase acceptance and support of grizzly bear management. Public attitudes are a major part of the success or failure of grizzly bear recovery efforts. It is critical to the recovery effort that people understand reasons for agency actions to have a favorable attitude toward grizzly bears (USFWS 1993). The combined agencies' alternatives would include funding for an additional position, a habitat conservation specialist, if both the Montanore and Rock Creek Projects are active. This habitat conservation specialist would focus on promoting land use decisions that benefit grizzly bears.

The combined action alternatives may increase grizzly bear mortality due to increased traffic volume and speeds. The main Bear Creek Road is currently not maintained for winter travel beyond the 3-mile mark (from US 2) near the private residences. During the Construction and Operations Phases of the mine, NFS road #278 would be easily drivable during the first two weeks of the spring bear hunting season (April 15 to May 1) and during the last two weeks (November 15 to November 30) of the general big game fall hunting season. Currently, the road is closed to conventional vehicles due to snowpack in April, and becomes a challenge to drive toward the end of the fall big game rifle season in November. Increased road access during these periods would allow increased hunter access, which would then increase the potential for human/bear encounters that could result in bear mortality. As described in section 2.5.7.4, *Wildlife*, the agencies' alternatives would include measures to minimize grizzly bear mortality from vehicle collisions, including prohibiting the use of salt on roads during the winter, removing road-killed animals from roads daily, monitoring the frequency of vehicle-killed animals, and reviewing the data to determine if additional mitigation for vehicle collisions is necessary, and developing a transportation plan to reduce mine traffic.

Because roads in the operating permit areas would be closed to the public, the risk of mortality from poaching would be minimized. Although new transmission line access roads would be gated or barriered after transmission line construction, mortality risks could increase due to improved hunter or poacher access. Alternatives 2B, 3C-R, and 4C-R would cross existing core and unroaded habitat in the upper Miller Creek and Midas Creek drainages. In addition, Alternatives 3C-R and 4C-R would result in a total of 3 miles of corridor clearing in two blocks of core during the Operations Phase due to core creation post-construction in the North Fork Miller Creek. Clearing in some segments of the transmission line corridor would provide improved access for forest users to the ridgeline between the Miller Creek, Midas Creek, or the main Libby Creek drainages, increasing mortality risk in this area for the duration of the project. Mortality risks due to improved hunter or poacher access would increase more for Alternative 2B than for the other combined action alternatives because more new roads would be built. The new law enforcement position included in the action alternatives grizzly bear mitigation plan, including Alternative 2B, would help reduce the mortality risk of grizzly bears in the area.

Mitigation designed to offset cumulative effects by changing access conditions to create grizzly bear core habitat will also a) contribute to reducing risk of human-caused bear mortality; b) provide undisturbed habitat area for displaced bears; c) improve habitat conditions in the north-south movement corridor; and d) help meet KFP standards for grizzly bear habitat conditions. The agencies' alternatives would create a total of 7,030 acres (includes acres from Trail #935) of new core habitat through road access change. Implementation of the entire mitigation plan would result in an improved condition over the baseline.

All combined action alternatives would result in an influx of human population. The local area of Libby would see the largest number of new households, and the other population increase would be distributed in the Troy and Eureka areas (Table 163). It is likely some new residences would be built on undeveloped private land in or near the CYE, which could result in permanent loss of habitat otherwise available to grizzly bears. Increased number of people would increase potential for conflicts with bears related to sanitation, habituation, or displacement, thus increasing mortality risk.

The agencies' mitigation plan, described in detail in the Wildlife BA (USDA Forest Service 2013a), specifically addresses these concerns to minimize increased potential for mortality risk. In summary, the potential increase in risk from human-caused grizzly bear mortality would be minimized by efforts that inform and educate mine employees and the public about living in grizzly bear country. These efforts would also improve public support for grizzly bear recovery. The major items include: 1) developing a detailed and enhanced information and education program; 2) hiring a grizzly bear specialist to work specifically in the CYE; 3) hiring a law enforcement officer to work specifically in the CYE; 4) making all garbage collection sites and Forest campgrounds in the CYE bear resistant through fencing and new bear-resistant garbage containers; and 5) providing the public with temporary electric fencing kits as needed to deter grizzly bear activity near residences. Details of these measures, along with several other items can be found in the agencies' alternatives mitigation plan. These efforts to curb attractant-related conflicts on public land and private land would become increasingly effective over time, along with the increased levels of information programs in the CYE. These measures would substantively reduce the risk of grizzly bear mortality as a result of habituation and food conditioning on National Forest System and private lands in and adjacent to the entire CYE, not just the directly affected BMUs.

Objective 4. Maintain/improve habitat suitability with respect to bear food production

Agencies' Mitigated Transmission Line Alternatives

As described previously under effects common to the action alternatives or common to the agencies' alternatives, objectives of the mitigation lands and their subsequent management would be to maintain and improve bear habitat, including OMRD, TMRD, and core. The agencies' alternatives would maintain and improve more grizzly bear habitat compared to Alternative B due to the greater amount of habitat compensation required and the adaptive management strategies incorporated into the agencies' mitigation plan.

Combined Mine-Transmission Line Alternatives

The agencies' combined action alternatives would maintain and improve more grizzly bear habitat compared to Alternative 2B due to the greater amount of habitat acquisition and or purchase of conservation easements required for habitat physically lost and long-term displacement effects associated with the mine. The agencies' mitigation plan specifically identifies the importance of the mitigation lands to include protection of seasonally important habitats, with primary emphasis on spring habitat and secondary emphasis on fall habitat, such as huckleberry fields.

Objective 5. Meet the management direction outlined in the Interagency Grizzly Bear Guidelines (51 Federal Register 42863) for Management Situation (MS) 1, 2, and 3.

Meeting Objectives 1-4 has been determined to meet the intent of the IGBC Guidelines (Buterbaugh 1991) and the KFP direction found in Appendix 8. The relevant language from the IGBC Guidelines (IGBC 1986) states: "Management decisions will favor the needs of the grizzly bear when grizzly habitat and other land use values compete. Land uses which can affect grizzlies and/or their habitat will be made compatible with grizzly needs or such uses will be disallowed or eliminated." The IGBC Guidelines do not provide a specific definition of "compete" or "compatible"; however, the intent of these provisions is made clear by the discussion in the IGBC Guidelines regarding Forest Service grizzly bear management policy: "The Forest Service will manage habitats essential to bear recovery for multiple land use benefits, to the extent these land uses are compatible with the goal of grizzly recovery. Land uses which cannot be made compatible with the goal of grizzly recovery, and are under Forest Service control, will be redirected or discontinued. Management guidelines and objectives, the cumulative effects process, and goals for habitat capability and mortality will be used to guide activities that are compatible with grizzly bear recovery. It is also the policy of the Forest Service to facilitate recreation use in occupied grizzly habitat to the extent such levels or use are compatible with both human safety and grizzly recovery objectives."

Thus, it is apparent that the IGBC Guidelines recognize the multiple use nature of National Forest System management. Furthermore, it is apparent that land uses that are, or can be made, compatible with grizzly bear recovery do not "compete" even if there is an impact on individual bears. The IGBC Guidelines provide a detailed process for determining compatibility between land uses and grizzly bear recovery, which utilizes the consultation process to assist in determining compatibility between proposed land uses and grizzly bear recovery.

The determination of compatibility is based on the proposed federal action, not on individual components of such action. This is apparent from the IGBC Guidelines that utilize the consultation process to assist in determining the compatibility of proposed land uses with grizzly bear recovery goals.

Thus, the relevant consideration in the present case is whether the Montanore Project, as consulted on with the USFWS, is compatible with grizzly bear recovery goals and objectives. If it is, or can be made compatible, then the land uses encompassed by this project do not "compete" within the meaning of the IGBC Guidelines. The KNF requested formal consultation on Alternative 3D-R with the USFWS. The final Biological Opinion was released on March 31, 2014 (USFWS 2014a, 2014b). With full implementation of the agencies' mitigation plan and all terms and conditions as specified in the Montanore Project Biological Opinion, the agencies' Alternative 3D-R would result in an improved condition over the baseline, would be compatible with grizzly bear recovery goals and objectives, and would meet IGBC Guidelines. The remaining agencies' combined alternatives are similar in effect to grizzly bears and their habitat and would require the same mitigation plan.

The KFP established guidelines and standards for its programs to provide for a more consistent interpretation and implementation of the Interagency Guidelines on the KNF. These guidelines provide broad direction that should be strived for in all management activities but may be altered on the basis of site-specific needs as determined in the biological evaluation (KFP, Appendix 8-7).

Within the Recovery Zone, with the exception of activities located on private MS-3 lands (Libby Adit, Rock Lake Ventilation Adit, and areas of the impoundment depending upon the alternative), nearly all of the activities associated with the combined action alternatives would be located in grizzly bear MS-1 as designated by the KFP and the Interagency Guidelines. Unlike Alternative 2B, the agencies' combined alternatives would ensure that habitat parameters and conditions are maintained or improved post-project (see Objectives 1-4) and would minimize potential impacts or effects of resource competition between bears and humans for the life of the mine (see mitigation plan). In addition, for all action combined alternatives, the mitigation lands would be managed for grizzly bears in perpetuity. The agencies' alternatives would ensure more lands would be managed for grizzly bears compared to Alternative 2B.

Alternative 2B would result in habitat parameters worse than the existing conditions, which do not meet standards and would only improve OMRD and/or TMRD post-project depending on the BMU (Table 234). The agencies' combined alternatives would improve habitat parameters prior to activity, or after construction in BMU 6 for Alternatives 3C-R and 4C-R. The agencies' alternatives would ensure movement corridors between adjacent BMUs would be maintained or improved and overall baseline parameters would improve. The agencies' combined alternatives mitigation plan would minimize mortality risk to grizzly bears as described under Objective 3.

Large connected areas of core habitat in the directly affected BMUs provide secure habitat for grizzly bears. The agencies' alternatives mitigation would improve core habitat to better than the standards prior to activity in both BMU 5 and BMU 6 through road access changes. OMRD and

TMRD would either be improved or maintained by the agencies' combined alternatives. Additional improvements to baseline habitat parameters would occur for all action alternatives as a result of habitat compensation, with greater improvements made by the agencies' combined alternatives due to the detailed mitigation plan and increased habitat compensation acreages required for grizzly bear habitat physically lost and displacement effects. Transmission line construction or reclamation activity on spring habitat would be restricted at some level for all action alternatives, with Alternative 2B providing the least protection.

During transmission line construction, operations, and reclamation, public motorized access on roads behind opened barriers or gates or newly constructed roads would be restricted on National Forest System lands.

Objective 6. Meet the management direction specified in the October 18, 2011 incidental take statement (USFWS 2011c, 2011d).

On October 18, 2011, the USFWS issued a Biological Opinion on the effects of the 2011 Access Amendment that now serves as the first-tier of a tiered consultation framework. Proposed projects in the CYRZ would be tiered to this Biological Opinion in which the 2011 Access Amendment's features and design elements, addressing the habitat parameters of core, OMRD, and TMRD, were analyzed. Projects that fall within the range of activities analyzed would be compliant with the incidental take statement.

Because the effects of land acquisition or conservation easement in perpetuity lands on baseline habitat parameters of core, OMRD, and TMRD are not calculable at this time, the effects of Alternative 2B activities would not adhere to the 2011 Access Amendment features and design elements, would not fall within the range of effects analyzed in the Access Amendment Biological Opinion, and would not be compliant with the 2011 incidental take statement.

The effects of the agencies' combined alternatives adhere to all of the 2011 Access Amendment's features and design elements for OMRD, TMRD, and core and, therefore, fall within the range of effects analyzed in the 2011 Access Amendment Biological Opinion (USFWS 2011c). Effects of the agencies' combined alternatives are described under the Environmental Consequences, Objectives 1.b. Core, 1.c. OMRD, and 1.d. TMRD.

Outside CYRZ – Effects of Transmission Line Alternatives

Cabinet Face BORZ

The Access Amendment (USFWS 2011c, 2011d; USDA Forest Service 2011a, 2011b) established design elements to conserve grizzly bear habitat in BORZ polygons on National Forest System Lands. In summary, the access management design elements (abbreviated) that apply to the BORZ and effects of the transmission line alternatives are as follows:

A&B. The Forest shall ensure no permanent increases in the total linear miles of "open roads" or increases in the total linear miles of "total roads" on National Forest System lands in any individual BORZ area above baseline conditions, except in cases where the Forests lack discretion to prevent road building across national forest land due to legal or other obligation (including ANILCA claims etc). Potential increases in linear miles of open roads must be compensated for with in-kind reductions in linear miles of open road or total road concurrently with, or prior to, project implementation… or new road construction or reconstruction of currently bermed or barriered roads, within the same BORZ…Temporary increases in linear *miles of open or total roads are acceptable under……not open for public use, road closed immediately upon completion of activities….*

C. Timber harvest activities that would occur within multiple watersheds shall be scheduled such that disturbance of grizzly bears from resulting road use is minimized.

Objectives of the proposed transmission line alternatives are associated with mine development, not vegetation management associated with timber harvest activities.

Other factors falling under Forest Service jurisdiction that can contribute to the risk of grizzly bear mortality, which are also present within the Cabinet Face BORZ, include displacement from human activity, including timber harvest (and associated road use), livestock grazing, and food attractants.

Alternative B – MMC's Transmission Line (North Miller Creek Alternative)

Access Amendment Design Elements: Under Alternative B, a total of about 0.1 mile of new road would be constructed during the Construction Phase within the Cabinet Face BORZ (Table 237). Although the road prism would remain during the Operations Phase, it would be soiled and reseeded after construction, but could be used as necessary for maintenance. New roads would be gated or barriered after construction until temporarily opened during reclamation. The road would be temporarily opened during the Closure Phase for removing the transmission line, and then would be bladed, recontoured, and seeded. Public use on the 0.1 mile of road construction on National Forest System land in the BORZ is not proposed. In-kind compensation for the short-term increase in linear open and total road during the Construction Phase as a result of the 0.1 mile of road being constructed is not required as "… *newly constructed roads would be effectively gated and restricted to public use. Roads utilized for administrative purposes (e.g., timber hauling, monitoring, etc.) but are not open to the general public are not considered "open," and do not re-categorize linear total road miles to linear open road miles*." No permanent change to linear miles of total open roads, or linear miles of total roads would occur and Alternative B would comply with these two Access Amendment design elements for the BORZ. Alternative B would begin at Sedlak Park (outside of the BORZ) and would cross the watersheds of the Fisher River, Miller Creek, a tributary to Miller Creek, Midas Creek, Howard Creek, Libby Creek, and Ramsey Creek (Figure 41). Due to the nature of the transmission line construction, activity would not occur along the entire length of the line at any one time and activity is not expected to occur in all watersheds concurrently.

Use of a helicopter is left to the contractor's discretion, and the agencies' assumed helicopters would not be used for logging or installing poles for the Alternative B grizzly bear analysis. Grizzly bear timing restrictions on transmission line construction are proposed within the CYRZ on spring range in the Miller Creek and Midas Creek drainages as previously described and would not occur within the BORZ. Additional timing restrictions for big game preventing construction activity during the winter period could benefit grizzly bears in both the CYRZ and the BORZ.

Livestock Grazing/Attractants: Alternative B would have no impact on livestock grazing. No livestock grazing on National Forest System lands occurs in the Cabinet Face BORZ. In 2011, the KNF issued a mandatory food storage order for all National Forest System lands, which will help mitigate for some of the less favorable conditions (increasing potential for human encounters, private lands, and miles of linear open road) for grizzly bears outside of the CYRZ by minimizing food-associated attractants. The order is automatically included in all permits and contracts issued and administered by the KNF and would be required in MMC's transmission line construction contract.

Disturbance/Displacement: The point source disturbances from construction of the transmission line, including use of helicopters for line stringing, and ground-based timber harvest activities related to clearing the line inside the BORZ may temporarily displace grizzly bears from suitable habitat.

Physical habitat removal in the Cabinet Face BORZ would be negligible, while the clearing area for Alternative B would include 8 acres of grizzly bear habitat (Table 235). Helicopter use during construction may increase disturbance to grizzly bears in the BORZ, potentially displacing them from suitable habitat. Line stringing would take a week or two. Annual inspections may take about a week a year. Increased noise would occur during these times and construction activities would be generally audible for about 2.5 miles, depending on the topography. Based on the 1-mile buffer either side of the transmission line, short-term displacement effects during the Construction Phase in the BORZ as a result of helicopter use would potentially occur on 2,366 acres of grizzly bear habitat, of which 1,636 acres are currently disturbed by existing activities (Table 236). However, only a portion of these acres would likely be unavailable at any given time as activity would not occur simultaneously along the entire line. In the Cabinet Face BORZ, the clearing area for Alternative B would affect 1.2 acres of wetlands/riparian habitat providing potential grizzly bear feeding areas. Direct effects to wetlands are expected to be mostly avoided by locating transmission line facilities and roads outside of wetlands and waters of the U.S. Disturbed areas would be reseeded after transmission line construction, potentially providing additional forage habitat for grizzly bears.

MMC would be governed by the Environmental Specifications for the 230-kV transmission line (MMI 2005b) to guide line construction, operation, maintenance, and decommissioning activities, but the Vegetation Removal or Disposal Plan, as described in the agencies' Environmental Specifications (Appendix D), does not apply to Alternative B.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

Effects to grizzly bears in the Cabinet Face BORZ are as described under Alternative B with the exception of the following:

Access Amendment Design Elements: About 0.7 mile of new road would be constructed and 2.8 miles of existing closed road would be opened in the BORZ (Table 237). Road access changes in the BORZ included in the agencies' alternatives (see section 2.5.7, *Mitigation Plans*) prior to the Construction Phase would prevent an increase in the baseline linear miles of open and total roads, and no public use would occur on the newly constructed access roads. After the transmission line was constructed, all new roads in the BORZ would be placed in intermittent stored service, and Alternative C-R would comply with these two design elements. Alternative C-R would traverse an east-facing ridge immediately north-northwest of the Sedlak Park Substation and would cross Hunter Creek 2 miles north-northwest of the substation. After crossing Hunter Creek, the alignment would head west, crossing US 2, the Fisher River, West Fisher Creek, and NFS road #231 (Libby Creek Road). The alignment then would head northwest, up and over the ridge between West Fisher Creek and Miller Creek. The alignment would then follow an unnamed tributary of Miller Creek and then cross into the upper Midas Creek drainage, and then down into the Libby Creek drainage. Mitigation prior to the Evaluation and Construction Phases would implement road access changes to reduce disturbance of grizzly bears. Due to the nature of the transmission line construction, activity would not occur along the entire length of the line at any one time and activity is not expected to occur in all watersheds concurrently. Transmission line construction-related activity would be restricted to outside the denning or spring period, minimizing potential to displace a grizzly bear.

Livestock Grazing/Attractants: In Alternative C-R, the agencies' mitigation plan would require MMC to provide funding for fencing and electrification of garbage transfer stations in grizzly habitat in and adjacent to the CYE, including the Cabinet Face BORZ, reducing the availability of food attractants and reducing mortality risks for the grizzly bears.

Disturbance/Displacement: In Alternative C-R, 2 acres of potential grizzly bear habitat in the BORZ would be removed due to construction of access roads and 51 acres would be cleared (Table 235). The actual clearing area would likely be less, depending on tree height, slope, and line distance above the ground. In Alternative C-R, impacts to wetlands/riparian habitat providing potential grizzly bear feeding areas would be avoided. Disturbed areas would be revegetated after transmission line construction, potentially providing forage habitat for grizzly bears during the Operations Phase.

Helicopter use during construction of Alternative C-R may increase disturbance to grizzly bears in the BORZ, potentially displacing them from suitable habitat. Short-term displacement effects in the BORZ would potentially occur on 2,206 acres of grizzly bear habitat, including 1,336 acres currently disturbed by existing activities (Table 236). Within the Cabinet Face BORZ, displacement effects would be minimized through implementation of transmission line construction and helicopter timing restrictions as described above for CYRZ displacement effects, and also road access changes in the BORZ prior to activity (see section 2.5.7, *Mitigation Plans*). Transmission line construction/decommissioning activities are likely to have minimal impacts on grizzly bears because they would occur outside of the denning or spring use periods. Road access mitigation associated with the agencies' combined alternatives would reduce the linear miles of road in the BORZ and reduce displacement effects on grizzly bear spring range. Risks of increased grizzly bear mortality would be minimized by restricting the construction and decommissioning activities to the summer months when there is low likelihood of a bear occurring because activity would be spread out along the transmission line over 2 years and because of the public education and law enforcement efforts of the bear specialist and law enforcement officer.

Alternative D-R – Miller Creek Transmission Line Alternative

Effects to grizzly bears in the Cabinet Face BORZ are as described under Alternative C-R with exception of the following:

Access Amendment Design Elements: About 0.8 mile of new road would be constructed and 2.8 miles of existing closed road would be opened in the BORZ (Table 237). From the substation, the alignment would follow the same alignment as Alternative C-R until the alignment crossed the ridge between West Fisher Creek and Miller Creek (Figure 44). After departing from the Alternative C-R alignment, this alternative would follow NFS road #4724 (South Fork Miller Creek Road) to a ridge separating Miller Creek from the Standard Creek drainage. The alignment would traverse the ridge into the Howard Creek drainage. The centerline would be about 500 feet east of the northeast corner of a private land parcel about 0.5 mile south of Howard Lake (Figure

44). North of the private land, the alignment would generally parallel Howard Creek and eventually be the same as Alternative C-R.

Disturbance/Displacement: Impacts on grizzly bears in the Cabinet Face BORZ from Alternative D-R would be the same as Alternative C-R, except that the extent of Alternative D-R short-term displacement effects in the BORZ would be less, Alternative D-R would require fewer miles of new access road (Table 237), and Alternative D-R would include less clearing (45 acres) in the Cabinet Face BORZ (Table 235).

Alternative E-R – West Fisher Creek Transmission Line Alternative

Alternative E-R would not be located on National Forest System lands within the Cabinet Face BORZ, but would be located in State section S36, T27N, R30 which the State HCP considers to be located in non-recovery occupied habitat. This section is discussed below under effects to State land. From the substation, the alignment would follow the same alignment as Alternative C-R until just north of Hunter Creek (Figure 44). After departing from the Alternative C-R, this alternative would cross the Fisher River and West Fisher Creek and follow West Fisher Creek until its confluence with Standard Creek. It would follow a small tributary to West Fisher Creek and would eventually follow the same path as Alternative D-R.

Combined Mine-Transmission Line Alternatives

Effects to grizzly bears in the Cabinet Face BORZ are as described under the transmission line alternatives and summarized here.

Access Amendment Design Elements: On National Forest System lands within the Cabinet Face BORZ, none of the combined mine-transmission line alternatives would permanently increase the total linear miles of open or total roads above the baseline conditions. All of the combined action alternatives except for 3E-R and 4E-R would involve the construction of less than 1 mile of new access road in the Cabinet Face BORZ (Table 237), and any existing barriered or gated roads opened for construction would not allow public access. Road access changes in the BORZ included in the agencies' alternatives (see section 2.5.7, *Mitigation Plans*) would offset the impacts of the agencies' alternatives on linear miles of open and total roads prior to activity in the BORZ. Open and total road miles would temporarily increase during the construction period. Temporary increases in total and open linear road miles meet the design elements for BORZ direction in the Access Amendment (USDA Forest Service 2011 a, 2011b). As all newly constructed temporary access roads and barriered roads opened for construction would be barriered after construction and any gated road opened for construction would be gated after construction, no combined action alternative would result in a permanent increase in linear miles of open or total roads. All combined alternatives located within the BORZ would comply with the access amendment design elements.

Livestock Grazing/Attractants: For all action alternatives, the KNF grizzly bear food storage requirements would be incorporated into the transmission line construction contract and no livestock grazing occurs or is proposed on National Forest System lands. The combined agencies' alternatives would include MMC funding for fencing and electrification of garbage transfer stations in grizzly bear habitat in and adjacent to the CYE, reducing the availability of attractants and reducing mortality risks for grizzly bears.

Disturbance/Displacement: Physical loss of potential grizzly bear habitat in the Cabinet Face BORZ would be similar for all action alternatives, ranging from 0 acres for Alternatives 3E-R and

4E-R to 2 acres for Alternatives 3C-R, 3D-R, 4C-R, and 4D-R (Table 238). In all combined action alternatives, helicopter use during line stringing, maintenance, and inspections may increase disturbance to grizzly bears, potentially displacing them from suitable habitat. The short-term displacement effects on grizzly bear habitat in the BORZ would range from 986 acres for Alternatives 3E-R and 4E-R to 2,366 acres for Alternative 2B (Table 236). New access road construction, helicopter use, and other construction activities in the BORZ would likely have minimal impacts on grizzly bears because of the agencies' alternatives timing restrictions and low likelihood of a grizzly bear occurring in the area outside of the spring season. Road access changes located in the BORZ included in the agencies' mitigation prior to the Evaluation and Construction Phases (all or portions of NFS roads #6787B, #4776C, and #6209E) would reduce mortality risk during the spring season within the BORZ by decreasing total linear road densities on spring range. Of the total acres of habitat outside of the CYRZ affected by the transmission line, between 217 acres for Alternatives 3E-R and 4E-R and 1,626 acres for Alternative 2B are currently disturbed by existing activities (Table 236). For the agencies' alternatives, road access changes in the BORZ (see section 2.5.7, *Mitigation Plans*) would also offset displacement effects related to using the Bear Creek Road for access.

The clearing area for the combined action alternatives includes between 0 acres (Alternatives 3E-R and 4E-R) and 51 acres (Alternative 2B) in the Cabinet Face BORZ (Table 235) and (Table 238). In the agencies' alternatives within the BORZ boundary on National Forest System lands, disturbed areas would be revegetated after transmission line construction, potentially returning to forage habitat for grizzly bears. These effects were discussed in detail under the individual effects of the transmission line alternatives.

For all action alternatives, public education and law enforcement efforts of the bear specialist and law enforcement officer would minimize the risk of increased grizzly bear mortality. In addition to these two positions, the combined agencies' alternatives would include funding for a habitat conservation specialist prior to the Evaluation Phase that would focus on promoting land use decisions that would benefit bears if both the Rock Creek and Montanore projects were active concurrently.

Effects on Private and State Land Outside of the CYRZ and Outside the BORZ

No private or State trust land would be directly affected by the transmission line alternatives inside the CYRZ or BORZ boundaries. Assuming that some temporary housing facilities would be developed near the project site on private lands, food attractants may become more available in these areas. All action alternatives would include mitigation requiring funding by MMC of a bear specialist and a law enforcement officer, which would help reduce mortality risk on all ownership. Education of the public on food storage in bear habitat and increased awareness of grizzly bear behavior by the grizzly bear specialist would help prevent human/bear conflicts on private and State trust land.

Within the MFSA Transmission Line Analysis Area

Alternative B

Effects of Alternative B would be as described under the Cabinet Face BORZ except for as follows: No activity would occur on big game winter ranges during the winter and this would apply to winter ranges located on private land within the MFSA analysis area. This big game winter range restriction would not apply to the Sedlak Park Substation construction. The Sedlak Park Substation would be located on winter range on private land within the MFSA analysis area.

Alternative B would remove 14 acres and clear 130 acres on private land (Table 235), including the 4 acres of habitat physically removed for construction of the Sedlak Park Substation, access road, and loop line. Actual clearing for the transmission line would likely be less, depending on tree height, slope, and line distance above the ground. Most of these lands have been logged in the past 20 to 30 years. In Alternative B, the new road prism would remain during transmission line operations but roads opened or constructed for transmission line access on private land would be gated after transmission line construction. New access roads on Plum Creek land would be reseeded after transmission line construction and gated at the landowner's discretion. With the exception of new access roads, disturbed areas would be revegetated after transmission line construction, potentially providing forage habitat for grizzly bears. Alternative B would parallel about 4.7 miles of the Fisher River and the existing road corridors of US 2, NFS road #835, and numerous Plum Creek roads would be within 1,000 feet of an open road through most of the MFSA analysis area. Within the transmission line clearing, grassland and shrub communities may remain after construction, but no Vegetation Removal or Disposition Plan was proposed by MMC. The coniferous forest community and riparian forest would take many years to re-establish after decommissioning because many species are relatively slow growing. New access roads on private land would likely be reclaimed during decommissioning, but the decision would be at the landowner's discretion. New access roads, helicopter use, and other construction activities, including construction of the Sedlak Park Substation, would likely have minimal displacement effects on grizzly bears because of the low potential for grizzly bears to occur in the immediate vicinity during construction or decommissioning activities. If a bear occurred and was moving through the area, it may change its movement pattern or avoid the area of concentrated activity. The increased activity associated with helicopter use and other activity related to construction or reclamation would be short-term, as previously described, within the BORZ. Maintenance that could occur during the Operations Phase would be less than 10 days over the entire length of the line, including the portions in the MFSA analysis area, BORZ, and Recovery Zone. Displacement effects already exist within the MFSA analysis area as road densities are currently high on private and State lands. As described previously, the public education and law enforcement efforts of the bear specialist and law enforcement officer would minimize the risk of increased grizzly bear mortality on all ownerships.

Alternatives C-R and D-R

The effects of Alternatives C-R and D-R on private land within the MFSA analysis area would be as described under the Cabinet Face BORZ and under Alternative B above except for as follows: Alternatives C-R and D-R would remove 9 acres and clear 111 acres on State and private land (Table 235). The agencies' Vegetation Removal and Disposition Plan would apply to private lands within the MFSA analysis area. The segments of Alternatives C-R and D-R that would parallel US 2 would be located upslope and out of the Fisher River riparian shrub and forest habitat. The agencies' construction schedule for transmission line construction and reclamation activity would not apply to private land within the MFSA analysis area.

Alternative E-R

Alternative E-R would include removing 8 acres and clearing 133 acres of State and private land (Table 235). The effects are as described for Alternatives C-R and D-R; however, the agencies' mitigation items for grizzly bears within the BORZ would be applied to the State section 36 T27N, R30W. See the discussion below for State trust lands.

Combined Transmission Line and Mine Alternatives

In all action alternatives within the MFSA analysis area, construction of the Sedlak Park Substation and loop line would disturb 4 acres of previously harvested coniferous forest on private land. Roads opened or constructed for transmission line access on private land would be gated after transmission line construction and reclaimed during the final Closure Phase, but the final decision of road status is the landowner's discretion. New access road construction, helicopter use, and other construction on private or State land outside of the CYRZ and the BORZ would likely have minimal impacts on grizzly bears because of the agencies' alternatives timing restrictions for big game winter range and low likelihood of a grizzly bear occurring in the area outside of the spring season. Existing road densities are high on private and State lands within the alternative transmission line corridors, which would also contribute to a lower likelihood of grizzly bears being present during the construction or decommissioning period.

The clearing area for the combined Alternatives 3E-R and 4E-R would affect 133 acres of State and private land (Table 235). On private land outside of the CYRZ and the Cabinet Face BORZ, the clearing area for the combined action alternatives includes between 10 and 27 acres of wetlands/riparian habitat providing potential grizzly bear feeding areas. The substation site and new substation access roads on private land would not be revegetated after transmission line construction.

State Trust Lands

Alternative B would not be located on or near any State trust land.

Transmission Line Alternatives C-R and D-R would cross the northeast quarter of State section 36 T27N, R30W, while Alternative E-R would be located across the section's two southern quarters. The clearing area on State trust land for the combined Alternatives 3C-R, 4C-R, 3D-R, and 4D-R would be 10 acres (Table 235), and less than 1 acre on State trust lands would be physically removed. The clearing area on State trust land for the combined Alternatives 3E-R and 4E-R would be 28 acres (Table 235), and less than 1 acre on State trust lands would be physically removed.

Impacts to grizzly bears and their habitat would be mitigated on State trust land by implementing the agencies' mitigations (Table 37), which would improve conditions for grizzly bears on all lands within and adjacent to the CYE, and by requiring applicable mitigation items to be implemented on State section 36 T27N, R30W. The agencies' mitigation plan is described in detail in the Wildlife BA (USDA Forest Service 2013a). In summary, the agencies' mitigation plan items that would also address DNRC's concern for information and education, firearm use, food storage, and sanitation to reduce mortality risk to grizzly bears on State trust land include 1) MMC would fund, develop, and implement an enhanced public outreach information and education program to build support and understanding of grizzly bear recovery in the CYE and to minimize mortality in adjacent areas (Grizzly Bear Mitigation Plan); 2) implement a wildlife awareness program for employees and contractors and prohibit MMC employees, contractors, and subcontractors when on duty from carrying firearms within the permit area boundary, feeding wildlife, and hunting within the permit area; 3) MMC would agree all mortality reduction measures would be subject to modification based on adaptive management where new information supports changes; and 4) MMC would provide funding to implement a long-term public attitude and input survey so the public Information and Outreach Program could respond to ongoing public perceptions and adapt appropriately. Other items reducing mortality risk to grizzly bears would require MMC to install and maintain fencing around the Libby Adit Site; provide funding for bear-resistant refuse containers for use at the mine and by mine personnel, as well as for the community at large and at developed campgrounds; provide funding for fencing and electrification of garbage transfer stations within grizzly bear habitat within and adjacent throughout the CYRZ; and provide funding for electric fencing kits for use at bear problem sites within and adjacent to the CYRZ. The Vegetation Removal and Disposition Plan (as specified in the Environmental Specifications (Appendix D)) developed for the agencies' alternatives would minimize tree removal and would maintain more shrub and tree cover in the transmission line right-of-way; this plan would also be implemented on State section 36. Impacts to wetland/riparian habitat providing potential grizzly bear feeding areas would be avoided, reducing road construction in riparian habitats and providing for retention of visual screening in riparian and wetland management zones where possible. Direct effects to wetlands are expected to be mostly avoided by locating transmission line facilities and roads outside of wetlands and waters of the U.S. To mitigate for helicopter displacement effects on spring bear range and denning habitat, the agencies' transmission line construction schedule for grizzly bears (construction-related activity would occur between June 16 and October 14) would also be required for the State section 36. In addition, the KNF mandatory food storage order for National Forest System lands would be included in the transmission line construction/decommissioning contract and implemented on State land. The agencies' alternatives mitigation items for grizzly bears applied to the State section affected by the transmission line alternatives would reduce potential for displacement and reduce mortality risk to grizzly bears on State lands.

Transmission Line Effects within the US 2 Linkage Zone

Due to construction or decommissioning activity related to the transmission line, grizzly bear movement in the US 2 linkage zone may be temporarily affected. The Barren Peak/Hunter Creek Approach Area (Brundin and Johnson 2008), which is included in the overall US 2 linkage zone, encompasses approximately 17,795 acres. This approach area was delineated on both sides of US 2, extends to or into the CYRZ (BMU 7), and overlaps the Cabinet Face BORZ boundary. Wildlife movement across the US 2 fracture zone occurs within the area.

Alternative B – MMC's Transmission Line (North Miller Creek Alternative)

Effects to grizzly bears within the US 2 linkage zone area are as described for Alternative B within the MFSA analysis area and BORZ except for as follows:

The eastern portion of the Alternative B transmission line alignment would occur within the US 2 linkage zone. The proximity of this alignment within the riparian area adjacent to US 2 would widen the disturbed corridor and may discourage grizzly bear movement within the US 2 linkage zone by decreasing cover. These effects would be short-term and occur twice: when the transmission line was built and when it was decommissioned. Once revegetated, cleared areas could provide forage habitat. Some shrub and tree cover would be maintained in the transmission line right-of-way because only the tallest trees would likely be removed, although vegetation removal is at the contractor's discretion. New access roads, helicopter use, and other construction activities would likely have minimal displacement effects on grizzly bears because of the low potential for grizzly bears to occur in the immediate vicinity during construction or decommissioning activities. If a bear occurred and was moving through the area, it may change its movement pattern or avoid the area of concentrated activity. The increased human activity associated with construction or reclamation would be short-term as previously described. Maintenance activities during operations are expected to last less than 10 days for the entire length of the line. Displacement effects already exist within the US 2 linkage zone as road densities are currently high on private and State lands. National Forest System lands within the linkage zone provide more secure habitat due to the lower amount of total roads.

As described previously, the public education and law enforcement efforts of the bear specialist and law enforcement officer would minimize the risk of increased grizzly bear mortality that could be associated with increased human activity associated with the transmission line construction and reclamation. The KNF food storage order would be required in Alternative B on all National Forest System lands within the linkage area affected by Alternative B. This overlap would only occur on National Forest System land within the BORZ boundary. As described above, Alternative B would have low potential to displace bear movement within the BORZ and MFSA analysis area, and the reasoning would apply to the US 2 linkage zone as well.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

Effects to grizzly bears within the US 2 linkage zone area are as described for Alternative C-R within the BORZ and MFSA analysis area except for as follows:

The eastern portion of the Alternative C-R transmission line alignment would occur within the US 2 linkage zone. A relatively small segment of the Alternative C-R transmission line would cross the Fisher River valley, potentially temporarily discouraging grizzly bear movement in a localized area due to transmission line construction activities. These effects would be short-term and occur twice: when the transmission line was built and when it was decommissioned. Once revegetated, cleared areas could provide additional forage habitat. Some shrub and tree cover would be maintained in the transmission line right-of-way because of the Vegetation Removal and Disposition Plan (Appendix D) to minimize vegetation removal. The segment of Alternative C-R that would parallel US 2 would be located upslope and out of the Fisher River valley, and would reduce effects to riparian habitat that bears may use during movement across the US 2 fracture zone. Due to mitigation efforts to minimize the removal of vegetation, greater amounts of cover for movement or forage habitat would likely be retained within the transmission line clearing compared to Alternative B.

New access roads, helicopter use, and other construction activities would likely have minimal displacement effects on grizzly bears because of the timing restricting activities outside of the spring use and denning period and the low potential for grizzly bears to occur in the immediate vicinity during construction or decommissioning activities. If a bear occurred and was moving through the area, it may change its movement pattern or avoid the area of concentrated activity. The increased human activity associated with construction, maintenance, or reclamation would be short-term as previously described. Displacement effects already exist within the US 2 linkage zone as road densities are currently high on private and State lands. National Forest System lands within the linkage zone provide more secure habitat due to the lower amount of total roads.

Mitigation for displacement consisting of land acquisition that could occur outside of the CYRZ may further reduce the effect of potential displacement and maintain or improve the ability of grizzly bears to move through the US 2 linkage zone.

Alternative D-R – Miller Creek Transmission Line Alternative

Impacts of Alternative D-R on grizzly bears in the US 2 linkage zone in the Fisher River valley would be the same as Alternative C-R. Mitigation for impacts of Alternative D-R to grizzly bears would be the same as previously described for Alternative C-R.

Alternative E-R – West Fisher Creek Transmission Line Alternative

Impacts of Alternative E-R on grizzly bears in the US 2 linkage zone in the Fisher River valley would be the same as Alternative C-R. Mitigation for impacts of Alternative E-R to grizzly bears would be the same as previously described for Alternative C-R.

Combined Mine-Transmission Line Effects

For all combined action alternatives, the eastern segment of the transmission line corridors would occur within the US 2 linkage zone. The effects and mitigation of the combined mine-transmission lines are as previously described under the individual transmission lines.

Cumulative Effects

The "Affected Environment" section describes relevant past and present factors affecting the existing habitat conditions in BMUs 2, 5, and 6. This "Cumulative Effects" section summarizes past actions as well as further describes ongoing and reasonably foreseeable activities potentially impacting grizzly bear habitat and mortality.

As described under the "Analysis Methods" section for the bounds of analysis, the cumulative effects analysis considers the directly affected BMUs 2, 5, and 6. In addition BMUs 1, 4, 7, 8, and 22 are considered. These BMUs are the appropriate scale for grizzly bear cumulative effects analysis. Detailed description of past, present and reasonably foreseeable management activities found within the Montanore Project Area PSUs (Crazy and Silverfish) are found in Appendix E. This list includes actions found within the directly affected BMUs 2, 5, and 6. Actions within BMUs 2, 5, and 6 may affect grizzly bear movement through the north-south corridor. Actions discussed in this cumulative effects analysis for BMUs 1, 4, 7, 8, and 22 extend outside of the Crazy and Silverfish PSUs and are relevant due to their potential effects to grizzly bear habitat parameters within the south Cabinets, which may cumulatively affect grizzly bear movement through the north-south corridor and BMUs 2, 5, and 6.

Limiting the assessment of cumulative effects to the southern half of the CYRZ is appropriate. The Cabinet Mountain portion lies south of the Yaak River drainage and contains about 60 percent of the Recovery Zone. Presently, there has been limited movement of native bears between the Cabinet Mountains and Yaak portions of the CYE. The number of bears in the south Cabinet portion is not considered dense enough to create sufficient pressure to push bears north to the Yaak portion (W. Kasworm, pers. comm. 2010). One sub-adult male has crossed the Kootenai River moving from the Yaak to the Cabinets and then returned to the Yaak (Kasworm *et al.* 2013c). In summary, the Cabinet Mountains south portion of the CYE is the appropriate scale for cumulative effects as 1) the BMUs are biologically meaningful to grizzly bears; 2) provide consistent boundaries for management and monitoring; 3) allows for analysis without minimizing activity effects; 4) considers activities within the directly affected BMUs and the remaining BMUS in the south Cabinets and considers how movement of grizzly bears may be cumulatively affected; and 5) cumulatively determines the conditions of OMRD, TMRD, and core, and if sufficient core would remain available for displacement or dispersal in the south Cabinets. The evaluation of the south Cabinets as a whole, instead of the directly affected BMUs, is necessary to adequately address the potential cumulative effects of two large-scale mining developments (Montanore Project and the Rock Creek Project) and the potential for increased constriction in the north-south corridor and restriction of bear movement within the south Cabinets. Therefore, BMUs 1, 2, 4, 5, 6, 7, 8, and 22 were considered the appropriate scale for cumulative effects in the Recovery Zone. The Cabinet Face BORZ was considered for cumulative effects outside the

Recovery Zone. The DEQ MFSA analysis area for private land and cumulative effects to private land outside of the CYRZ and outside of the BORZ remains the 1-mile buffer either side of the transmission line.

Past Actions: The primary measure of habitat availability and quality is related to the density and juxtaposition of open and total roads on the landscape. Table 230 of the grizzly analysis summarizes the existing condition in the directly affected BMUs based on the effects of motorized access management, including past road construction, decommissioning, storage, and gating or barriering/berming of roads, as they relate to grizzly bear habitat parameters of core, OMRD, and TMRD. Roads constructed in association with timber harvest, mining, and other development have cumulatively reduced grizzly bear core areas. Timber harvest has occurred in these BMUs since the 1950s and has provided a variety of successional stages across the area. In some cases, previous post-harvest site treatment provided habitat conditions favorable for huckleberry production and other forage for grizzly bears and big game. Harvest units more than 15 years old generally provide hiding cover for these species. Historically, wildfire resulted in a mosaic of habitats and successional stages providing both forage opportunities and cover to grizzly bears. Fire suppression beginning in the early 1900s has resulted in the encroachment of conifers into foraging habitat and aging of shrub habitat, which in turn reduced huckleberry and other berry production on some sites. The 1910 fires influenced large acreages in the project area, resulting in even-aged and dense stands. Numerous small lode mining and placer operations on federal or patented lands have existed since the early 1900s, resulting in small pockets of human activity within the Cabinet Mountain portion of the Recovery Zone. Human activities affecting grizzly bear habitat have changed since the 1980s. Open road densities have decreased as a result of restricting roads to motorized traffic, or reclaiming them, through decisions intended to facilitate grizzly bear recovery. Since implementation of the KNF 1987 KFP and beginning in the 1990s, more intermediate harvest has occurred, which provided for both foraging and cover in closer juxtaposition. Other past activities on federal land include precommercial thinning in harvest units, herbicide spraying, prescribed burning, and road development and maintenance. The Crazy and Silverfish PSUs overlap the directly affected BMUs and have had mineral development since the 1800s, which has resulted in patented land being located within the CMW and BMUs and motorized access to these lands. Development of private lands within the analysis area, including commercial timber harvest, land clearing, home construction, and road construction, has contributed to increased disturbance of grizzly bears, loss or reduction in quality of grizzly bear habitat, and increased human/grizzly bear conflicts.

Alternative 1A – No Mine or Transmission Line Combined Alternative

The no mine or transmission line alternative would not directly contribute to any cumulative effects. Without construction of the mine or transmission line, vegetation succession in those areas and across the action area would continue. Both timbered stands and open areas with encroaching tree regeneration or brush buildup would result in a decline in the availability and productivity of forage species over time as well as potential for increased severe fire behavior.

The KNF would be responsible to bring those BMUs not meeting grizzly bear habitat parameter standards under its jurisdiction into compliance within the timeframes specified by the Access Amendment. The Montanore Project was identified as a tentative plan to meet standards in the Access Amendment Compliance Strategy for BMUs 5, 6, and 7. Under the no action alternatives, compliance with the 2011 Access Amendment individual numerical habitat parameter standards in these BMUs would occur under a different management strategy. Current BMUs in the south Cabinets not meeting standards are BMUs 4, 5, 6, 8, and 22.

Ongoing and Reasonably Foreseeable Actions and Combined Mine-Transmission Line Alternatives

For BMUs 1, 4, 7, 8, and 22, also considered for cumulative effects and located within the Cabinet Mountain portion of the SCYE, the Access Amendment (USDA Forest Service 2011a, 2011b) provided estimated timelines for KNF compliance for habitat parameter standards. In BMU 4, compliance is by the end of 2019 and in BMU 8, by the end of 2014. BMU 7 is currently in compliance. The Lolo National Forest estimated bringing BMU 22 into compliance by the end of 2019. Of these BMUs, two have lower OMRDs than that reportedly used by grizzly bears in the CYE (Wakkinen and Kasworm 1997). OMRDs in BMU 4 (38 percent) are higher than the average reportedly being used by grizzlies in the CYE (33 percent), in part due to the presence of MT 200 along the unit's southern boundary and MT 56, which bisects the unit. TMRDs in the action area are likewise near or lower than the average reportedly being used by grizzlies in the CYE (26 percent) (Ibid). BMUs 4 (29 percent) and 22 (37 percent) have higher TMRDs than that reported as used by grizzly bears in the CYE. BMU 4 is higher than the CYE research average (26 percent). The density in BMU 4 is due in part to MT 200 running along its southern boundary and MT 56 bisects the BMU. BMUs not meeting habitat parameter standards would provide lower quality habitat than researchers found being used by female grizzly bears.

Road access changes included in the agencies' alternatives would serve to mitigate cumulative displacement effects, providing 4,588 acres of grizzly bear core habitat in BMU 5 and 2,144 acres in BMU 6 (Table 240). The proposed agencies' combined mine-transmission line alternatives create core prior to activity phases, and core areas serve to partially mitigate for the displacement impacts of the proposed activities and cumulative effects of reasonably foreseeable actions. Both the existing and resulting levels of secure core and the seasonal habitats contained within them would provide essential and available habitat for grizzly bears in BMUs 2, 5, and 6. Core areas of substantial sizes are also provided in the surrounding BMUs of 4, 7, 8, and 22 (Table 242).

The effects shown in Table 242 do not reflect potential improvements to grizzly bear baseline habitat parameters that would result from required land acquisitions associated with mitigation for the combined action alternatives, or the Rock Creek Project, a reasonably foreseeable action.

Table 242. Cumulative Effects on Grizzly Bear Habitat Parameters in the South Cabinet-Yaak Ecosystem by Combined Mine-Transmission Line Alternative.

Habitat Parameter and Standard (%)	Existing Conditions	No Action Alternative[1]		[Alt 2] MMC's Proposed Mine TL-B[2]		
		C/O	R	C	O	R
BMU 1						
Core (80%)	83	81	83	81	81	83
OMRD (15%)	14	**18**	14	**18**	**18**	14
TMRD (15%)	8	11	9	11	11	9
BMU 2						
Core (75%)	76	77	77	77	77	77
OMRD (20%)	20	19	19	19	19	19
TMRD (18%)	16	13	13	13	13	13
BMU 4						
Core (63%)	62	**62**	**62**	**62**	**62**	62
OMRD (36%)	37	36	36	36	36	36
TMRD (26%)	**29**	**29**	**29**	**29**	**29**	**29**
BMU 5						
Core (60%)	**58**	60	**58**	**57**	**57**	**58**
OMRD (30%)	28	27	28	**31**	30	27
TMRD (23%)	23	23	23	**26**	**26**	22
BMU 6						
Core (55%)	**54**	**53/53**	55	**52**	**52**	**53**
OMRD (34%)	29	**36/36**	**27**	**37**	**36**	27
TMRD (32%)	**33**	**35/35**	**33**	**36**	**36**	**36**
BMU 7						
Core (63%)	**62**	63/63	63	63	63	63
OMRD (26%)	**32**	25/26	25	25	26	25
TMRD (23%)	23	23/23	23	23	23	23
BMU 8						
Core (55%)	55	55	55	55	55	55
OMRD (32%)	**33**	**33**	**33**	**33**	**33**	**33**
TMRD (21%)	**24**	**22**	**22**	**22**	**22**	**22**
BMU 22						
Core (55%)	**51**	**51**	**54**	**51**	**51**	**54**
OMRD (33%)	**38**	**38**	**38**	**38**	**38**	**38**
TMRD (35%)	**37**	34	34	34	34	34

Bolded values do not meet Access Amendment standards.
BMUs directly affected (physical ground-disturbing activities) by the Montanore combined action alternatives (BMUs 2, 5, and 6) are shaded.
[1]Displays effects of the Miller-West Fisher Project Phase 1/Phase 2 in BMUs 6 and 7, in addition to the other reasonably foreseeable activities in each BMU.
[2]Includes effects of the Miller-West Fisher Project Phase 1 in BMU 6.
[3]Includes effects of the Miller-West Fisher Project Phase 1/Phase 2 in BMU 6.
TL = Transmission Line Alternative.
C = Construction Phase – shown with mitigation in place as mitigation plan requires this before start of Construction Phase.
O = Operations Phase – includes all mitigation in place.
R = Closure Phase (post-project) – includes all mitigation in place. Effects to grizzly bear habitat as reclamation activities are implemented were considered to be the same as the Construction Phase, and are not displayed.
BMU = Bear Management Unit; OMRD = open motorized route density; TMRD = total motorized route density.

Table 242. Cumulative Effects on Grizzly Bear Habitat Parameters in the South Cabinet-Yaak Ecosystem by Combined Mine-Transmission Line Alternative. (continued)

Habitat Parameter and Standard (%)	Existing Conditions	[Alt 3] Agency Mitigated Poorman Impoundment Alternative									[Alt 4] Agency Mitigated Little Cherry Creek Impoundment Alternative								
		TL-C-R[2]			TL-D-R[3]			TL-E-R[3]			TL-C-R[2]			TL-D-R[3]			TL-E-R[3]		
		C	O	R	C	O	R	C	O	R	C	O	R	C	O	R	C	O	R
BMU 1																			
Core (80%)	83	81	81	83	81	81	83	81	81	83	81	81	83	81	81	83	81	81	83
OMRD (15%)	14	**18**	**18**	14	**18**	**18**	14	**18**	**18**	14	**18**	**18**	14	**18**	**18**	14	**18**	**18**	14
TMRD (15%)	8	11	11	9	11	11	9	11	11	9	11	11	0	11	11	9	11	11	11
BMU 2																			
Core (75%)	76	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77	77
OMRD (20%)	20	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
TMRD (18%)	16	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
BMU 4																			
Core (63%)	**62**	**62**	**62**	**62**	**62**	**62**	**62**	**62**	**62**	**62**	**62**	**62**	**62**	**62**	**62**	**62**	**62**	**62**	**62**
OMRD (36%)	**37**	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
TMRD (26%)	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29
BMU 5																			
Core (60%)	**58**	66	66	65	66	66	65	66	66	65	66	66	66	66	66	65	66	66	65
OMRD (30%)	28	27	28	27	27	27	27	27	27	27	27	27	26	27	27	26	26	27	26
TMRD (23%)	23	19	19	18	20	19	18	20	19	18	19	19	18	19	19	18	19	19	18
BMU 6																			
Core (55%)	**54**	**54**	**54**	56	**54**/55	**54**/55	56	**54**/55	**54**/55	56	**54**	**54**	**54**	**54**/55	**54**/55	56	**54**/55	**54**/55	56
OMRD (34%)	29	**36**	**36**	27	**36/36**	**36/36**	27	**36/36**	**36/36**	29	**36**	**36**	27	**36/36**	**36/36**	26	**36/36**	**36/36**	27
TMRD (32%)	**33**	**34**	**34**	32	**35/35**	**34/35**	32	**34/35**	**34/35**	32	**34**	**34**	32	**35/35**	**34/34**	32	**34/35**	**34/35**	32
BMU 7																			
Core (63%)	**62**	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63
OMRD (26%)	32	25	26	25	25	26	25	25	26	25	25	26	25	25	26	25	25	26	25
TMRD (23%)	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23
BMU 8																			
Core (55%)	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55
OMRD (32%)	**33**	**33**	**33**	**33**	**33**	**33**	**33**	**33**	**33**	**33**	**33**	**33**	**33**	**33**	**33**	**33**	**33**	**33**	**33**
TMRD (21%)	**24**	**22**	**22**	**22**	**22**	**22**	**22**	**22**	**22**	**22**	**22**	**22**	**22**	**22**	**22**	**22**	**22**	**22**	**22**
BMU 22																			
Core (55%)	**51**	**51**	**51**	**54**	**51**	**51**	**54**	**51**	**51**	**54**	**51**	**51**	**54**	**51**	**51**	**54**	**51**	**51**	**54**
OMRD (33%)	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**	**38**
TMRD (35%)	**37**	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34

See p. 1301 for footnotes.

Inside Recovery Zone

Combined Mine-Transmission Line Alternatives

Reasonably foreseeable actions include those federal, State, or private activities that are ongoing or scheduled to occur within the next five years, independent of this federal action. Appendix E identified those current and reasonably foreseeable actions in the directly affected BMUs that were determined to be appropriate for inclusion in the cumulative analysis of environmental effects. This cumulative effects analysis also discusses additional actions relative to grizzly bears in the remaining BMUs within the south Cabinet Mountains.

Road use and access information is available for the current and reasonably foreseeable Bear Lakes blasting, Wayup Mine/Fourth of July Road Access Project, Plum Creek activities, the Rock Creek Project, and Phase 1 and Phase 2 of the Miller-West Fisher Vegetation Management Project. The cumulative effects of the mine and transmission line alternatives on percent core habitat, OMRD, and TMRD in BMUs 2, 5, and 6 are shown in the shaded rows in Table 242. Cumulatively, these projects, including the Miller-West Fisher Project, may be completed before the proposed action alternatives and, as such, the impact on habitat parameters may be less than displayed in Table 242 for the cumulative action alternatives. It should also be noted that habitat parameters that cumulatively exceed or are worse than standards for the agencies' alternatives during the Construction or Operations Phases would only occur for the time the activities would actually be concurrent with the action alternatives. As the life of the mine would be approximately 30 years, and a timber sale would be likely be completed in 3 to 5 years, actual habitat parameters would be better than shown. In addition, as previously described, the habitat parameters displayed do not reflect improvements in the baseline OMRD, TMRD, and core that are expected due to either the Rock Creek Project or combined action alternatives habitat compensation mitigation.

Federal Actions on National Forest System Lands: Basic road maintenance, precommercial thinning, mushroom picking, prescribed burning, timber hauling, wildlife habitat improvement projects, and various recreational uses have occurred and would continue to occur within the analysis area. These activities are generally not considered to have cumulative adverse impacts on the grizzly bear due to the use being concentrated along existing open roads.

Additional reasonably foreseeable actions would contribute to additional changes to grizzly bear habitat parameters of OMRD, TMRD, and core due to road access changes. Within BMUs 5 and BMU 6, access to reasonably foreseeable projects and private land parcels could open roads within the north-south corridor. Open roads within the north-south corridor pose displacement and mortality risks to bears attempting to move north or south through the ecosystem. These roads also cross spring habitat and early-season huckleberry habitat, and any displacement resulting from these open roads would displace bears during sensitive times (USFWS 2014a).

Within BMU 1, reasonably foreseeable actions include the Flower Creek Vegetation Management Project and the Sparring Bull Project. The Flower Creek Project includes vegetation treatment as well as road storage and temporary trail construction. The Sparring Bull Project includes vegetation treatment and road storage. BMU 1 meets or is better than its OMRD, TMRD, and core standard. Cumulatively, BMU 1 would comply with the Access Amendment design elements and standards, as shown under the Sparring Bull analysis. Analysis for the Flower Creek Project is ongoing.

Within BMU 2, reasonably foreseeable actions include the Paulson Access on Prospect Hill. This project includes storing almost 7 miles of road, gating 1.4 miles, and constructing and reconstructing almost 1 mile of road. The project permits the property owner to construct approximately 1 mile of road on National Forest System land, with permanent year-round vehicle access permitted to the landowner. Road storage implemented prior to road construction will compensate for core lost prior to activity, and will increase core habitat overall, while overall OMRD and TMRD would decrease associated with the No Action Alternative. Cumulative OMRD, TMRD, and core percentages in BMU 2 would not be measurably affected by the action alternatives. The agencies' alternatives mitigation prior to activity would slightly decrease the linear miles of total road and increase the acreage of core, but would not change the percentages. BMU 2 meets or is better than its habitat parameter standards and cumulatively would maintain these levels during all phases of the action alternatives.

Within BMU 4, the Rock Creek Project is reasonably foreseeable. This project is a proposed underground copper and silver mine and mill/concentrator complex near Noxon, Montana, and would occur across the Cabinet Mountains from the proposed Montanore Project mine development in BMU 5. Project mitigation for grizzly bears would include the acquisition of land or perpetual conservation easements of 2,350 acres of replacement grizzly habitat, with 53 acres acquired prior to the Evaluation Phase, 1,721 acres prior to mine construction, 10 acres prior to the air-intake ventilation adit, and 566 acres prior to mine operation. An additional 100 acres would also be secured or protected by Rock Creek Resources. Road access changes associated with the Rock Creek Project include a berm or barrier on portions of NFS road #4784 in BMU 5 prior to the evaluation adit construction, barriers on portions of NFS roads #2285 and 2741X, and gates on portions of NFS roads #2741A and #150. In addition, a grizzly bear specialist and law enforcement officer would be hired and six female grizzlies will be augmented into the south Cabinet Mountains, with augmentation already completed. BMU 4 core and TMRD are worse than the standard, but road access changes associated with the Rock Creek Project will decrease OMRD to meet the standard. The levels of core, OMRD, and TMRD shown in Table 242 do not reflect the habitat compensation required for the Rock Creek Project, which would likely result in the BMU meeting its standards. Cumulatively, the Montanore combined action alternatives may also affect BMU 4, though its mitigation requiring habitat compensation also would result in improvement to the baseline and would provide more secure habitat for grizzly bears.

Within BMU 5, reasonably foreseeable actions include the Rock Creek Project mitigation and the Libby Creek Ventures drilling. Rock Creek Project road access mitigation on the Upper Bear Creek Road #4784 would decrease OMRD and TMRD and increase core to meet the BMU standard, providing more secure habitat for grizzly bears. In the agencies' alternatives, road access changes associated with mitigation would be implemented before project activities affecting core habitat and road densities. Mitigation implemented before the Evaluation and Construction Phase would contribute to the cumulative improvement of OMRD, TMRD and core in BMU 5, where the majority of impacts would occur. Alternative 2B would cumulatively increase OMRD and TMRD and decrease core in BMU 5 to worse than Access Amendment standards during construction and operations, and would cumulatively decrease OMRD and TMRD, and return core to the existing condition which does not meet standard post-reclamation. As a result of road access mitigation, the agencies' alternatives core would be greater than the standard, and OMRDs in BMU 5 would be at or below existing levels during construction and operations. The agencies' alternatives, in combination with other reasonably foreseeable actions, would cumulatively decrease TMRD in BMU 5 during all phases of the proposed projects.

During reclamation OMRD and TMRD would cumulatively decrease due to mitigation of other reasonably foreseeable actions and the action alternatives. Core would also cumulatively decrease due to the end of the Rock Creek Project mitigation on the Upper Bear Creek Road, but cumulatively would remain better than the standard during all phases of the agencies' action alternatives. A reduction in security for grizzly bears could occur within the north-south corridor if human use on the Rock Creek or St Paul trails increased to levels that displace grizzly bears and contribute to fragmentation of the north to -south corridor, or result in a corresponding increase in human food and attractants made available to bears (Rock Creek Biological Opinion 2006, p. A-71, USFWS 2006). Should the Rock Creek Project proceed, the Rock Creek Project mitigation plan specifically incorporated monitoring of the Rock Creek Trail 150A and other trails with potential for high recreation use, such as the St. Paul Lake Trail 646, and requires modification to prevent high use, such as utilizing permits to maintain low levels of recreational access.

Within BMU 6, reasonably foreseeable actions include the Bear Lakes Blasting, Wayup Fourth of July Mine Access (Skranak), Miller-West Fisher Vegetation Management Project Phases 1 and 2, and Plum Creek harvest activities. Within BMU 6, use of existing barriered or closed roads, or construction of temporary roads associated with projects such as the Miller-West Fisher Vegetation Project and Skranak Wayup Mine Access would result in changes to OMRD and TMRD as shown for the No Action Alternative (Table 242). In BMU 6, the Miller-West Fisher Vegetation Project would increase OMRD to 31 percent in Phase 1 and to 32 percent in Phase 2. Post-MWF, OMRD would return to pre-project conditions, and as the BMU standard is no more than 34 percent OMRD, the MWF Project would comply with the BMU standard in all phases. The Miller-West Fisher Project by itself will increase TMRD to 34 percent in Phase 1 and 35 percent in Phase 2. Post-project Miller-West Fisher will drop TMRD to 32 percent to meet Access Amendment standards. The Miller-West Fisher Project maintains the percent core through both Phase 1 and Phase 2. The additional 3-percent increase in OMRD to 36 percent, TMRD increase to 35 percent, and additional decrease in core (all worse than the BMU standard during both phases of the Miller-West Fisher Project as shown in the No Action Alternative) would result from the additional road access and road construction associated with the Skranak Wayup Mine Project (NFS road #6748) as well as Plum Creek harvest activities (only affecting OMRD). In the agencies' alternatives, road access changes associated with mitigation would be implemented before project activities affecting core habitat and road densities. Construction and operations of all action alternatives, in combination with other reasonably foreseeable actions, would increase TMRD in BMU 6 above existing levels, which does not meet the standard and would increase OMRD above the standard. Cumulative core would be maintained at the existing level, which does not meet the standards when concurrent with the Miller-West Fisher Project Phase 1, while core would increase to 55 percent during operations for all agency alternatives except for 3C-R and 4C-R. In the agencies' alternatives, OMRD, TMRD, and core in BMU 6 after reclamation would meet Access Amendment standards due to the combined effects of mitigation measures implemented for the agencies' alternatives and other reasonably foreseeable actions, while Alternative 2B would not meet the standards.

BMUs 2, 5, and 6

Near the proposed combined action alternatives, the ecosystem narrows to approximately 15 miles, its narrowest portion. Human development on the east and west slopes impacts the north-south movement corridor for grizzly bears in BMUs 2, 5, and 6. The Wildlife BA delineated this north-south movement corridor and existing and potential sites that, if developed, may constrict the corridor and impair movement of bears through the area (USDA Forest Service 2013a Figures 9-12). Distances between existing or potential sites of high human use could be less than 2 miles in some cases and when displacement distances are considered, it could be less than 1 mile. This corridor is critical as it links grizzly bear habitat in the southern Cabinet Mountains, specifically BMUs 7, 8, and 22, with habitat in the Cabinet Mountains BMUs to the north.

Unmitigated, the disturbance and displacement of grizzly bears from the proposed combined action alternatives and existing roads on the east side of the Cabinet Mountains could reduce the safe movement and/or inhibit movement of bears traveling north and south along the Cabinet Mountains. The effects of the reasonably foreseeable Rock Creek Project, when added to existing roads occurring on the east side of the divide, would contribute to high levels of human disturbance within BMUs 4, 5, and 6. Although it would not constitute a complete barrier to movement, the disturbance could evoke avoidance behavior by some bears and reduce use of the north-south movement corridor by inhibiting movement west of the divide. Unmitigated, the disturbances associated with the Rock Creek Project and other reasonably foreseeable actions and the combined action alternatives, occurring on both sides of the Cabinet Mountain divide, could impede grizzly bear movement to and from the south, impacting BMUs 6, 7, 8, and 22. Some grizzly bears could move into areas of increased human activity and face increased mortality risk. Grizzly bears using BMUs 2, 5, and 6 may be compelled to change traditional movement patterns and behaviors. However, the effects of the reasonably foreseeable Rock Creek Project are mitigated as are the effects of the combined action alternatives, although the mitigation plan for the agencies' combined alternatives would be more effective.

Surface impacts and complete removal of habitat from reasonably foreseeable actions in BMU 5 would be minimal as the reasonably foreseeable Libby Creek Ventures would disturb about 1 acre due to drilling. Cumulatively, the greatest impact on removal of grizzly bear habitat would result from the action alternatives.

In BMU 6, the combined mine-transmission line alternatives would clear vegetation within the transmission line clearing area but some level of vegetation in the form of low shrubs and low trees is expected to remain. More vegetation in the cleared area would remain under the agencies' combined alternatives due to the Vegetation Removal and Deposition Plan. Movement patterns through BMU 6 may change during the short-term displacement effects caused by construction and reclamation activities, and cumulatively the transmission lines located in BMU 6 would not contribute to cumulative decreases or changes in grizzly bear movement. The combined action alternatives, in combination with reasonably foreseeable actions, would result in cumulative disturbance to grizzly bears during spring. The Miller-West Fisher Project also would occur in grizzly bear spring habitat. Compared to Alternative 2B, more effective timing restrictions for transmission line construction and reclamation would be implemented by the agencies' combined alternatives to minimize displacement effects on denning and spring range.

The combined action alternatives, in combination with reasonably foreseeable actions such as the Rock Creek, Miller-West Fisher, Skranak Wayup Mine, and Libby Creek Ventures projects, could disrupt bear movement in the north-south movement corridor and along riparian corridors. The agencies' combined alternatives mitigation plan would require yearlong closures that would improve grizzly bear habitat. This would include restricting the upper segment of NFS road #150A/Trail 935 with an earthen berm (in conjunction with transfer of MMC's 5-acre parcel at Rock Creek Meadows to the Forest Service included in the habitat compensation requirements). Combined, these two actions would increase the width of secure habitat between disturbances associated with the Montanore Mine Project and the Rock Creek Project and would reduce displacement and fragmentation within the north-south corridor. Additional road closures in Poorman Creek (NFS road #2317) and Ramsey Creek (NFS road #4781) would also contribute to reducing fragmentation in the corridor. The Rock Creek Project mitigation on the Upper Bear Creek Road (NFS road #4784) would close the road with an earthen barrier for the life of the mine. The agencies' action alternatives would only barrier the Upper Bear Creek Road if the Rock Creek Project had not yet done so. All of these road closures would contribute to a significant improvement in grizzly bear habitat within BMU 5 and the larger north-south corridor.

If activities associated with the Miller-West Fisher Project and construction of the combined action alternatives occurred concurrently, grizzly bear movement may be particularly affected in either the Miller Creek or West Fisher Creek corridor, depending on the alternative. Road access changes associated with the agencies' combined alternatives would increase core, provide more secure areas for movement, and further reduce cumulative impacts on grizzly bears in the Miller Creek area by installing an earthen berm on the North Fork Miller Creek Road (NFS road #4725) and in the West Fisher Creek drainage by installing an earthen berm on the Standard Creek Road (NFS road #6745).

Land acquisition associated with mitigation for the combined action alternatives and the reasonably foreseeable Rock Creek Project would be implemented prior to activity of the associated phase of the mine. The amount of land acquisition or conservation easement in perpetuity would vary by combined action alternative for either habitat physically lost or for displacement effects, but all action alternatives and the reasonably foreseeable Rock Creek Project habitat compensation mitigation would reduce displacement and mortality risk by reducing fragmentation and improving the north-south corridor connectivity and mitigate for effects of the mine prior to the Evaluation and Construction Phases. Habitat replacement for displacement effects would offset mine displacement effects on areas affected by increased long-term and high-intensity disturbances associated with mine development (including the impoundment, adits, facilities, conveyer belt system, and access roads). Habitat compensation or replacement mitigation would also result in improved baseline habitat parameters of OMRD, TMRD, and core. Land acquisition included in the combined action alternatives, especially the agencies' alternatives, are designed to offset cumulative impacts on bear movement through additional road access changes, and elimination of sources of grizzly bear disturbance.

The combined action alternatives, in combination with other reasonably foreseeable actions, may increase mortality risk due to the influx of employees and vehicles into the analysis area. The combined agencies' alternatives and the reasonably foreseeable Rock Creek Project would include measures to counteract the increased risk of grizzly bear mortality, such as busing employees to the project site, educating employees about the biology and behavior of grizzly bears, and equipping project sites and surrounding areas with bear-resistant garbage containers. The new law enforcement and bear specialist positions included in the combined action alternatives and the Rock Creek Project would help reduce the risk of illegal killing of grizzly bears in the area, increase public awareness, and help increase acceptance and support of grizzly bear management across the CYE and adjacent BORZ, not just in the directly affected BMUs. The combined agencies' alternatives would include funding for a habitat conservation biologist who would focus on promoting land use decisions that would benefit bears.

Public Actions on Forest Service Land

With population growth and development on private lands independent and related to the combined action alternatives, it is reasonable to assume some level of corresponding increase in human use of National Forest System lands is likely to occur. As a result, bears may experience increased intensity or duration of human-related disturbance in proximity to roads, or increased recreational use. As described previously, any increase in mortality risk and potential cumulative effects to grizzly bears by public actions on Forest Service lands within the Cabinet Yaak Ecosystem and Cabinet Face BORZ would be addressed by the combined action alternatives mitigation plans. These were previously described under *Actions on Forest Service Lands*.

Actions on Private Land

As noted in section 3.18, *Social/Economics*, population growth in the area is converting areas of private land from timber or agricultural production and open space use into residential subdivisions and ranchettes, increasing the potential for additional food attractants and human/grizzly bear conflicts. Anticipated effects could include species displacement, habitat alteration, and or habitat loss. The agencies' action alternatives would include mitigation to reduce attractants and mortality risk on all ownerships within and adjacent to the Cabinet Yaak CYRZ as well as throughout the local communities.

Actions Outside CYRZ and BORZ on Private and State Lands, and all Lands within the US 2 Linkage Area

On National Forest System lands, none of the reasonably foreseeable actions or the combined action alternatives would change the baseline miles of open and total roads as established in the Access Amendment. No livestock grazing occurs or is proposed. The KNF mandatory food storage order in addition to actions included in the agencies' mitigation plans would minimize food attractants and any associated mortality risk on National Forest System land within the Cabinet Face BORZ.

The combined action alternatives, in combination with reasonably foreseeable actions, may increase displacement effects due to increased traffic and human activity along Bear Creek Road. Displacement effects along the access road were accounted for within the 0.5-mile road buffer used in the displacement analysis (ERO Resources Corp. 2015). In addition, cumulative activity may increase temporary housing facilities developed on private lands, potentially resulting in a cumulative increase in the availability of food attractants and human/grizzly bear conflicts, as well as the miles of total and open roads on private land. The combined agencies' alternatives mitigations would include MMC funding for fencing and electrification of garbage transfer stations in grizzly bear habitat in and adjacent to the CYE, reducing the availability of attractants and reducing mortality risks for the grizzly bears. The bear specialist included in the combined action alternatives would help prevent human/bear conflicts by educating the public on food storage in bear habitat and increasing awareness of grizzly bear behavior. In addition to the new positions funded by MMC, the combined agencies' alternatives would include funding for a habitat conservation specialist who would focus on promoting land use decisions that would benefit bears.

As discussed in section 3.18, *Social/Economics,* many areas of private land are being converted from timber or agricultural production and open space use into residential subdivisions and ranchettes. The combined action alternatives, in combination with increased development of private land, could contribute to disturbance of grizzly bears on private land. However, private land outside of the CYRZ and BORZ is infrequently used by grizzly bears, and the area currently has high road densities. The low potential to displace a grizzly bear from disturbance associated with the transmission line construction and decommissioning of the combined action alternatives is also a factor of the short-term and temporary nature of these activities that for the majority of the private land would occur outside of the spring and denning periods due to winter range restrictions in Alternative B. The agencies' alternatives also propose a big game winter range restriction with no transmission line construction or decommissioning in elk, white-tailed deer, goat, or moose winter range (December 1 through April 30) unless a waiver is approved by the agencies. This big game winter range activity waiver, however, would not occur on those lands where required grizzly bear transmission line timing mitigation would be implemented (all National Forest System lands in the CYRZ and BORZ, and State trust lands). Construction of the Sedlak Park Substation would be exempt from these timing mitigations. The cumulative impacts of the combined action alternatives on private land outside the CYRZ and outside the Cabinet Face BORZ would likely be minimal.

Other reasonably foreseeable actions, especially increased development on private land, would affect grizzly bear use of the US 2 linkage zone. For all combined action alternatives, the eastern segment of the transmission line corridor would occur within the US 2 linkage zone. Relatively small segments of all alternative transmission line corridors would cross the Fisher River valley, potentially discouraging grizzly bear movement in a localized area due to transmission line construction activities. These effects would be short-term and occur twice: when the transmission line was built and when it was decommissioned. Contributions of the action alternatives to cumulative effects on the US 2 linkage zone would likely be minimal because of the short-term nature of transmission line disturbance and because the US 2 linkage zone potentially affected by the combined action alternatives is generally heavily roaded and has been logged in the past 20 to 30 years.

Regulatory/KFP Consistency

Organic Administration Act and Forest Service Mineral Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest System surface resources; comply with applicable state and federal water quality standards including the Clean Water Act; take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations; and construct and maintain all roads so as to assure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water, and other resource values.

Alternative 2B analyzed without the improvements to grizzly bear baseline habitat parameters expected from the land compensation mitigation would not take all practicable measures to maintain and protect grizzly bear or grizzly bear habitat; would not comply with the KFP, as amended by the 2011 Access Amendment; and would not comply with 36 CFR 228.8. The agencies' combined alternatives also analyzed without the improvements to grizzly bear baseline parameters expected from the agencies' land compensation mitigation would comply with 36 CFR 228.8 by taking practicable measures to meet Access Amendment standards prior to activity with road access mitigation and would maintain and protect grizzly habitat that may be affected by the operations.

National Forest Management Act/Kootenai Forest Plan

Alternative 2B would not meet all KFP guidelines and standards, as amended by the Access Amendment. During construction and/or operations, Alternative 2B would further reduce percent core habitat to below Access Amendment standards in BMUs 5 and 6 and would reduce TMRD in BMU 5, where TMRD is worse than the standard. The agencies' combined action alternatives would meet all KFP guidelines and standards, as amended, as they apply to grizzly bears, except in BMU 5 where activities associated with the mine development and operations would not meet the guideline to avoid activity during the spring use period. The action alternatives would require project-specific amendment to MA12 to exceed open road density (ORD) standard of 0.75 mile per square mile during activities. The ORD standard applies to big game species, including elk, where a detailed analysis of this amendment is provided. ORD is a measurement that applies specifically to big game species and is calculated differently from the OMRD measurement used in this grizzly bear analysis. The project-specific amendment is required for project activities specifically and does not increase motorized public use of roads. Therefore, this project-specific amendment is not likely to have effects other than those already considered in this analysis.

Road access changes associated with the agencies' alternatives provide greater improvements to core, OMRD, and TMRD and the agencies' alternatives would meet Access Amendment requirements for these habitat parameters prior to activity. The agencies' alternatives would provide a more extensive mitigation plan than Alternative 2B to improve the baseline habitat parameters for bears, offset direct habitat loss and displacement, and reduce the overall risk of mortality throughout and adjacent to the CYRZ.

The purpose and need of the action alternatives is mine development, not timber management. However, as a result of proposed activities, timber harvest would occur and all vegetation would be removed in areas affected by mine development and clearing of trees and tall shrubs would occur for transmission line construction and maintenance. An additional indirect result of the action alternatives would be an influx and increase in human population and an associated increase in traffic and recreational use of the affected BMUs and surrounding area in the long term. Thus, depending on the combined alternative, timber, recreation, and minerals requirements were considered when developing the mitigation plans.

The KFP Guidelines and standards applicable to grizzly bears include:

Evaluate Cumulative Effects – Timber KFP Appendix 8-9, Recreation KFP Appendix 8-13, ”……activities will be evaluated for their effects on grizzly bears and their habitat. A cumulative effects perspective will be used in the evaluation”: evaluated in a cumulative effects/biological evaluation process. See section 3.25.5.2.1, *Analysis Area and Methods* for a discussion of assumptions and the analysis area and section 3.25.5.4, *Environmental Consequences* for direct, indirect, and cumulative effects.

Project Design – KFP App. 8-10: "protect or enhance habitat components; timing constraints, scheduling, movement corridors; provision of displacement areas; access management." Project design of the action alternatives would include a combination of mitigation depending on the alternatives to reduce potential effects to grizzly bears.

F*or habitat components and timing constraints*: See the effectiveness of mitigation plan discussion and Objective 2. Project mitigation requiring land acquisition to offset direct habitat loss (Alternative 2B and Agency Alternatives) and also displacement (Agency Alternatives) would protect and enhance habitat components as specified in the mitigation plan, with the agencies' alternatives providing the most protection due to the increased acreage. Project design of the action alternatives includes timing restrictions for transmission line construction and decommissioning activities to reduce potential effects to grizzly bears. The agencies' alternatives mitigation would restrict these activities to between June 16 and October 14, more effectively minimizing transmission line impacts to both spring range and denning habitat than Alternative 2B. Due to the nature of the construction, operations, and first part of the Closure Phase within the influence zone of the mine development (impoundment, plant site, conveyer belt, and associated facilities and roads), no timing restrictions on spring range are proposed for the facilities and associated roads in BMU 5, which would not comply with the guideline to avoid spring grizzly bear habitat during the spring use period (see Objective 2) within BMU 5. In all action alternatives, mine-related activities would occur continuously along the east Cabinet front during the grizzly bear spring use period (April 1 to June 15) throughout the life of the project.

A total of about 45,000 acres of spring habitat components are present in the three BMUs directly affected by the combined action alternatives. Within BMU 5, the agencies' alternatives would affect 716 acres and Alternative 2B would affect 1,410 acres of spring habitat with long-term displacement caused by the proposed mine sites and associated roads. Of the 45,000-acre total, about 3,843 acres are already affected by use on existing roads, especially NFS roads #278 and #231. Due to the increased traffic volume and significant human activity along these forest roads and at the mine site, this spring habitat would be underused by grizzly bears. Den habitat in the three affected BMUs totals just more than 44,000 acres, with 1,694 acres already affected by use on existing roads. Only Alternative 2B would physically remove den habitat (17 acres). Alternative 2B would cause long-term displacement effects on 896 acres within BMU 5 due to the mine and associated activities and roads. For the agencies' combined alternatives, den habitat is not expected to be directly impacted, but would result in long-term displacement effects on an estimated 453 acres within the influence zone of the agencies' alternative mine sites and roads. With the agencies' alternatives planned road access changes, 2,291 acres of spring habitat would be made secure by creating core habitat. Displacement areas would not result in a net increase in acres of spring habitat, but would ensure that more acres of spring habitat were protected from major disturbances, throughout the life of the mine, than the amount of spring habitat lost to the mine. This measure provides for more than 45,500 acres of spring habitat to be available for use by grizzly bears throughout the life of the agencies' combined alternatives. BMUs 2, 5, and 6 provide den habitat in designated roadless areas in high-elevation grizzly bear habitats within the Cabinet Mountain Wilderness area. Displacement areas created by agencies' alternatives proposed road access changes also secure more potential den habitat than that currently occurring in the active BMUs (USFWS 2014a).

Disturbance impacts within spring, denning, or avalanche habitat in portions of BMUs 2, 5, and 6 would also be alleviated by varying degrees due to habitat compensation required for physical habitat removal (all combined alternatives) and displacement (agencies' combined alternatives). This would be dependent upon the parcel's location, existing habitat, existing access, and development on the properties acquired, potential for reducing motorized access, and proximity to these seasonal habitat components.

Movement Corridors: See effectiveness of mitigation plan discussion and Objective 2A. Acquisition of mitigation lands and road access changes on both National Forest System and the parcels would enhance security in the north-south movement corridor and provide for long-term movement between the north and south Cabinet Mountains. The agencies' mitigation plan for additional habitat compensation for displacement potentially may improve movement corridors outside the Recovery Zone. The agencies alternatives incorporation of a Vegetation Removal and Disposition Plan would provide for more cover retention in the transmission line clearing and the timing restriction would limit potential to disrupt movement patterns during the important spring use period within the affected BMUs.

Provision of Displacement Areas: See the effectiveness of mitigation plan discussion and Objective 1A. The agencies' alternatives road access changes on both National Forest System and the parcels would improve core to better than the standards in BMUs 5 and 6, resulting in substantial more improvement in displacement areas than Alternative 2B. For all action alternatives, acquisition of mitigation lands would further improve the level of core, with greater improvement resulting from the agencies' alternatives.

Access Management will be Considered: The agencies' grizzly bear mitigation plan describes road access changes and discusses the effectiveness of mitigation plans, Objectives 1A, B, and C, and Objective 2C. The agencies' alternatives would result in more improvement than Alternative 2B. For the agencies' alternatives there would be no increase in the amount of roads open to public motorized use during the active bear year. Restricted, barriered, or impassable and temporary roads opened or constructed for transmission line activity would return to designated status during operations or post-project on National Forest System lands. During construction and operations, road use would result in changes to habitat parameter levels depending on the action alternative. The agencies' mitigation plan ensures no degradation of access management conditions for grizzly bears in BMUs 2, 5, and 6 for the life of the mine.

Attractants –Displacement: Timber KFP App. 8-12; Recreation KFP App 8-14

…there will be strict regulation of garbage, pets and human waste to minimize grizzly/human conflict; *bear-proof garbage containers, regular collections, information brochure summarizing human conduct in grizzly country; …areas may be closed to reduce conflict potential…if backcountry recreational use exceeds grizzly tolerance levels some means of restriction or reduction of human use should be implemented to avoid grizzly displacement; reduce grizzly mortality illegally occurring*…See Objective 3. All action alternatives would incorporate the KNF mandatory food storage order into all contracts.

As described in detail in Chapter 2, Alternative 2 grizzly bear mitigation plan, Alternative 2B would fund two new full-time wildlife positions, a law enforcement officer and an information and education specialist with duties aimed directly at minimizing effects on grizzly bears. The law enforcement officer duties would include deterring illegal killing, minimizing/eliminating mortality due to mistaken identity, enforcing applicable regulations, enforcing road access changes, while the information and education specialist would focus on educating school-age children regarding grizzly bear conservation, developing educational materials for mine employees and the public, and integrating the actions and programs of the Interagency Grizzly Bear Committees. In addition to these two positions, the agencies alternatives mitigation plan would provide for an additional habitat conservation specialist if both the Rock Creek Project and Montanore Project are active, and the mitigation plan has specific items to address attractants such as bear-resistant refuse containers for the mine facility and personal and community at large under the direction of grizzly bear management specialists, funding for fencing and electrification of garbage transfer stations, electric fence kits for bear problem sites, and a detailed wildlife grizzly bear awareness program for both MMC employees and the communities. Potential for increased recreation trail use within the north-south corridor and mitigation for those effects if the Rock Creek Mine Project is concurrent with the Montanore combined action alternatives has been addressed by the Rock Creek Project.

Land Adjustment: KFP App. 8-15

…. Emphasize the acquisition of critical habitat components or important seasonal ranges (especially spring range)….

The agencies' mitigation plan specifically requires that proposed mitigation properties meet one or more criteria, including protection of seasonally important habitats, with a primary emphasis on spring and secondary emphasis on fall habitats.

Minerals: KFP App. 8-15

*…In Situation 1 habitat proposed activities will be made compatible with grizzly bear management objectives…*See Objective 5 – Alternative 2B would not be compatible with all of the grizzly bear management objectives.

The agencies' combined action alternatives would provide grizzly bears an adequate quantity and quality of secure habitat at the home range scale because in these situations, grizzly bears can sustain disturbance within their home range without injury or death (USFWS 2011, p. A-77). The agencies' combined action alternatives would meet the KFP grizzly bear requirements for project activities except for mine construction and operation activity on spring range during the use period, and the agencies' grizzly bear mitigation plan summarizes the design features based on the grizzly bear standards and guidelines, as well as additional mitigation for the projected direct, indirect, and cumulative effects. Effects to spring range would be alleviated due to road access changes and land acquisition (see Objective 2b). The agencies' alternatives would maintain or improve core, OMRD, and TMRD due to required mitigation. The mitigation plan would require the KNF to manage at a level better than baseline conditions for the life of the mine once mitigation properties are acquired and additional access management opportunities arise on National Forest System lands. This level of access management would contribute to reducing or mitigating for displacement and fragmentation effects of the agencies' combined alternatives on grizzly bears. The mitigation plan requires funding to conduct a long-term monitoring study of grizzly bears throughout the life of the mine, and this information would be used to ensure the mitigation measures, including road closures, habitat acquisition, and easements were in fact alleviating fragmentation of habitat. Information gained through monitoring would inform the adaptive management process provided for in the mitigation plan.

The agencies' mitigation plan would require an Oversight Committee to establish a MOU that would define roles and responsibilities of members and the committee, whose primary function would be to oversee the 30-year grizzly bear management plan. The combination of the Oversight Committee and detailed management plan would coordinate and monitor the complex mitigations, habitat acquisition and easements, monitoring and reporting, use of new information, and other requirements to ensure conservation needs of grizzly bears are met. This would ensure full implementation of the mitigation plan, with adaptive management where needed, which would alleviate potential for fragmentation of the southern Cabinet Mountains as a result of the agencies' combined alternatives. The USFWS (2014) concluded for Alternative 3D-R the combination of the actions required in Alternative 3D-R and mitigation plan would eliminate the likelihood that the alternative would appreciably diminish survival and recovery of grizzly bears and would improve conditions over the long term over the existing conditions, ultimately promoting the recovery of the CYE grizzly bear population. As all of the agencies' combined action alternatives require the same actions and incorporate the same mitigation plan, with only slight differences in acreages of habitat compensation required, all of the agencies' mitigated action alternatives would have a similar effect. However, Alternative 3C-R and 4C-R would result in an increased potential for displacement and mortality risk to grizzly bears within core habitat. The other combined alternatives would not locate transmission lines within core habitat.

All operation plans and special use permits will reflect Forest grizzly bear objectives and contain appropriate clauses needed to meet the objectives….Provisions will include at least the following:

- *a. Food, garbage and human waste will be handled in a manner which minimizes or eliminates them as bear attractants.* See Objective 3 and discussions above.
- b. *Firearms and pets will not be allowed….*The action alternatives prohibit MMC employees from carrying firearms into permit areas. The agencies' alternatives not only prohibit MMC employees, but also contractors and subcontractors from carrying firearms within the permit area boundary, or along the Libby Creek access road, except for security officers and other designated personnel.
- c. *Temporary living facilities will be located away from known bear use areas, away from habitat components or not allowed…*With or without assistance from MMC, some temporary housing would be developed near the project site on private land. Temporary housing would not be permitted on National Forest System lands.
- d. *Development of new access incompatible with forest objectives will be discouraged…*New and temporary roads would be constructed for mine and facility development and transmission line construction. Those roads not used during operations would be gated or bermed. Development of access associated with the action alternatives would be compatible with forest objectives for mine development and managed to minimize effects to grizzly bears.
- e. *Periods of operations will be modified to eliminate or minimize conflict…*See discussion above under Timing Constraints.

State Requirements

Alternatives 3 and 4 would comply with the MMRA regarding disturbed lands being reclaimed to a post-mining land use with stability and utility comparable to that of the pre-mining landscape. Draft findings regarding compliance with MFSA requirements are discussed in the Summary, beginning on p. S-53.

Endangered Species Act. For all combined action alternatives, ESA compliance would be ensured through Section 7 consultation. The agencies' combined Alternative 3D-R is in compliance with the ESA. This statement is based on: 1) consultation with the USFWS is completed and a Biological Opinion has been issued (USFWS 2014a, 2014b) for Alternative 3D-R; and 2) Implementation of Alternative 3D-R would meet all terms and conditions established by the USFWS (2014a, 2014b). If the agencies selected any other combined action alternative, the KNF would request an opinion from the USFWS on whether formal consultation would need to be re-initiated regarding the selected alternative.

Statement of Findings

The No Action Alternatives (Alternative 1 and Alternative A) may affect, are not likely to adversely affect, the grizzly bear for the following reasons: 1) all existing habitat parameters would be maintained in the short term, including those that do not meet the individual BMU standard; 2) however, in the long term and in the time-frame specified by the Access Amendment, habitat parameters in the CYE BMUs would meet their individual BMU standards for OMRD, TMRD, and core.

Alternative 2B may affect, is likely to adversely affect, the grizzly bear for the following reasons:

- Alternative 2B would result in the physical removal of 2,598 acres of grizzly bear habitat for at least 35 years. Although the mitigation plan requires acquisition or purchase of conservation easement in perpetuity of mitigation lands for habitat physically lost due to mine development, no habitat compensation for long-term mine-associated displacement effects is proposed.
- Alternative 2B would not comply with the KFP as amended by the Access Amendment for the following reasons:
  - During construction and operations, Alternative 2B would cause additional decreases in core habitat in BMUs 5 and 6, where existing percent core habitat is worse than the standard. MMC road access mitigation would not offset effects to core prior to or concurrent with loss of core. Core would remain lower than the standard in both BMUs 5 and 6 for the life of the mine, and post-project core would return to existing conditions, with no trend toward meeting the standards. Implementation of habitat compensation mitigation would result in an improvement to the baseline parameters, including core, but this could not be calculated at this time, as previously described.
  - During construction, operations, and decommissioning, Alternative 2B would increase TMRD in BMU 6, where it is currently worse than the standard, and would not improve or trend TMRD toward meeting the standard after reclamation.
- In Alternative 2B, mine-related activities would occur continuously along the east Cabinet front during the grizzly bear spring use period (April 1 to June 15) throughout the life of the project. Alternative 2B would cause long-term disturbance in the upper Ramsey Creek and Libby Creek drainages, which are adjacent to or in proximity of the CMW and core grizzly bear habitat, and in the north-south movement corridor.

In its BA (KNF 2013b), the KNF determined that Alternative 3D-R may affect, is likely to adversely affect, the grizzly bear. The BA provides detailed information for this determination and is incorporated by reference. The KNF's determination for Alternative 3D-R, and the reasons supporting it, are applicable to the other agency alternatives, although the effects would differ. The KNF's basis for a determination of may affect, is likely to adversely affect, the grizzly bear for the agencies' mitigated combined alternatives is summarized as follows:

- If the agencies select any combined action alternative other than Alternative 3D-R, the KNF would request an opinion from the USFWS on whether formal consultation would need to be re-initiated regarding the selected alternative.

- In all agency combined alternatives, between 1,560 and 1,926 acres of grizzly bear habitat would be physically removed for at least 32 years.
- Currently, the CYRZ grizzly bear population is estimated to have a minimum population of 42 bears with a 64-percent probability of a downward population trend from 2006-2011 (Kasworm *et al.* 2013c). However, data from the previous 5 years indicates an improving trend (Ibid).
- Use of a helicopter could have displacement effects to any grizzly bears that may be in the zone of influence (USDA Forest Service and USFWS 2009).
- In all combined agencies' alternatives, mine-related activities would occur continuously along the east Cabinet front during the grizzly bear spring use period (April 1 to June 15) throughout the life of the project. Mine-related activities in Libby Creek would occur in proximity of the CMW and core grizzly bear habitat and would result in displacement effects in the north-south movement corridor. Habitat near the mine site, facilities, and roads, including spring habitat, may be underutilized by grizzly bears for the life of the mine.
- Increased traffic on the Bear Creek Road #278 access road could inhibit movement to lower elevation spring range to the east or toward linkage areas across US 2.
- The increased level of activity associated with the agencies combined action alternatives would result in a substantial increase in human activity over the existing conditions and could increase the risk of grizzly bear mortality within and adjacent to the Cabinet Yaak Ecosystem.

3.25.5.1 Canada Lynx

3.25.5.1.1 Summary of Conclusions

Implementation of Montanore Alternative 2B *may affect is likely to adversely affect*, the Canada lynx. Alternative 2B 1) would clear less than 1 percent of lynx habitat from the West Fisher Lynx Analysis Unit (LAU), but would remove 2 percent of lynx habitat within the Crazy 14504 LAU for the life of the mine (about 30 years, plus an additional 15 years or more until the stands became suitable for summer foraging habitat (early stand initiation) if reclamation was successful; and 2) would not comply or meet the intent of three applicable Northern Rocky Lynx Management Direction (NRLMD) Guidelines. Implementation of the agencies' mitigated combined action alternatives *may affect are not likely to adversely affect*, the Canada lynx. The agencies combined action alternatives would 1) remove less than 1 percent of lynx habitat from either the Crazy or West Fisher LAU; and 2) would meet all applicable NRLMD Objectives, Standards, and Guidelines. No effect to lynx critical habitat would occur with implementation of any of the action alternatives as the affected LAUs are not located within critical habitat.

3.25.5.1.2 Introduction

Canada lynx occupy northern boreal forests, which are primarily composed of cool, moist subalpine fir and Engelmann spruce and moist lodgepole pine forest that receive abundant snowfall. Snowshoe hares are the primary prey of lynx and habitat use by lynx is associated with those conditions that support hare populations. Therefore, young regenerating and mature multistory forest that provide habitat for snowshoe hares is important to lynx conservation. Especially important is winter habitat that continues to provide snowshoe hare forage and cover (twigs and stems that protrude above the snow or limbs that drop to the snow surface) during high snow periods. Denning habitat is found in forests with abundant dead and down trees, especially in areas near foraging habitat. Both natural (*e.g.*, fire) and human disturbances such as timber harvest and prescribed fires can affect lynx habitat (USDA Forest Service 2007a).

Although a variety of habitat and forest types may be found within a lynx's home range and used to some level (*e.g.*, matrix habitat for travelling between patches of boreal forest), in northwestern Montana lynx select forest stands with high horizontal cover primarily consisting of Engelmann spruce and subalpine fir. Both mature multistory and early successional forest habitats provide for snowshoe hares, but use by lynx varies seasonally in response to snowshoe hare availability. Mature multistory stands provide the greatest foraging opportunities for both hares and lynx during winter and management that maintains and promotes a mosaic of mature multistory spruce-fir forests is most beneficial to the species (Squires *et al.* 2010).

Canada lynx population ecology, biology, habitat description, and relationships are described in Ruggiero *et al.* (2000), Ruediger *et al.* (2000), and Interagency Lynx Biology Team (2013). Population and habitat status on a national scale is provided in the final lynx listing rule (USFWS 2000) and the most recent lynx distinct population segment is found in the Biological Opinion on the effects of the Northern Rocky Mountains Lynx Amendment (NRLMD) (USFWS 2007d). National population and habitat status descriptions in these documents are incorporated by reference.

3.25.5.1.3 Data Sources, Methods, Assumptions, Bounds of Analysis

National Forest System Lands

The USFWS listed the contiguous U.S. distinct population segment of the Canada lynx as threatened in 2000 (USFWS 2000). The Final EIS for the NRLMD was completed in 2007 with the ROD signed in 2007 (USDA Forest Service 2007a, 2007f). This decision amended the 1987 KFP by providing lynx habitat management Objectives, Standards, and Guidelines. The decision replaces the interim consideration of the Lynx Conservation Assessment and Strategy (LCAS) (Ruediger *et al.* 2000). The NRLMD contains direction related to vegetation, grazing, human uses, and linkage areas and applies to lynx habitat in LAUs in occupied habitat. There is direction on linkage areas in the NRLMD that may also contain areas outside of LAUs. This direction is used during project development to maintain lynx habitat across the KNF. The USFWS reviewed new information regarding Canada lynx that was published or made available since the NRLMD was completed and determined that it did not reveal effects that were not previously considered in the 2007 Biological Opinion on the NRLMD (USFWS 2013a) (Figure 95). The direction provided in the NRLMD is applied to lynx habitat at the LAU scale. The KNF has delineated 47 LAUs, which approximate a lynx home range size.

Lynx habitat was mapped for the KNF based on elevation, forest type and stand age data available in 2010. Based on knowledge of the area and lack of harvest and fire occurrences in the previous four years, designation of mapped habitat would not have changed for this analysis. This data source was used for the existing condition and analysis of effects to lynx habitat. In addition to lodgepole pine, Engelmann spruce, and subalpine fir forest types, mapping includes cedar-hemlock and other cool, moist forest types as they may provide lynx habitat (USDA Forest Service 2007a, 2007b). Successional or structural stage is based on year of origin and assumptions about the length of time it takes for a stand to move from one stage to the next. However, age does not account for environmental conditions or disturbance processes that affect development of the successional stage. For example, cold temperatures and short growing seasons at high-elevation sites may maintain a more early seral stage despite an old age and multiple years of origin. Also, natural disturbances such as fire and wind play an important role in the development of multistoried stands and, without disturbance stands may remain in a stem exclusion stage for a longer period than expected. Therefore, mapping of lynx habitat based on stand data provides a broad estimation of lynx habitat within a LAU and may be fine-tuned based on field review.

The direct and indirect effects analysis for Canada lynx on federal land follows the Objectives, Standards, and Guidelines established in the NRLMD and only those relevant to the proposed activities are analyzed in detail. Objectives, Standards, and Guidelines considered, but found "not applicable" are summarized under the "Effects Common to All Action Alternatives" section. Lynx habitat connectivity is provided by an adequate amount of vegetation cover arranged in a way that allows lynx movement. Connectivity was evaluated by visually examining mapped lynx habitat and past management activities to determine possible movement areas and potential areas where lynx travel may be hindered. Ridgelines and draws were considered high-value movement areas.

Based on the NRLMD, the analysis area for analyzing and monitoring project effects (direct, indirect, and cumulative) to lynx habitat is the affected LAUs. As described in the LCAS (Ruediger *et al.* 2000), the LAU is an appropriate scale for analysis because: 1) the LAU approximates the size of a home range of a female lynx, 2) maintaining habitat conditions at the scale of a lynx home range will allow for good distribution of lynx habitat components, and 3) expanding the analysis area could dilute the effects of the proposed activities. In addition, the boundaries of a LAU remain constant and therefore provide for monitoring of and compliance with the Objectives, Standards, and Guidelines of the NRLMD. The action area (as defined under the ESA), or project area considered for the lynx analysis are located within the West Fisher (14503), Crazy (14504), and Rock (14702) LAUs (Figure 95). The directly affected Crazy LAU (mine-related facilities and transmission line), Silverfish LAU (transmission line), and Rock LAU (Rock Lake Ventilation Adit only) have records of lynx occurrence, and have ample lynx habitat remaining for lynx use during and post-project implementation. The action alternatives' mine-related facilities are largely concentrated in or adjacent to low-elevation non-habitat areas that are roaded in the existing condition; however, lynx habitat (early stand initiation, stand initiation, and multistory forage) (Table 243) would be removed by the mine plant site and related facilities, the tailings impoundment, associated new road construction or road reconstruction, and certain components of the transmission line (*e.g.,* pole footprints). The remaining components of the transmission line and associated temporary road construction in the Crazy and Silverfish LAUs would affect lynx habitat, but some vegetation would remain or recover during the Operations Phase and movement across the landscape would not be adversely affected. A wide variety of lynx habitat occurring across the landscape would remain available within all three LAUs for lynx to use during project implementation and post-project based on current conditions. Therefore, the Crazy, Silverfish, and Rock LAUs have been chosen as the appropriate scale of analysis for determining direct, indirect, and cumulative effects for the Montanore Project. Indirect and cumulative effects not only consider the directly affected LAUs, but also consider adjacent LAUs (for effects on habitat connectivity) and potential movement corridors or linkage areas outside of the LAUs. As required in 36 CFR 220.4.(f) the analysis considers the present effects of past activities. These effects are reflected in the existing condition provided for each LAU and include the effects of past road building and vegetation changes due to either natural or management activities. In addition, the analysis considers the temporal effects of the activities, that is how long would the effects of the action last. For the lynx analysis, temporal effects were considered to be short-term (2 to 5 years) or long-term (lasting for life of the mine (30 years) or longer (see descriptions provided in section 3.25.1, *Introduction* (p 1000. These descriptions of short-term and long-term effects are not consistent with the definitions provided in section 3.1.1, Direct, Indirect, and Cumulative Effects (p. 267), but they are appropriate for analysis of most wildlife species, including the threatened lynx. Most female lynx reach reproductive maturity at 22 months, with reproductive rates and survival of kittens tied to prey availability (Ruggiero *et al*. 1994). At southern latitudes, where hare densities are typically low (Dolbeer and Clark 1975), older age individuals appear to predominate in lynx populations. Harvest records from Washington from 1976-1981 showed an average age of 4.5 years for 14 lynx harvested (Ruggiero *et al*. 1994). A 16-year old lynx killed by a mountain lion was the longest-lived wild lynx every identified (Foresman 2012). Temporal effects also were used to determine what, if any, reasonably foreseeable activities overlap the activities, the project (geographic) area that could cause cumulative effects. Lynx occurrence data comes from KNF historical records (NRIS Wildlife), and other agencies (MNHP, FWP, and USFWS). The effects analysis also includes an evaluation of the effectiveness of the mitigation plans applicable to each action alternative.

Analysis Methods on Private and State Lands

The NRLMD management direction only applies to federal lands within a LAU; however, for LAUs that include non-federal lands (private or State), the acreage of non-federal land in a stand initiation structural stage is considered when the LAU is evaluated for compliance with the NRLMD standard VEG S1 (see “Affected Environment” section below). This was considered in the evaluation of existing conditions for the affected LAUs.

Outside of the LAU, to evaluate potential direct, indirect, and cumulative impacts of the transmission line and Sedlak Park Substation on lynx on private and State lands as required by the DEQ for MMC’s MFSA and MEPA evaluation, the MFSA analysis area includes all additional non-National Forest System land within a corridor 1 mile on each side of the alternative transmission line alignments. The 1-mile buffer around the transmission line (in which the Sedlak Park Substation would be located), was guided by DEQ circular 2, Section 3.7 Baseline Data and Impact Assessment Requirements for Electric Transmission Lines, item 12(a). To determine the adequate size of an analysis area to measure potential displacement effects from the transmission line on private lands, the 1-mile zone of influence for aircraft as determined by the Cumulative Effects Analysis Process for the Selkirk/Cabinet-Yaak grizzly bear ecosystems (USDA Forest Service *et al.* 1988; USDA Forest Service *et al.* 1990) was considered sufficient to measure potential disturbance to other wildlife species less sensitive to human activity than the grizzly bear.

Impacts to lynx on private lands from the transmission line alternatives were evaluated qualitatively, based on KNF lynx habitat mapping for potentially affected LAUs; mapping of broad vegetation types within the vegetation analysis area, which includes all lands, including private lands outside a LAU, that would be disturbed by facility construction under any alternative; tracking surveys; hair sample analyses conducted by Western Resource Development (1989f) and FWP; and predicted changes in habitat and disturbance resulting from the proposed mine and transmission line alternatives.

The DNRC developed a voluntary State HCP for forest management activities with technical assistance from the USFWS. The State HCP identified two lynx habitat areas: 1) lynx habitat within the HCP project area and 2) Lynx Management Areas (LMAs), which are specific subsets of lands encompassing select portions of the HCP project area where resident lynx populations are known to occur or where there is a high probability of periodic lynx occupancy over time. No

LMAs were identified in the Cabinet Mountains or near the DNRC Libby Unit. The State HCP identified the Libby Unit, which includes the two State trust sections within the Crazy and Silverfish PSUs as located within the general distribution area for lynx (DNRC 2011, Appendix C, Figure C-17). Not all State trust land located within this overall distribution area are included within the HCP or are managed for lynx habitat (DNRC 2011, Appendix C, Figure C-26). The two State trust sections located in the Montanore analysis area of the Crazy and Silverfish PSUs are included in the HCP, and the DNRC mapped lynx habitat. according to protocol established in the HCP. DNRC provided the KNF with ArcGIS layers identifying lynx habitat on State trust lands within the Libby Unit and this data source was used in the analysis of effects to lynx. The State HCP covers forest management activities including timber harvest and associated activities, road construction and maintenance, and forest grazing. Construction and operations of the proposed mine and transmission line action alternatives are not covered activities under the State HCP. For this analysis, which will fulfill both the MEPA and NEPA requirements of the agencies, proposed activities on State trust land will be evaluated on the effects to lynx and lynx habitat and mitigations will be applied consistent with those for affected federal land. Measurement criteria will be the potential for disturbance to lynx and effects to lynx habitat, including coarse woody debris, winter and summer foraging habitat, and habitat suitability and connectivity.

Differences in lynx habitat mapping occur between the KNF and DNRC. For DNRC units west of the Continental Divide, preferred habitat types, as defined by the HCP, were used as the primary indicators of potential lynx habitat regardless of elevation or average snow depth. The KNF considered both elevation and average snow depth in addition to preferred habitat types in delineating lynx LAUs and in mapping lynx habitat components.

General Analysis Methods

Disturbance area boundaries for mine facilities and impoundment areas are specific to each alternative. To assess direct effects on surface resources, including lynx habitat, the disturbance area boundaries were based on the maximum “worst-case-scenario” amount of actual ground disturbance, even if no proposed activities were currently planned, and were determined by the lead agencies (see section 2.4.1.1, *Permit and Disturbance Areas*). This would allow MMC to construct additional temporary and seasonal roads and other facilities within these disturbance boundaries as needed. Roads associated with the mines and facilities were buffered at a 100-foot width total for new roads, or 67-foot width for existing road reconstruction.

For the analysis, the agencies assumed the clearing or disturbance widths for the transmission line analysis direct effects on vegetation, including lynx habitat, were 150 feet for Alternative B and 200 feet for Alternatives C-R, D-R, and E-R. However, actual on the ground effects to lynx are discussed. Within the rights-of-way where vegetation would be cleared, the right-of-way width for Alternative B would be 100 feet, and the right-of-way width for the agencies’ alternatives would be 150 feet. Outside of the right of way right-of-way width, only danger trees would be removed as necessary, which would retain low-growing trees and shrubs therefore providing more cover. For roads associated with the transmission line, a 25-foot width was used for temporary access roads or upgraded existing roads.

3.25.5.1.4 Affected Environment

Crazy, West Fisher, and Rock LAUs

Current conditions in the West Fisher (14511), Crazy (14504), and Rock (14702) LAUs meet the NRLMD standards based on 2010 data for the LAUs (Table 243 and Project record). Effects of natural vegetation succession and of more recent vegetation management and other activities between 2010 and 2012 were also considered. On federal land, little to no activity has occurred on the ground in these LAUs since 2010. Private property, including corporate timberland, located within all three LAUs is considered with respect to connectivity and movement concerns both inside and outside the LAUs. Adjacent LAUs are also considered with respect to connectivity and movement of lynx, including the Treasure 14505 LAU to the north, Bull 14701 LAU to the west of the Crazy LAU, and the Silver Butte 14502 LAU to the south of both the West Fisher and Rock LAUs.

The higher elevations within the Crazy, West Fisher, and Rock LAUs are located within the CMW where steep topography dominates. Approximately 10,084 acres of the Crazy LAU, 4,712 acres of the West Fisher LAU, and 13,413 acres of the Rock LAU are located within the CMW. Using information from the timber stand database, lynx habitat within the wilderness boundary is largely comprised of travel habitat (also known as matrix habitat) widely interspersed with stands of multistory forage. Based on aerial photo interpretation, some areas identified as part of multistory lynx habitat have large inclusions of sparse herb to shrub-dominated communities unsuitable for lynx winter foraging habitat. Vegetation within the CMW was influenced by the large-scale 1910 fires, and provides natural vegetative conditions and connectivity within and between LAUs that straddle the Cabinet Mountains. Wildfire in the CMW was the primary disturbance factor to result in structural changes within lynx habitat by reducing timber overstory and resulting in a variety of age classes and species diversity. The most recent large-scale fires occurred between 1885 and 1939, with the 1910 fires affecting the largest area. Within the last 15 years, fires occurred on the south-facing slopes in Leigh Creek and Big Cherry Creek in the Crazy LAU. Forested habitats that experienced stand-replacing fire would be in the stand initiation structural stage and would soon become snowshoe hare winter foraging habitat. In areas where fire severity was low to mixed-severity, smaller patches of early successional vegetative stages would result. In contrast, fire suppression since the early 1900s has altered stand structure, resulting in more homogenous stands with greater canopy closure and poorly developed understories in some areas, which in turn reduced snowshoe hare habitat and lynx foraging opportunities.

Outside of the wilderness boundary, vegetation management has occurred within the LAUs on both federal and private lands. At lower elevations on roaded lands, timber production has occurred, utilizing a number of silvicultural treatments including regeneration harvest, commercial thinning, and salvage harvest. Harvest activities within the database indicate that timber harvest began in the 1950s and has continued to present. Within the West Fisher LAU, regeneration harvest has occurred on 2,617 acres of National Forest System land while 1,641 acres of private land has been harvested. Within the Crazy LAU, regeneration harvest has occurred on 2,011 acres of National Forest System land and on about 51 acres of private land. Not all of this activity occurred within lynx habitat. Within the Rock LAU, about 190 acres of regeneration harvest has occurred on National Forest System land (with 48 acres now multistory forage, 49 acres in stand initiation stage with 79 acres occurring in non-habitat matrix, and 14 acres in non-habitat low-elevation habitat).

Past harvest has provided a variety of age classes and successional stages in areas of the LAUs outside of the wilderness boundary. The majority of the harvest has occurred at lower elevations due to access and topographical limitations. Regeneration harvest in lynx habitat resulted in vegetation structural changes that influenced lynx, lynx habitat, and travel habitat. Immediately following regeneration for about 15 years, stands would have become temporarily unsuitable for lynx as the vegetative structural composition of the stand would not have provided winter forage habitat for snowshoe hares. Conditions on the KNF indicate that winter snowshoe hare foraging opportunities are met after about 15 years and occur within age classes of 16 to 50 years old.

Boreal forest landscapes are naturally in a state of change, through disturbance and succession processes, and result in a changing environment of habitat types, distribution, and juxtaposition (USFWS 2013b). As such, not all potential lynx habitat acres provide suitable habitat all of the time and there may naturally be periods with low levels of suitable habitat. This variability of habitat suitability and distribution is reflected in habitat mapping done on lynx habitat to estimate historical range of lynx habitat levels, current levels on the KNF, and projected future levels under different management scenarios (Ecosystems Research Group 2012). Historically, the KNF provided 69,681 acres to 278,725 acres of multistoried suitable lynx habitat (Ibid). Currently the KNF has 149,781 acres of suitable lynx habitat, which falls within the historic range of variation (Ibid).

The NRLMD requires that no additional regeneration harvest is allowed if more than 30 percent of lynx habitat in a LAU is in a stand initiation structural stage that does not provide winter snowshoe hare habitat, except for fuel treatments in the wildland urban interface. Although the management direction would apply only to federal lands, the 30 percent takes any private land into account if that private land is within a LAU. No LAU on the KNF, including the directly affected West Fisher, Crazy, and Rock LAUs, exceed the 30-percent stand initiation structural stage (Table 243).

Under the NRLMD, no more than 15 percent of lynx habitat on National Forest System lands in a LAU may be changed by regeneration harvest in a 10-year period. Percent is the percent of total LAU acres that provide lynx habitat. The KNF has regenerated less than 15 percent of any LAU over the past 10 years. No LAU should have more than two adjacent LAUs that exceed 30 percent. No LAUs on the KNF, including the directly affected West Fisher, Crazy, and Rock LAUs, have any adjacent LAUs that exceed 30 percent.

Lynx habitat and travel (or matrix) habitat in the directly affected West Fisher, Crazy, and Rock LAUs were assessed for all ownerships in terms consistent with the NRLMD; both private and National Forest System lands are found within the affected LAUs. All lynx habitat components are represented and dispersed throughout the LAUs (Figure 95), and all three LAUs are consistent with the NRLMD.

Table 243. Existing Lynx Habitat in Analysis Area.

Lynx Habitat Component	14503-West Fisher LAU				14504-Crazy LAU				14702-Rock LAU			
	NFS Lands		Private/ State		NFS Lands		Private/ State		NFS Lands		Private/State	
	(ac.)	%	(ac.)	%	(ac.)	%	(ac.)	%	(ac.)	%	(ac.)	%
Early stand initiation structural stage – all lands unsuitable for SSH[3] VEG S1	0	0	0	0	81	<1	0	0	0	0	1	<1
Number of adjacent LAUs that exceed 30% lynx habitat in an early stand initiation structural stage[3] VEG S1	0	0	0	0	0	0	0	0	0	0	0	0
Stand initiation structural stage suitable for SSH[4]	337	3	0	0	3,009	13	0	0	364	2	0	0
Habitat changed to early stand initiation structural stage on NFS lands over the past 10 years by timber management with regeneration harvest[5] VEGS2	0	0	0	0	0	0	0	0	0	0	0	0
Multistory mature - late successional forest[6] VEG S6	10,940	89	354	100	18,434	82	140	82	20,893	93	46	100
Other (non-forage stem exclusion)[7]	970	8	0	0	1,033	5	31	<1	1,254	5	0	0
Total Lynx Habitat Acres[2]	**12,247**	**41**	**354**	**11**	**22,557**	**44**	**171**	**1**	**22,511**	**54**	**47**	**<1**
Non-habitat low elevation	6,234	21	2,163	65	7,824	15	805	67	1,845	4	7	<1
Travel (matrix) habitat[1]	11,215	38	806	24	21,076	41	219	18	17,597	42	40	4
No data	0	0	0	0	0	0	0	0	0	0	877	0
Total	**29,696**	**90**	**3,323**	**10**	**51,457**	**98**	**1,195**	**2**	**41,972**	**98**	**971**	**2**
Total LAU	33,019				52,652				42,943			

Snowshoe Hare – SSH, NFS – National Forest System.
[1] Travel (or matrix) habitat (*e.g.*, hardwood forest, dry forest, non-forest, or other habitat types that do not support SSH) that occurs between patches of boreal forest in close juxtaposition (at the scale of a lynx home range) such that lynx are likely to travel through such habitat while accessing patches of boreal forest within a home range.
[2] Lynx habitat: Acres do not include "travel\matrix" or low-elevation stands (considered unsuitable SSH habitat, but suitable for lynx habitat connectivity); travel and low-elevation habitat comprises the remaining suitable plus unsuitable habitat. Unsuitable habitat is habitat that currently does not provide sufficient vegetation quantity or quality to be used by SSH.
[3] Early stand initiation stage: These acres are lynx habitat that currently do not provide sufficient vegetation quantity or quality (height) to be used by SSH and lynx in winter. The NRLMD standard VEG S1 states no additional regeneration harvest is allowed if more than 30 percent of lynx habitat in a LAU is in a stand initiation structural stage (*i.e.*, early stand initiation stage) that does not provide winter SSH habitat, except for limited fuel treatments in the wildland urban interface.
[4] Stand initiation structural stage currently suitable SSH winter habitat.
[5] Portion of total LAU acres that provide lynx habitat (suitable + unsuitable acres). The NRLMD standard VEG S2 states no more than 15 percent of lynx habitat on National Forest System lands in a LAU may be changed by regeneration harvest in a 10-year period.
[6] Multistory mature late successional stages with multiple age classes and structural components that provide winter SSH habitat. Standard VEG S6 states no vegetation management projects that reduce SSH habitat in multistory mature or late successional forests, with exceptions for infrastructure, research, and incidental removal.
[7] Other, including stem exclusion, currently unsuitable structural stages that currently do not provide SSH winter habitat NRLMD (USFWS 2007d).

In addition to lynx habitat mapped by the KNF within the Crazy and Silverfish LAUs, the State mapped lynx on State land included in the State HCP (Table 244). As described in the analysis methods, the DNRC State sections affected by proposed activities and located within the Crazy and Silverfish Planning Subunits were considered.

Table 244. Lynx Habitat on State Lands within the Crazy and Silverfish Planning Subunits.

State HCP Mapped Lynx Habitat	Section 16 T28N, R30W	Section 36 T27N, R30W	
Size (acres)	600	640	
Elevation (feet)	<4,000	<4,000	>4,000
Not Mapped as Lynx Habitat (acres)	104	322	138 [1]
Winter Forage (acres)	364	94 [2]	0
Summer Forage (acres)	14	18	0
Temporary Non-suitable (acres)	17	69	0
Other Suitable (acres)	101	0	0

[1] These 138 acres are also located within the West Fisher LAU and mapped at a landscape scale by the KNF as either low-elevation non-habitat or travel habitat.
[2] 45 acres of this 94-acre total is mapped by the KNF within the West Fisher LAU as travel habitat (44 acres) or low-elevation non-habitat (1 acre), with the remaining located <4,000 feet in elevation and outside of the LAU.

Studies in Montana indicated that lynx depended almost exclusively on snowshoe hares during winter (Squires and Ruggiero 2007). Other prey species include red squirrel, northern flying squirrel, grouse, marten, voles, and occasionally small birds. Red squirrels were the second most common prey, but they only provided 2 percent biomass to the winter diet (Ibid). Data indicate red squirrel abundance was not a factor in lynx habitat selection, lynx foraging and habitat selection was strongly driven by the abundance of snowshoe hares, and red squirrels were only killed opportunistically (Squires and Ruggiero 2007).

In western Montana, the red squirrel is most common in montane (yellow or ponderosa pine and Douglas fir) and subalpine (subalpine fir and Engelmann spruce). Red squirrels den in old woodpecker holes, tree hollows, and other small crevices (MNHP 2014). Red squirrels are often associated with large live and dead trees, down woody debris, and overstory and understory diversity (Holloway and Malcolm 2006; Russell *et al.* 2010). As described in section 3.25.2.2, *Snags and Woody Debris*, existing levels of down wood in surveyed stands are sufficient and are better than KNF-recommended levels. Levels of down wood in untreated stands would be at levels appropriate or higher, due to fire suppression, for the specific vegetation type. Red squirrel habitat could occur within old growth or replacement old growth forest. As described in section 3.22.2, *Old Growth Ecosystems*, old growth in the Crazy and Silverfish PSUs, which overlap to a great extent the West Fisher and Crazy LAUs, currently meet or are better than KNF standards, and habitat for red squirrels is available throughout the affected LAUs.

Summer foraging habitat (also good summer hare habitat) consists of early successional stages of dense, young (about 15- to 30-year-old) forests. Because of this short time frame (about 15 years), it is not long before the forest grows into a structure that does not provide good foraging for lynx. A regular influx of early successional vegetation is important to maintain a level of summer foraging habitat through time. This can be created by any disturbance process, such as fire, windthrow, or vegetation management activities. Generally, maintaining no more than 30 percent of a lynx home range in early succession habitat is considered good for lynx management.

Denning habitat generally consists of mature stands of spruce, subalpine fir, lodgepole pine, cedar, or hemlock forest with a complex structure of large down trees to provide cover for lynx kittens. In Montana, abundant woody debris from piled logs was the dominant habitat feature at den sites. Lynx generally denned in mature spruce-fir forests with high horizontal cover and abundant coarse woody debris (Squires *et al*. 2008). Eighty percent of dens was in mature forest stands and 13 percent was in mid-seral regenerating stands, while young regenerating (5 percent) and thinned (either naturally sparse or mechanically thinned) stands with discontinuous canopies (2 percent) were seldom used (Ibid). Lynx with kittens need well-distributed patches of denning habitat throughout their home range. Denning habitat is abundant on the KNF and is not limiting (Squires, pers. comm. September 6, 2012).

Landscape-scale connectivity, which allows animals to move within ecosystems and provides for genetic exchange with outside populations, is a crucial component of carnivore recovery and conservation. The primary causes of wildlife habitat fragmentation are human activities such as road building, and residential, recreational, and commercial developments. When these developments reach a certain concentration, they become impermeable and are termed “habitat fracture zones” (Servheen *et al.* 2003). Transportation corridors characterized by high road densities and substantial vehicle traffic can result in “fracture zones” that increase risk of mortality and impede natural patterns of animal movement (Long *et al.* 2010). There is direction on linkage areas in the NRLMD that may also contain areas outside of LAUs. This direction is used during project development to maintain lynx habitat across the KNF. Broad-scale lynx linkage areas have been identified (Claar *et al.* 2004; USDA Forest Service 2007a) and are intended to assist in land use planning to maintain connectivity and allow for movement of animals between blocks of habitat that are otherwise separated by intervening non-habitat areas such as basins, valleys, and agricultural lands, or where habitat naturally narrows due to topographic features. Seven identified linkage areas (Claar *et al.* 2003; USDA Forest Service 2007a; KNF Lynx Taskforce 1997) for lynx on the KNF. Four of these seven linkage areas cross private lands between parcels of KNF lands, while two cross the Kootenai River or Lake Koocanusa. The remaining linkage area lies within the KNF along the Cabinet Mountains. Six of the seven linkage areas cross non-lynx habitat at lower elevations between LAUs, while the linkage area in the Cabinet Mountains is located within LAUs (including Silver Butte, West Fisher, and Rock) at higher elevations (including Silver Butte, West Fisher, and Rock) (see map of linkage areas in NRLMD, USDA Forest Service 2007a, Figure 1-1). Maintaining connectivity or “linkage” between wildlife populations across the landscape could reduce or prevent the negative consequences of habitat fragmentation (Servheen *et al.* 2003). For lynx in Montana at the southern periphery of the species’ range, maintaining connectivity with source populations to the north in Canada is especially important (Squires *et al.* 2013). Squires *et al.* (2013) found that connectivity between lynx habitat in Canada and that in the conterminous U.S. is facilitated by only a few presumed corridors that extend south from the international border, and maintaining the integrity of these connectivity corridors is of primary importance to lynx conservation in the Northern Rockies. These corridors identified by Squires *et al.* (2013) are not located near or within the south Cabinet Mountains.

Connectivity between more extensive areas of lynx habitat may be provided by narrow forested mountain ridges, shrub-steppe plateaus, wooded riparian communities, or lower elevation ponderosa pine woodlands between high-elevation spruce-fir forests (Ruediger *et al.* 2000). Within the West Fisher and Crazy LAUs, and within the adjacent LAUs, a large tract of lynx habitat occurs along the CMW. The CMW (94,272 acres) is about 34 miles long and varies in width from 7 miles to about 0.5 mile near the upper headwaters of Libby Creek in the Crazy LAU. The CMW forms the central section of a potential north-south movement corridor for large carnivores. Lynx habitat and travel habitat providing movement corridors and habitat connectivity (juxtaposed between rock and talus cliffs at high elevations in the CMW) within and adjacent to this corridor appear more than adequate to support movement and dispersal of lynx.

Additional general wildlife linkage areas or approach zones, collectively described below as the US 2 linkage zone, have been identified, which overlap and are adjacent to the directly affected LAUs. Specifically these approach areas include the US 2 – Horse Mountain/Teepee Lake approach zone, which overlaps the south end of the Crazy LAU along the eastern edge, and the US 2 – Barren Peak/Hunter Creek approach zone, which overlaps portions of the eastern edge of the West Fisher LAU. These approach zones within the US 2 linkage area are described in detail below under the *Affected Environment*, *Private, State, and National Forest System Land Outside of the LAU*.

Lynx are generally tolerant of human activity (Ruediger *et al.* 2000), although it cannot be completely ruled out that in a few instances human activity could create a large enough disturbance that individual lynx may be temporarily displaced away from the activity. The effects of human activities on lynx activity patterns and energetics are unknown (Ruediger *et al.* 2000). Research on the effects of roads and trails on lynx is inconclusive, although limited information suggests that lynx do not avoid roads (McKelvey *et al.* 2000) except at high traffic volume (Apps 2000). Research by Alexander *et al*. (2005) evaluated whether traffic volume significantly reduced wildlife movement rates (or habitat permeability or road crossings). Alexander *et al*. (2005) identified winter average daily traffic on four highways (three paved two-lane highways and a graveled road) and recorded movement of ungulates and carnivores across the roads utilizing winter track surveys. Carnivores monitored included coyote, wolf, cougar, lynx, marten, and wolverine, and data indicated average daily traffic volume between 300 and 500 vehicles per day may be the threshold above which successful crossings by these carnivores are impeded (Ibid).

Plowing roads or using over-snow motorized vehicles that compacts snow can allow competing predators (*e.g.*, coyotes) into lynx habitat during the winter and was once thought to have an effect on lynx (Ruediger *et al.* 2000). However, Kolbe *et al.* (2007) found that compacted trails from over-snow motorized vehicles in their study area (western Montana) had only minimal impacts on coyote movements and foraging success. The results of the Kolbe *et al.* (2007) study and the effects of snow compaction on lynx were discussed in the NRLMD Biological Opinion (p. 53-55 in USFWS 2007d). On p. 55 in the Biological Opinion for the NRLMD it states, “The best information available has not indicated that compacted snow routes increase competition from other species to levels that adversely impact lynx populations, and under the [NRLMD], the amount of areas affected by snow compacted routes within the NRLMD would not substantially increase.” Open roads occur throughout the West Fisher and Crazy LAUs; existing roads most relevant to the Montanore Project include those in major drainages such as Poorman Creek, Ramsey Creek, Libby Creek, as well as the Bear Creek Road (NFS road #278) and Libby Creek Road (NFS road #231). Roads in the Ramsey Creek, Poorman Creek, and uppermost Libby Creek drainages are currently closed to motorized traffic except winter snowmobile traffic. The current status of roads potentially affected by the Montanore Project is described in Chapter 2.

As of 2008, the KNF authorized MMC for snowplowing on NFS roads #231 and #2316 for access to the Libby Adit for maintenance. As part of this authorization, the KNF implemented seasonal restrictions on these two roads from April 1 to May 15 when only mine traffic is allowed access behind the gate. This restriction was implemented to reduce displacement and mortality risk to grizzly bears on spring range, but it may provide some benefit to lynx. Most of this activity occurs in low-elevation non-habitat within the Crazy (14504) LAU.

Snowmobile activity and the related snow compaction also occur within the Crazy (14504) and West Fisher (14503) LAUs. With the advancement in snowmobiles and increase in winter recreation on the KNF, snowmobile use has increased throughout lynx habitat. Most winter use occurs on roads open to snowmobile use and free of vegetation protruding above the snow. Popular snowmobile routes include the main access roads for Libby Creek – Howard Lake – Miller Creek and the West Fisher Creek. No trails are groomed in the Crazy and West Fisher LAUs.

A large portion of the KNF LAUs are also within the recovery zones for grizzly bear on the KNF (62 percent of the total KNF LAU acreage is within a BMU, with 87 percent of the total KNF LAU acreage within a BMU or a BORZ polygon. Of the directly affected LAUs, about 30,772 or 93 percent of 14503 West Fisher LAU, 43,160 acres or 82 percent of 14504 Crazy LAU, and 29,200 acres or 68 percent of 14702 Rock LAU are within the CYRZ. In addition, about 1,980 acres (6 percent) of LAU 14503 and 9,420 acres (19 percent) of LAU 14504 are within the Cabinet Face BORZ. Canada lynx are afforded the security provided for bears in these areas. Security for bears is maintained by controlling and managing access and this maintains or improves Canada lynx use by reducing the risk of displacement and poaching. Currently wheeled motorized vehicle access management strategies for grizzly bear have been analyzed (USDA 2011a, 2011b). With implementation of the Access Amendment, there will be lower levels of wheeled motorized vehicle access and an increase in the amount of core (secure) habitat, which in turn would potentially provide higher levels of security for lynx. Many roads restricted to create core, however, allow snowmobile access during the winter.

Exact lynx population numbers are unknown for the KNF, although the population seems to be doing well in the Purcell Mountains (*e.g.,* small home ranges, higher survival rate, and more kittens compared to the rest of the continental U.S.) (Squires, pers. comm. September 6, 2012). From 1999 through 2006, lynx reproduction was documented at 57 dens of 19 female lynx in Seeley Lake, the Garnet Range, and the Purcell Mountains (Squires *et al*. 2008). Lynx are known to occur throughout the KNF, based on historical and recent trapping records. Research has been conducted throughout the region, including the KNF (Squires *et al*. 2013) to capture and radio collar lynx in the Purcell Mountains. From 2003 to 2005, 25 individual lynx were captured and collared. Stands with abundant horizontal cover are common in the area of the KNF where lynx and snowshoe hare are most abundant (north of the town of Libby and west of Koocanusa Reservoir and east of Pete Creek in the Yaak) in the Purcell Mountains (Squires, pers. comm. 2012).

Lynx rarely use, or are considered absent from the Cabinets Mountains (south of Libby) and West Cabinets (Squires, pers. comm. 2012; Squires 2010). The reason is unknown, but limiting factors for lynx habitat present (*e.g.,* spruce-fir forests and high horizontal cover) in the Cabinet Mountains may be the steep topographical roughness and/or unfavorable Pacific Maritime climatic conditions resulting in unsuitable snow characteristics (Squires, pers. comm. 2012). Squires *et al*. 2013 specifically described the distribution of lynx in Montana based on 81,523 telemetry points from resident lynx from 1998-2007. Lynx are primarily restricted to northwestern Montana from the Purcell Mountains (on the KNF this area is described previously) as north of the town of Libby, west of Koocanusa Reservoir, and east of Pete Creek in the Yaak east to Glacier Park, then south through the Bob Marshall Wilderness Complex to MT 200 (Squires, pers. comm. 2012; Squires 2010). The southernmost lynx population in Montana is currently in the Garnet Range, except for a few individuals in the Greater Yellowstone Area (Ibid).

Most historical (before 1997) observations of lynx or their signs in the West Fisher LAU were in the Lake Creek or West Fisher Creek drainages, although three observations were recorded near Miller Creek. At least 20 lynx observations have been recorded in the Crazy LAU, near Howard Lake, and in most of the major drainages including Libby, Ramsey, and Poorman creeks, with many of the records in the low-elevation non-habitat (where more gentle rolling topography exists). Most records of lynx in the West Fisher and Crazy LAUs are from 1985 through 1995, and none have been recorded since 1997. In the West Cabinet Mountains in Idaho, in January 2014, a female lynx was caught by trappers, and subsequently collared by Idaho Fish and Game. Table 243 displays the current lynx habitat conditions in the directly affected LAUs.

Private Land

Private lands within or near the alternative transmission line corridors and located in the West Fisher LAU or Crazy LAU are mapped by the KNF as either low-elevation non-habitat or travel habitat. This includes a parcel of Plum Creek land along West Fisher Creek, a parcel of private land at the confluence of Libby and Howard creeks mapped as non-habitat, and a narrow parcel of private land southeast of Howard Lake as travel habitat. This narrow parcel, consisting of a lodgepole forest type, has been subdivided, logged, and has three developed home sites.

Other private land within the West Fisher and Crazy LAUs, mapped by the KNF using the best vegetation data available, are a mixture of low-elevation non-habitat, travel habitat, or multistory mature late successional habitat.

Outside of the LAUs, private land is not mapped as lynx habitat under the NRLMD. Although lynx may travel outside LAU boundaries, private and National Forest System land outside of the West Fisher and Crazy LAUs have low potential for lynx due to elevation range (below 4,000 feet) and subsequent poor snow conditions, previous timber harvest and commercial thinning practices, and high road densities.

State Land

The two State parcels and the HCP mapped habitat within these sections are displayed in Table 244. One parcel (section 36 T27N, R30W) is partially located within the KNF West Fisher LAU. The DNRC mapped the portion of section 36 within the West Fisher LAU as either winter forage or non-habitat, and mapped the portion of section 36 outside the West Fisher LAU as temporary unsuitable habitat, winter foraging habitat, summer foraging, or non-habitat. The state parcel (section 16 T28N, R30W) is adjacent to the lower elevational limit of the Crazy LAU, with approximately 7 acres overlapping the LAU. These 7 acres were mapped as winter forage by the HCP.

Private, State, and National Forest System Land Outside of the LAU

The KNF has identified three approach areas for crossing the US 2 fracture zone in the general vicinity of the Montanore Project area (Brundin and Johnson 2008). Servheen *et al.* (2003), using a Linkage Zone Prediction model, found linkage areas were scattered but allowed numerous crossing opportunities west of Marion along the US 2 fracture zone. As development again became more concentrated approaching the community of Libby, small scattered crossing opportunities existed until just north of Poker Hill. Approximately 4 miles south of Poker Hill the US 2 – Horse Mountain/Teepee Lake approach area (Brundin and Johnson 2008) is adjacent to and overlaps the eastern edge of the Crazy 14504 LAU in the Horse Mountain area. The most southern approach area identified, the US 2 – Barren Peak/Hunter Creek (Ibid), extends from the Miller Creek area southward toward the Jumbo Peak and Fosseum Mountain Area, and overlaps the eastern edge of the West Fisher 14503 LAU. The Barren Peak/Hunter Creek and most of the Horse Mountain/Teepee Lake approach areas are located within the larger landscape scale Lost Trail – Kenelty linkage area identified by American Wildlands (2008), a regional non-profit organization. The Lost Trail – Kenelty linkage area was identified as an important movement area connecting lynx habitat across the KNF (Ibid). This general area is considered an important wildlife corridor for many species, including grizzly bear, black bear, lynx, wolverine, white-tailed deer, mule deer, elk, moose, gray wolf, coyote, mountain lion, and a variety of smaller animals (KNF Lynx Taskforce 1997; Ruediger *et al.* 2001; American Wildlands 2008; Brundin and Johnson 2008). Servheen *et al*. (2003) examined grizzly bear habitat linkage between the Cabinet-Yaak and the Northern Continental Divide ecosystems and identified more site-specific linkage areas consisting of small scattered crossings between Libby and Sedlak Park. These areas would likely also serve as areas of movement suitable for lynx. Lynx are highly mobile, have relatively large average home ranges, and are capable of moving long distances to find abundant prey (68 FR 40076-40101, July 3, 2003, p. 40083). For the FEIS analysis, the linkage areas described by Servheen *et al.* (2003), Brunden and Johnson (2008), and American Wildlands (2008) are referred to collectively as the US 2 linkage zone. The eastern part of the MFSA transmission line analysis area, which includes the Sedlak Park Substation, is comprised mainly of private land, especially in the vicinity of US 2, and is situated within the US 2 linkage zone.

3.25.5.1.5 Environmental Consequences

Alternative 1 (No Mine), Alternative A (No Transmission Line), Alternative 1A (No Mine or Transmission Line)

Direct and Indirect Effects of No Action Alternatives on Canada Lynx and Lynx Habitat on National Forest System Lands

No direct effects from federal actions would occur under the No Action Alternatives. NRLMD standards would continue to be met, as described in the “Affected Environment” section. The No Action Alternatives would maintain the existing vegetative conditions within the West Fisher 14503 LAU, Crazy 14504 LAU, and Rock 14702 LAU. The existing vegetation conditions providing lynx habitat would continue to provide a mosaic of structural stages providing for lynx foraging and denning. Currently lynx habitat in the early successional stages is limited within all three LAUs.

Direct and Indirect Effects of No Action Alternatives on Canada Lynx and Lynx Habitat on Private and State Land

No direct effects from federal actions would occur and any lynx habitat present on private or State land would not be affected under the No Action Alternatives. NRLMD management direction does not apply to private or State land.

Direct and Indirect Effects of No Action Alternatives on Canada Lynx and Lynx Habitat on All Lands

Climate change over time may change lynx habits and habitat. At this time, however, the scope and scale of such changes are unknown, and the effects (negative or positive) on lynx would likely be variable across the landscape. Snowfall was the strongest predictor of lynx occurrence at a regional scale (Hoving *et al.* 2005). In addition to snow depth, other snow properties, including surface hardness or sinking depth, are important factors in the spatial, ecological, and genetic structuring of the species (Stenseth *et al.* 2004). An important consideration is that the topography strongly influences local snow conditions.

Climate change may result in lynx prey becoming more vulnerable to predation (Ruggiero *et al.* 2008). Coupled with past fire suppression, climate change can increase the impact of insects and disease and change the amount of habitat available for lynx. In some areas, changes in the fire regime associated with climate change may increase the availability of suitable habitat by increasing fire frequency, and in some areas potentially leading to increased acreage of brushy, early successional foraging habitat (McKenzie *et al.* 2004).

One of the primary constituent elements (PCEs) of lynx critical habitat is light deep snow. The Cabinet Mountains and the affected Crazy, West Fisher, and Rock LAUs are located south of US 2 and are not located within critical habitat and, therefore, would have no effect on critical habitat or PCEs. Climate change may influence the availability of deep fluffy snow in the future, and this is outside the control of the KNF to dictate the location of deep fluffy snow on the landscape. Deep fluffy snow may be located in higher elevations and patches separated by greater distances in the future if the climate becomes warmer. Lynx and snowshoe hare are adapted to life in the deep snow. The snowshoe hare has adapted to deep, fluffy, and persistent snow in winter (large feet and a pelage that turns white in winter), and changes in snow patterns and conditions as a result of a warming climate would put the species at a disadvantage (Ruggiero *et al.* 2008). Based on food habits and logistic modeling, lynx foraging and habitat selection is strongly driven by the abundance of snowshoe hares (Squires and Ruggiero 2007), especially in winter. As each species responds differently to climate change, the predator/prey relationship between snowshoe hares and lynx may dissolve (Ruggiero *et al.* 2008).

Lynx habitat may shift upward in elevation and north in latitude as the climate warms, and peninsular extensions of habitat may become fragmented (p. 8617 in USFWS 2009; Ruggiero *et al.* 2008; Carroll 2007). If a warming climate leads to less snowfall and warmer temperatures, snowshoe hare populations may decline as lynx predation efficiency increases. As described by Griffin *et al.* (2005), predator avoidance is a critical aspect of snowshoe hare behavior. When coloration of hares does not match the background (*e.g.,* white hare and brown background), hares may be more vulnerable to predators (McKelvey *et al.* 2013). Gonzales *et al.* (2007) modeled the potential shift in boreal forest and areas that have continuous winter snow coverage for at least four months each winter. Gonzales *et al.* (2007) predicted a potential decline of up to two-thirds of potential habitat in the lower 48 states by the year 2100. Lynx habitat may shift northward as much as 125 miles. Areas that could lose potential lynx habitat in the long term (about the year 2100) include the KNF (Gonzales *et al.* 2007). A lack of adequate snow in the long term may render at least some lynx habitat on the KNF less than optimal for lynx.

Mine Alternatives 2, 3, and 4; Transmission Line Alternatives B, C-R, D-R, and E-R; and Combined Action Alternatives Direct and Indirect Effects to Canada Lynx

Effects Common to the Mine Alternatives and Combined Action Alternatives

The location of the impoundment sites would slightly differ between the three mine alternatives but the chemical makeup of the tailings water is not likely to pose a risk to wildlife, including lynx. The impoundments would affect habitat along the lower elevational edge of the Crazy LAU. Lynx have been previously documented in the impoundment areas, likely due to the location with more gentle and rolling topography suitable for travel through the LAU. The metals in the water would be similar to what is found at the Troy Mine decant ponds (Table 120 in the *Water Quality* section), and where adverse effects on wildlife have not been observed (USDA Forest Service and DEQ 2012). For Alternative 2, concentrations of metals in mine and adit water, which would be stored in the mine/yard pond at the Ramsey Plant Site and in a surge pond at the LAD Areas, would be lower than tailings water (Table 120 in the *Water Quality* section). The Ramsey Plant Site would be fenced, restricting wildlife access.

Lynx would be at less risk of contaminant uptake from storage of mine, adit, and tailings water in Alternatives 3 and 4. All mine and adit water would be treated and discharged at the Libby Adit Water Treatment Plant and not stored in ponds. Tailings water quality would have lower metal concentrations than in Alternative 2; the factors leading to lower metal concentrations in tailings water quality in Alternatives 3 and 4 are discussed in the *Water Quality* section, p. 674.

Northern Rocky Mountain Lynx Management Direction Compliance Analysis

Effects Common to All Action Alternatives

A. Objectives, Standards, and Guidelines Applicable to ALL Management Projects in Lynx Habitat in LAUs in Occupied Habitat and in Linkage Areas, Subject to Valid Existing Rights.

Objective All 01: *Maintain or restore lynx habitat connectivity in and between LAUs, and in linkage areas.*

Standard All S1*: New or expanded permanent development and vegetation management projects must maintain habitat connectivity in a LAU and/or linkage area.*

Although the amount of mitigation lands required for habitat compensation would vary (Table 28 and Table 29 in Chapter 2) by combined mine-transmission line alternatives (Alternative 2B or any of the agencies' combined action alternatives), the acquisition of mitigation lands for grizzly bears could improve connectivity for lynx habitat, and provide additional habitat for both lynx and their prey. Some of the parcels identified for potential acquisition occur within the directly affected LAUs or in areas identified as important for linkage outside of LAUs. Land acquired for grizzly bear mitigation that might otherwise be developed in a manner inconsistent with bear needs would be managed for grizzly bear use in perpetuity. The objective of the grizzly bear habitat compensation would be to improve the baseline habitat conditions for grizzly bears, which would include decreasing open and total miles of road. Dependent upon the actual location of the acquired mitigation lands, any additional reductions in wheeled motorized vehicle access, and increase in amount of secure (core) habitat for grizzly bears in turn, could provide higher levels of security for lynx and potentially reduce risk of displacement and potential poaching.

Standard LAU S1: *Changes in LAU boundaries shall be based on site-specific habitat information and after review by the Forest Service Regional Office.*

No changes in LAU boundaries are proposed; therefore, this standard does not apply.

B. Objectives, Standards, and Guidelines Applicable to Vegetation Management Activities and Practices in Lynx Habitat within LAUs in Occupied Habitat. "With the exception of Objective VEG 03 that specifically concerns wildland fire use, the Objectives, Standards, and Guidelines do not apply to wildfire suppression, wildland fire use, or removal of vegetation for permanent developments such as mineral operations, ski runs, roads and the like. None of the objectives, standards, or guidelines apply to linkage areas."

The objective of all action alternatives is mineral development and the Vegetation Objectives, Standards, and Guidelines (Standard VEG S1, VEG S2, and VEG S6; Objectives VEG O1, O2, O3, and O4; Guidelines VEG G1, G4, G5, and G11) do not apply.

C. Objectives and Guidelines Applicable to Livestock Management in Lynx Habitat within LAUs. [Applies to Grazing Projects. Does Not Apply to Linkage Areas.]

The objective of all action alternatives is mineral development and not livestock management. No grazing allotments are found on public lands in the Crazy, West Fisher, or Rock LAU. Objectives GRAZ 01 and Guidelines GRAZ G1, G2, G3, and G4 do not apply

D. Objectives and Guidelines Applicable to Human Use Projects in Lynx Habitat within LAUs.

Objective HU O2: *Manage recreational activities to maintain lynx habitat and connectivity.*

The objective of the action alternatives is mineral development. No recreational activities are proposed. Winter recreational (snowmobile) access is discussed under each action alternative under Objective HU O1. The action alternatives would manage public access in the mine area during the Construction and Operations Phases and would not create new recreation routes affecting lynx habitat or connectivity. The potential increase in use on plowed roads is discussed under each action alternative. The intent of **Objective HU O2** would be met.

Objective HU O4: *Provide for lynx habitat needs and connectivity when developing new or expanding existing developed recreation sites or ski areas.*

No development or expansion of recreation or ski sites is proposed. No new snowmobile trails or play areas are proposed or would be created. Objective HU 04 does not apply.

Guideline HU G1: *When developing or expanding ski areas, provisions should be made for adequately sized inter-trail islands that include coarse woody debris, so winter snowshoe hare habitat is maintained.*

No development or expansion of ski areas is proposed and Guideline HU G1 does not apply.

Guideline HU G2: *When developing or expanding ski areas, lynx foraging habitat should be provided consistent with the ski area's operational needs, especially where lynx habitat occurs as narrow bands of coniferous forest across mountain slopes.*

No development or expansion of ski areas is proposed and Guideline HU G2 does not apply.

Guideline HU G3: *Recreation developments and operations should be planned in ways that both provide for lynx movement and maintain the effectiveness of lynx habitat*

No recreational developments or operations are proposed and Guideline HU G3 does not apply. Lynx movement through the project area is addressed under Objective All 01 and Standard All S1 for each action alternative.

Guideline HU G10: *When developing or expanding ski areas and trails, consider locating access roads and lift termini to maintain and provide lynx security habitat, if it has been identified as a need.*

No development or expansion of ski areas is proposed and Guideline HU G10 does not apply.

Guideline HU G11: *Designated over-the-snow routes or designated play areas should not expand outside baseline areas of consistent snow compaction, unless designation serves to consolidate use and improve lynx habitat.*

Designated new over-the-snow routes or play areas are not proposed and Guideline HU G11 does not apply.

E. Objectives, Standards, and Guidelines Applicable to ALL Projects in Linkage Areas in Occupied Habitat, Subject to Valid Existing Rights.

Standard LINK S1: *When highway or forest highway construction or reconstruction is proposed in linkage areas, identify potential highway crossings.*

No proposed highway or forest highway construction is proposed. Potential crossings on US 2 have been identified. See the *Affected Environment* section and ***Objective All 01 and Standard All S1*** discussion above. Standard Link S1 does not apply.

Guideline LINK G1: *National Forest System lands should be retained in public ownership.*

The sale or exchange of National Forest System lands is not proposed and this guideline is not applicable.

Guideline LINK G2: *Livestock grazing in shrub-steppe habitats should be managed to contribute to maintaining or achieving a preponderance of mid- or late-seral stages, similar to conditions that would have occurred under historic disturbance regimes.*

No livestock grazing in shrub-steppe habitat is proposed and Guideline Link G2 does not apply.

Alternative 2 – MMC's Proposed Mine

A. *Objectives, Standards, and Guidelines Applicable to ALL Management Projects in Lynx Habitat in LAUs in Occupied Habitat and in Linkage Areas, Subject to Valid Existing Rights.*

Objective ALL O1: *Maintain or restore lynx habitat connectivity in and between LAUs, and in linkage areas.*

Standard All S1*: New or expanded permanent development and vegetation management projects must maintain habitat connectivity in a LAU and/or linkage area.*

Activities that alter vegetative cover over large areas or wide bands of cover, especially in travel corridors (*e.g.,* saddles and ridges) or linkage areas, could reduce connectivity within or between LAUs. Alternative 2 would not affect any designated linkage areas. None of the Alternative 2 activities would occur along ridgelines that might serve as lynx movement areas. In Alternative 2, construction of mine facilities, including the plant site and tailings impoundment, could affect lynx movement within LAU 14504 by removing forest cover in potential movement areas such as the Little Cherry Creek, Ramsey Creek, and upper Libby Creek riparian corridors. New disturbance would be primarily concentrated within specific areas of these drainages, such as for the plant, adit, and impoundment sites, while direct habitat loss or alteration along most of the length of these riparian corridors would be minimal. During the Construction Phase, the plant site and the tailings impoundment disturbance areas within the Crazy LAU (the proposed impoundment site straddles the LAU boundary) would result in large openings.

Most mine access roads located within the Crazy LAU would not be in lynx habitat and displacement effects from human activity, including low-traffic roads, do not appear to be a major concern for lynx (Ruediger *et al.* 2000). There is no evidence that lynx avoid or are displaced by unpaved roads; therefore, unpaved roads are not considered a threat to lynx movement (USFWS 2003a).

MMC's proposed Alternatives 2 and B include an access change in NFS road #4724 from April 1 to June 30 and the yearlong access change in a segment of NFS road #4784 to mitigate for impacts to grizzly bears. NFS road #4784 is proposed for an access change by the Rock Creek Project and is no longer available for Montanore Mine mitigation. However, if Alternative 2B were selected, and the Rock Creek Project had not yet implemented the closure on the Upper Bear Creek Road #4784, then MMC would decommission or place into intermittent stored service and barrier NFS road #4784 prior to Forest Service authorization to initiate the Montanore Project Evaluation Phase. Core created as a result of the closure would also result in benefits to lynx by providing more secure habitat and improving habitat connectivity within the LAU.

The extent to which fragmentation from roads and urbanization can impact connectivity of mesocarnivore populations such as lynx likely depends on the physical design of highway improvements, the surrounding environmental features, the density of increased urbanization, and the increased traffic volume (Clevenger and Waltho 2005; Grilo *et al*. 2009). High traffic volume roads probably affect lynx through increased mortality, habitat fragmentation, and reduced ability of lynx to successfully disperse. Along a highway in Banff National Park, Alberta that had a traffic volume of 4,000 vehicles per day, 7 of 15 crossing attempts by lynx were aborted (Ruediger *et al.* 2000). In the central Cascades, Interstate 90 averages more than 24,000 vehicles per day (Singleton and Lehmkuhl 2000) and may affect the chance that lynx will re-colonize potential habitat in the southern Cascades, and would affect movements between subpopulations. Squires *et al.* (2013) documented 44 radio-collared lynx with home ranges within an 8-km buffer of two-lane highways; only 12 of these individuals crossed the highway (Squires, unpublished data).

The Bear Creek Road (NFS road #278) is considered a high-use road based on the grizzly bear CEM model (greater than 10 vehicles per day) in the existing condition. Calculations of projected traffic volume are described previously (p. 1252). In summary, estimates of increased traffic range from 187 percent to 234 percent (Table 172 in section 3.21, *Transportation*) about three times existing levels throughout the life of the mine. The KNF revised Johnson (2013) calculations which replace Johnson (2013) used in the Wildlife BA (USDA Forest Service 2013b) and Grizzly Bear Biological Opinion (USFWS 2014a, 2014b), result in an estimated increased traffic volume range over a 7-month period from 109 percent to 132 percent and an estimated 232 to 253 vehicles per day over that same period. Although the *Transportation* section 3.21, Johnson (2013) and KNF revised Johnson (2013) calculations differ, all reflect a substantial increase in traffic volume. Widening, improvement, and yearlong access of the Bear Creek Road would lead to increased vehicle volumes and speeds. Overall, improved road conditions that allow higher vehicle speeds and increased traffic could increase the risk for lynx mortality due to vehicle collisions.

The mine would generate an estimated additional 132 vehicles per day (an additional 66 trips) on the Bear Creek Road. At peak production, about 420 tons of concentrate, or 21 trucks per day, would be trucked daily via Bear Creek Road and US 2 to the loading site in Libby. The speeds on the Bear Creek Road would increase from the existing 15 to 25 mph to 35 to 45 mph, equating to a 40-percent to 80-percent increase in potential traffic speeds over the existing conditions. MMC would limit concentrate haulage to daylight hours during the day shift (0800 to 1600), which would minimize traffic and the potential for vehicle-lynx collisions outside of these times. Mitigation to reduce mortality risk to grizzly bears, which would also benefit lynx, include: MMC would provide transportation to employees using buses, vans, and pick-up trucks, thereby limiting the use of personal vehicles; MMC would report road-killed animals to the FWP as soon as road-killed animals were observed; and FWP would either remove road-killed animals or direct MMC on how to dispose of them.

Estimated projected traffic volume with both mine and estimated existing use increase up to 253 vehicles per day in 2029 and decrease to an estimated projected existing 123 vehicles a day post-closure (revised KNF Johnson (2013) calculations). It should be noted that the estimated projected traffic levels may be substantially less based on the assumption that logging traffic would remain at a substantial decrease compared to the 1986-1991 timeframe used to develop the estimated baseline traffic volume. Significant decreases in logging traffic have occurred since the baseline data were collected. Based on this, throughout the Construction and Operations Phases, projected daily traffic volume with both mine and existing traffic is expected to be much lower than the 300 to 500 vehicles per day identified by Alexander *et al.* (2005) as the potential threshold above which successful crossings by carnivores such as lynx may be impeded. In general, lynx are considered a highly mobile species (Aubry *et al.* 2000) and are known to cross highways (Squires and Oakleaf 2005).

Future traffic volume on the Bear Creek Road when all activities at the mine are completed in the Post-Closure Phase would be higher than in Alternative 1 because of reconstruction of Bear Creek Road and the loss of the Little Cherry Loop Road beneath the impoundment. Mine traffic would be substantially less in the Closure Phase, and traffic volume would return to estimated future volumes when all mine activities were completed in the Post-Closure Phase. In the Post-Closure Phase, mortality risk to lynx would decrease on the Bear Creek Road compared to operations, but the permanently improved road conditions (*e.g.,* increased road width, improved sight distance, and paving) and higher traffic speeds would result in an increased mortality risk compared to pre-mine conditions. Even with the projected traffic volume increases and road improvements, increased risk in mortality to lynx is considered small because collisions are unlikely to occur due to the low potential for lynx to be present, restriction of concentrate hauling to daylight hours, overall expected lower traffic volume than projected, presence of cover adjacent to the road, and the low–elevation non-habitat nature of the area where the Bear Creek Road is located (see *Effects to Lynx Habitat Components* section, p. 1362).

Increased traffic levels can contribute to fracturing of habitat connectivity. The Bear Creek Road is situated in low-elevation non-habitat where it passes through the Crazy LAU; however, it does lie between habitat in the main LAU and the Big Hoodoo Mountain portion of the LAU. Approximately 3,000 acres of the Crazy LAU are located in the Big Hoodoo Mountain area, consisting of about 1,367 acres of multistory mature late successional, 65 acres of stem exclusion, 50 acres of early stand initiation, 35 acres of stand initiation, 530 acres of travel habitat, with the remainder identified as low-elevation non-habitat. This is about 6.7 percent of the total lynx habitat available within the Crazy LAU. The surrounding low-elevation non-habitat environmental features adjacent to the portion of the Bear Creek Road located near the Hoodoo Mountain area would remain and continue to provide opportunity for movement across the Bear Creek Road.

The mine facilities consisting of the adit, conveyor belt system, mill site, pipes, and impoundment would likely cause a change in movement patterns in the immediate area. A lynx may find it difficult to cross under the ore conveyor belt system between the adit and the mill site. The configuration of the conveyor may allow passage of smaller animals through the framework supporting the conveyor, whereas larger animals the size of a bear or deer would have difficulty passing under the conveyor (Klepfer, pers. comm. 2014). The noise associated with the conveyor, coupled with the framework that a lynx would have to negotiate, may deter a lynx from passing under the conveyor. However, lynx are highly mobile, as described previously, and with the 1,200-foot length of the conveyor system, a lynx would be able to bypass this site. North and south connectivity in the main Crazy LAU would remain undisturbed. Explosive use during construction at the Libby Adits or the Rock Lake Ventilation Adit would be a short duration ‘pulse’ event of less than 24 hours, and potential for disturbance effects would occur only when the last section of blasting broke through the surface. Otherwise, noise would be muffled underground and would not be expected to create a noticeable amount of disturbance. During the Operations Phase, any potential disturbance would be minimized by specially designed low-noise fan blades or active noise-suppression equipment estimated to reduce fan noise so that it would not be audible over ambient noise levels (Big Sky Acoustics 2006). No measurable effect to lynx movement or connectivity would occur along this high-elevation area identified by the NRLMD as important for linkage as a result of the Rock Lake Ventilation Adit.

None of Alternative 2 mitigation plans are specific to lynx. The effects to wetlands and riparian areas that may provide potential lynx movement corridors would be minimized through implementation of MMC’s proposed Wetland Mitigation Plan. Alternative 2 would mitigate affected forested and herbaceous wetlands at a 2:1 ratio and herbaceous/shrub wetlands and waters of the U.S. at a 1:1 ratio (as described under section 2.4.6.1, *Wetlands and Other Waters of the U.S.*). The feasibility of MMC’s proposed Wetland Mitigation Plan to replace the lost functions of all potentially affected wetlands is uncertain. MMC’s plan is conceptual and would be refined during the 404 permitting process. All potential wetland mitigation sites identified for Alternative 2 (Figure 21) are either located in low-elevation non-habitat within the Crazy LAU or outside or adjacent to the LAU and are expected to have little benefit to lynx.

Identified broad-scale linkage areas identified for lynx would not be affected. The additional movement and linkage areas, or approach zones previously described in detail under the *Affected Environment* section and important for many wildlife species, including lynx, and collectively called the US 2 linkage area would remain suitable for lynx. Connectivity toward the east through the Crazy LAU and West Fisher LAU across US 2 would remain. The main access route on the Bear Creek Road, and the Libby Creek Road used during the Evaluation Phase, is largely situated outside or along the edge of the lower elevation boundary of the LAUs or are located in low-elevation non-habitat when inside the LAU. Lynx movement within the affected LAUs and to adjacent LAUs would remain, and the intent of ***Objective ALL O1*** and ***Standard ALL S1*** would be met.

Guideline ALL G1: *Methods to avoid or reduce effects on lynx should be used when constructing or reconstructing highways or forest highways across federal land. Methods could include fencing, underpasses, or overpasses.*

Forest roads rarely receive motorized use at levels that create barriers or impediments to lynx movements (USFWS 2007d). The primary concern with highways is the risk of lynx mortality due to collisions with high-speed vehicles on paved highways or straight gravel roads on flatter terrain. The best information available suggests that the types of roads in the project area that are managed by the Forest Service do not provide surface conditions conducive to fast speeds and do not adversely affect lynx (USFWS 2007d). Lynx mortality from vehicle strikes has not been documented on National Forest System lands on the KNF and, although possible, is not likely to occur.

In the existing condition, the first 9.5 miles of the Bear Creek Road (NFS road #278) has a chip-seal paved surface that is in poor condition, and after the first 0.75 mile from the intersection with US 2, the remainder of the road is a two-way single lane with a total width of about 14 feet. The current design speed for the Bear Creek Road ranges from 15 to 25 mph.

Alternative 2 would not include underpasses/overpasses or fencing for any mine access road, including NFS road #278. In Alternative 2, MMC would upgrade 11 miles of the Bear Creek Road and build 1.7 miles of new road between the Little Cherry Creek Tailings Impoundment Site and the Ramsey Plant Site. The 11 miles of the Bear Creek Road (NFS road #278), from US 2 to the Bear Creek bridge, would be chip-and-seal paved and upgraded to applicable NFS road standards. The road would be widened to 20 to 29 feet and designed to handle speeds of 35 to 45 mph. Between the plant site and the impoundment area where both mine haul and public traffic would occur, for about 2.5 miles, the road width could be up to 56 feet to accommodate joint use safely (section 3.21.4.22, *Transportation*). About 4.3 miles are within the Crazy LAU but are below the elevation of lynx habitat. Of the 7.5 miles of realigned and new road needed from the Bear Creek bridge to the Ramsey Plant Site, only 0.8 mile would be in lynx habitat. A single-lane bridge over Poorman Creek would be constructed to accommodate mine traffic. Public access to any portion of Bear Creek Road would not be restricted. Public access to the new mine access road would be restricted to mine-related traffic.

When the Bear Creek Road would be reconstructed during the Construction Phase, mine-related traffic (and public traffic) would use Libby Creek Road (NFS road #231) as the primary access to the mine facilities and the area of the KNF surrounding the mine facilities. The Libby Creek Road enters the Crazy LAU along its eastern boundary just to the southeast of the proposed LAD Area location and about 0.7 mile after the existing intersection with the Bear Creek Road. The existing Libby Creek Road design speed reduces from 25 mph to 20 mph where it enters the LAU, and the road is located in low-elevation non-habitat. Roads improved for Alternative 2 would allow higher vehicle speeds (and increased traffic and could increase the potential risk of lynx mortality due to vehicle collision. Reconstructed and new roads associated with Alternative 2 would not incorporate specific measures to avoid or reduce effects on lynx, although some grizzly bear mitigation would also benefit lynx. With the mine and road improvements on the Bear Creek

Road, the speeds would increase to 35 to 45 mph. Other roads associated with the project may experience higher volumes of traffic, but would not likely cause or increase lynx mortality given the relatively slow speeds at which vehicles on these roads travel (USFWS 2007d).

Most mine access roads would not be in lynx habitat, which would lower mortality risk to lynx, but the increased traffic speeds and volume on the Bear Creek Road could result in increased fracture of connectivity between the Big Hoodoo Mountain Area and the remainder of the Crazy LAU. See *Objective ALL O1 and Standard All S1* above for a discussion of how connectivity would remain within the LAU and the effects of roads on lynx. Alternative 2 would not include monitoring of roads to document lynx mortalities due to vehicle collisions in permit areas and along access roads. Alternative 2 would not meet the intent of ***Guideline ALL G1.***

Objectives and Guidelines Applicable to Human Use Projects in Lynx Habitat in LAUs.

Objective HU O1: *Maintain the lynx's natural competitive advantage over other predators in deep snow, by discouraging the expansion of snow-compacting activities in lynx habitat.*

The USFWS concluded in their initial Final Rule that snow compaction created by human activities was not found to be a threat to the lynx distinct population segment (USFWS 2000). The USFWS also concluded that there was no evidence that any competition existed between lynx and other species that exerted a population-level impact on lynx, and that there was no evidence that packed snow routes facilitated competition to a level that negatively affected lynx or lynx populations (USFWS 2003b). The USFWS does acknowledge that there is evidence that competing predators do use packed trails, suggesting a potential effect on individual lynx. Because there could be possible adverse effects at the site-specific scale and because of the possibility that unregulated expansion could further impair conservation efforts over time, the NRLMD included provisions to discourage the expansion of snow-compacting activities in lynx habitat above the existing conditions (USFWS 2007d). No particular threshold of allowable increases is provided in the NRLMD.

The main Bear Creek Road is currently not maintained for winter travel beyond the 3-mile mark (from US 2) near the private residences. During the Construction and Operations Phases of the mine, NFS road #278 would be easily drivable during the winter due to snowplowing. Currently, the road becomes a challenge to drive toward the end of the fall big game rifle season in November, and the road is closed to conventional vehicles due to snowpack in April. The Ramsey Creek Road would be open yearlong to mine traffic only, but this road is currently open for administrative use and winter snowmobile use.

Alternative 2 would result in changes in motorized access by conventional motorized vehicles during the winter and early spring season (December 1 to April 30) within the Crazy LAU. The main Bear Creek Road #278 would be maintained for winter travel during the Evaluation, Construction, and Operations Phases of the mine. When the Bear Creek Road was being reconstructed during the Construction Phase, mine-related traffic (and public traffic) would use Libby Creek Road as the primary access route to the mine facilities and surrounding area. NFS road #231 would be plowed while Bear Creek Road was being reconstructed. The Upper Libby Creek Road would be plowed during the Evaluation Phase through the Operations Phase. Overall, about 25 miles of roads normally not accessed by conventional motorized vehicles during the winter would be plowed for winter motorized travel within lynx habitat. Currently, these roads are open for winter snowmobile travel. There would be no expansion of areas accessible to snowmobiles beyond the existing road system. There may be a slight increase in the ability of predators and competitors (coyotes and mountain lions) to move into and/or through the area during the winter period. Based on local research by Kolbe *et al.* (2007), this potential increase is not likely to create enough competition with coyotes for snowshoe hares that lynx at the site-specific scale would be adversely affected.

The main Bear Creek Road #278, through the impoundment area and the road from the facility site up to the Libby Adit Site is largely located in low-elevation non-habitat, or in lynx travel habitat. Both trapping records and observations of lynx have occurred in this low-elevation non-habitat. Reasons for this may include the more gentle topography that occurs at these lower elevations. Although the Cabinet Mountains appear to have lynx habitat, for some reason the habitat does not appear to be occupied by lynx and this could be a combination of topographic roughness (steep bisected slopes), aspect, and snow conditions (*e.g.,* Cabinet Mountains has a more maritime climate – wetter and associated vegetation) (personal observation by J. Squires, pers. comm. 2011; Regional Silviculturist meeting Yaak 2011; Squires pers. comm. to Carly Walker 2009; and Squires and DeCesare, pers. comm. KNF field trip 2006).

Mountain lions are known predators of lynx in northwest Montana (Squires *et al.* 2006), and increased cougar access could potentially result in lynx mortality. Regular mine traffic on the area roads would tend to discourage mountain lion use of roads, particularly after the Evaluation Phase when traffic would increase and continue for 24 hours a day. Squires *et al.* (2006) found that lions were the major predator of lynx in Montana with most kills occurring in the non-snow season. The risk of increased mountain lion use of the area due to compacted snow on road surfaces would be considered low. The intent of ***Objective HU O1*** would be met.

Objective HU O3: *Concentrate activities in existing developed areas rather than developing new areas in lynx habitat.*

Activities associated with Alternative 2 were designed to avoid lynx habitat and use existing roads and facilities (*i.e.*, the Libby Adit). However, the existing facilities are not adequate to contain the magnitude of the project, and additional facilities (ventilation adits, plant site, tailings impoundment, and transmission line corridor) are required. These activities would impact lynx habitat, although the majority of the disturbance areas would not affect lynx habitat (see *Effects to Lynx Habitat Components* section, p. 1362). The intent of ***Objective HU O3*** would be met.

Objective HU O5: *Manage human activities, such as special uses, mineral and oil and gas exploration and development, and placement of utility transmission corridors, to reduce impacts on lynx and lynx habitat.*

Activities associated with Alternative 2 were designed to avoid lynx habitat and use existing roads and facilities (*i.e.*, the Libby Adit). However, the use of the Libby Adit up Libby Creek and the adit, plant site, and conveyer belt system in Ramsey Creek affects two adjacent drainages in the Crazy LAU. Activity and human use associated with the Alternative 2 mine would become predictable once construction-related activity was over. Most indications are that lynx do not significantly alter their behavior to avoid human activities (summarized in USFWS NRLMD Biological Opinion 2007, p. 68). The majority of impacted acres in the Crazy LAU from the mineral development and facilities would occur in low-elevation non-habitat; however, 2 percent of lynx habitat within the Crazy LAU would be removed for mine development for the life of the mine. The USFWS found no evidence that mineral development was a factor threatening lynx

(USFWS 2007d) and concluded that the NRLMD contained guidelines to minimize the impacts of mineral-related activities on individual lynx and lynx habitat, including Objective HU 05. The intent of ***Objective HU 05*** would be met.

The remaining NRLMD guidelines that would minimize the impacts of mineral-related activities (USFWS 2007d), Guideline HU G4, Guideline HU G6, Guideline HU G9, and Guideline HU G12 are described below.

Objective HU O6: *Reduce adverse highway effects on lynx by working cooperatively with other agencies to provide for lynx movement and habitat connectivity, and to reduce the potential of lynx mortality.*

The effects of highways on lynx have previously been discussed for Guideline ALL G1. The primary concern with highways is the risk of lynx mortality due to collisions with high-speed vehicles on paved highways or straight gravel roads on flatter terrain. Managing habitat beneficial to lynx movement and cover across linkage areas where lynx tend to cross highways could help reduce mortality. US 2, on the east side of the project area, is the only highway associated with this project. The highway corridor is below 4,000 feet in elevation and does not include lynx habitat; however, it is partially located in the linkage area that was also previously discussed (see discussion under Standard All S1). Alternative 2 would not include mitigation for lynx; however, as discussed under *Effects Common to All Action Alternatives*, mitigation for grizzly bears may benefit lynx by improving connectivity in the US 2 fracture zone. The intent of ***Objective HU 06*** would be met.

Guideline HU G4: *For mineral and energy development sites and facilities, remote monitoring should be encouraged to reduce snow compaction.*

Alternative 2 would include several operational and post-operational monitoring plans (see section 2.4.5, *Monitoring Plans*), which include hydrology, aquatic life, tailings dam stability, and revegetation, but none monitor snow compaction. No monitoring for lynx, lynx habitat, or snow compaction was proposed in Alternative 2. The potential effect of snow compaction was previously addressed for **Objective HU O1,** and the intent of Objective HU 01 would be met by Alternative 2. Because about 25 miles of the access roads (Bear Creek #278 and Libby Creek #231) would be snowplowed from the Evaluation Phase through to at least the end of the Operations Phase, public snowmobile access to new areas could increase; however, these roads are currently open for winter over-snow vehicles. Plowing of the Bear Creek Road would increase public wheeled-vehicle motorized access where currently it does not occur during the winter. Although remote monitoring for snow compaction is not feasible, Alternative 2 also would not include on-the-ground monitoring for increases in snow compaction off of the access roads by public snowmobiles, and Alternative 2 would not meet the intent of ***Guideline HU G4***.

Guideline HU G5: *For mineral and energy development sites and facilities that are closed, a reclamation plan that restores lynx habitat should be developed.*

Alternative 2 would include a reclamation plan that over the long term would likely restore affected lynx habitat (see section 2.4.3,*Closure and Post-Closure Phases*). The reclamation plan for Alternative 2 was developed with the goal of establishing a post-mining environment compatible with existing and proposed land uses, and consistent with the KFP. Disturbed areas would be re-contoured where appropriate and revegetated with mostly native species. Tree and shrub seedlings would be planted in selected areas of the Ramsey Plant Site, the Libby Adit Site, and the Little Cherry Creek Tailings Impoundment Site. If reclamation were successful, sites with lynx habitat potential would return to suitable lynx habitat in the long term. The analysis for lynx considered long-term effects as lasting for the life of the mine, or longer. Those sites impacted by mine-related development and having lynx habitat potential would not provide habitat for the life of the mine, and if reclamation was successful would then require additional time for plant establishment and succession. Alternative 2 would meet the intent of ***Guideline HU G5***.

Guideline HU G6: *Methods to avoid or reduce effects on lynx should be used in lynx habitat when upgrading unpaved roads to maintenance levels 4 or 5, if the result would be increased traffic speeds and volumes, or a foreseeable contribution to increases in human activity or development.*

Maintenance levels define the level of service provided by and maintenance required for a road (FSH 7709.58, sec 12.3 – Transportation System Maintenance Handbook). Maintenance level 4 is assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double-lane and aggregate surfaced. Some may be single-lane and some may be paved or have dust abated. Maintenance level 5 is assigned to roads that provide a high degree of user comfort and convenience. Normally roads are double-lane and paved, but some may be aggregate surfaced with the dust abated.

The existing Bear Creek Road #278 is currently a level 3 maintenance road. A road maintenance level 3 is defined (FSH 7709.59, sec. 62.32) as a road opened and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities. Roads in this level are typically low speed with single lanes and turnouts, have low to moderate traffic volume, and typically have potholes or a washboard surface. The Bear Creek Road primarily functions as a recreation road. The first 0.75 mile of the road is a two-way two-lane road with a total width ranging from 18 to 20 feet, while the remainder is a two-way single-lane road with a total width of about 14 feet. The first 9.5 miles has chip-seal paved surface that is in poor condition. After the Bear Creek bridge, the remainder of the road is a native dirt surface. The proposed upgrades, as described under Standard All S1 and Guideline All G1, would result in the road being upgraded to a level 4 maintenance road.

The USFWS (2003a) concluded the overall threat to lynx populations from high traffic volume on roads that bisect suitable lynx habitat and associated suburban developments is low, especially for resident lynx. High-volume highways reported as hazards to dispersing lynx have high average daily traffic volume, with ranges reported from 14,940 vehicles (Clevenger and Waltho 2005) to more than 24,000 vehicles (Stinson 2001; Singleton and Lehmkuhl 2000). Please see Alternative 2, *Objective All 01,* and *Standard All S1* for a discussion of effects to lynx due to the increases in projected traffic volume and traffic speeds.

As described for *Guideline ALL G1* above, reconstructed and new roads associated with Alternative 2 do not incorporate specific methods to avoid or reduce effects on lynx.

Most mine access roads would not be in lynx habitat, but portions of the road used do occur within the LAU. In all mine alternatives, MMC would continue to snowplow the Libby Creek Road during the Evaluation Phase and early in the Construction Phase. Snowplowing of the Libby Creek Road would cease after the Bear Creek Road was reconstructed. Throughout the Evaluation, Construction, and Operations Phases, the Upper Libby Creek Road #2316 would be plowed for access to the Libby Adit. Traffic would be limited to mine traffic during the KNF seasonal closure period of April 1 to May 15, but otherwise would be open to the public. Plowing where public access could occur would make access to lynx habitat easier for trappers and increase the risk of incidental lynx mortality. No monitoring of access roads or permit areas to document lynx mortality due to vehicle collisions was proposed for Alternative 2. Alternative 2 would not include mitigation to avoid or reduce effects of the road upgrades to lynx and would not meet the intent of ***Guideline HU G6.***

Guideline HU G7: *New permanent roads should not be built on ridgetops, saddles, or in areas identified as important for lynx habitat connectivity. New permanent roads and trails should be situated away from forested stringers (i.e., narrow bands of forest habitat).*

The majority of Alternative 2 activity would be located within the Crazy LAU in low-elevation non-habitat and travel habitat, with some stand initiation and multistory forage habitat affected. New permanent roads would not be built on ridgetops or saddles. Alternative 2 would require three new road crossings across major streams and one new road crossing across a minor stream. During construction, disturbances within the riparian and floodplain would be minimized. The existing Bear Creek bridge would likely remain at the existing 14-foot width. New bridges are proposed over Ramsey (single-lane) and Poorman creeks and a culvert would likely be installed in Little Cherry Creek above the Diversion Dam. Although construction would occur in riparian areas suitable as potential travel corridors, the extent of development would not be expected to disrupt normal lynx movement patterns in the long term. The intent of ***Guideline HU G7*** would be met by Alternative 2.

Guideline HU G8: *Cutting brush along low-speed, low-traffic-volume roads should be done to the minimum level necessary to provide for public safety.*

Low-speed, low-traffic forest roads would generally refer to single-lane roads where roadside brush would be likely to intrude into the vehicle-width corridor (about 14 feet wide). The clearing width for most of the constructed or reconstructed roads associated with Alternative 2 would be upgraded to 20 to 29 feet wide, with a total disturbed area of 100 feet including ditches and cutbanks to facilitate safe passage for mine-related and public traffic. Road maintenance, which is likely to include roadside brushing at times, would occur throughout the life of Alternative 2. The minimum level necessary to provide for public safety would most likely be more extensive than what would be needed for low-speed, low-traffic-volume roads. These roads would not be considered low-volume roads in terms of forest road use until well into the Closure Phase. Overall, ***Guideline HU G8*** is generally not applicable to the wider, higher traffic volume roads associated with the mine-related roads.

Guideline HU G9: *On new roads built for projects, public motorized use should be restricted. Effective closures should be provided in road designs. When the project is completed, these roads should be reclaimed or decommissioned, if not needed for other management objectives.*

All new roads associated with Alternative 2, except for the reconstructed segments of the Bear Creek Road to provide for safety of public and mining road use, would be gated and restricted to public access. All newly constructed roads would be decommissioned following mine closure. Alternative 2 would meet the intent of ***Guideline HU G9***.

Guideline HU G12: *Winter access for non-recreation special uses and mineral and energy exploration and development, should be limited to designated routes or designated over-the-snow routes.*

Winter road access for activities associated with Alternative 2 would be limited to designated routes. Alternative 2 would plow the Libby Creek Road #231 and the Upper Libby Creek Road #2316 during the Evaluation Phase, and would plow the Libby Creek Road #231 while the Bear Creek Road was being reconstructed. During the Operations Phase, the Bear Creek Road and the Upper Libby Creek Road #2316 would be plowed. For Alternative 2, all motorized winter access for mine-related activities would be confined to the existing road network and new roads proposed to access mine facilities, and winter access associated with Alternative 2 would meet the intent of ***Guideline HU G12***.

E. *Objectives, Standards, and Guidelines Applicable to ALL Projects in Linkage Areas in Occupied Habitat, Subject to Valid Existing Rights.*

Objective LINK O1: *In areas of intermingled land ownership, work with landowners to pursue conservation easements, habitat conservation plans, or other solutions to reduce the potential of adverse impacts on lynx and lynx habitat.*

Please see the discussion above under *"Effects Common to All Combined Action Alternatives."* In summary, Alternative 2, as part of MMC's Grizzly Bear Mitigation Plan, would acquire lands or conservation easements as mitigation for habitat physically lost, and all lands would be managed in perpetuity for grizzly bears. If these lands were located in lynx habitat, management for grizzly bears would also benefit lynx in terms of offsetting direct loss of habitat, precluding private parcels within lynx habitat from being developed, improve connectivity for lynx, and by reducing motorized access could provide higher levels of security for lynx and potentially reduce risk of displacement and potential poaching. Due to the required habitat compensation for grizzly bear mitigation for combined action alternatives, potential to reduce impacts on lynx and habitat may occur, and Alternative 2 would meet the intent of ***Objective LINK 01***.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

In respect to NRLMD applicable Objectives, Standards, and Guidelines, impacts on lynx in Crazy LAU 14504 from Alternative 3 would be the same as described in *Effects Common to All Action Alternatives* or under Alternative 2, with the exception of the following.

A. *Objectives, Standards, and Guidelines Applicable to ALL Management Projects in Lynx Habitat.*

Objective ALL O1: *Maintain or restore lynx habitat connectivity in and between LAUs, and in linkage areas.*

Standard ALL S1: *New or expanded permanent development and vegetation management projects must maintain habitat connectivity in a LAU and/or linkage area.*

Alternative 3 potential impacts on lynx movement within the Crazy LAU would be minimized by concentrating disturbance from plant facilities and adits in the Libby Creek drainage. The mine facilities consisting of the adit, conveyor belt system, mill site, pipes, and impoundment would likely cause a change in movement patterns in the immediate area. A lynx may find it difficult to cross under the ore conveyor belt system between the adit and the mill site. The configuration of the conveyor (10 feet high by 10 feet wide or 8 feet high by 16 feet wide) may allow passage of smaller animals through the framework supporting the conveyor, whereas larger animals the size of a bear or deer would have difficulty passing under the conveyor (Klepfer, pers. comm. 2014).

The noise associated with the conveyor, coupled with the framework that a lynx would have to negotiate, may deter a lynx from passing under the conveyor. The conveyor would be 6,000 to 7,500 feet long. Lynx would be able to bypass the conveyor. In respect to the effectiveness of Alternative 3 mitigation plan, the agencies' Terrestrial Threatened and Endangered Mitigation Plan requires yearlong closures that would improve grizzly bear habitat by reducing fragmentation in the north-south movement corridor (see the *Grizzly Bear* section). These closures would also serve to provide additional secure habitat for lynx where those closures occurred in LAUs. In addition to the agencies' proposed road closures (Table 28 and Table 29 in Chapter 2), an additional closure may be implemented by Alternative 3. If the Rock Creek Project has not yet implemented the closure on the Upper Bear Creek Road #4784, then MMC would decommission or place into intermittent stored service and barrier NFS road #4784 prior to Forest Service authorization to initiate the Evaluation Phase), as discussed under Alternative 2. This additional closure would not only improve grizzly bear habitat but would improve connectivity for lynx in the Crazy LAU.

The effects to wetlands and riparian areas that may provide potential lynx movement corridors would be minimized through avoiding RHCAs to the extent feasible (Table 74 in the *Aquatic Life and Fisheries* section) and implementing the agencies' Vegetation Removal and Disposition Plan. As part of the final design, MMC would submit a Vegetation Removal and Disposition Plan that would minimize vegetation clearing, particularly in RHCAs. However, wetland mitigation sites that may be used would be located either at lower elevations outside of the Crazy LAU or adjacent to the LAU boundary and would have little beneficial effect for lynx.

Guideline ALL G1: *Methods to avoid or reduce effects on lynx should be used when constructing or reconstructing highways or forest highways across federal land. Methods could include fencing, underpasses, or overpasses.*

In Alternative 3, MMC would use the same roads as Alternative 2 for main access during operations, but the amount of miles utilized would differ. About 13 miles of Bear Creek Road (NFS road #278), from US 2 to the Poorman Tailings Impoundment Site, would be paved and upgraded to a road width of 26 feet. Actual disturbance for new and upgraded mine access roads was considered at 100-foot total width, including cutbanks. South of Little Cherry Creek, MMC would build 3.2 miles of new road west of Bear Creek Road that would connect Bear Creek Road with Ramsey Creek Road (NFS road #4781). The new road would be designated NFS road #278 (the new Bear Creek Road) and would generally follow the 3,800-foot contour to north of the Poorman Creek bridge. To maintain a public access connection between the Bear Creek Road and the Libby Creek Road (NFS road #231), the public would use the new Bear Creek Road, a segment of the Poorman Creek Road (NFS road #2317), and a segment of the Bear Creek Road south of Poorman Creek. Overall road use and traffic volume increases expected for Alternative 3 are as described for Alternative 2 in ***Standard All S1*** and ***Guideline HU G6***.

Alternative 3 would not include fencing, underpasses, or overpasses to avoid or reduce effects on lynx due to the low volume of traffic expected relative to the volume of traffic known to cause lynx mortality (see the ***Standard All S1*** and ***Guideline HU G 6*** discussion for Alternatives 2 and 3). The USFWS (2003a) concluded the overall threat to lynx populations from high traffic volume on roads that bisect suitable habitat is low, especially for resident lynx, and low potential for lynx to occur in the Cabinet Mountains. However, the agencies' alternatives, including Alternative 3, would incorporate adaptive mitigation measures that would reduce effects to lynx from changes to forest roads. Prior to the Evaluation Phase, to reduce mortality risk to grizzly bears, the agencies' Terrestrial Threatened and Endangered Species Mitigation Plan would 1) require the development of a transportation plan designed to minimize mine-related vehicular traffic (Part A, item A.1.b); 2) monitor frequency of vehicle-killed animals and review with the KNF and FWP to determine if additional mitigation measures are necessary (Part A, item A.1.f); and 3) report all grizzly bear, lynx, wolf, and black bear mortalities within 24 hours (Part A, item A.1.f). The transportation plan would reduce disturbance from increased motorized activity along roads in forested corridors between mine components by reducing traffic levels and would require busing employees to the mine facilities and limiting private vehicles. These measures would also reduce mortality risk to lynx. Alternative 3 would meet the intent of ***Guideline ALL G1***.

D. Objectives and Guidelines Applicable to Human Use Projects in Lynx Habitat in LAUs.

Objective HU O1: *Maintain the lynx's natural competitive advantage over other predators in deep snow by discouraging the expansion of snow-compacting activities in lynx habitat.*

Objective HU O2: *Manage recreational activities to maintain lynx habitat and connectivity.*

Objective HU O3: *Concentrate activities in existing developed areas, rather than developing new areas in lynx habitat.*

Objective HU O5: *Manage human activities, such as special uses, mineral and oil and gas exploration and development, and placement of utility transmission corridors, to reduce impacts on lynx and lynx habitat.*

Activities associated with Alternative 3 were designed to avoid lynx habitat and use existing roads and facilities (*i.e.*, the Libby Adits and Upper Libby Adit) and to avoid new expansion of snow-compacting activities in lynx habitat. Potential impacts on lynx movement within the LAU also would be minimized by concentrating disturbance from plant facilities and adits in the Libby Creek drainage. Public access would be managed in the mine area during the Construction and Operations Phases, and no new recreation routes would be created that affect lynx habitat or connectivity.

Activity and human use associated with the Alternative 3 mine would become predictable once construction-related activity was complete. Grizzly bears have been documented to forage and use areas close to high levels of human use, including mines, where activities were temporally and spatially predictable and people associated with the work were carefully regulated against carrying firearms and providing human-associated attractants (USFWS 2014a). Most indications are that lynx do not significantly alter their behavior to avoid human activities (summarized in USFWS NRLMD Biological Opinion 2007, p. 68). The USFWS found no evidence that mineral development was a factor threatening lynx (USFWS 2007d) and concluded that the NRLMD contained guidelines to minimize the impacts of mineral-related activities on individual lynx and lynx habitat, including Objective HU 05, Guideline HU G4, Guideline HU G6, Guideline HU G9, and Guideline HU G12. Guidelines HU G4, HU G6, HU G9, and HU G12 are described below.

Less than 1 percent of lynx habitat within the Crazy LAU would be removed for mine development for the life of the mine (for effects to lynx habitat, see the *Effects to Lynx Habitat* section). Remaining effects are as described for Alternative 2. Alternative 3 would meet the intent of ***Objectives HU 01, HU 02, HU 03,*** and ***HU 05***.

Guideline HU G4: *For mineral and energy development sites and facilities, remote monitoring should be encouraged to reduce snow compaction.*

As described in sections 2.5.6, *Monitoring* and 2.5.7, *Mitigation Plans*, the KNF would monitor new snow compaction activities (such as snowmobiling) in the analysis area and take appropriate action if compaction monitoring identified increased predator access to new areas (agencies' Terrestrial Threatened and Endangered Species Mitigation Plan, Lynx, Item B). Remote monitoring is difficult and impractical, and new off-road use can easily be monitored from the access roads. Alternative 3 would meet ***Guideline HU G4***.

Guideline HU G5: *For mineral and energy development sites and facilities that are closed, a reclamation plan that restores lynx habitat should be developed.*

For Alternative 3, during reclamation, disturbed areas would be reseeded with native species only, except in specific situations as approved by the lead agencies. Also, reclamation success criteria and planting/seeding conditions would be more rigorous, and tree planting densities would be greater in Alternative 3 than Alternative 2. Alternative 3 modifications in the reclamation plan are expected to result in more rapid revegetation of lynx habitat than Alternative 2. Alternative 3 would meet ***Guideline HU G5***.

Guideline HU G6: *Methods to avoid or reduce effects on lynx should be used in lynx habitat when upgrading unpaved roads to maintenance level 4 or 5, if the result would be increased traffic speeds and volumes, or a foreseeable contribution to increases in human activity or development.*

The agencies' alternatives would incorporate adaptive mitigation measures that would reduce effects to lynx from changes to forest roads. Prior to the Evaluation Phase, to reduce mortality risk to grizzly bears, the agencies' Terrestrial Threatened and Endangered Species Mitigation Plan would 1) require the development of a transportation plan designed to minimize mine-related vehicular traffic (Part A, item A.1.b); 2) monitor the frequency of vehicle-killed animals and review with the KNF and FWP to determine if additional mitigation measures are necessary (Part A, item A.1.f); and 3) report all grizzly bear, lynx, wolf, and black bear mortalities within 24 hours (Part A, item A.1.f). The transportation plan would reduce disturbance from increased motorized activity along roads in forested corridors between mine components by reducing traffic levels and would require busing employees to the mine facilities and limiting private vehicles. These measures would also reduce mortality risk to lynx. Alternative 3 would meet the intent of ***Guideline HU G6***.

Guideline HU G7: *New permanent roads should not be built on ridgetops and saddles, or in areas identified as important for lynx habitat connectivity. New permanent roads and trails should be situated away from forested stringers.*

Alternative 3 associated activities (evaluation adit, plant site, impoundment, and associated roads) are largely located within the Crazy LAU, mainly affecting low-elevation non-habitat, travel habitat, and affecting less stand initiation and multistory mature late successional habitat than Alternative 2. Alternative 3 would not include building new permanent roads on ridgetops or saddles. Alternative 3 would require one major stream crossing and one minor stream crossing. During construction, disturbances within the riparian and floodplain would be minimized. The existing 14-foot-wide Bear Creek bridge would be replaced and widened to a width compatible with a 26-foot-wide Bear Creek Road. Although construction would occur in riparian areas suitable as potential travel corridors, the extent of development would not be expected to disrupt normal lynx movement patterns in the long term. Cover for movement is retained in the remaining undisturbed areas, and no designated lynx linkage area would be measurably affected (Claar *et al.* 2003; USDA Forest Service 2007a).The intent of ***Guideline HU G7*** would be met by Alternative 3.

E. *Objectives, Standards, and Guidelines Applicable to ALL Projects in Linkage Areas in Occupied Habitat, Subject to Valid Existing Rights.*

Objective LINK O1: *In areas of intermingled land ownership, work with landowners to pursue conservation easements, habitat conservation plans, or other solutions to reduce the potential of adverse impacts on lynx and lynx habitat.*

Please see discussion above under *"Effects Common to All Combined Action Alternatives."* In summary, the agencies' Threatened and Endangered Species Mitigation Plan for grizzly bear would acquire lands or conservation easements (acreages depend upon the combination) as mitigation for habitat physically lost and for habitat displacement. The acreages required for the agencies' combined action alternatives are greater than the habitat mitigation acreage for Alternative 2B and, as a result, the potential benefit to grizzly bears, and consequently lynx, is greater. These lands would be managed in perpetuity for grizzly bears. If these lands were located in lynx habitat, management for grizzly bears would also benefit lynx in terms of offsetting direct loss of habitat, precluding private parcels within lynx habitat from being developed, improving connectivity for lynx, and by reducing motorized access could provide higher levels of security for lynx and potentially reduce risk of displacement and potential poaching. Due to the required habitat compensation for grizzly bear mitigation for the agencies' combined action alternatives, potential to reduce impacts on lynx and their habitat may occur, and Alternative 3 would meet the intent of ***Objective LINK 01***.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

With respect to NRLMD applicable Objectives, Standards, and Guidelines, impacts on lynx in LAU 14504 from Alternative 4 would be the same as discussed under *Effects Common to All Action Alternatives*, and Alternative 2 as modified by Alternative 3.

Direct and Indirect Effects of Transmission Line Alternatives

With respect to NRLMD applicable Objectives, Standards, and Guidelines, where general effects to lynx or lynx habitat from management activities as described under "*Effects Common to All Combined Action Alternatives*," or as described under the mine alternatives, would apply to similar activities in the transmission line alternatives, and there are no substantial differences in the reasoning, those conclusions will not be repeated here.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Effects on Lynx on National Forest System Lands

A. Objectives, Standards, and Guidelines Applicable to ALL Management Projects in Lynx Habitat in LAUs in Occupied Habitat and in Linkage Areas, Subject to Valid Existing Rights.

Objective ALL O1: *Maintain or restore lynx habitat connectivity in and between LAUs, and in linkage areas.*

Standard ALL S1: *New or expanded permanent development and vegetation management projects must maintain habitat connectivity in a LAU and/or linkage area.*

Alternative B would not affect any NRLMD designated linkage areas within the LAUs. North and south connectivity and identified linkages in the main Crazy and West Fisher LAUs would remain undisturbed. Existing movement areas and connectivity toward the east in the Crazy LAU through the Horse Mountain to the Poker Hill area would remain, as well as toward the eastern edge of the West Fisher LAU. Movement through the US 2 linkage zone area, which partially overlaps the Crazy and West Fisher LAUs, may be temporarily disrupted while construction activity is occurring but this would be of short duration and would not occur along the entire line, allowing for movement areas without construction-related activity. Alternative B could affect movement by removing forest cover in potential movement areas such as the Miller, Howard, Libby, and Ramsey creek corridors. Vegetation would be cleared in areas of ground disturbance, such as access roads and pulling and tensioning sites. In some portions of transmission line clearing areas, only the tallest trees would be removed, leaving some shrub and tree cover in the transmission line right of way (100 feet). However Alternative B has no plan for minimizing vegetation removal in the 100-foot right of way. For Alternative B, the analysis assumed a 150-foot clearing width due to potential hazard tree removal outside of the right of way.

Clearing of timber through harvest would occur on up to 6 acres of lynx habitat in LAU 14503, and up to 79 acres of lynx habitat in LAU 14504, with the habitat affected being scattered along the entire transmission line. The Alternative B transmission line right of way of 100 feet, and the clearing area (150 feet) would be relatively narrow and the removal of vegetation would have a minimal long-term effect on lynx behavior or movement patterns due to the amount of shrubs and low trees expected to remain in the clearing area or that would grow back during operations. Displacement effects from human activity, including low-traffic roads, do not appear to be a major concern for lynx (Ruediger *et al.* 2000). Construction activities associated with the transmission line and access roads could temporarily disturb a lynx or movement patterns within LAUs 14503 and 14504. However, activities would be spread along the transmission line alignment over a 2-year period, hiding cover would remain throughout most of the clearing area outside of roads, plant succession would occur on temporary roads throughout the Operations Phase, and actual potential to affect movement patterns is considered low.

Outside of the West Fisher LAU and within the MFSA analysis area, about 6.5 miles of road under Alternative B, originating at the Sedlak Park Substation, would be located within the US 2 linkage zone, which includes the US 2 – Barren Peak/Hunter Creek Approach area. Discussion of this portion of the transmission line and Sedlak Park Substation is in the *Effects on Lynx on Private and State Land Analysis* section following the federal lands discussion for Alternative B.

No mitigation plans associated with Alternative B are specific for lynx. MMC would be governed by its proposed Environmental Specifications (MMI 2005b) to guide line construction, operation, maintenance, and decommissioning activities, but the specifications did not include a Vegetation Removal and Disposition Plan. Alternative B would incorporate mitigation for other resources that would benefit lynx. Alternative B would include a timing restriction for short-term displacement effects for grizzly bears, which would restrict motorized activity associated with the transmission line construction from April 1 to June 15 within bear habitat in the Miller Creek and

Midas Creek drainages. This area located within the Cabinet Yaak CYRZ for grizzly bears also overlaps lynx habitat in the West Fisher and Crazy LAUs and would minimize disturbance to potential movement between the drainages and decrease the risk of mortality in the spring. Alternative B construction would also not occur during the winter (December 1 to April 30) in big game winter range areas as identified by MFWP. This would eliminate winter disturbance caused by Alternative B construction in the West Fisher LAU, while partially restricting it in the Crazy LAU. Between the grizzly and big game timing restrictions, winter disturbance in the West Fisher LAU and spring disturbance in the West Fisher LAU, Miller Creek Area, and the Crazy LAU in Midas Creek associated with Alternative B would not occur. This would maintain the existing security levels and connectivity for lynx between the drainages during the winter and spring.

In summary, Alternative B construction and associated road reconstruction or temporary road construction would affect travel and lynx habitat within both LAUs. The transmission line narrow clearing area would not be expected to impede movement within the Crazy or West Fisher LAU or outside of the LAU in the approach/linkage area due to the short-term construction period of 2 years, the amount of vegetative cover that is expected to remain in the clearing area, and low potential for lynx. The intent of ***Objective ALL 01*** and ***Standard ALL S1*** would be met.

Guideline ALL G1: *Methods to avoid or reduce effects on lynx should be used when constructing or reconstructing highways or forest highways across federal land. Methods could include fencing, underpasses, or overpasses.*

Reconstructed and new roads associated with Alternative B are not considered forest highways and do not incorporate specific measures to avoid or reduce effects on lynx. Alternative B would include the construction of new roads and reconstruction of existing roads for transmission line access, which were analyzed as affecting a 25-foot road width. Use of most of these roads would be limited to construction equipment during the construction period, and traffic volume would be low. Specific measures that would minimize potential impacts on lynx would not be necessary due to the short duration of use, low traffic volume and speeds, low potential to affect lynx, and a low potential for lynx to occur. Alternative B would meet the intent of ***Guideline ALL G1***.

B. Objectives and Guidelines Applicable to Human Use Projects in Lynx Habitat within LAUs.

Objective HU O1: *Maintain the lynx's natural competitive advantage over other predators in deep snow by discouraging the expansion of snow-compacting activities in lynx habitat.*

Snow compaction created by human activities was not found to be a threat to lynx (USFWS 2000). Alternative B transmission line construction could occur during the winter, but the USFWS also concluded there is no evidence that packed snow routes facilitated competition to a level that negatively affected lynx or lynx populations (USFWS 2003b). Alternative B transmission line construction would not occur during the winter in big game winter ranges (December1 to April 30). Thus, no late winter activity associated with Alternative B construction would occur within the West Fisher LAU as it is located entirely on winter range. In the Crazy LAU, Alternative B activities would be partially located on winter range. A timing restriction for grizzly bear restricts motorized activity associated with construction from April 1 to June 15 within bear habitat in the Miller Creek and Midas Creek drainages, which also overlap both LAUs. Activities related to construction of Alternative B and associated road use would occur outside of the big game and grizzly bear timing restriction, which would reduce potential for snow compaction along portions of the transmission line. Activities associated with Alternative B construction could occur in late October and November and snow compaction is possible. The short-term nature of the activities occurring in 2 months where snow is likely would not be expected to measurably change the lynx's natural competitive advantage. Based on local research by Kolbe *et al.* 2007, any potential increase in the ability of predators and competitors to move into lynx habitat on snow-compacted roads or trails is not likely to create enough competition with coyotes for snowshoe hare that lynx on the site-specific scale would be adversely affected. The intent of ***Objective HU 01*** would be met by Alternative B.

Objective HU O3: *Concentrate activities in existing developed areas, rather than developing new areas in lynx habitat.*

Objective HU O5: *Manage human activities, such as special uses, mineral and oil and gas exploration and development, and placement of utility transmission corridors, to reduce impacts on lynx and lynx habitat.*

The components of Alternative B were designed, to the extent possible, to avoid lynx habitat and use existing roads and facilities. However, due to the objective of the project, to construct a powerline from the substation located on US 2 to the plant site up Ramsey Creek, some construction would occur in undeveloped areas, mainly over the ridge from Miller Creek into Midas Creek. Where possible, roads currently open year-round would be used for construction access. Although some new access roads would be built and some currently closed roads would be opened for transmission line access, these roads would be used temporarily during transmission line construction and would not likely be used during winter. Helicopter use is at the discretion of the contractor and may be used for four activities – structure placement, line stringing, timber harvest, and annual inspection and maintenance. Logging may take 1 to 2 months over the 2-year period. Structure placement and line stringing would take 1 to 2 weeks each. Annual inspections may take about a week a year. Increased noise would occur during these times and construction activities would be generally audible for about 2.5 miles, depending on the topography. Noise associated with the transmission line activity would not be expected to measurably change lynx use patterns. Most indications are that lynx do not significantly alter their behavior to avoid human activities (summarized in USFWS NRLMD Biological Opinion, 2007, p. 68).

No mitigation plans are associated with Alternative B specifically for lynx. However, Alternative B incorporates mitigation for other resources that would reduce impacts on lynx. Alternative B would require a timing restriction for short-term displacement effects for grizzly bears, which would restrict motorized activity associated with the transmission line construction from April 1 to June 15 within bear habitat in the Miller Creek and Midas Creek drainages. This area located within the Cabinet Yaak CYRZ for grizzly bears also overlaps lynx habitat in the West Fisher and Crazy LAUs and would minimize disturbance to potential movement and provide for a decreased risk of mortality during this time. See Objective HU 01 for a description of the big game winter range timing that would also reduce impacts to lynx. The intent of ***Objective HU 03*** and ***HU 05*** would be met by Alternative B.

Guideline HU G4: *For mineral and energy development sites and facilities, remote monitoring should be encouraged to reduce snow compaction.*

Alternative B includes several operational and post-operational monitoring plans (see section 2.4.5, *Monitoring Plans*), which include hydrology, aquatic life, tailings dam stability, and revegetation, but none monitor snow compaction. No monitoring for lynx, lynx habitat, or snow compaction was proposed in Alternative B. The potential effect of snow compaction was previously addressed for ***Objective HU O1,*** and the intent of ***Objective HU 01*** would be met by Alternative B. Although remote monitoring for snow compaction is not feasible, Alternative B also would not include on-the-ground monitoring for increases in snow compaction off of the access roads by public snowmobiles. However, due to mitigation incorporated for big game and grizzly bears (described under ***Objectives HU 01***, ***HU 03***, and ***HU 05***), which restricts Alternative B construction during the winter (December 1 to April 15) on big game winter ranges (as mapped by FWP) and in early spring (April 1 to June 15) for grizzly bears in the Miller Creek and Midas Creek drainages, the potential for snow compaction resulting from Alternative B during these times on about 3 miles in the West Fisher LAU and about 3 miles in the Crazy LAU would not occur. Alternative B, due to non-related lynx mitigation, would meet the intent of ***Guideline HU G4***.

Guideline HU G5: *For mineral and energy development sites and facilities that are closed, a reclamation plan that restores lynx habitat should be developed.*

Alternative B includes a reclamation plan that over the long term would likely restore affected lynx habitat. The reclamation plan for Alternative B was developed with the goal of establishing a post-mining environment compatible with existing and proposed land uses and consistent with the KFP. Following construction, land within the clearing area that has been rutted, compacted, or disturbed would be reclaimed. Access roads opened or constructed for transmission line access would be gated or barriered, regraded, scarified, and reseeded after transmission line construction. At mine closure, the transmission line would be removed and all new roads would be reclaimed and graded to match the adjacent topography and obliterate the road prism. Interim and permanent seed mixes with both native and introduced species would be used. Native shrubs, such as alder or willow, would be planted on streambanks to reduce bank erosion. Alternative B would meet ***Guideline HU G5***.

Guideline HU G6: *Methods to avoid or reduce effects on lynx should be used in lynx habitat when upgrading unpaved roads to maintenance levels 4 or 5, if the result would be increased traffic speeds and volumes, or a foreseeable contribution to increases in human activity or development.*

As described for ***Guideline ALL G1*** above, reconstructed and new roads associated with Alternative B do not incorporate specific methods to avoid or reduce effects on lynx. Roads that would be built or reconstructed would have a disturbance area no more than 25 feet wide. Use of most of these roads would be limited to construction equipment during the construction period, and traffic volume would be low. Specific measures that would minimize potential road reconstruction impacts on lynx for Alternative B are probably not necessary due to the short duration of use and low potential to affect lynx. Alternative B would meet ***Guideline HU G6***.

Guideline HU G7: *New permanent roads should not be built on ridgetops and saddles, or in areas identified as important for lynx habitat connectivity. New permanent roads and trails should be situated away from forested stringers.*

Alternative B would cross over the ridge between the Miller Creek and Upper Midas drainage where currently no road exists. Temporary roads would be constructed. Alternative B construction activity would be of short duration (about 2 years) and would not occur on the entire line at one time. In addition, due to mitigation incorporated for grizzly bears (see ***Objectives HU 01***, ***HU 03***, and ***HU 05***), construction-related activity would not occur in the Miller Creek and Midas Creek drainages from April 1 to June 15. Known lynx locations are to the west and lynx appear to use the divide below Midas Peak, south of Howard Lake, where the Libby Creek Road and NFS road #4724 cross. Lynx habitat connectivity would remain with implementation of Alternative B as shrubs and other low vegetation is expected to remain in the transmission line clearing area. Alternative B would meet ***Guideline HU G7***.

Guideline HU G8: *Cutting brush along low-speed, low-traffic-volume roads should be done to the minimum level necessary to provide for public safety.*

Roads opened or temporary access roads constructed for the transmission line access would be closed after the transmission line was built. On new roads, all trees and shrubs would be cleared for a 12-foot width, with a total road width assumed to be 25 feet. After construction, temporary access roads would be closed and surfaces reseeded for the Operations Phase. Roads could be used for maintenance as needed, and brushing for safety may be needed during the Operations Phase. On open roads and gated administrative roads opened for construction, brushing would likely occur for public or administrative use safety. Alternative B would comply with ***Guideline HU G8*** as roads used for Alternative B construction/maintenance access are low-speed, low-traffic-volume roads and brushing would only occur where required for safety.

Guideline HU G9: *On new roads built for projects, public motorized use should be restricted. Effective closures should be provided in road designs. When the project is over, these roads should be reclaimed or decommissioned, if not needed for other management objectives.*

Access roads opened or constructed for transmission line access would be used only during the Construction Phase or for maintenance, which is expected to be required infrequently. Where seasonally closed roads were used for construction, efforts would be made to minimize their use during the restricted period. Restricted roads used or built for constructing the transmission line would restrict public use. Yearly inspection and repair of the line would be conducted by helicopter. Monitoring at monthly intervals during the growing season would be conducted along the clearing area and access roads to detect the invasion of weeds. Herbicide would be carried in tanks mounted on vehicles or in backpack tanks. Routine maintenance would identify and remove targeted trees and tall shrubs through manual or mechanical means. Clearing of hazard trees and tall shrubs in the clearing area would continue until decommissioning of the line. Roads opened or constructed for access would be closed and reseeded as an interim reclamation activity to stabilize the surface during the Operations Phase. MMC expects the transmission line facilities would be the last facilities reclaimed following mine closure. After the transmission line was removed, all newly constructed roads on National Forest System lands would be bladed and re-contoured, obliterating the road prism. Alternative B would comply with ***Guideline HU G9***.

Guideline HU G12: *Winter access for non-recreation special uses and mineral and energy exploration and development should be limited to designated routes or designated over-the-snow routes.*

If road access occurred during the October and November activities associated with Alternative B, access would be limited to designated routes. Due to mitigation restricting construction during winter on winter ranges for big game (December 1 to April 30) and restricting motorized activity associated with construction from April 1 to June 15 within bear habitat in the Miller and Midas

Creek drainages, motorized access for Alternative B construction during winter is limited. Alternative B meets ***Guideline HU G12***.

Effects on Lynx on Private and State Land

The NRLMD management direction does not apply to private land or State land located within a LAU. Alternative B would not be located on any private or State land in the West Fisher 14503 or Crazy 14504 LAUs. Effects to lynx habitat inside the LAUs, and outside of the LAUs within the MFSA analysis area, are discussed in the *Effects to Lynx Habitat Components* section, p. 1362. Although an individual lynx may alter its route to avoid the increased activity associated with construction of the transmission line and Sedlak Park Substation, effects within the US 2 linkage zone would be short-term due to the short duration (over a 2-year period) of construction, transmission line construction activity would not occur all the time on any one section of the line during that time frame, some level of low shrubs providing cover would likely remain within the transmission line clearing or would recover during the Operations Phase, and the low potential for lynx to occur.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

Effects on Lynx on National Forest System Lands

With respect to NRLMD applicable Objectives, Standards, and Guidelines, general effects to lynx in the Crazy LAU 14504 and the West Fisher LAU 14503 from Alternative C-R are as described for Alternative B, with the exception of the following:

A. Objectives, Standards, and Guidelines Applicable to ALL Management Projects in Lynx Habitat in LAUs in Occupied Habitat and in Linkage Areas, Subject to Valid Existing Rights.

Objective ALL O1: *Maintain or restore lynx habitat connectivity in and between LAUs, and in linkage areas.*

Standard ALL S1: *New or expanded permanent development and vegetation management projects must maintain habitat connectivity in a LAU and/or linkage area.*

More clearing area and tree clearing, but fewer structures and access roads, would be required for Alternative C-R than Alternative B. In Alternative C-R, construction of the transmission line and access roads could affect lynx movement within LAUs 14503 and 14504 by removing forest cover in potential movement areas such as the Miller Creek and Howard Creek riparian corridors (see the *Effects to Lynx Habitat Components* section, p. 1362 for a discussion of effects to lynx habitat). Existing movement areas and connectivity toward the east side of the Crazy LAU through the Horse Mountain to the Poker Hill area would remain, as well as toward the eastern edge of the West Fisher LAU, but cover would be modified in the 150-foot transmission line right of way. Within this right of way area trees and shrubs would likely be removed, which may affect lynx movement across the opening. The analysis assumed a 200-foot clearing width (Table 37. Comparison of Mitigation in Transmission Line Alternatives.) as outside of the 150-foot right of way danger trees may be removed as necessary. Removing danger trees in this additional 50-foot width would not be expected to affect the availability of low shrubs and trees providing cover for movement. It is expected however that low-growing shrubs would also persist in portions of the right of way clearing area, providing some level of cover, and not all areas would be cleared due to the height of the line as a result of mitigation.

Outside and to the east of the West Fisher LAU about 4.5 miles of Alternative C-R, beginning at the Sedlak Park Substation, would be located within the US 2 linkage zone area. Discussion of this portion of the transmission line is in the *Effects on Lynx on Private and State Land a*nalysis sections following the federal lands discussion for Alternative C-R.

Slash would be left in the clearing area, providing down wood, but the clearing area would not be expected to provide habitat suitable for lynx denning. Most documented den sites in Montana have been in mature spruce-fir forests with high horizontal cover and abundant coarse woody debris, while younger stands and stands with discontinuous canopies were seldom used (Squires *et al*. 2008). Areas of surface disturbance in lynx habitat, such as access roads and pulling and tensioning sites, would return to suitable lynx habitat in the long term once vegetation is re-established. For access roads constructed, this return to suitable lynx habitat could be after reclamation if the road was used for maintenance and bladed for safety during the Operations Phase. Vegetation succession would continue on pulling and tensioning sites during the Operations Phase, but would be re-disturbed during reclamation.

The acreages of lynx habitat affected are probably an overestimate of the actual effects because a Vegetation Removal and Disposition Plan (as specified in Environmental Specifications, Appendix D) developed for Alternative C-R would minimize tree removal, thereby maintaining more shrub and tree cover in the transmission line clearing area than Alternative B. This would serve to maintain connectivity within the LAUs by minimizing vegetation removal in the clearing area. MMC would develop this plan and submit it for agency approval before the Construction Phase (see section 2.5.3.3.1, *Vegetation Removal and Disposition* in the Alternative 3 discussion). For more detailed discussion of the effects to lynx habitat, see the *Effects to Lynx Habitat Components* section, p. 1362.

Construction activities associated with the transmission line and access roads would not be expected to measurably affect lynx movement within LAUs 14503 and 14504 due to the activities that would be spread along the transmission line route over a 2-year period, hiding cover would remain throughout most of the clearing area outside of roads, and plant succession would likely continue on most temporary roads throughout the Operations Phase. Alternative C-R would meet the intent of ***Objective ALL 01*** and ***Standard ALL S1***.

B. *Objectives and Guidelines Applicable to Human Use Projects in Lynx Habitat within LAUs.*

Objective HU O3: *Concentrate activities in existing developed areas, rather than developing new areas in lynx habitat.*

Due to the objective of Alternative C-R, to construct a powerline from the substation located at Sedlak Park on US 2 to the plant site located on Libby Creek, construction activities would occur in undeveloped areas, mainly over the ridge from Miller Creek into Midas Creek. Fewer structures and access roads would be required for Alternative C-R than Alternative B. For Alternative C-R, helicopters would be used to construct structures at 26 locations in the Miller Creek, Midas Creek, and Howard Creek drainages, thereby eliminating the need for access roads in these locations. Alternative C-R would meet ***Objective HU 03***.

Objective HU O5: *Manage human activities, such as special uses, mineral and oil and gas exploration and development, and placement of utility transmission corridors, to reduce impacts on lynx and lynx habitat.*

Required grizzly bear timing mitigation for Alternative C-R construction, which would restrict all activities on National Forest System lands for both construction seasons of the transmission line between June 16 and October 14, would remove transmission line construction disturbance during the important winter period and early spring in both the West Fisher 14503 and Crazy 14504 LAUs. Due to grizzly bear mitigation, Alternative C-R would meet the intent of ***Objective HU 05***.

Guideline HU G4: *For mineral and energy development sites and facilities, remote monitoring should be encouraged to reduce snow compaction.*

In northwest Montana, Kolbe *et al.* (2007) found that coyotes remained in lynx habitat with deep snow throughout the winter months, and although readily available, selected compacted surfaces for only a small portion of their travel time. Kolbe *et al.* (2007) concluded that the overall influence of compacted snowmobile trails on coyote movements and hunting success was minimal, and that compacted routes would not significantly affect competition with lynx for snowshoe hare. However, the agencies' Threatened and Endangered Species Mitigation Plan for lynx incorporates measures to monitor snow compaction off designated mine access routes. Remote monitoring is difficult and impractical, and new off-road use can easily be monitored from the access roads. To address Northern Rockies Lynx Management ***Guideline HU G4***, Forest Service personnel would monitor new snow compaction activities (such as snowmobiling) in the project area and take appropriate action if compaction monitoring identified increased predator access to new areas. Alternative C-R would meet ***Guideline HU G4***.

Guideline HU G5: *For mineral and energy development sites and facilities that are closed, a reclamation plan that restores lynx habitat should be developed.*

See the Alternative 3 and Alternative B ***Guideline HU G5*** discussion. Alternative C-R would include permanent seed mix with native species only, if commercially available. Snags would also be left in clearing areas, unless required to be removed for safety reasons, and up to 30 tons per acre of coarse woody debris would be left within the clearing area providing for more down woody potential. Alternative C-R would meet ***Guideline HU G5***.

Guideline HU G7: *New permanent roads should not be built on ridgetops and saddles, or in areas identified as important for lynx habitat connectivity. New permanent roads and trails should be situated away from forested stringers.*

Alternative C-R would differ in route location compared to Alternative B, but would also meet ***Guideline HU G7***.

Guideline HU G12: *Winter access for non-recreation special uses and mineral and energy exploration and development should be limited to designated routes or designated over-the-snow routes.*

Alternative C-R incorporates the grizzly bear transmission line construction timing mitigation, and activity associated with the transmission line construction would occur between June 16 and October 14 within the Cabinet-Yaak Grizzly Bear CYRZ and Cabinet Face BORZ on federal lands. This would include all federal lands within with West Fisher and Crazy LAUs, and winter access for the transmission line construction would not occur. Alternative C-R would comply with ***Guideline HU G12***.

C. *Objectives, Standards, and Guidelines Applicable to ALL Projects in Linkage Areas in Occupied Habitat, Subject to Valid Existing Rights.*

Objective LINK O1: *In areas of intermingled land ownership, work with landowners to pursue conservation easements, habitat conservation plans, or other solutions to reduce the potential of adverse impacts on lynx and lynx habitat.*

Alternative C-R does not meet ***Objective LINK 01*** by itself. Grizzly bear habitat compensation mitigation associated with the agencies' combined action alternatives, which include combinations with Alternative C-R, would meet the intent of ***Objective LINK 01***. Please see the discussion under "*Effects Common to all Combined Action Alternatives*" and also under Alternatives 3 and 4, ***Objective LINK 01***.

Effects on Lynx on Private and State Land

The NRLMD management direction does not apply to private or State land. Alternative C-R would not affect lynx habitat on private land in LAUs 14504 and 14503. See the *Effects to Lynx Habitat Components* section, p. 1362 for discussion of effects to habitat on private land outside the LAUs.

Alternative C-R would affect lynx habitat on DNRC section 36 T27N, R30W. For effects to lynx habitat mapped on State lands, see the Alternative C-R discussion under the *Effects to Lynx Habitat Components* section, p. 1362. As described under Alternative B, potential movement through the US 2 linkage zone area would not be impeded. More shrubs and low trees would remain in the Alternative C-R transmission line clearing area due to the mitigation requirement for a Vegetation Removal and Disposition Plan. This plan would minimize vegetation removal, allowing for more remaining cover for lynx movement. This mitigation would also be applied to State land. To mitigate for helicopter displacement on spring bear range on State land, the agencies' transmission line construction schedule for grizzly bears (construction-related activity would occur between June 16 and October 14) would be applied to the State section 36, partially located within the West Fisher LAU. As a result, this would remove transmission line construction-related activity on State lynx habitat during the important winter period for lynx and early spring and reduce potential displacement and mortality risk to lynx during this time frame.

Alternative D-R – Miller Creek Transmission Line Alternative

With respect to NRLMD applicable Objectives, Standards, and Guidelines, impacts on lynx in the Crazy LAU 14504 and the West Fisher LAU 14503 from Alternative D-R would as described for Alternative B modified by Alternative C-R, with the exception of the following:

Effects on Lynx on National Forest System Lands

Objective ALL 01: In Alternative D-R, construction of the transmission line and access roads could affect lynx movement within LAUs 14503 and 14504 by removing forest cover in potential movement areas such as the Miller Creek and Howard Creek corridors.

Objectives HU 01, HU 03, and HU 05: For Alternative D-R, helicopters would be used to construct structures at 16 locations in the Miller Creek and Howard Creek drainages, thereby eliminating the need for access roads in these locations.

Effects on Lynx on Private and State Land

The NRLMD management direction does not apply to private or State land within the LAUs. Alternative D-R would not affect lynx habitat on private land in LAUs 14504 and 14503. See the *Effects to Lynx Habitat Components* section, p. 1362 for a discussion of the effects on private land outside the LAUs.

Alternative D-R would affect lynx habitat on State section 36 T27N, R30W. For effects to lynx habitat on State lands, see the Alternative D-R discussion under the *Effects to Lynx Habitat Components* section, p. 1362.

Alternative D-R vegetation removal mitigation and timing mitigation and effects to lynx on State section 36 T27N, R30W are as described for Alternative C-R.

Alternative E-R – West Fisher Creek Transmission Line Alternative

Effects on Lynx on National Forest System Lands

With respect to NRLMD applicable Objectives, Standards, and Guidelines, impacts on lynx in the Crazy LAU 14504 and the West Fisher LAU 14503 from Alternative E-R would be the same as Alternative B, as modified by Alternatives C-R and D-R, with the exception of the following:

Objectives HU 01, HU 03, and HU 05:

For Alternative E-R, helicopters would be used to construct structures at 31 locations along West Fisher Creek and Howard Creek, thereby eliminating the need for access roads in these locations.

Effects on Lynx on Private and State Land

The NRLMD management direction does not apply to private or State land within the LAUs. Alternative E-R would not affect lynx habitat on private land in LAUs 14504 and 14503. Please see the *Effects to Lynx Habitat Components* section, p. 1362 for a discussion of the effects on private land outside the LAUs.

Alternative E-R would affect lynx habitat on State section 36 T27N, R30W. For effects to lynx habitat on State lands, see the Alternative D-R discussion under the "*Effects to Lynx Habitat Components*" section, as both Alternatives D-R and E-R affect the same acreage on the State section. Alternative E-R vegetation removal and timing mitigation and effects to lynx on State section 36 T27N, R30W are as described for Alternative C-R.

Combined Mine-Transmission Line Effects

With respect to NRLMD applicable Objectives, Standards, and Guidelines, effects to lynx are described in detail under the "*Effects Common to All Action Alternatives*" section and specific action alternative for the mine or transmission line and are briefly summarized in the following paragraphs.

National Forest System Lands

As previously described, the action alternatives for the mine would not affect lynx or lynx habitat in the West Fisher LAU 14503. Impacts in the West Fisher LAU 14503 are due entirely to the effects of the transmission line, while Crazy LAU 14504 would be affected by action alternatives for both the mine and transmission line alternatives.

Objective ALL O1: *Maintain or restore lynx habitat connectivity in and between LAUs, and in linkage areas.*

Standard ALL S1: *New or expanded permanent development and vegetation management projects must maintain habitat connectivity in a LAU and/or linkage area.*

None of the combined mine-transmission line alternatives would affect any NRLMD designated linkage areas within the LAUs. North and south connectivity and identified linkages in the main Crazy and West Fisher LAUs would remain undisturbed. In all of the combined action alternatives, construction and reconstruction of the mine access roads, including the main haul route on the Bear Creek Road #278, would result in increased traffic volume and speeds. Connectivity and movement toward the west or eastward in the LAUs to the identified approach areas along US 2 would be maintained with construction of the transmission line, although movement may be temporarily disturbed during construction activities on any one section of the line being worked on.

In all combined action alternatives, construction of the transmission line and access roads could affect lynx movement within LAUs 14503 and 14504 by removing forest cover in potential movement areas in the Miller, Howard, Libby, West Fisher, and Ramsey creek corridors. Vegetation would be cleared in areas of ground disturbance, such as access roads and pulling and tensioning sites. In some portions of transmission line clearing areas, only the largest trees would be removed, leaving some shrub and tree cover in the transmission line clearing area. Portions of the clearing area would not require clearing, such as within high spans across valleys. Areas of surface disturbance in lynx habitat would return to suitable lynx habitat in the long term if natural successional processes were permitted to occur. Displacement effects from human activity, including low-traffic roads, do not appear to be a major concern for lynx (Ruediger *et al.* 2000), and this would apply to the opened, reconstructed, or new constructed access roads used for the transmission line construction, or maintenance. Construction activities and transmission line access roads may temporarily disturb lynx during construction, but connectivity for lynx movement within and between LAUs 14503 and 14504 would remain.

With respect to the effectiveness of mitigation plans, Alternative 2B and the agencies' combined action alternatives would include a road closure for grizzly bear mitigation, also included as mitigation for the Rock Creek Project. If the Rock Creek Project has not yet implemented the closure, prior to the Evaluation Phase, the Upper Bear Creek Road (NFS road #4784) would be closed with an earthen barrier for the life of the mine and would significantly improve grizzly bear habitat in BMU 5, which would consequently improve security for lynx in the Crazy LAU. In the adjacent Rock LAU, prior to the Construction Phase, the agencies' alternatives only would require the Rock Lake Trail 150A to be closed with a barrier that would also significantly improve grizzly bear habitat in both BMU 4 and BMU 5. As a result of the Rock Lake Trail 150A mitigation closure, connectivity and security for lynx would directly improve in the West Fisher and Rock LAUs by reducing a fracture zone, and would indirectly provide for better connectivity between LAUs to the north and south. This improvement would occur in the linkage area identified in the NRLMD (USDA Forest Service. 2007a, Figure 1-1), and the general wildlife north-south movement corridor displayed in the Wildlife BA 2013, Figure 6d.

With respect to effectiveness of other mitigation plans associated with Alternative 2B, implementation of MMC's proposed Wetland Mitigation Plan would include the Libby Creek Recreation Gold Panning Area Site as potential wetland mitigation, just south of Alternative B, which may maintain wetland and riparian areas used for movement near the transmission line. The vegetation removal or disposition plan as described in Environmental Specifications (Appendix D) does not apply to Alternative 2B. Implementation of the agencies' combined action alternatives proposed Wetland Mitigation Plan would not include the Libby Creek Recreation Gold Panning Site, but includes other additional wetlands, plus the Vegetation Removal and Disposition Plan would apply to Alternatives C-R, D-R, and E-R, and the Environmental Specifications (Appendix D) would promote connectivity by increasing availability of continuous forest or shrub cover.

Alternative 2B and any of the agencies' combined action alternatives would meet ***Objective ALL 01*** and ***Standard ALL S1***.

Guideline ALL G1: *Methods to avoid or reduce effects on lynx should be used when constructing or reconstructing highways or forest highways across federal land. Methods could include fencing, underpasses, or overpasses.*

Reconstructed and new roads associated with all combined action alternatives do not incorporate specific measures such as fencing, underpasses, or overpasses to avoid or reduce effects on lynx. Upgrades that would be made would not result in the construction of a forest highway. Roads improved for any of the combined action alternatives mine access would allow higher vehicle speeds and increased traffic, and could increase the risk of lynx mortality due to vehicle collision. Overall, the volume of traffic expected is substantially increased over the existing condition, but is low relative to the volume of traffic known to cause lynx mortality or identified with potential to impede movement (see the ***Standard ALL S1*** discussion for Alternative 2). The USFWS (2003b) concluded the overall threat to lynx populations from high-traffic volume on roads that bisect suitable habitat is low, especially for resident lynx. The Cabinet Mountains has low potential for lynx and travel habitat would be maintained adjacent to mine access roads.

All combined action alternatives would include the construction of new roads and reconstruction of existing roads for transmission line access. Use of most of these roads would be limited to construction equipment during the construction period, and traffic volume would be low. Specific measures that would minimize potential impacts on lynx are not necessary as previously discussed under the transmission line only alternatives.

Alternative 2B would not include any measures to reduce potential effects to lynx from road use or access changes. Alternative 2B would not meet the intent of ***Guideline ALL G1***.

The combined agencies' action alternatives would incorporate adaptive management mitigation measures that would reduce effects to lynx from changes to forest roads. See Alternative 3 ***Guideline ALL G1***. All agency combined action alternatives would meet ***Guideline ALL G1***.

Objectives HU 01, HU 03, and HU 05: No new snowmobile trails or play areas would be created for any of the combined mine-transmission line alternatives. Components of combined action alternatives were designed, to the extent possible, to avoid lynx habitat and to use existing roads and facilities. Where possible, roads currently open year-round would be used for construction access. Although some new access roads would be built and some currently closed roads would be opened for transmission line access, these roads would be used temporarily during transmission line construction and would not be used during the main wintering period.

Alternative 2B or any of the agencies' combined action alternatives would meet ***Objectives HU 01, HU 03,*** and ***HU 05.***

Guideline HU G4: *For mineral and energy development sites and facilities, remote monitoring should be encouraged to reduce snow compaction.*

Remote monitoring for snow compaction is difficult and impractical; however, Alternative 2B did not propose on-the-ground monitoring for lynx, lynx habitat, or snow compaction. Alternative 2B would not meet the intent of ***Guideline HU G4***.

The agencies' combined action alternatives propose to monitor snow compaction and new off-road use by monitoring from the access roads. As described in sections 2.5.6*, Monitoring* and 2.5.7*, Mitigation Plans*, to comply with Guideline HU G4, Forest Service personnel would monitor new snow-compaction activities (such as snowmobiling) in the project area and would take appropriate action if compaction monitoring identified increased predator access to new areas. The agencies' combined action alternative would meet ***Guideline HU G4.***

Guideline HU G5: *For mineral and energy development sites and facilities that are closed, a reclamation plan that restores lynx habitat should be developed.*

All combined action alternatives would include a reclamation plan that over the long term (after the 30 year life of the mine)) in the mine disturbance areas where all vegetation has been removed, is expected to return disturbed lynx habitat to pre-project quality. Compared to Alternative 2B, the agencies' combined action alternatives success criteria and planting/seeding conditions for reclamation would be more rigorous, as discussed previously, and is expected to result in more successful regeneration of vegetation that may provide lynx habitat.

Guideline HU G6: *Methods to avoid or reduce effects on lynx should be used in lynx habitat when upgrading unpaved roads to maintenance levels 4 or 5.*

As described previously for ***Guideline ALL G1*** above, reconstructed and new roads associated with the combined action alternatives do not incorporate specific physical methods such as construction of overpasses or fences to avoid or reduce effects on lynx. Roads improved for mine access would allow higher vehicle speeds and increased traffic, and could increase the risk of lynx mortality due to vehicle collision.

Alternative 2B would not include any monitoring to detect lynx mortalities in permit areas or along access roads. Alternative 2B, as proposed, would not meet the intent of ***Guideline HU G6***.

The agencies' combined action alternatives would include mitigation plans that incorporate adaptive management strategies to reduce the risk of mortality to lynx, including monitoring of lynx mortalities in permit areas and along access roads, and would meet the intent of ***Guideline HU G6***.

Winter road access for activities associated with the combined action alternatives would be limited to designated routes. Access roads opened or constructed for transmission line access would be used only during the Construction Phase or for maintenance, which is expected to be required infrequently, and based on required mitigation for grizzly bear or big game, would not be used during winter. Annual inspections and most transmission line maintenance would be completed via helicopter or non-motorized access. All combined action alternatives would include plowing of the Bear Creek Road (NFS road #278) and the Libby Creek Road (NFS road #231) during the 2-year evaluation program and the 1-year period while the Bear Creek Road is reconstructed, which would make access to lynx habitat easier for trappers and increase the risk of incidental lynx mortality. Plowing would occur on the Upper Libby Creek Road #2316 through all phases from Evaluation through Operations, but access would limited to mining traffic with a lower potential for increased mortality risk due to incorporated mitigation.

Private Land

The NRLMD management direction does not apply to private land. For effects to lynx habitat on private land, see the *Effects to Lynx Habitat Components* section, p. 1362. Potential movement through private land located in identified approach areas for any of the combined action alternatives transmission lines are as described under Alternative B or C-R.

State Land

The NRLMD management direction does not apply to State land. The combined action Alternative 2B would not be located on State land and, therefore, would not affect State mapped lynx habitat. The agencies' combined action alternatives would not affect lynx habitat on the State section 16, T28N, R30W located outside and adjacent to the Crazy 14504 LAU as no upgrading or widening of the NFS road #231 is proposed prior to use during the Construction Phase while the Bear Creek Road #278 was reconstructed and upgraded. The agencies' mitigated transmission line alternatives would cross portions of State section 36 T27N, R30W and would affect lynx habitat. See the *Effects to Lynx Habitat Components* section, p. 1362.

To mitigate for helicopter displacement on spring bear range on State land, the agencies' transmission line construction schedule for grizzly bears (construction-related activity would occur between June 16 and October 14) would be applied to the State section 36, partially located within the West Fisher LAU. This would remove the transmission line construction of any of the agencies' mitigated combined action alternatives activity on State habitat during the important winter period for lynx and early spring and would reduce potential displacement and mortality risk to lynx during this time frame.

For effects to lynx habitat mapped on State lands, see the discussion under the *Effects to Lynx Habitat Components* section, p. 1362 for combined action alternatives effects.

Mine, Transmission Line, and Combined-Mine Transmission Line Alternatives – Summary of Effects within the LAUs

The proposed activities associated with mine or transmission line development would result in a period of increased human activity and noise. Although lynx are generally considered tolerant of human activity, it is expected that a range of behavioral response could occur depending on the individual and circumstances involved (Interagency Lynx Biology Team 2013). As such, implementation of the proposed activities within occupied lynx habitat may result in disturbance and avoidance of the disturbed area by resident lynx for the life of the mine.

Large areas of lynx habitat are not being treated and would not experience increased levels of use within the Crazy and West Fisher LAUs. The proposed Rock Creek Project may occur in the adjacent Rock LAU, but LAUs to the north and south have no known or limited ongoing activities in lynx habitat. Any lynx potentially displaced during project activities would be able to find secure habitat given the ample suitable habitat within the affected LAUs and adjacent LAUs.

The USFWS found no evidence that mineral development was a factor threatening lynx (USFWS 2007d), and concluded that the NRLMD contained guidelines to minimize the impacts of mineral-related activities on individual lynx and lynx habitat. The USFWS concluded that most actions in lynx habitat that are in compliance with the NRLMD would either have no effect on lynx or would not likely adversely affect lynx. Only the agencies' mitigated combined action alternatives comply with all applicable NRLMD Objectives, Standards, and Guidelines and, therefore, human activities associated with the access roads and haul route (including winter use and plowing), impoundment site, mill facility and ore conveyor system, mine adits and ventilation adits (including blasting during construction), helicopter use during transmission line construction and maintenance once a year), monitoring sites, or any other related activities associated with the agencies' alternatives are not expected to measurably affect lynx that may occur or their habitat that occurs in the Cabinet Mountains.

Effects to Lynx Habitat Components

Impacts on lynx habitat from individual mine and transmission line alternatives are shown in Table 245 and Table 246. The impacts described for mine alternatives would be limited to LAU 14504 (Crazy) and include acres for the plant site and associated facilities, impoundment, Libby Adit Site, and all associated reconstructed and new roads. Lynx habitat components associated with the mine alternatives are considered removed for the life of the mine. Impacts from the transmission line alternatives would occur in both LAU 14503 (West Fisher) and LAU 14504 (Crazy) and include disturbance widths for the transmission line, temporary access roads or new road construction or existing road reconstruction, and power pole footprints. Within the transmission line disturbance boundaries, outside of existing and new roads, after commercial tree removal, shrubs/grass and short trees are expected to remain and provide some level of cover. Buffer widths are described previously in the *Analysis Method* section. Impacts on lynx habitat from the combined mine-transmission line alternatives, which affect both the Crazy and West Fisher LAUs, are shown in Table 247.

Table 245. Impacts on Lynx Habitat Components with National Forest System and Private Lands in the Crazy LAU 14504 by Mine Alternative.

Lynx Habitat Component	[Alt 1] No Mine/ Existing Condition				[Alt 2] MMC's Proposed Mine		[Alt 3] Agency Mitigated Poorman Tailings Impoundment Alternative		[Alt 4] Agency Mitigated Little Cherry Creek Tailings Impoundment Alternative	
	NFS		Private		NFS	Private	NFS	Private	NFS	Private
	(acres)	(%)	(acres)	(%)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)
Non-habitat low-elevation	7,824		805		1,349	14	830	0	1,127	14
Travel (matrix) habitat[1]	21,076		219		43	15	35	15	36	15
Total lynx habitat[2]	22,557	44	171	1						
Early stand initiation[3] summer forage only	81	<1	0	0	0	0	0	0	0	0
Stand initiation[4] winter forage	3,009	13	0	0	342	0	137	0	70	0
Other (stem exclusion)[5] Non-forage	1,033	5	31	<1	20	0	0	0	0	0
MSMLS[6] (forage)	18,434	82	140	82	85	0	22	0	14	0
Total lynx habitat on NFS lands removed (%)					447 (2%)	0 (0%)	159 (0.7%)	0 (0%)	84 (0.4%)	0 (0%)

Impacted habitat is removed for the life of the mine; see existing condition Table 243 for total ownership.
NFS – National Forest System.
[1]Travel (or matrix) habitat does not support snowshoe hares (SSH) but is suitable for lynx habitat connectivity and occurs between patches of boreal forest in close juxtaposition (at the scale of a lynx home range) such that lynx are likely to travel through such habitat while accessing patches of boreal forest within a home range.
[2]Lynx habitat: Percent of total ownership and comprised of suitable and currently unsuitable habitat. Unsuitable habitat currently does not provide sufficient vegetation quantity or height to be used by SSH/lynx. Acres do not include travel habitat or low-elevation habitat that comprises the remaining percentage of the LAUs.
[3]Early stand initiation stage: These acres are currently unsuitable lynx habitat that do not provide sufficient vegetation quantity or quality (height) to be used by SSH and lynx in winter.
[4]Stand initiation structural stage currently suitable SSH winter habitat.
[5]Other, including stem exclusion, currently unsuitable structural stages that do not provide winter SSH habitat.
[6]MSMLS - Multistory mature late successional stages with multiple age classes and structural components that provide winter SSH habitat.

Table 246. Impacts on Lynx Habitat Components by Transmission Line Alternative within the LAUs.

Lynx Habitat Component	[Alt. A] No Transmission Line Existing Condition				[Alt. B] North Miller Creek		[Alt. C-R] Modified North Miller Creek		[Alt. D-R] Miller Creek		[Alt. E-R] West Fisher Creek	
	NFS		State/ Private		NFS	State/ Private	NFS	State/ Private	NFS	State/ Private	NFS	State/ Private
	(acres)	(%)	(acres)	(%)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)
West Fisher LAU (14503)												
Non-habitat low-elevation	6,234		2,163		25	0	56	<1	39	<1 [7]	57	30 [8]
Travel habitat[1]	11,215		806		17	0	53	<1	43	<1 [7]	80	0
Total lynx habitat[2]	12,247		354									
Early stand initiation[3]	0		0		0	0	0	0	0	0	0	0
Stand initiation[4]	337		0		0	0	0	0	0	0	0	0
Other (stem exclusion)[5]	970		0		0	0	1	0	1	0	4	0
MSMLS[6]	10,940		354		6	0	5	0	61	0	37	0
Total lynx habitat cleared or removed (%)					6 (0.5%)	0 (0%)	6 (0.5%)	0 (0%)	62 (0.5%)	0 (0%)	41 (0.5%)	0 (0%)

Lynx Habitat Component	[Alt. A] No Transmission Line Existing Condition				[Alt. B] North Miller Creek		[Alt. C-R] Modified North Miller Creek		[Alt. D-R] Miller Creek		[Alt. E-R] West Fisher Creek	
	NFS		State/ Private		NFS	State/ Private	NFS	State/ Private	NFS	State/ Private	NFS	State/ Private
	(acres)	(%)	(acres)	(%)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)
Crazy LAU (14504) (only National Forest System lands affected by the transmission line)												
Total LAU	51,457		0									
Non-habitat low-elevation	7,824		0		14	0	15	0	15	0	15	0
Travel habitat[1]	21,076		0		23	0	1	0	10	0	10	0
Total lynx habitat[2]	22,557		0									
Early stand initiation[3]	81	<1	0	0	0	0	0	0	0	0	0	0
Stand initiation[4]	3,009	13	0	0	34	0	20	0	8	0	8	0
Other (stem exclusion)[5]	1,003	5	0	0	3	0	4	0	9	0	9	0
MSMLS[6]	18,434	82	0	0	42	0	33	0	28	0	28	0
Total lynx habitat cleared or removed (%)					79 <(0.5%)	0 (0%)	57 <(0.5%)	0 (0%)	45 <(0.5%)	0 (0%)	45 <(0.5%)	0 (0%)

Impacted habitat is vegetation cleared within the transmission line corridor.
See existing condition Table 243 for total ownership.
Note that transmission line alternatives in the Crazy LAU impact National Forest System lands only.
MSMLS – multistory late successional, SSH - snowshoe hare, NFS – National Forest System.
[1]Travel (or matrix) habitat that does not support SSH that occurs between patches of boreal forest in close juxtaposition (at the scale of a lynx home range) such that lynx are likely to travel through such habitat while accessing patches of boreal forest within a home range.
[2]Lynx habitat: Acres do not include "travel\matrix" or low-elevation stands (considered unsuitable SSH habitat, but suitable for lynx habitat connectivity); travel and low-elevation habitat comprises the remaining suitable plus unsuitable habitat.
[3]Early stand initiation stage: These acres are lynx habitat that currently does not provide sufficient vegetation quantity or quality (height) to be used by SSH and lynx in winter.
[4]Stand initiation structural stage currently suitable SSH winter habitat.
[5]Other, non-forage, including stem exclusion, currently unsuitable structural stages not providing winter SSH habitat.
[6]MSMLS - stages with multiple age classes and structural components that provide winter SSH habitat.
[7]These acres are <1-acre portion of State section 36 T27N, R30W. Within the LAU, the KNF mapped the State land impacted by C-R or D-R transmission line alternatives as either travel or low-elevation non-habitat. The State HCP mapped the affected portion of these stands as winter forage habitat.
[8]These 30 cleared acres of non-habitat for the Alternative E-R transmission line are located on Plum Creek property.

Table 247. Impacts on Lynx by Transmission Line Alternative Outside the LAU.

LAU Component	[Alt. A] No Transmission Line Existing Condition	[Alt. B] North Miller Creek	[Alt. C-R] Modified North Miller Creek	[Alt. D-R] Miller Creek	[Alt. E-R] West Fisher Creek
Transmission Line Analysis Area (mainly outside LAU) for compliance with MEPA and MFSA					
Plum Creek		132	107	107	109
Other Private		1	0	0	0
NFS		16	6	6	25
Northwestern Land Office (NWLO) Total Potential Lynx Habitat	65,473				
Montana State S36, T27N, R30W, State HCP Mapped Lynx Habitat	180 acres				
Summer Forage	(<4,000 ft) 18 acres	0	0	0	0
Winter Forage (two stands)	(>4,000ft) 46 ac[1]. (<4,000 ft) 48 ac.	0	<1 2	<1 2	1
Temporary Non-suitable	(<4,000 ft) 69 ac.	0	0	0	6
Not Mapped as Lynx Habitat	322/138[2] 460	0	<3	<3	25
Total State HCP Lynx Habitat Cleared on the NWLO			<3 acres (<1%)	<3 acres (<1%)	7 acres (<1%)

Impacted habitat is vegetation cleared within the transmission line corridor.

[1]The (>4,000-foot) 46-acre portion of State section 36 mapped by the State as lynx habitat is also within the West Fisher LAU and mapped by the KNF as either travel habitat or low-elevation non-habitat, with those effects disclosed previously in Table 246, and corresponding footnote #7.

[2]These 138 acres are also located within the West Fisher LAU and mapped by the KNF as either low-elevation non–habitat or travel habitat.

Table 248. Impacts within LAUs by Combined Mine-Transmission Line Alternative.

LAU Habitat Component	[1] No Mine/ Existing Conditions		[2] MMC's Proposed Mine		[3] Agency Mitigated Poorman Impoundment Alternative						[4] Agency Mitigated Little Cherry Creek Impoundment Alternative					
	TL-A		TL-B		TL-C-R		TL-D-R		TL-E-R		TL-C-R		TL-D-R		TL-E-R	
	NFS	State Pri-vate	NFS	State Pri-vate	NFS	State Pri-vate	NFS	State Pri-vate	NFS	State Pri-vate	NFS	State Pri-vate	NFS	State Pri-vate	NFS	State Pri-vate
	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)
West Fisher LAU (14503) *(transmission line and associated road effects only)*																
Non-habitat low-elevation			26	0	56	<1	39	<1	58	30	56	0	39	<1	58	30
Travel habitat			18	0	53	<1	43	<1	8	3	53	0	43	<1	8	3
Total lynx habitat	12,247	353														
Early stand initiation			0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stand initiation			0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other (stem exclusion)			0	0	1	0	1	0	4	0	1	0	1	0	4	0
MSMLS			6	0	5	0	61	0	37	0	5	0	61	0	37	0
Total lynx habitat removed/cleared in LAU			6 (<1%)	0	6 (<1%)	0	62 (<1%)	0	41 (<1%)	0	6 (<1%)	0	62 (<1%)	0	41 (<1%)	0

LAU Habitat Component	[1] No Mine/ Existing Conditions		[2] MMC's Proposed Mine		[3] Agency Mitigated Poorman Impoundment Alternative						[4] Agency Mitigated Little Cherry Creek Impoundment Alternative					
	TL-A		TL-B		TL-C-R		TL-D-R		TL-E-R		TL-C-R		TL-D-R		TL-E-R	
	NFS	State Pri-vate	NFS	State Pri-vate	NFS	State Pri-vate	NFS	State Pri-vate	NFS	State Pri-vate	NFS	State Pri-vate	NFS	State Pri-vate	NFS	State Pri-vate
	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)	(ac.)
Crazy LAU (14504) *(mine development-impoundment/plant site & conveyor belt/associated roads etc/transmission line/associated road effects)*																
Non-habitat low-elevation habitat			1,363	14	845/0		845/0		845/0		1,143	14	1,142	14	1,142	14
Travel habitat			59	16	36	16	46	16	45	16	36	16	46	16	46	16
Total lynx habitat	22,557	171														
Early stand initiation			0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stand initiation			366	0	154	0	142	0	142	0	88	0	76	0	76	0
Other (stem exclusion)			23	0	4	0	9	0	9	0	4	0	9	0	9	0
MSMLS habitat			123	0	54	0	50	0	50	0	47	0	43	0	43	0
Total lynx habitat removed/cleared in LAU			512 (2%)	0	212 (<1%)	0	201 (<1%)	0	201 (<1%)	0	139 (<1%)	0	128 (<1%)	0	128 (<1%)	0

Number in parentheses is percentage of all lynx habitat in LAU.

[1]Travel (or matrix) habitat that does not support SSH that occurs between patches of boreal forest in close juxtaposition (at the scale of a lynx home range) such that lynx are likely to travel through such habitat while accessing patches of boreal forest within a home range.

[2]Lynx habitat: Acres do not include "travel\matrix" or low-elevation stands (considered unsuitable SSH habitat, but suitable for lynx habitat connectivity); travel and low-elevation habitat comprises the remaining suitable plus unsuitable habitat.

[3]Early stand initiation stage: These acres are lynx habitat that currently does not provide sufficient vegetation quantity or quality (height) to be used by SSH and lynx in winter.

[4]Stand initiation structural stage currently suitable SSH winter habitat.

[5]Other, non-forage, including stem exclusion, currently unsuitable structural stages not providing winter SSH habitat.

[6]MSMLS - stages with multiple age classes and structural components that provide winter SSH habitat.

Effects to Lynx Habitat Common to All Alternatives

Private Land

Rock LAU 14702. The no action alternatives or any of the individual mine and transmission line alternatives or combined mine-transmission line alternatives would have no measurable impact on lynx habitat on the 13 acres of MMC-owned private land above Rock Lake in the Rock LAU 14702. The 13-acre property is a mosaic of steep rock and talus slopes, interspersed with shrub/grass and trees. The KNF broadly mapped the area as multistory late successional habitat, but aerial imagery clearly shows the preponderance of rock and talus. The Rock Lake Ventilation Adit portal opening would be about 15 feet wide by 15 feet high and would be gated with a steel grate or similar structure. Total surface disturbance associated with the Rock Lake Ventilation Adit would be about an acre (see *Alternative 2 Proposed Action*). Based on aerial imagery, about 0.5 acres of the 1-acre site identified as the disturbance area supports shrubs and some standing timber. According to MMC's proposed action, the adit location is very steep and is likely bare rock (see *Alternative 2, Post-mining Topography of Project Facilities, Rock Lake Ventilation Adit*), and does not provide lynx habitat. The National Forest System land surrounding the MMC parcel containing the 1-acre adit disturbance site provides similar habitat of rock, talus, scattered timber, and shrub cover. The availability of lynx habitat within the Rock LAU or the immediate area would not be measurably affected (less than 0.1 percent), and similar habitat would remain on National Forest System land. Thus, this LAU will not be evaluated further.

West Fisher 14503 and Crazy 14504 LAUs. No measurable impact on lynx habitat on private land (MMC or Plum Creek lands) in LAUs 14503 and 14504 would result from the no action alternatives, any of the individual mine or transmission line alternatives, or any of the combined mine-transmission line alternatives. Private lands potentially affected by any of the action alternatives within LAUs 14503 and 14504 have the majority of the acreage mapped as low-elevation non-habitat or travel habitat.

Private Land MFSA Analysis Area Considered Outside of LAU Boundaries. Lynx habitat is not mapped on private lands outside of the LAUs, and no impact on lynx habitat would occur. Any displacement effects to potential lynx movement outside of the LAU would be minimal due to the short duration of the transmission line and Sedlak Park Substation construction activity and low potential for the species to occur in the low-elevation area. Vegetative cover in the form of shrubs and grass would continue to be provided in the transmission line clearing area.

State Lands: As described under the *Affected Environment* section, two DNRC State-owned sections within the Montanore Project action area are identified by the State HCP as being located within the general distribution area for lynx, and where lynx will be considered for State activities. State section 16, T28N, R30 is located outside of the Crazy LAU 14504 boundary in the Libby Creek drainage with the Libby Creek Road located through the northwest quarter, and is not affected by any of the mine disturbance or transmission line disturbance boundaries. Libby Creek Road #231, which passes through State section 16, is currently used by MMC to access the Libby Adit site. State section 36 T27N, R30W is partially located within the West Fisher 14503 LAU and is considered under 1) existing conditions for lynx habitat components within the West Fisher LAU, and 2) effects to lynx habitat within the Private/State land Montana DEQ MFSA Transmission Line Analysis Area for each alternative where applicable.

National Forest System Lands. Lynx habitat within the West Fisher LAU 14503 (impacted by transmission line alternatives only) and Crazy LAU 14504 (impacted by both mine only and transmission line alternatives) would be affected by the proposed action alternatives.

The potential for any of the action alternatives to remove or clear lynx habitat and affect lynx is considered low as lynx rarely use, or are absent from, the Cabinet Mountains, although both lynx habitat and records of lynx occur. The reason for the low level of lynx use is unknown, but limiting factors for lynx habitat present in the Cabinet Mountains potentially include the combination of topographic roughness (steep bisected slopes), aspect, and a moist pacific maritime climate resulting in unsuitable snow conditions (Squires, pers. comm. 2012; personal observation by J. Squires, pers. comm. 2011; and Squires and DeCesare, pers. comm. 2006).

Existing conditions provide a mosaic of habitat except for the early stand initiation structural stage, which is lacking in both LAUs due to limited harvest and fire history in the last 15 to 20 years. The most abundant lynx habitat in both LAUs is multistory mature late successional forage habitat (Table 248), with the Crazy LAU having the highest amount of stand initiation at 13 percent. In the Rockies, lynx habitat relationships appear to be less tied to early successional forest stage. High use, especially in the critical winter season, is tied to mature multilayer forests with Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) in the overstory and midstory. These stands are composed of larger diameter trees with higher horizontal cover and more abundant snowshoe hares (*Lepus americanus*), and deeper snow compared to random availability. Multilayer spruce–fir forests provide high horizontal cover, with tree branching that touches the snow surface (Squires *et al.* 2006; Squires *et al.* 2010).

Denning habitat is not limited in the LAUs associated with the proposed action alternatives. Coarse woody materials are found throughout the LAUs, especially in areas that receive limited active management (*e.g.,* Cabinet Mountain Wilderness and old growth stands). Both the West Fisher and Crazy LAUs have a preponderance of multistory mature late successional stands that provide abundant opportunities for denning (Table 248). Currently available winter snowshoe hare habitat in either the stand initiation stage or multistory mature/late successional forests would be near or within a reasonable distance from denning habitat.

None of the mine, transmission line, or combined mine-transmission line alternatives would include the direct use of fire for habitat improvement except as potential mitigation to compensate for the effects of the mine on grizzly bears and their habitat.

No Action Alternatives

The No Mine Alternative 1, No Transmission Line Alternative A, and No Action Combined Mine Transmission Line Alternative would have no direct or indirect impacts on lynx or lynx habitat.

Mine Alternatives

Crazy LAU 14504

The Construction Phases of mine Alternatives 2, 3, and 4 would include vegetation removal to provide space for project facilities, including evaluation and ventilation adits, plant site and conveyor belt, tailings impoundment, and any associated road reconstruction or construction (Table 245). Lynx habitat removed for the mine alternatives would not be expected to provide lynx habitat for at least the life of the mine.

Alternative 2

Alternative 2 would remove lynx habitat on 447 acres, resulting in about 2 percent of lynx habitat within the LAU being affected. Habitat removed would include stands currently providing winter forage (stand initiation structural stage), multistory mature late successional structural stage also providing forage, and other habitat mapped as stem exclusion stands that currently do not provide foraging habitat for snowshoe hare or lynx. The plant site and the impoundment disturbance areas would remove small amounts of stand initiation stage habitat (Table 245), while the LAD and remaining acreage affected by the impoundment within the LAU would remove low-elevation non-habitat.

The Upper Bear Creek Road access road (NFS road #278) follows the low-elevation edge of the LAU and then extends south into the LAU located in low-elevation non-habitat. Once inside the LAU, about the first 1.5 miles of the access road bisects the main LAU from the Hoodoo Mountain area and then continues to the Little Cherry Creek impoundment and LAD Area 2 at the base of Ramsey Creek. Both the LAD Area 2 and Little Cherry Creek impoundment are located on the edge of the LAU and extend outside of the boundary. Within the LAU, the majority of vegetation removed for the impoundment and all of LAD Area 2 is mapped as low-elevation non-habitat, but the impoundment would remove a mix of lynx habitat (stand initiation and multistory mature late successional stages providing foraging habitat, and a stem exclusion stand not providing foraging habitat). Lynx habitat removed by the impoundment and LAD Area 1 would be at the lower elevation of mapped lynx habitat within the LAU and would not be expected to deter movement through the LAU. The Ramsey Creek Plant site would affect winter forage habitat at the head of Ramsey Creek, while the access road reconstruction would impact travel habitat further bisecting the drainage. Ramsey Creek would be crossed by the plant site disturbance boundary and, along with the access road, would be located within 900 feet of the creek. The access road from Ramsey Creek to the Libby Adit Site is about 50 percent in low-elevation non-habitat with the remainder a mosaic of travel, stand initiation, or multistory mature late successional habitat and located at the lower elevation of mapped habitat. The Libby Adit Site located on private MMC-owned land and included in travel habitat would be expanded.

Alternative 2 would remove 2 percent of lynx habitat within the LAU for the life of the mine, and removal of habitat would extend up into both the Ramsey and adjacent Libby Creek drainages.

Impacts from Alternative 2 on old growth forest potentially providing red squirrel habitat are described in section 3.22.2, *Old Growth Ecosystems*. About 367 acres of old growth would be affected by Alternative 2 (Table 179) and would impact 0.4 percent of the approximate 17 percent of old growth available within the Crazy PSU. Compared to the other mine alternatives, Alternative 2 would affect the most old growth habitat, but its effects on the proportion of old growth in the Crazy PSU would be less than 1 percent and the PSU would remain well above the KFP standard of a minimum of 10 percent. Approximately 95 percent of the Crazy LAU is located within the Crazy PSU, and potential habitat provided by old growth for red squirrels would remain well distributed throughout both areas.

Alternative 3 and Alternative 4

Alternatives 3 and 4 would remove 159 acres or 85 acres, respectively, or less than 1 percent of lynx habitat within the Crazy LAU. Habitat removed would include stands currently providing winter forage (stand initiation structural stage) or multistory mature late successional stages also providing foraging habitat.

The location of the access road (NFS road #278) and effects to low-elevation non-habitat would remain the same from the edge of the LAU to either of the agencies' impoundment locations. The Poorman Creek impoundment site used in Alternative 3 would mainly remove low-elevation non-habitat, with the site extending outside of the LAU, but it would remove a small stand of multistory mature late successional habitat and the eastern portion of a stand in the initiation stage, both of which provide winter foraging habitat. The impoundment used for Alternative 4 and effects to the Crazy LAU are the same as described for Alternative 2. South from the impoundment locations to the Libby Plant site location, the NFS road #278 access road reconstruction and construction would remove low-elevation non-habitat except for a small amount on the edge of a stand providing winter forage (stand initiation habitat).

The Libby Creek Plant site location for both agency mine alternatives would remove 65 acres of a stand in the initiation stage that provides winter foraging habitat. The construction/reconstruction of the road from the Libby Creek Plant site to the Libby Adit Site would remove foraging habitat consisting of multistory mature late successional habitat and stand initiation habitat located along the lower elevation of mapped lynx habitat. Travel habitat and low-elevation habitat would also be removed by the road reconstruction.

Impacts from Alternative 3 or Alternative 4 on old growth forest potentially providing red squirrel habitat are described in section 3.22.2, *Old Growth Ecosystems*. About 236 to 214 acres of old growth would be removed under Alternative 3 or 4, respectively, with corresponding increases of old growth being affected by edge effects (Table 179). At the Crazy PSU scale, Alternative 3 would result in a 0.5-percent loss of designated old growth, while Alternative 4 would result in a 0.2-percent loss of designated old growth. Both Alternatives 3 and 4 would remove less than 1 percent of designated old growth and the percentage of old growth in the Crazy PSU would remain above the 10-percent KFP minimum standard. Approximately 95 percent of the Crazy LAU is located within the Crazy PSU, and potential habitat provided by old growth for red squirrels would remain well distributed throughout both areas.

Evaluation of Effects Resulting from Mitigation

Impacts to lynx habitat resulting from the proposed agencies' alternatives would be mitigated for by habitat enhancement on lynx stem exclusion habitat at a 2:1 ratio (2 acres treated for every acre lost) as described in the agencies' alternatives mitigation plan. Between 436 and 526 acres for Alternative 3 or 290 to 380 acres for Alternative 4 of treatment would occur. Post-Alternative 2, 3, and 4, after the mine closes, reclamation efforts would reinitiate vegetation succession on the tailings impoundment, plant sites, and roads. Based on the inherent habitat potential of the individual stand, and success of the reclamation efforts, lynx habitat could develop over time (after reclamation ends in about 30 years, and for at least an additional 15 years or more until the stands reached the early stand initiation stage).

Transmission Line Alternatives Impact on Lynx Habitat Components within LAUs

Impacts on lynx habitat on KNF/private or State lands within the West Fisher 14503 and Crazy 14504 LAUs from transmission line alternatives are shown in Table 246. Due to the linear nature of the transmission line alternatives, clearing of tall trees in a 150- to 200-foot-wide strip, and the expected retention of low trees, shrub, and grass cover in the transmission line clearing outside of road surfaces or cutbanks, sufficient vegetation providing cover for lynx movement is expected to remain or recover through the Operations Phase. Temporary access roads would remove vegetation during construction, but during the Operations Phase, vegetation succession would continue or be maintained at a certain height within the clearing for the transmission line alternative. Within the Crazy LAU, only federal land would be affected by the transmission line alternatives, while in the West Fisher LAU, both federal and non-federal lands would be affected, depending upon the alternative.

Alternative B – MMC's Proposed Transmission Line North Miller Creek

In Alternative B, about 6 acres and up to 79 acres of commercial timber harvest removal would occur in lynx habitat in LAUs 14503 and 14504, respectively. As shown in Table 246, Alternative B would remove overstory trees and tall shrubs within multistory mature late successional habitat on about 6 acres in LAU 14503, and 42 acres in LAU 14504. In the Crazy 14504 LAU, Alternative B would also remove any overstory trees on 34 acres of stand initiation and 3 acres of stem exclusion habitat. Included in these acres of affected lynx habitat is the construction of new temporary access roads, which would remove vegetation during the Construction Phase. Lynx habitat acres actually impacted on the ground are expected to be less because some shrub and tree cover would be maintained in the transmission line clearing area; only the largest trees would be removed and some areas would not be cleared. However, for Alternative B, no mitigation for limiting vegetation clearing is proposed and it could be removed. For Alternative B, following construction, land within the clearing area that has been rutted, compacted, or disturbed would be reclaimed, and roads opened or constructed for transmission line access would be gated or barriered, regraded, scarified, and reseeded as an interim reclamation activity designed to stabilize the surface. Any vegetation, such as shrubs or low trees, within the transmission line clearing area that may remain or grow back on the temporary access roads during the Operations Phase would provide cover for lynx movement within and across the LAUs and temporary or closed roads used for maintenance would not provide cover for movement. For the West Fisher 14503 or the Crazy 14504 LAUs, less than 0.5 percent of lynx habitat within either individual LAU would be affected by Alternative B.

Impacts from Alternative B on old growth forest potentially providing red squirrel habitat are described in section 3.22.2, *Old Growth Ecosystems*. A total of about 29 acres of old growth would be cleared, with about 22 acres located in the Crazy PSU and about 2 acres within the Silverfish PSU. Alternative B would affect the most old growth habitat of the transmission line alternatives, but its effects on the proportion of old growth in the analysis area would be minor. Alternative B would result in less than 0.5 percent of old growth cleared within the transmission line clearing area in each PSU. More than 17 percent of old growth would remain in the Crazy PSU and about 13.6 percent would remain in the Silverfish PSU, both above the KFP standard of a minimum of 10 percent. As about 95 percent of the Crazy LAU is located within the Crazy PSU and 97 percent of the Silverfish PSU is located within the Silverfish PSU, potential habitat provided by old growth for red squirrels would remain well distributed throughout all four areas.

Suitable habitat for snowshoe hares would remain throughout both LAUs, with multistory mature late successional habitat comprising 82 to 89 percent of the lynx habitat available in the Crazy and West Fisher LAUs, respectively. Although stands in the early successional stages (early stand initiation stage, summer forage only and unsuitable for snowshoe hare in winter, or stand initiation structural stages providing winter snowshoe hare habitat) are limited, both LAUs would continue to provide habitat for lynx and snowshoe hares. As previously described, in the Rockies, lynx habitat relationships appear to be less tied to early successional forest stage.

Post-project and after the transmission line was removed, all newly constructed roads would be bladed and re-contoured to match the existing topography, obliterating the road prism. Reclamation efforts would reinitiate vegetation succession on the transmission line. Based on the habitat potential of the individual stand, lynx habitat could develop over time.

Effects on Lynx Habitat on Private and State Land

Within the MFSA Transmission Line Analysis Area, lynx habitat has not been identified on private lands either inside or outside of the LAUs, and no impact on lynx habitat would occur. Within the LAUs, Transmission Line Alternative B would not impact privately owned lands. Any effects to potential lynx movement outside of the LAUs would be minimal due to the short duration of the transmission line and Sedlak Park Substation construction activity, and low potential for the species to occur in the low-elevation area. Vegetative cover in the form of shrubs and grass would continue to be provided on most of the transmission line clearing area.

State Land

Transmission Line Alternative B would not be located near or adjacent to the State lands and no direct or indirect effect to lynx habitat on State lands would occur.

Alternative C-R - Agency Modified North Miller Creek Transmission Line Alternative

In Alternative C-R, in LAUs 14503 and 14504, about 6 acres and 57 acres, respectively, of timber removal would occur in lynx habitat. The least timber harvest and removal of commercial timber would occur with Alternative C-R, compared to the other transmission line alternatives. As shown in Table 246, Alternative C-R would remove overstory trees and tall shrubs within multistory mature late successional habitat on about 5 acres in LAU 14503 and 33 acres in LAU 14504. Compared to the other transmission line alternatives, impacts on multistory or late-successional forest snowshoe hare habitat would be the least for Alternative C-R. In the Crazy 14504 LAU, Alternative C-R would also remove any overstory trees on 20 acres of stand initiation and 4 acres of stem exclusion habitat. Included in these acres of affected lynx habitat is the construction of new temporary access roads, which would remove vegetation during the Construction Phase. Lynx habitat acres actually impacted on the ground are expected to be less because some shrub and tree cover would be maintained in the transmission line clearing of 150 feet; only the largest trees would be removed, some areas would not be cleared, and the clearing would provide cover for lynx movement within and across the LAUs. In the wider 200-foot clearing area considered for the analysis, outside of the 150-foot right of way danger trees may be removed but otherwise vegetation is expected to remain. For Alternative C-R, following construction, land within the clearing area that has been rutted, compacted, or disturbed would be reclaimed, and roads opened or constructed for transmission line access would be gated or barriered, regraded, scarified, and reseeded as an interim reclamation activity designed to stabilize the surface. Coarse down wood would also be left within the right of way and larger clearing area, providing a component for potential denning if the overall habitat remained suitable. This is unlikely, however, as most documented den sites in Montana have been in mature spruce-fir forests with high horizontal cover and abundant coarse woody debris, while younger stands and stands with discontinuous canopies were seldom used (Squires *et al*. 2008).

Within either LAU, less than 0.2 percent of multistory mature late successional habitat would be affected, with this habitat component in the West Fisher and Crazy LAUs remaining at 89 percent and 82 percent, respectively. Overall, for the West Fisher 14503 or the Crazy 14504 LAU, less than 0.5 percent of lynx habitat within either individual LAU would be affected by Alternative C-R.

Impacts from Alternative C-R on old growth forest potentially providing red squirrel habitat are described in section 3.22.2, *Old Growth Ecosystems*. No old growth would be removed in the Crazy PSU but 6 acres of old growth in the Silverfish PSU would be removed. Compared to the other agency-mitigated transmission line alternatives, Alternative C-R would affect the most old growth habitat, but its effects on the proportion of old growth in the analysis area would be minor. Alternative C-R would result in less than 0.2 percent of old growth cleared within the transmission line clearing area in the Silverfish PSU. More than 17 percent of old growth would remain in the Crazy PSU and about 13.6 percent would remain in the Silverfish PSU, both above the KFP standard of a minimum of 10 percent. As about 95 percent of the Crazy LAU is located within the Crazy PSU and 97 percent of the Silverfish PSU is located within the Silverfish PSU, potential habitat provided by old growth for red squirrels would remain well distributed throughout both PSUs.

Suitable habitat for snowshoe hares would remain throughout both LAUs, with multistory mature late successional habitat comprising 82 to 89 percent of the lynx habitat available in the Crazy and West Fisher LAUs, respectively. Although stands in the early successional stages (early stand initiation stage, summer forage only and unsuitable for snowshoe hare in winter, or stand initiation structural stages providing winter snowshoe hare habitat) are limited, both LAUs would continue to provide habitat for lynx and snowshoe hares. As previously described, in the Rockies, lynx habitat relationships appear to be less tied to early successional forest stage. Post-project and after the transmission line was removed, all newly constructed roads would be bladed and re-contoured to match the existing topography, obliterating the road prism. Reclamation efforts would reinitiate vegetation succession on the transmission line. Based on the habitat potential of the individual stand, lynx habitat could develop over time.

Effects on Lynx on Private and State Land

Within the MFSA Transmission Line Analysis Area, lynx habitat has not been identified on private lands and no impact on lynx habitat would occur. Within the LAUs, Transmission Line Alternative C-R would not impact privately owned lands. Any displacement effects to potential lynx movement outside of the LAU would be minimal due to the short duration of the transmission line and Sedlak Park Substation construction activity and low potential for the species to occur in the low-elevation area. Vegetative cover in the form of shrubs and grass would continue to be provided on most of the transmission line clearing area.

State Land

Transmission Line Alternative C-R would cross the northeast quarter of section 36 T27N R30W. Effects to lynx habitat within the section are disclosed in Table 246. Less than 1 acre (about 0.33 acre) of low-elevation non-habitat or travel habitat would be affected based on the KNF LAU mapping. Based on DNRC habitat mapping, a total of 3 acres from two different stands identified as winter forage would be cleared of overstory trees, leaving the majority of the mapped winter foraging habitat within the section untreated. Within the transmission line clearing area disturbance boundary, cover from the remaining vegetation of shrubs and low trees would provide cover for lynx movement, although suitability for winter forage may be reduced. The remaining area cleared within the section was not mapped as habitat, but cover for movement would remain.

Impacts to lynx habitat on State land would be mitigated by implementing the agencies' alternatives transmission line mitigations on State land. A Vegetation Removal and Disposition Plan, as specified in the Environmental Specifications (Appendix D) developed for Alternative C-R, would minimize tree removal and would maintain more shrub and tree cover in the transmission line clearing area. To provide for down wood within the clearing area, Alternative C-R would leave snags in the clearing area, unless required to be removed for safety reasons, and up to 30 tons per acre of coarse woody debris would be left within the clearing area. Woody material would be scattered and not concentrated within the clearing area. Individual logs would exceed 3 inches in diameter, and preference would be for a down “log” to be at least 8 feet long with a small end diameter of 6 inches or more. This material would originate from existing logs on-site, unused portions of designated cut trees, broken tops, or similar materials. This mitigation would be incorporated into the Vegetation Removal and Disposition Plan. The amounts of coarse woody debris left would depend upon Vegetation Response Unit (VRU). The KNF has mapped VRUs on a landscape scale, including State section 36, and Alternative C-R would be located within VRU3 on State section 36, where mitigation direction would be to leave 15 to 30 tons (23 to 30 logs) per acre of coarse woody debris on-site after timber clearing.

Transmission line construction-related activity would not occur during the critical winter period. By applying the agencies’ timing mitigation to reduce disturbance to grizzly bears during the denning and spring seasons, construction-related activity would occur between June 16 and October 14.

Alternative C-R construction would occur during that time frame over a 2-year period, and activity would not occur on the entire line at any one time. Potential for disturbing a lynx would be low due to the short duration of activity, and secure habitat would remain widely available across the adjacent federally designated LAU. Low-growing shrubs would persist in most of the clearing area (150- to 200-foot width), providing some level of cover for movement, and not all areas would be cleared, depending upon the height of the line. Alternative C-R would affect less than 3 acres of winter foraging habitat on the State section 36, and summer foraging habitat potential would remain on the 3 acres. Lynx movement and connectivity of habitat would be maintained through the State section and into the adjacent LAU. Connectivity toward the east and the US 2-Barren/Hunter Peak approach area would be maintained. During construction activities, short-term displacement may occur, but as activity would be spread temporally and spatially across the transmission line, the amount and duration of disturbance that any one lynx may potentially experience would be minimal. As described previously, lynx are highly mobile and movement across the transmission line clearing area could occur in a section with no activity. Most indications are that lynx do not significantly alter their behavior to avoid human activities (summarized in USFWS NRLMD Biological Opinion 2007, p. 68).

Alternative C-R would not measurably change the total potential lynx habitat available within the Libby Unit, which includes State section 36 affected by the transmission line. Less than 3 acres of lynx habitat on State land would be affected by Alternative C-R.

Alternative D-R – Miller Creek Transmission Line Alternative

In Alternative D-R, about 62 acres and 45 acres of timber removal would occur in lynx habitat in LAUs 14503 and 14504, respectively. As shown in Table 246, Alternative D-R would remove overstory trees within multistory mature late successional habitat on about 61 acres in LAU 14503, and 28 acres in LAU 14504. Compared to other agencies’ mitigated transmission line alternatives, Alternative D-R would have the greatest effect on multistory or late-successional forest snowshoe hare habitat when both LAUs are considered. Additionally in the West Fisher 14503 LAU, Alternative D-R would remove overstory trees on 1 acre of stem exclusion habitat and in the Crazy 14502 LAU, would remove overstory trees on 8 acres of stand initiation and 9 acres of stem exclusion habitat. Included in these acres of affected lynx habitat is the construction of new temporary access roads, which would remove vegetation during the Construction Phase. Lynx habitat acres actually impacted on the ground are expected to be less due to that some shrub and tree cover would be maintained in the transmission line clearing area; only the largest trees would be removed and some areas would not be cleared. For Alternative D-R, following construction, land within the clearing area that has been rutted, compacted, or disturbed would be reclaimed, and roads opened or constructed for transmission line access would be gated or barriered, regraded, scarified, and reseeded as an interim reclamation activity designed to stabilize the surface. Any vegetation such as shrubs or low trees within the transmission line clearing area that would remain or grow back on the temporary access roads during the Operations Phase would provide cover for lynx movement within and across the LAUs. Coarse down wood would also be left within the clearing area, providing a component for potential denning if the overall habitat remained suitable. This is unlikely, however, as most documented den sites in Montana have been in mature spruce-fir forests with high horizontal cover and abundant coarse woody debris, while younger stands and stands with discontinuous canopies were seldom used (Squires *et al*. 2008). Post-project and after the transmission line was removed, all newly constructed roads would be bladed and re-contoured to match the existing topography, obliterating the road prism. Reclamation efforts would reinitiate vegetation succession on the transmission line. Based on the habitat potential of the individual stand, lynx habitat could develop over time. Within either LAU, less than 0.5 percent of multistory mature late successional habitat would be affected, with this habitat component in the West Fisher and Crazy LAUs remaining at 89 percent and 82 percent, respectively. Overall, for the West Fisher 14503 LAU or the Crazy 14504 LAU, less than 0.5 percent of lynx habitat within either individual LAU would be affected by Alternative D-R.

Impacts from Alternative D-R on old growth forest potentially providing red squirrel habitat are described in section 3.22.2, *Old Growth Ecosystems*. No old growth would be removed in the Crazy PSU but 4 acres of old growth in the Silverfish PSU would be removed. Compared to the other agencies' mitigated transmission line alternatives, Alternative D-R would clear less than Alternative C-R, but more than Alternative E-R, and its effects on the proportion of old growth in the analysis area would also be minor. Alternative D-R would result in less than 0.2 percent of old growth cleared within the transmission line clearing area in the Silverfish PSU. More than 17 percent of old growth would remain in the Crazy PSU and about 13.6 percent would remain in the Silverfish PSU, both above the KFP standard of a minimum of 10 percent. As about 95 percent of the Crazy LAU is located within the Crazy PSU and 97 percent of the Silverfish PSU is located within the Silverfish PSU, potential habitat provided by old growth for red squirrels would remain well distributed throughout the four areas.

Effects on Lynx Habitat on Private Land

Within the MFSA transmission line analysis area, lynx habitat has not been identified on private lands either inside or outside of the LAUs, and no impact on lynx habitat would occur. Within the LAUs, Transmission Line Alternative D-R would not impact privately owned lands. Any effects to potential lynx movement outside of the LAU in the MFSA analysis area would be minimal due to the short duration of the transmission line and Sedlak Park Substation construction activity and low potential for the species to occur in the low-elevation area. Vegetative cover in the form of shrubs and grass would continue to be provided on most of the transmission line clearing area.

State Land

Just as Alternative C-R, Alternative D-R would cross the northeast quarter of section 36 T27N, R30W. Effects to lynx habitat within the section are disclosed in Table 246. Less than 1 acre (about 0.33 acre) of low-elevation non-habitat or travel habitat would be affected based on the KNF LAU mapping. Based on State mapping, a total of 3 acres from two different stands identified as winter forage would be cleared of overstory trees, leaving the majority of the winter foraging habitat identified in the section unaffected. Cover from the remaining vegetation of shrubs and low trees would provide cover for lynx movement, although suitability for winter forage may be reduced. The remaining area cleared was not mapped as habitat, but cover for movement would remain. Impacts to lynx habitat on State land would be mitigated by implementing the agencies' alternatives transmission line mitigations on State land as described under Alternative C-R.

Alternative E-R – West Fisher Creek Transmission Line Alternative

In Alternative E-R, about 40 acres and 45 acres of timber removal would occur in lynx habitat in LAUs 14503 and 14504, respectively. The impacts of Alternative E-R at 45 acres in the Crazy 14504 LAU are the same as Alternative D-R. As shown in Table 246, Alternative E-R would remove overstory trees within multistory mature late successional habitat on about 36 acres in LAU 14503 and 28 acres in LAU 14504. Additionally in the West Fisher 14503 LAU, Alternative E-R would remove overstory trees on 4 acres of stem exclusion habitat, and in the Crazy 14502 LAU, would remove overstory trees on 8 acres of stand initiation and 9 acres of stem exclusion habitat, the same as Alternative D-R. Included in these acres of affected lynx habitat is the construction of new temporary access roads, which would remove vegetation during the Construction Phase. Lynx habitat acres actually impacted on the ground are expected to be less due to that some shrub and tree cover would be maintained in the transmission line clearing area; only the largest trees would be removed and some areas would not be cleared. Any vegetation such as shrubs or low trees within the transmission line clearing area that would remain or grow back on the temporary access roads during the Operations Phase would provide cover for lynx movement within and across the LAUs. Coarse down wood would also be left within the clearing area, providing a component for potential denning if the overall habitat remained suitable. However, this is unlikely as most documented den sites in Montana have been in mature spruce-fir forests with high horizontal cover and abundant coarse woody debris, with younger stands and stands with discontinuous canopies seldom used (Squires *et al*. 2008). Post-project and after the transmission line was removed, all newly constructed roads would be bladed and re-contoured to match the existing topography, obliterating the road prism. Reclamation efforts would reinitiate vegetation succession on the transmission line. Based on the habitat potential of the individual stand, lynx habitat could develop over time. Within either LAU, less than 0.5 percent of multistory mature late successional habitat would be affected, with this habitat component in the West Fisher LAU and Crazy LAU remaining at 89 percent and 82 percent, respectively. Overall, for the West Fisher 14503 LAU or the Crazy 14504 LAU, less than 0.5 percent of lynx habitat within either individual LAU would be affected by Alternative E-R.

Alternative E-R would not impact any old growth that provides potential red squirrel habitat as described in section 3.22.2, *Old Growth Ecosystems*.

More than 17 percent of old growth would remain in the Crazy PSU and about 13.6 percent would remain in the Silverfish PSU, both above the KFP standard of a minimum of 10 percent. As about 95 percent of the Crazy LAU is located within the Crazy PSU and 97 percent of the Silverfish PSU is located within the Silverfish PSU, potential habitat provided by old growth for red squirrels would remain well distributed throughout both PSUs.

Effects on private land due to construction of the transmission line and Sedlak Park Substation within the MFSA analysis area are as described for Alternative D-R.

Evaluation of Effectiveness of Mitigation Plans or Other Plans for Alternatives C-R, D-R, and E-R

For the agencies' Alternatives C-R, D-R, and E-R, calculations for lynx habitat impacted are probably an overestimate of the actual effects because a Vegetation Removal and Disposition Plan would minimize tree clearing. MMC would develop this plan and submit for agencies' approval before the Construction Phase (see section 2.5.3.3.1, *Vegetation Removal and Disposition* in the Alternative 3 discussion). For Alternative C-R, impacts on multistory or late-successional forest would be offset through enhancement of either 336 or 484 acres of lynx stem exclusion habitat, depending on the paired mine alternative, included in the agencies' alternatives. For Alternative D-R, effects on multistory or late-successional forest would be offset through enhancement of either 416 or 552 acres of lynx stem exclusion habitat, depending on the paired mine alternative, included in the agencies' alternatives. For Alternative E-R, effects on multistory or late-successional forest would be offset through enhancement of either 368 or 518 acres of lynx stem exclusion habitat, depending on the paired mine alternative, included in the agencies' alternatives.

Effects on Lynx on Private Land

Within the MFSA Transmission Line Analysis Area, lynx habitat has not been identified on private lands and no impact on lynx habitat would occur. Within the West Fisher LAU, Alternative E-R crosses Plum Creek land. This section occurs below 4,000 feet within the LAU, and is identified as low-elevation non-habitat. As shown in Table 246, about 30 acres of this section would be cleared of overstory trees. Any effects to potential lynx movement on Plum Creek land outside of the LAU (Table 247) would be minimal due to the short duration of transmission line construction activity and low potential for the species to occur in the low-elevation area. Vegetative cover in the form of shrubs and grass would continue to be provided on most of the transmission line clearing area, providing suitable habitat for lynx movement across the transmission line.

Effects to Lynx on State Land

Transmission Line Alternative E-R would pass through section 36 T27N, R30W outside of the LAU. Effects to lynx habitat mapped by the State HCP within the section are disclosed in Table 247. Less than 1 acre along an edge of winter foraging habitat and 6 acres along the outer edge of a stand identified as temporary non-suitable habitat would be affected. Timber removal has already occurred in the temporary non-suitable habitat and effects to the existing stand would be minimal. Cover from the remaining vegetation of shrubs and low trees would provide cover for lynx movement, although suitability for winter forage may be reduced. The remaining area cleared was also not mapped as habitat, but cover for movement would remain.

The effects of Alternative E-R on State land differ from Alternatives C-R and D-R as the transmission line alignment would be in a different location. Alternative E-R would cross section 36 T27N, R30W following the existing Libby Creek Road. Much of the State lynx habitat identified as currently non-suitable located within Alternative E-R's clearing area is also in the existing road disturbance area. As shown in Table 247, Alternative E-R would affect less than 1 acre of a stand identified as winter foraging habitat and less than 6 acres total along the edge of a stand currently identified as temporary non-suitable habitat. Due to the lack of tall overstory trees in this stand, it is unlikely any additional clearing would occur during the Construction Phase, but tall trees would be removed as maintenance during the about 25-year Operations Phase. The amounts of coarse woody debris left in Alternative E-R's clearing area would depend upon VRU and the existing condition of the stand. Alternative E-R would be located within VRU 2s and

VRU 7n, where the direction is to leave 10 to 15 tons (15 to 20 logs) per acre of coarse woody debris on-site after timber clearing, and to leave 12 to 25 tons per acre of coarse woody debris on-site after timber clearing, respectively. Impacts to lynx habitat on State DNRC land would be mitigated by implementing the agencies' alternatives transmission line mitigations on State land as described under Alternative C-R.

Combined Mine-Transmission Line Alternatives

Impacts on lynx habitat components from combined mine-transmission line action alternatives are shown in in Table 248 and summarized in the following paragraphs.

Effects on Lynx on National Forest System Lands
Alternative 2B would remove 2 percent of lynx habitat from the Crazy LAU for the life of the mine, the most lynx habitat of any of the combined action alternatives, and would remove the most stand initiation habitat and the most multistory mature late successional habitat (1 percent) of any of the combined action alternatives. The majority of the 512 acres of habitat that would be removed for Alternative 2B are for mine development, including the impoundment, adits, plant site, aboveground conveyor system or pipelines, and associated road reconstruction and construction. The removal of lynx habitat for Alternative 2B in the Crazy LAU is concentrated in the Little Cherry Creek drainage and extends to the upper end of Ramsey Creek. Of the 512 acres, about 79 acres would be cleared for the transmission line construction and associated temporary road construction. Within the West Fisher LAU, about 6 acres of multistory mature habitat would be cleared for transmission line construction. The affected suitable lynx habitat is widely scattered along the transmission line. The removal of overstory timber and vegetation associated with transmission line clearing would be minor relative to the amount of habitat available (Table 248).

For the agencies' mitigated combined action alternatives, no more than 1 percent of LAU 14503 and no more than 1 percent of LAU 14504 would have lynx habitat removed or cleared for the life of the mine. Those areas affected by the transmission line would still largely provide cover and may provide summer foraging habitat. The proposed agencies' mitigated combined action alternatives would remove or clear multistory mature or late successional habitat in the West Fisher 14503 and Crazy 14504 LAUs for mine facility and transmission line development and maintain much of these areas in a state unsuitable for lynx for the life of the mine. Less than 1 percent of the available multistory mature habitat would be affected in each LAU by these alternatives. The size and distribution of these reduced acres of multistory mature or late successional habitat would not be expected to have site-specific adverse effects to snowshoe hare or lynx as the species are highly mobile and the successional stage would remain distributed throughout the LAUs. It is not expected that the small reductions in multistory mature winter foraging habitat (see Table 246, Table 247, and Table 248) would reduce prey availability or increase risk of mortality from starvation as more than 80 percent of each LAU would continue to provide this type of habitat. Vegetation succession on facilities and other sites would only begin after reclamation occurs in about 30 years, plus an additional 15 years for stand initiation habitat to develop.

All combined action alternatives would affect multistory or late-successional forest snowshoe hare habitat. Impacts on multistory or late-successional forest snowshoe hare habitat in the West Fisher LAU 14503 would be 6 to 61 acres for all combined action alternatives. Impacts on multistory or late-successional forest snowshoe hare habitat in the Crazy LAU 14504 would be 50 to 54 acres for Alternatives 3C-R, 3D-R, and 3E-R; 43 to 47 acres for Alternatives 4C-R, 4D-R, and 4E-R; and 123 acres for Alternative 2B. These acreages equate to less than 1 percent of the 10,940 acres and less than 1 percent of the 18,434 acres of multistory late successional habitat available within the West Fisher and Crazy LAUs, respectively. Effects to lynx or their prey would be minimal.

As described in section 3.22.2, *Old Growth Ecosystems*, all combined action alternatives would affect old growth forest potentially providing red squirrel habitat. Impacts on old growth would range from 214 acres for Alternative 4E-R to 395 acres for Alternative 2B. For all combined action alternatives within the Crazy PSU, less than 1 percent of old growth would be affected with the PSU remaining at 18 percent old growth, well above the KFP minimum of 10 percent. Within the Silverfish PSU, the percentage of old growth would remain slightly above 13 percent for all combined action alternatives. Old growth habitat would remain above the KFP standards within both PSUs, providing red squirrel habitat.

Throughout the remaining areas of the Crazy and West Fisher LAUs, available habitat would remain. In the higher elevations west of the Bear Creek (#278) and Libby-West Fisher (#231) roads, available habitat is predominantly multistory mature late successional habitat with widely scattered stands providing stand initiation habitat. In the lower elevations to the east of these two roads, a more diverse mosaic of habitat exists with increased number of stands providing stand initiation habitat due to previous timber harvest.

Evaluation of Effectiveness of Mitigation Plans or Other Plans for the Combined Action Alternatives

For the agencies' alternatives, the designation of between 802 acres and 857 acres of old growth habitat would offset impacts on old growth forest, and maintain red squirrel habitat as described under the mine and transmission line alternatives.

In the agencies' combined alternatives, impacts on multistory or late-successional forest would be offset through enhancement of 484 to 552 acres for Alternative 3, or 336 to 416 acres for Alternative 4, of lynx stem exclusion habitat. These stands are currently in stem exclusion stage (stands that currently have poorly developed understories and do not provide winter snowshoe hare habitat). Field verification with snowshoe hare horizontal cover surveys would be conducted before any treatment occurs. The proposed treatments would be intended to mitigate for the physical loss of currently suitable early stand initiation, stand initiation, and multistory forage habitat resulting from project implementation, and would accelerate the development of suitable habitat that is currently in an unsuitable condition. The West Fisher LAU has 971 acres of stem exclusion habitat available that could potentially be treated, and the Crazy LAU has 1,063 acres. Selected stands would be thinned to allow sun to reach understory vegetation and develop the dense horizontal vegetation favored by snowshoe hares. Mitigation would be at a 2:1 ratio (2 acres treated for each acre lost). Allowing these stands to develop suitable snowshoe hare habitat in a shorter timeframe would benefit lynx by improving the availability of prey. Enhancement of lynx stem exclusion habitat is included in the agencies' combined action alternatives as mitigation for the physical loss of suitable lynx habitat due to construction of the project facilities and transmission line.

For the agencies' alternatives, impacts on lynx habitat would be offset by implementation of the Vegetation Removal and Disposition Plan developed for the agencies' alternatives (section 2.5.2.3.2, *Vegetation Removal and Disposition Plan*).

Effects to Lynx on Private and State Land

The combined action alternatives would not affect lynx habitat on private lands in the Crazy 14504 LAU or West Fisher 14503 LAU. No lynx habitat is mapped on private land within the LAUs. Outside of the LAUs, private lands potentially affected by the combined action alternatives are not mapped as lynx habitat. Impacts on lynx on private lands outside of LAUs 14503 and 14504 would be minimal because they do not provide suitable lynx habitat.

Effects to private land from the combined action alternatives, including the Sedlak Park Substation, within the MFSA analysis area, are as described for the individual transmission line alternatives.

The combined action alternatives would affect section 36 T27N, R30W as described under the transmission line alternatives. Alternative 2B would not be located on or near the two sections in the project area and would have no effect to State land. The agencies' combined action alternatives, depending on the combination, would affect less than 7 acres of the total lynx habitat identified on lands managed by the Northwestern Land Office. With the agencies' transmission line mitigations applied to State section 36, and only 7 acres affected, the combined agencies' mitigated action alternatives would have no measurable effect to lynx or their habitat.

Cumulative Effects

Effects on Lynx on National Forest System Lands

The affected environment and existing condition sections describes relevant past and present factors affecting the lynx and existing lynx habitat conditions and trends in the Crazy and West Fisher LAUs. This cumulative effects section summarizes the past actions as well as further describes ongoing and other reasonably foreseeable contributions potentially impacting lynx in terms of the applicable standards and guidelines of the NRLMD and effects to lynx habitat components.

As described under the section "*Analysis Methods*," the affected LAUs were chosen as the appropriate scale for lynx cumulative effects analysis. In summary, 1) the LAU represents the size of a home range of a female lynx; 2) maintaining habitat conditions at the scale of a lynx home range will allow for good distribution of lynx habitat components; 3) expanding the analysis area could dilute the effects of the proposed activities; 4) the LAU provides a consistent boundary for monitoring of and compliance with the Objectives, Standards, and Guidelines of the NRLMD; and 5) the LAU is large enough to include all important effects of the proposed activities.

In addition, areas outside of the impacted LAUs were evaluated for potential impacts related to habitat availability and connectivity to adjacent LAUs. Given the location of the combined action alternatives, the existing conditions of all adjacent LAUs, and type and nature of activities along the shared boundaries of the project and adjacent LAUs, no apparent conditions would warrant expanding the boundary beyond the Crazy and West Fisher LAUs. Therefore, these LAUs were chosen as the appropriate scale for cumulative effects analysis.

Please see Appendix E for a detailed list of all past, present, and reasonably foreseeable activities located within the West Fisher and Crazy LAUs.

Past Actions

See existing condition and Table 244, which summarize the existing condition based on effects of past actions and post-treatment conditions as they relate to lynx habitat. The detailed description of previous vegetation management, special uses, and road management activities in the affected PSUs are found in Appendix E. Table 243 summarizes the existing condition based on effects of past actions as they relate to lynx. Stand-replacing wildfires have occurred periodically within the affected LAUs and created early successional habitat that was temporarily unsuitable for lynx foraging. In addition, regeneration harvest has occurred since the 1950s, which also resulted in forest structural changes that were temporarily unsuitable for lynx foraging. After about 15 years, these stands developed into foraging habitat. Over time, the combination of wildfire and regeneration harvest has resulted in a mosaic of structural stages within these LAUs. However, due to the lack of natural wildfires or regeneration timber harvest within the past 15 years, less than 3 percent of the West Fisher, and less than 1 percent of either the Crazy or Rock LAUs are currently providing early stand initiation habitat (unsuitable for winter foraging). Stand initiation habitat, which is suitable winter foraging habitat within these two LAUs, ranges from 3 percent to 13 percent (Table 243). The LAUs predominantly provide multistory mature late successional habitat. As described previously, those stands comprised of multilayer forests of spruce and fir providing high horizontal cover and boughs touching the snow surface receive high use during the critical winter period.

Past Actions Considered with No Action Alternatives
Neither Alternative 1, Alternative A, nor Alternative 1A directly contribute to any cumulative impacts on lynx. Disturbance processes, such as wildfire, contribute to vegetation succession, which provide for diversity of lynx habitat. Any unsuitable stem exclusion habitat, comprising up to 8 percent of the Crazy LAU and 5 percent of the West Fisher LAU affected by wildfire would eventually transition into suitable multistory habitat. Without active management, such as prescribed fire or timber harvest functioning as a source of disturbance, the existing early stand initiation and stand initiation habitat would continue through successional stages and further reduce the diversity of habitat available.

Past Actions Considered with the Combined Mine-Transmission Line Action Alternatives
The KNF considers the condition of lynx habitat on non-federal lands within LAUs to the extent possible in its assessment of baseline conditions during development of projects on National Forest System lands, and adjusts its alternatives to reduce negative effects in the LAU. This is reflected in the agencies' mitigated combined action alternatives. Standard ALL S1 (maintain habitat connectivity) requires evaluating the existing condition to determine where linkage areas and movement corridors exist as their current location and availability are a consequence of past actions. The cumulative effects analysis identifies potential changes to those existing corridors or linkage areas from the proposed action alternatives in the context of effects resulting from other past, present, and reasonably foreseeable actions. The combined action alternatives would develop a mine (including an impoundment, plant site and conveyor belt system, evaluation and ventilation adits, associated reconstructed and new road construction and, depending on the combined alternative, LAD sites). Large openings would result from the impoundment site and increased traffic would occur on the roads connecting the mine facilities and the Bear Creek Road #278 haul route. Disturbance from the impoundment sites largely occur in low-elevation non-habitat as the locations straddle the boundary of the Crazy LAU. The haul route and many of the mine access roads are also located in low-elevation non-habitat or travel habitat, although lynx habitat would be affected. Alternative 2B removes stand initiation habitat with construction of the impoundment, LAD Area 1, and the Ramsey Plant Site. The agencies' mitigated combined action alternatives mine development and associated facilities remove less lynx habitat. Transmission lines would cross ridges and habitat cleared by the transmission lines is widely scattered along the

line with low-growing shrubs and trees expected to remain and cover provided. Alternative 2B, however, could remove the vegetation as no mitigation is specified. The width of the transmission lines clearing area disturbances range from 150 to 200 feet. With the agencies' mitigation, vegetation clearing would be minimized in the clearing area and lynx movement across the clearing area would not be impeded. There would be no increase in the amount of roads open to the public motorized use or development or increase in winter snowmobile routes. Connectivity and movement within the LAUs and to adjacent LAUs would remain. Connectivity and movement potential toward the east and the identified approach areas discussed previously would be maintained. The proposed combined action alternatives would not decrease connectivity in the project LAUs, and cumulatively there would be no change to overall connectivity.

If connectivity is considered with the combined action alternatives grizzly bear mitigation, connectivity for lynx would improve. Both Alternative 2B and the agencies' combined action alternatives would include implementing a road closure associated with the proposed Rock Creek Project mitigation prior to Montanore's Evaluation Phase, but only if the Rock Creek Project has not already implemented the closure. This Rock Creek Project access mitigation on the Upper Bear Creek Road (NFS road #4784) would significantly contribute to the core created by the Montanore Mine Project road access mitigation within the north-south movement corridor, and would result in improvement to grizzly bear habitat in BMU 5 as well as secure habitat for lynx in the Crazy LAU.

In the adjacent Rock LAU, prior to the Construction Phase, the agencies' alternatives only would require the Rock Lake Trail 150A to be closed with a barrier that would also significantly improve grizzly bear habitat in both BMU 4 and BMU 5. As a result of the Rock Lake Trail 150A mitigation closure, connectivity and security for lynx would directly improve in the West Fisher and Rock LAUs by reducing a potential fracture zone and indirectly would provide for better connectivity between LAUs to the north and south. This improvement would occur in the linkage area identified in the NRLMD (USDA Forest Service 2007, Figure 1-1) and the general wildlife north-south movement corridor displayed in the Wildlife BA 2013, Figure 6d. The grizzly bear mitigation plan also would require habitat compensation for habitat loss and displacement. Although the amount of mitigation lands required for habitat compensation varies (Table 28 and Table 29) by combined mine-transmission line alternatives (Alternative 2B or any of the agencies' combined action alternatives), the acquisition of mitigation lands for grizzly bears could improve connectivity for lynx habitat and provide additional habitat for both lynx and their prey. Some of the parcels identified for potential acquisition occur within the directly affected LAUs or in areas identified as important for linkage outside of LAUs.

Both inside and outside the LAUs, development of private land would continue. Although the majority of the private land is located in low-elevation non-habitat or outside the LAU, private land does exist at higher elevations within the LAUs and is providing multistory mature late successional habitat, as well as travel habitat. Within the US 2-Barren Peak/Hunter Creek Approach area identified on the eastern edge of the West Fisher LAU, human development potential on most of the Plum Creek land has been removed due to the successful Fisher River Conservation Easement that Plum Creek enacted with Montana FWP. This helps to maintain connectivity to LAUs located to the north and east. Development on private land outside the LAU would continue. Cumulative effects of this development to lynx would be partially dependent on the extent and type of development of these parcels, but many already support year-round residences. Within the LAU, development of private land could contribute to cumulative effects to connectivity, but this again would be partially dependent on the extent and type of development and disturbance, and habitat alteration of these parcels. Activities that may occur on private land can only be estimated and are outside the control of the Forest Service. Because proposed activities would occur within the Crazy and West Fisher LAUs and in the Rock LAU to the west; private property is located within the general location of the linkage area identified in the NRLMD (USDA Forest Service 2007, Figure 1-1); and the general wildlife north-south movement corridor is displayed in the Wildlife BA 2013, Figure 6d, cumulative effects to lynx movement could occur. However, this is unlikely considering the amount of suitable habitat or travel habitat that would remain on the National Forest System land surrounding the scattered parcels and the low potential for lynx to occur in the Cabinet Mountains. Connectivity corridors with source populations in Canada identified by Squires *et al*. 2013 would not be affected by the proposed activities.

Less than 1 percent of the available lynx habitat in the Crazy, West Fisher, and Rock LAUs is currently in a temporarily unsuitable condition. Most of the private land within the LAUs is located in low-elevation non-habitat, but removal of multistory late successional habitat could occur on scattered private parcels. This stage of lynx habitat comprises 82 to 89 percent of the lynx habitat available on federal lands. Development of the private land and effects to lynx habitat would depend on the level of habitat alteration. Loss of multistory late-successional habitat on scattered private parcels may potentially disturb or displace an individual lynx that could occur, but ample habitat remains in the LAUs on federal lands and cumulative effects to lynx habitat in the LAUs would be negligible.

The proposed combined action alternatives would remove lynx habitat for the life of the mine. Alternative 2B would remove 2 percent of lynx habitat from the Crazy LAU, while the agencies' mitigated combined action alternatives would remove less than 1 percent of lynx habitat in this LAU. Habitat would not be provided on these sites within the Crazy LAU for the life of the mine. Based on the habitat potential of the individual stand, and success of the reclamation efforts, lynx habitat could develop over time (in about 30 years and for at least an additional 15 years or more until the stands reached the early stand initiation stage). In the West Fisher LAU, all combined action alternatives would clear vegetation within the transmission line clearing areas, with the amount removed likely being more under Alternative 2B and less in the agencies' mitigated combined alternatives due to the Vegetation Removal and Disposition Plan that would minimize tree and vegetation clearing. Early stand initiation habitat may be provided, and cover for movement would remain in the clearing areas.

Ongoing Actions and Reasonably Foreseeable Actions

Present and reasonably foreseeable actions in the West Fisher and Crazy LAUs are described in detail in Appendix E, and summarized here. Actions that could occur on any land ownership include road construction and/or maintenance (including roadside brushing), timber harvest, fire suppression, mining, real estate/residential development, and recreational pursuits such as hunting, trapping, fishing, pleasure driving, camping, snowmobiling, skiing, and forest product gathering (*e.g.*, firewood, Christmas trees, mushrooms, and huckleberries).

Vegetation changes from timber harvest or road construction can add to the effects of the proposed combined action alternatives on lynx if it occurs in the habitat types that support lynx prey. Road construction could permanently remove acres from available habitat. Timber harvest could change one lynx habitat successional stage to another, but it would also contribute to the mosaic of successional stages favorable for lynx habitat. This would be beneficial for lynx due to the limited acres in this age class in both LAUs. Roadside brushing could occur on other lands as part of road maintenance and could reduce some roadside cover for lynx travel and foraging.

Hunting and trapping is likely to continue to occur on all lands throughout the life of any of the combined action alternatives. Hunting activities are regulated by the FWP. The Forest Service influences hunter access through road management. Such activities always carry the risk of accidental mortality from non-target trap captures, misidentified targets, or malicious killings. Potential human-caused mortality is a function of other factors such as hunting or trapping regulations that are outside Forest Service control. This risk of mortality on other lands would be independent of the proposed combined action alternatives and would not involve cumulative effects with this project to lynx.

Christmas tree cutting is likely to occur on all lands throughout the life of the combined action alternatives. Removing individual trees that contribute to winter snowshoe hare habitat and lynx foraging habitat would not be expected to occur on a large enough scale to affect the suitability of lynx winter habitat, and any cumulative effects of the combined action alternatives with incidental tree cutting on other lands would be negligible.

Snowmobiling and/or skiing (generally cross-country) would continue to occur on all land ownerships, and would most likely increase over the next 30 to 40 years. Recreational snow activities can compress snow surfaces; however, as previously discussed, current research has not shown that snow compression significantly increased competitor access to lynx and hare habitat (Kolbe *et al.* 2007). Future development of ski areas in either of the two LAUs on non-federal lands is not likely. No recreational or over-the-snow routes are proposed under the combined action alternatives. No cumulative adverse effects with snow-related activities on other lands is expected.

Other actions such as mining, fishing, pleasure driving, camping, and other forest product gathering (*e.g.*, mushrooms and huckleberries) would continue to occur on all land ownerships throughout the life of any of the combined action alternatives. These activities typically have little to no effect on lynx due to their short-term nature and limited vegetation disturbance. However, they would still have the potential to displace or increase the risk of mortality for lynx under unique circumstances.

Firewood gathering would continue to occur adjacent to open roads and would reduce potential habitat for denning structure. Denning habitat has not been identified as a limiting factor for lynx and is widely available across the action area. Firewood gathering would not likely measurably modify lynx habitat to the extent that cumulative effects with any of the combined action alternatives would be anticipated.

Wildfires are likely to occur in the two LAUs associated with the project over the 30- to 40-year span of any of the combined action alternatives and may include fire-suppression activities as well. Initial suppression would be aimed specifically at controlling undesirable wildfire, but suppression of fires that escape initial attack, regardless of ownership, would be planned with all resource values considered, including lynx habitat. Historically, wildfires have had beneficial effects to lynx habitat by providing the regular influx of early successional stages needed for a mosaic of age classes. Larger fire-suppression efforts would include consideration of the NRLMD to conduct fire use activities to restore ecological process and maintain or improve lynx habitat, which relate to the NRLMD Objective VEG O3.

The USFWS biological opinion for the NRLMD (USFWS 2007d) found no evidence that mineral development was a factor threatening lynx. Lynx appear to be quite tolerant of such activities (Ruediger *et al*. 2000), and these activities are generally not considered to have adverse impacts on lynx. Most disturbances associated with locatable minerals are less than 20 acres in size (USFWS 2007d) on National Forest System lands. The NRLMD contains guidelines designed to minimize the impacts of mineral-related activities on individual lynx and lynx habitat. Small locatable mining-associated activities may incidentally affect lynx use within some areas on a temporary basis due to disturbance, but these effects would not be measurable. Alternative 2B would not comply with NRLMD Guideline ALL G1, Guideline HU G4, or Guideline HU G6 and could add to cumulative effects to lynx. The agencies' mitigated combined action alternatives comply with the NRLMD applicable Standards, Objectives, and Guidelines and would not add to cumulative effects to lynx.

Actions on State-Owned Lands

The State owns a section of land partially within the West Fisher LAU (14503) and adjacent to the Crazy LAU (14504). NRLMD management direction does not apply to private or State land, but if the land occurs within a LAU, the NRLMD Standard VEG 01 takes into account the amount of unsuitable habitat on State land in determining compliance with the standard. As described under the *Analysis Method* section, the DNRC manages for lynx and their habitat on the lands managed by the Northwestern Land Office, which includes the Libby DNRC Unit. Because State-owned lands comprise less than 1 percent of the West Fisher LAU, the potential for adverse cumulative effects with any of the agencies' mitigated combined action alternatives are low.

Two recently completed State timber sales occurred just outside of both LAUs. The Six Hills Timber Sale had one unit of 175 acres of overstory removal in the Crazy PSU, located in section 16, T28W, R30W, and was completed in 2012. The sale covered six widely spaced sections, but no activity occurred within a LAU. The second recently completed project was a small 17-acre seed tree treatment in section 36 T29W, R31W, called the Crazy Man Timber Sale, and was completed by 2011.

Because of the long time span of any of the combined action alternatives, it is possible that additional actions on the two State sections that occur adjacent to the Crazy LAU or partially within the Fisher LAU boundary could occur at a future date. Any future federal activity would consider State lands under the NRLMD for determining compliance with Vegetation Standard VEG S1. Activities that alter vegetation are not likely to impact lynx due to the limited amount of lynx habitat that occurs on State land within the West Fisher LAU, and the DNRC would follow the State HCP implementation guide for lynx habitat. Any activities affecting lynx habitat mapped on State land either inside or outside the LAU would be managed under the HCP management for lynx. Lynx habitat would be maintained on State land within the Montana DNRC Libby Management Unit. The State HCP has been previously discussed in detail.

Other actions (not addressed above) on the two sections of State lands within the project area that are likely to occur include data collection and other administrative access use, prescribed fire, fire suppression, pre-commercial thinning, or other non-commercial treatments of vegetation. The potential for adverse cumulative effects from these actions with any of the combined action alternatives would not be measurable.

Montana FWP developed the first State Wildlife Action Plan, the Comprehensive Fish and Wildlife Conservation Strategy, in 2005 and it was approved by the USFWS in 2006. Montana

FWP submitted a revised State Wildlife Action Plan in 2014 (FWP 2014). The East Cabinet Face, which encompasses the analysis area, is one of 55 Tier I terrestrial focal areas. The lynx was identified as a species of greatest conservation need in the 2014 plan. The State HCP has been previously discussed in detail.

Actions on Tribal-Owned Lands

No tribal-owned lands are within the project area or within any of the LAUs associated with the project. Tribal members are likely to use both federal and non-federal lands for various cultural or recreation activities, but these would not be expected to affect lynx or their habitat. The combined action alternatives would have no cumulative effects on tribal-owned lands.

Actions on Privately Owned Lands

A number of land parcels are owned by private individuals within the West Fisher LAU (14503), Crazy LAU (14504), and Rock LAU (14702). Of the about 729 privately owned acres within the West Fisher LAU boundary, 355 of those acres are currently suitable lynx habitat (multistory mature/late-successional). Of the 1,079 privately owned acres within the Crazy LAU boundary, only 140 acres are currently suitable lynx habitat (also multistory mature/late-successional). Within the Rock LAU are about 789 acres of privately owned land, with one 640-acre section being harvested in 1999. No habitat data are available for most of this section, but a small stand of multistory forage may occur. Most of the private lands in the lower elevations of the West Fisher and Crazy LAUs do not provide lynx habitat, with either travel or low-elevation non-habitat identified, which could be used for travel cover and connectivity within and between LAUs. Some of the higher elevation parcels provide lynx habitat. Timber harvest has occurred on some of the private lands. Vegetation-altering activities, such as private land development for homes or businesses with associated access road construction, is likely to occur on private lands over the next 30 to 40 years during the life of any of the combined action alternatives. Commercial timber harvest is also likely to occur over the same time span. These actions, especially on the east side of the Cabinet Mountains, have the potential to affect lynx connectivity or habitat due to the direct loss of or reduced suitability of existing habitat. The Forest Service has no regulating authority over activities on private lands, and activities such as private land development are expected to continue. Activities on private land in-holdings, when added to the effects of any of the combined action alternatives, could have localized negative cumulative effects to lynx habitat, but overall, due to the small percentage of lynx habitat that occurs within the LAUs, there is low potential for negative cumulative effects to lynx or their habitat.

Road construction and/or timber harvest actions could remove or reduce the effectiveness of existing lynx habitat or could create large openings that would alter travel patterns, similar to that discussed in *Actions Common to All Ownerships*. Large-scale timber harvest or development on some land parcels could create large openings that lynx may be reluctant to cross. This is unlikely on most land parcels due to parcel size and previous harvest activities. However, in the West Fisher LAU, some of the larger privately owned lands are being considered for real estate sale that currently provide multistory forage habitat. Timber harvest and/or residential development on lynx habitat would have the potential to occur at a future date, and could cumulatively add to the small decrease in multistory forage resulting from the transmission line.

Actions on Industry-Owned Lands

The majority of corporate timberland in the affected LAUs is owned by Plum Creek. Within the West Fisher LAU (14503) are 2,408 acres of Plum Creek and 46 acres are in the Crazy LAU

(14504). Stimson Lumber Corporation owns a total of 62 acres in the Crazy LAU and 42 acres in the Rock LAU.

Within the Crazy LAU (14504), both pieces of Stimson Lumber Company lands, which are located along the boundary of the LAU, were identified as low-elevation non-habitat for lynx. The small 8-acre parcel located within the LAU was harvested about 10 years ago and within about 5 years should begin to develop cover for lynx travel. The larger 54-acre parcel was harvested between 1990 and 1999, the harvest is 15 to 24 years old, and the parcel likely already provides some cover for lynx movement. The 42 acres of Stimson property within the Rock LAU is comprised of small portions (7 acres, 19 acres, and 16 acres) of three separate sections. The 7- and 19-acre pieces have been previously harvested and, based on 2009 NAIP aerial photos, may provide lynx habitat in the stand initiation stage, but no on-the-ground data are available. The remaining 16-acre piece appears to be providing multistory forage habitat, based on the surrounding National Forest System lands and the 2009 photos.

At some point in the next 30 to 40 years, tree thinning could occur on these acres; however, as the majority of industry ownership occurs in low-elevation non-habitat, no adverse cumulative effects with any of the combined action alternatives is expected. All of the 2,407 Plum Creek acres within the West Fisher LAU boundary are non-lynx habitat, either travel (339 acres) or low-elevation (2,068 acres), and all of the 100 acres of Plum Creek within the Crazy LAU boundary are considered non-habitat, either travel (33 acres) or low-elevation (67 acres). Most of the Plum Creek properties were harvested 23 to 32 years ago, with some harvest occurring within the last 3 to 12 years. The units harvested 23 to 32 years ago would be providing travel cover and connectivity within and between LAUs. Future timber harvest or tree thinning is likely to occur on these lands, but would not cumulatively affect lynx habitat. For all lands within lynx habitat, Plum Creek follows guidelines for pre-commercial thinning. Future land sale to private individuals or land developers is possible, especially parcels near existing road systems. Because Plum Creek lands in both the Crazy and West Fisher LAUs occur at low elevations and do not provide lynx habitat, potential future alteration of vegetation would not be expected to cause cumulative adverse effects to lynx with any of the combined action alternatives. One section of Plum Creek land in the West Fisher LAU is located on the boundary with the LAU to the south (Silver Butte 14502) within lynx habitat. The portion of this section located within the West Fisher LAU is identified as travel habitat, and across the boundary in the Silver Butte LAU, the Plum Creek harvest 23 to 32 years ago has created stand initiation stage lynx habitat. These units provide winter foraging habitat within a mosaic of multistory forage and stem exclusion habitat. Harvest within the Plum Creek travel habitat stands would not inhibit lynx movement around the section due to the availability of habitat on surrounding National Forest System lands.

Industry has and continues to work with private (non-governmental), state, and federal agencies to conserve habitat, including lynx habitat, on their lands. Avista Corporation, The Conservation Fund, Plum Creek, and FWP completed a conservation agreement on more than 1,800 acres of land formerly owned by Plum Creek and Genesis Mining Company. The result was the creation of the Bull River Wildlife Management Area (WMA), which is managed by FWP. The Bull River WMA was formally dedicated in 2005. This WMA is at the south end of Bull Lake and connects/protects habitat on either side of MT 56. This general area has been identified as a potential lynx linkage area.

The Thompson-Fisher Conservation Easement, discussed in the *Land Use and Recreation* section, includes lands near the Fisher River just outside the West Fisher LAU boundary. The easement does not protect lynx habitat related to the Crazy and West Fisher LAUs, but benefits lynx by protecting the conservation values of the easement lands, which include low-elevation travel cover in linkage corridors between the West Fisher LAU and other lynx habitat to the east.

Actions on Federal Lands

Reasonably foreseeable and ongoing federal actions with treatments occurring in the Crazy, West Fisher, and Rock LAUs are listed in Appendix E and include the Miller-West Fisher Vegetation Management Project, Wayup Mine/Fourth of July Access, Bear Lakes Access, and the Rock Creek Project. These and other cumulative projects are discussed in detail under the summary of NRLMD Objectives, Standards, and Guidelines below.

Standard ALL S1 (connectivity) requires evaluating the existing condition to see what linkage areas and movement corridors exist as their location and availability have been influenced by past actions. The cumulative effects analysis identifies potential changes in those movement corridors/linkage areas from the proposed actions in the context of effects to those corridors/linkages resulting from other past, present, and reasonably foreseeable actions. None of the combined mine-transmission line alternatives would contribute to negative cumulative impacts on any designated linkage areas. Cumulative effects of both mine and transmission line alternatives, in combination with other ongoing or reasonably foreseeable actions on federal lands, on lynx movement within the Crazy LAU would be minor. Lynx movement would not appear to be affected by the level of traffic expected on the mine access roads, and areas of reduced cover would be small relative to surrounding habitat. The combined mine and transmission line alternatives would largely affect low-elevation non-habitat within the Crazy LAU and scattered lynx habitat within the transmission line clearing area in both the Crazy and the West Fisher LAUs. Less than 0.5 acre of lynx habitat on private land owned by MMC located within the Rock LAU would be affected by any of the Montanore Project combined mine-transmission line alternatives as a result of the Rock Lake Ventilation Adit.

The Miller-West Fisher Vegetation Management Project maintained habitat connectivity within the West Fisher LAU and some timber harvest units would re-initiate several areas of general lynx habitat no longer providing foraging opportunities. Stand re-initiation, while it may impact travel in the short term, would benefit snowshoe hares in the 20 or so years following treatment. The Miller-West Fisher Project was determined to not affect the ability of lynx to move within LAUs or established linkage areas. The cumulative effects of both projects occurring in the West Fisher LAU would be alterations of lynx habitat and lynx travel or non-habitat, disturbance, and possibly avoidance of the project areas during construction of any of the transmission line action alternatives and Miller-West Fisher Project activities. Construction-related activities for transmission line Alternative B would occur outside of the winter period on big game winter range, which overlaps all lynx habitat affected in the West Fisher LAU 14503, and part of the lynx habitat affected in the Crazy LAU. Construction-related activities for any of the agency combined alternatives would occur over a 2-year period between June 16 and October 14 due to grizzly bear mitigation, and would not be expected to occur over the entire length of the transmission line at any one time. This timing mitigation designed to remove construction-related activity associated with the transmission line during the grizzly bear spring and denning periods would also benefit lynx within the West Fisher LAU and a portion of the Crazy LAU. No measurable cumulative effects to suitable lynx habitat would occur. Suitable lynx habitat would remain in the vicinity, across the directly affected LAUs and in adjacent LAUs for lynx to use.

Other reasonably foreseeable activities in the West Fisher LAU include the Fourth of July Project. The Fourth of July proposal involves reconstruction of 0.72 mile of road and will begin at the end of NFS road #6748 at the Lake Creek trailhead and proceed southwest on the non-system Irish Boy Mine Road to a proposed bridge site on Lake Creek. Reconstruction will consist of clearing trees, brush, and stumps from the existing road corridor. The project will also include removing slumps, outsloping and installing surface drainage structures, and disposing of slash. New construction of 1.8 miles of road would begin at the proposed bridge site and extend to the Fourth of July parcel. Construction would consist of clearing trees, brush, and stumps for a road corridor up to 60 feet wide on steep slopes, earthmoving to create a 12- to 16-foot surface, installation of road surface drainage structures and culverts, construction of one bridge, and slash disposal. Construction of the new road would decrease the amount of secure high-elevation habitat available for lynx. The project would mitigate for construction impacts by gating the newly constructed road and restricting motorized access to the Fourth of July parcel to the claimant. More than half of the new road construction and the Fourth of July parcel are located within lynx habitat that the KNF has identified as multistory mature late successional habitat. The cumulative effects of the three projects occurring in the West Fisher LAU would be alterations of lynx habitat and lynx travel or non-habitat, disturbance, and possibly avoidance of the activity areas during construction of any of the transmission line action alternatives and Miller-West Fisher Project activities. Connectivity through the LAU would remain, allowing for lynx movement within and to adjacent LAUs.

Within the Rock LAU, the Rock Creek Project exploration adit would be located within a 10-acre parcel on which the KNF mapped stem exclusion and multistory mature late-successional habitat. Aerial imagery shows a mix of rocky talus with timber. Existing conditions within the Rock LAU (Table 243) show a preponderance of multistory mature late-successional habitat exists, with 93 percent comprising the lynx habitat on federal lands. Suitable habitat is well connected within the Rock LAU and toward the Bull and Crazy LAUs to the north and the West Fisher and Silver Butte LAUs toward the south. Below the elevation boundary of the Rock LAU along Rock Creek, busing mine employees and incorporation of animal-friendly crossings along NFS road #150 would reduce mortality risk to dispersing lynx (USDA Forest Service 1998). All combined action alternatives, in combination with reasonably foreseeable actions, would not contribute to a decline in connectivity or movement within the Rock LAU. The combined action alternatives, in combination with reasonably foreseeable actions, including the Rock Creek Project, would result in greater connectivity within the LAUs due to grizzly bear mitigation associated with habitat acquisition and road closures as compensation for grizzly bear habitat lost or displacement effects.

Guideline ALL G1: All combined action alternatives, in combination with reasonably foreseeable actions, would result in increases in traffic speeds and volume in LAUs 14503 and 14504, thereby increasing the risk of lynx mortality due to vehicle collisions. Within the Rock LAU, the combined action alternatives would not contribute to cumulative effects relating to traffic speeds or volume. For the transmission line alternatives, cumulative traffic increases would occur primarily during the construction period and would be short-term. Cumulative traffic increases for the combined alternatives associated with mine related development would be long-term (lasting for the life of the mine) and would last through the Closure Phase. Alternative 2B would not incorporate any measure to avoid or reduce effects on lynx. Alternative 2B could cumulatively increase mortality risk to lynx within the Crazy 14504 LAU. The agencies' combined action alternatives would incorporate adaptive mitigation measures to avoid negative effects to lynx, and when considered in combination with reasonably foreseeable actions, would not result in cumulative increases to mortality risks to lynx associated with increased traffic volume and speed associated with the mine access routes.

Objectives HU 01, HU 03, and HU 05: New winter road use would be minimal for the mine alternatives and would be limited to a few new access roads within permit boundaries. With the exception of the Bear Creek Road, all open roads in the impoundment permit area would be gated and limited to mine traffic only. Non-motorized public access would be restricted within each permit area by signage at the permit area boundary. During the Construction and Closure Phases, transmission line access roads would not be used during the critical winter period when snow would occur due to mitigation incorporated for species other than lynx. Use of roads during the winter may occur during the Operations Phase if maintenance needs occurred on the transmission line. This would not occur on a regular basis, and activity would be of short duration. All combined action alternatives would include plowing of the Bear Creek Road (NFS road #278), the Libby Creek roads (NFS road #231 and #2316) during the 2-year Evaluation Phase, and for 1 year while the Bear Creek Road was reconstructed, which would make access to lynx habitat easier for trappers and increase the risk of incidental lynx mortality. These roads would continue to be snowplowed during the Operations Phase to allow access to the surface facilities at the Libby Adit Site. MMC would install and maintain a gate on the Libby Creek Road, and the KNF would seasonally restrict access on the Libby Creek Road (NFS road #231) and the Upper Libby Creek Road (NFS road #2316) as long as MMC used and snowplowed the two roads, or as directed by the KNF or the Oversight Committee. Only mining access would occur on NFS road #2316 during the closure period of April 1 to May 15. Most of this activity would occur in low-elevation non-habitat within the Crazy LAU 14504. The restriction was implemented to reduce displacement and mortality risk to grizzly bears on spring range, but also provides some benefit to lynx. Public access on the Libby Creek and upper Libby Creek could occur at any other time during the year outside of the closure period, including winter. Minor levels of additional winter road use could occur for other ongoing and reasonably foreseeable actions. Cumulatively, when considered with reasonably foreseeable actions, expansion of snow-compacting activities and increased winter access for trappers is expected to be minimal in all combined action alternatives.

In all combined action alternatives, traffic volume and speeds may cumulatively be greater in the Miller Creek and West Fisher Creek drainages and near main access roads (see section 3.21, *Transportation*), resulting in an increased risk of lynx mortality from vehicle collisions. Cumulative traffic increases in the West Fisher LAU 14503 would occur primarily during transmission line construction and would be short-term. Cumulative traffic increases from the mine alternatives in the Crazy LAU 14504 would be long-term and would last through the Closure Phase, although traffic increases would be lower during Closure than Operations. The agencies' mitigated combined action alternatives would include monitoring of lynx mortalities in permit areas and along access roads. If threatened and endangered species mortality occurred, MMC would haul future road-killed animals to a disposal location approved by FWP, if deemed necessary by the grizzly bear specialists or law enforcement officer to avoid additional grizzly bear or other threatened and endangered species mortality. Mitigation plan item A.1.o provides agreement that all mortality-reduction measures would be subject to modification based on adaptive management, where new information supports changes. Modifications to reduce vehicle collisions, if appropriate, could include installing wildlife crossing signs or reducing speed limits on roads used for the agencies' combined alternatives. Cumulative traffic volumes are not anticipated to be high enough to warrant incorporation of specific road design measures, such as underpasses, or fencing to minimize potential impacts on lynx, but the adaptive management strategies associated with the agencies' alternatives would allow for changes to reduce lynx mortality if necessary.

Cumulative Effects to Lynx Habitat Components

Alternative 2B would remove 2 percent of lynx habitat in the Crazy LAU 14503 for the life of the mine. Alternative 2B, in combination with other ongoing or reasonably foreseeable actions, potentially could result in cumulative effects to lynx habitat in the LAU. Habitat in the stand initiation stage is already limited in the LAU, and Alternative 2B would remove 11 percent of the habitat currently in the stand initiation stage for the life of the mine.

The agencies' combined alternatives would remove less than 1 percent of lynx habitat in either the Crazy or West Fisher LAU. The total amount of habitat removed is small compared to the amount of habitat that would remain in each LAU. The habitat affected by the transmission line alternatives is widely scattered and not likely to hinder lynx movement in the Libby Creek and Miller Creek drainages.

Activities associated with the Miller-West Fisher Vegetation Management Project would retain down wood within KFP guideline levels for the Silverfish PSU, and while prescribed burns associated with the Miller-West Fisher Vegetation Management Project would consume some down wood, it also would create down wood by killing live trees. Down wood created in burned areas could provide lynx denning habitat and habitat for alternative prey species such as red squirrels. Cumulative impacts from the action alternatives would not result in a shortage of snags and down wood associated with lynx denning habitat. Denning habitat is not limited on the KNF.

The combined mine-transmission line alternatives, in combination with other current and reasonably foreseeable actions on federal lands would maintain the designated management level of old growth (see section 3.22.2, *Old Growth Ecosystems*). The designated management level of old growth would continue to be maintained despite potential cumulative effects of the combined action alternatives and ongoing or reasonably foreseeable actions. Thus, the combined action alternatives would maintain old growth and potential red squirrel habitat in both the Crazy and West Fisher LAUs.

As proposed, Alternative 2B would not meet the intent of the NRLMD, and in combination with the existing condition and other current and reasonably foreseeable actions, could result in cumulative changes to lynx.

The agencies' mitigated combined action alternatives, in combination with the existing condition and ongoing actions, would not result in cumulative changes in or significant loss of lynx habitat, and would be consistent with the 2007 NRLMD. The affected LAUs would continue to meet the NRLMD Objectives, Standards, and Guidelines. No reasonably foreseeable activities are planned that would change the magnitude or scope of effects described above.

Cumulative Effects on Lynx on Private and State Land

The combined action alternatives, in combination with reasonably foreseeable actions, could result in a cumulative increase in temporary housing facilities developed on private lands, potentially resulting in cumulative impacts on lynx habitat in the West Fisher 14503, Crazy 14504, and Rock 14702 LAUs. Also, as discussed in section 3.18, *Social/Economics*, many areas of private land are being converted from timber or agricultural production and open space use into residential subdivisions and ranchettes. Development of private land would likely occur primarily outside of the Crazy, West Fisher, and Rock LAUs. More private land exists within the Crazy and West Fisher LAUs located within the low-elevation non-habitat areas and development could occur on those areas in the future. Impacts of the combined action alternatives, in combination with increased development of private land, could result in cumulative losses of lynx habitat on private land; however, most potentially affected parcels supporting lynx habitat are adjacent to or interspersed with Forest Service land providing lynx habitat, and some of the potential negative effects on the private parcels would be moderated by the amount of lynx habitat remaining on federal lands, and federal land management decisions would meet NRLMD Objectives, Standards, and Guidelines. In addition, grizzly bear mitigation associated with the combined action alternatives may reduce potential private land development within the LAUs and, therefore, would also improve the availability of secure habitat and lower mortality risk for lynx.

NRLMD Biological Opinion – Terms and Conditions

In addition to the evaluation of the above NRLMD Standards for cumulative effects, the Terms and Conditions of the Biological Opinion are also a measure to evaluate cumulative effects. The Terms and Conditions address the exemptions from Standards VEG S1, S2, S5, and S6 for fuels management projects within the Wildland-Urban Interface and exceptions under VEG S5 and S6 for pre-commercially thinned and vegetation management projects that reduce snowshoe hare habitat. Both the exemptions and exceptions are limited to a certain amount of activity within lynx habitat that is measured cumulatively within a LAU and/or within an administrative unit (*i.e.*, National Forest). Table 249 describes the Terms and Conditions and the project's compliance with the Terms and Conditions.

Canada Lynx Critical Habitat

Effects to Canada Lynx Critical Habitat

The USFWS listed the contiguous U.S. distinct population segment of the Canada lynx as threatened in March 2000 (USFWS 2000). In February 2008, the USFWS issued a proposed rule revising critical lynx habitat (USFWS 2008b). Then, in February 2009, the USFWS issued their final rule to revise the critical habitat designation for lynx in the U.S. (USFWS 2009). The final rule delineated lynx critical habitat units across the lower 48 states from Maine to Washington. Based on this delineation, the directly affected LAUs 14503 (West Fisher), 14504 (Crazy), and 14702 (Rock) and the Montanore Project, all of which are located south of US 2, are not located within the Northern Rocky Mountains Critical Habitat Unit #3. A new proposal to revise critical habitat was issued in September 2013, which would change the existing boundary based on State boundaries to wherever the lynx population occurs within the contiguous U.S. (USFWS 2013b). The directly affected LAUs (Rock, Crazy, and Silverfish), the Montanore Project analysis area (Crazy and Silverfish PSUs), and all of the combined action alternatives would remain outside of Unit #3 and critical habitat under the proposed rule.

The combined action alternatives are not located within designated lynx critical habitat, and would have no direct, indirect, or cumulative effects on lynx critical habitat.

Table 249. Terms and Conditions from the Biological Opinion on the Effects of the NRLMD on Canada Lynx.

Term and Condition	Compliance
Fuels management projects conducted under the exemptions from Standards VEG S1, S2, S5, and S6 in occupied habitat shall not occur in greater than 6 percent of lynx habitat on any forest.	The KNF currently conducted 3,548 acres of fuels management projects under the exemptions for NRLMD Standards VEG S1, S2, S5, and S6 in lynx habitat within the Wildland-Urban Interface (see project record). Vegetation management standards to not apply to mining development. The combined action alternatives would comply with the Terms and Conditions and no exemptions would be used. No acres would be added to the forest total and the KNF would remain at about 6 percent of the 60,600 acres allocated for the forest.
Fuels management projects conducted under the exemptions from Standards VEG S1, S2, S5, and S6 in occupied habitat shall not result in more than three adjacent LAUs not meeting the VEG S1 standard of no more than 30 percent of a LAU in stand initiation structural stage.	All affected and adjacent LAUs are currently far below the standard of no more than 30 percent of a LAU in stand initiation structural stage (with affected LAUs 0 to 3 percent, and adjacent LAUs at 0 percent). Vegetation management standards do not apply to mining development. The combined action alternatives would comply with the Terms and Conditions. No exemptions would be used.
In occupied lynx habitat, pre-commercially thinned and vegetation management projects allowed per the exceptions listed under VEG S5 and S6 shall not occur in any LAU exceeding VEG S1, except for protection of structures.	The KNF has currently pre-commercially thinned on 1,658 acres allowed per the exceptions under VEG S5 and S6 (see project record). The affected Crazy, Rock Creek, and West Fisher Creek LAUs meet VEG S1. Vegetation management standards do not apply to mining development. The combined action alternatives would comply with the Terms and Conditions. No exceptions would be used for proposed activities. No acres would be added to the KNF total and the KNF would remain well below the allocated 13,520 acres.

Regulatory/Forest Plan Consistency

Organic Administration Act and Forest Service Mineral Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest System surface resources; comply with applicable state and federal water quality standards including the Clean Water Act; take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations; and construct and maintain all roads so as to assure adequate drainage and to minimize or, where practicable, eliminate damage to soil, water, and other resource values.

Alternative 2B would not take all practicable measures to maintain and protect lynx or lynx habitat, would not comply with the KFP (as amended by the 2007 NRLMD), and would not comply with 36 CFR 228.8. The agencies' combined action alternatives would comply with 36 CFR 228.8 by taking practicable measures to maintain and protect lynx habitat that may be affected by the operations.

Endangered Species Act

Alternative 2B as proposed would require additional consultation to be in compliance with the ESA. This is because Alternative 2B 1) would not meet all NRLMD Objectives, Standards, or Guidelines; and 2) would remove 2 percent of lynx habitat for the life of the mine (about 30 plus years) from the Crazy LAU. If Alternative 2B was selected, then ESA compliance would be ensured through Section 7 formal consultation.

Consultation with the USFWS has occurred for the agencies' combined action Alternative 3D-R. Regarding the Canada lynx, the USFWS reviewed the KNF biological assessment and additional information and concurred that the agencies' combined action Alternative 3D-R (Agency Mitigated Poorman Impoundment Miller Creek Transmission Line) may affect, but is not likely to adversely affect, this threatened species (USFWS 2014a).

National Forest Management Act/Kootenai Forest Plan, as Amended by the Northern Rockies Lynx Management Direction

Alternative 2B would not comply with the NFMA/KFP, as amended by the NRLMD. Alternative 2B would not meet the intent of NRLMD Guideline ALL G1, Guideline HU G4, or Guideline HU G6. Alternative 2B would remove 2 percent of lynx habitat within the Crazy LAU 14504 for the life of the mine due to the mine and associated facility development, including the impoundment, LADs, plant site and ore conveyor belt system, and associated constructed and reconstructed roads.

All of the agencies' mitigated combined mine-transmission line alternatives would comply with NFMA/KFP direction on threatened and endangered species that applies to the lynx (KFP Vol. 1, II-1 #7, and II-22) and the NRLMD and include: Forestwide Management Direction – KFP II-1 #7 and II-22.

p.II-1 #7 –Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species: The agencies' mitigated combined action alternatives are located within the Crazy (facilities and transmission line), West Fisher (transmission line), and Rock (Rock Lake Ventilation Adit) LAUs. As discussed in the above analysis, less than 1 percent of lynx habitat on federal land would be removed for the life of the mine in either the West Fisher LAU or the Crazy LAU, and less than 1 acre of lynx habitat on private land in the Rock LAU has potential to be affected.

p.II-22, 23 –Maintenance of viable populations of existing native and desirable non-native vertebrate species, as monitored through indicator species, attained through the maintenance of a diversity of plant communities and habitats: See p.11-1#7 above for habitat diversity. In addition, the agencies' mitigation Plan would treat currently unsuitable habitat and would improve the acres of winter snowshoe hare habitat in the long term. Connectivity within and between LAUs would be maintained.

All of the agencies' mitigated combined action alternatives comply with or meet the intent of the NRLMD applicable Objective, Standards, and Guidelines: Objective ALL 01, Standard ALL S1, Guideline ALL G1, Objective HU 01, Objective HU 02, Objective HU 03, Objective HU 05, Objective HU 06, Guideline HU G4, Guideline HU G5, Guideline HU G6, Guideline HU G7, Guideline HU G8, Guideline HU G9, Guideline HU G12, and Objective Link 01.

Statement of Findings

The No Action Alternatives (Alternative 1, Alternative A, and Alternative 1A) *may affect, are not likely to adversely affect, Canada lynx.* This determination is based on: 1) no activities would take place that would alter lynx habitat, 2) all LAU vegetation management standards would continue to be met in the short term with no increases in mortality risk, 3) active fire suppression would continue the trend toward uncharacteristic vegetative and fuel conditions, 4) risk of severe fire behavior or insect and disease would increase, and 5) the potential for large-scale changes in available suitable and unsuitable lynx habitat within the affected LAUs would increase.

Although the USFWS (2007 NRLMD Biological Opinion) concluded adverse effects would not always occur where guidelines were not implemented, **Alternative 2B** *may affect, and is likely to adversely affect, the Canada lynx***.** This determination is based on: Alternative 2B 1) would remove 2 percent of lynx habitat within the Crazy LAU for the life of the mine (about 30 years, plus at least an additional 15 years for plant succession to reach early stand initiation habitat stage, if reclamation was successful), 2) would not comply with the NRLMD by not meeting the intent of Guideline ALL G1 (avoid or reduce effects on lynx) or Guideline HU G4 (monitoring of snow compaction), and 3) would not comply with Guideline HU G6 (methods to avoid or reduce effects on lynx in lynx habitat).

In its BA (USDA Forest Service 2013), and as concurred by the USFWS (USFWS 2014b), the KNF determined that the agencies combined action **Alternative 3D-R** *may affect, but is not likely to adversely affect, the Canada lynx***.** All other agencies' mitigated combined action alternatives (Alternatives 3C-R, 3E-R, 4C-R, 4D-R, and 4E-R) would require and incorporate the same Terrestrial Threatened and Endangered Species Mitigation Plan, and the effects of these combined alternatives are within the extent considered in the Alternative 3D-R consultation. The KNF's determination for Alternative 3D-R, and the rationale supporting the finding, would apply to the other agencies' combined action alternatives due to similar effects and the same mitigation plans required. The USFWS concluded in the NRLMD Biological Opinion (USFWS 2007d) that most actions in lynx habitat in compliance with the NRLMD would either have no effect on lynx or would not likely adversely affect lynx. The **agencies combined mine-transmission action alternatives** *may affect, are not likely to adversely affect, the Canada lynx and its habitat.* This determination is based on:

1) If another agency mitigated combined action alternative besides Alternative 3D-R was selected, additional consultation with the USFWS would occur.

2) All agency mitigated combined action alternatives have the low potential to displace or disturb a lynx due to location of the proposed activities.

3) The agencies' mitigated combined action alternatives have the potential for an increase in risk of mortality with snowplowing and increased traffic volume (mitigated for by limiting vehicular traffic, and limiting use of salt and monitoring and removal of roadkill).

4) The agencies' mitigated combined action alternatives have the potential for an increase in risk of mortality due to increased snow-compaction activities (mitigated for by monitoring and appropriate action if monitoring identifies increased snowmobiling and/or predator access, Lynx Mitigation Plan item B).

5) No more than 1 percent of physical habitat loss would occur due to the construction of project-related facilities and transmission line, depending upon the agencies' mitigated combined action mine-transmission line alternative for the life of the mine, and up to 15 years following reclamation for vegetation succession to proceed into the early stand initiation stage.

6) The agencies' mitigated combined action alternatives mitigate for habitat physically lost by implementing habitat enhancement on lynx stem exclusion habitat at a 2:1 ratio (2 acres treated for every acre lost) to improve lynx winter foraging opportunities, with acreage depending on the combined mine-transmission line alternative (484 to 556 acres with Alternative 3 and transmission line alternative, or 336 to 416 acres with mine Alternative 4, depending on transmission line alternative) (Table 31 in Chapter 2).

7) Linkage and movement areas would be maintained within and between adjacent LAUs.

8) Large areas within all affected LAUs are free of activity to accommodate potential lynx displacement from activity areas.

9) All agencies' mitigated combined action alternatives would comply with all applicable Objectives, Standards, and Guidelines of the NRLMD (USDA Forest Service 2007f) (see above under Forest Plan consistency), which amended the 1987 KFP.

10) The NRLMD USFWS Biological Opinion (USFWS 2007d) found no evidence that mineral development was a factor threatening lynx; the agencies' mitigated combined action alternatives comply with all applicable NRLMD Objectives, Standards, and Guidelines, including the guidelines designed to specifically minimize impacts of mineral-related activities HU G4, HU G5, HU G6, HU G9, and HU G12 and, thus, is consistent with the NRLMD Biological Opinion (USFWS 2007d) conclusion that the effects of mineral development would not appreciably reduce the reproduction, numbers, and distribution of lynx.

Canada Lynx Critical Habitat

Statement of Findings

Implementation of any of the no action or combined mine-transmission line action alternatives would have ***no effect*** on Canada lynx critical habitat. This determination is made because the alternatives are not located within designated lynx critical habitat.

During consultation with the USFWS for Alternative 3D-R, the KNF made a no effect determination for designated lynx critical habitat for the Canada lynx. Although the USFWS does not review or provide concurrence on no effect determinations, the USFWS acknowledged the Forest Service's analysis (USFWS 2014b). Therefore, pursuant to 50 CFR 402.13(a), formal consultation on this species' critical habitat was not required.

Effects to Lynx on State Land

Transmission Line Alternative B would not affect State trust land. The agencies' mitigated Transmission Line Alternatives C-R, D-R, and E-R, depending on the alternative, would affect up to 7 acres total of lynx habitat on section 36 T27N, R30W, and would have no measurable effect to lynx habitat on the section 36 or on the total of lynx habitat available on State lands managed by the DNRC Libby Unit. Mitigation associated with the agencies' mitigated transmission line alternatives for the lynx would be applied to State land affected: 1) the Vegetation Removal and Disposition Plan to minimize vegetation clearing within the clearing area; 2) retention of snags and down wood within the clearing area, where safety allows; and 3) the grizzly bear transmission line scheduling requirement that all transmission line construction activity would occur between June 16 and October 14, which would also prevent construction disturbance-related activity during the important winter and early spring period for lynx. As a result of the minimal acreage of lynx habitat affected and incorporation of the agencies' mitigation associated with the transmission line located on State trust land, no measurable effects to lynx or lynx habitat on the State section 36 would occur.

3.25.6 Migratory Birds

3.25.6.1 Regulatory Framework

The Organic Administration Act authorizes the Forest Service to regulate the occupancy and use of National Forest System lands. The Forest Service's locatable minerals regulations are promulgated at 36 CFR 228, Subpart A. The regulations apply to operations conducted under the U.S. mining laws as they affect surface resources on National Forest System lands under the jurisdiction of the Secretary of Agriculture. One of these regulations (36 CFR 228.8) requires that mining activity be conducted, where feasible, to minimize adverse environmental impacts on National Forest surface resources. 36 CFR 228.8 also requires that mining operators take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations.

The National Forest Management Act requires the Secretary of Agriculture to promulgate regulations specifying guidelines for land management plans that "provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives…" The "specific land area" (scale) for providing diversity is established in the framework as the area covered by the Forest Plan, or the entire KNF. One of the KFP goals is to "maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species… and in sufficient quality and quantity to maintain habitat diversity representative of existing conditions" (II-1 #7).

Executive Order 13186, Responsibilities of Federal agencies to Protect Migratory Birds, requires analysis of effects of federal actions on migratory birds as part of the environmental analysis process. This order requires that each Federal agency develop a MOU that promotes the conservation of migratory bird populations. A MOU was signed between the Forest Service and USFWS (USFWS and USDA 2008) and extended in 2014 (USFWS and USDA 2014) that outlines the responsibilities for both parties regarding migratory birds. The responsibilities include the Forest Service's consideration of migratory birds in NEPA analyses and as well as guidance for developing effects analyses. The purpose of the MOU "is to strengthen migratory bird conservation by identifying and implementing strategies that promote conservation and avoid or minimize adverse impacts on migratory birds."

3.25.6.2 Analysis Area and Methods

Neotropical migratory birds are those bird species that migrate to more northerly latitudes to breed on the KNF each spring. In the fall, these species migrate south to spend the winter months. Of the 205 bird species known to occur on the KNF as breeders, migrants, winter visitors, or transients, about 70 species could be classified as neotropical migratory land birds (Bratkovich 2007). A wide range of habitat preferences exist from open environments (*e.g.*, grassland communities) to a variety of forest habitat types. A mosaic of habitat types that reflect the historical range of vegetation communities and seral stages would provide the greatest diversity of migratory species. Migratory birds have been recognized for their ecological (biological diversity) and economic (*e.g.*, bird watching and hunting) value.

The analysis area includes the PSUs impacted by proposed activities. While the bulk of activities occur within the Crazy and Silverfish PSUs, there are also project activities within McElk, Riverview, Treasure, and Rock PSUs. The analysis area boundary for direct effects is the proposed activity areas, as activities and alteration of the habitat would affect suitability for different species. The acres directly impacted by activities are put into the context of the PSU scale to provide a consistently sized analysis unit and better gauge the relative impacts of the activities. The boundaries for indirect and cumulative effects are the planning subunits that contain the analysis area as alteration of habitat could affect the availability and use of habitats. The impacts to the Rock PSU are limited to a less than 1 acre of patch of steep, rocky ground, the impacts are nearly undetectable at the PSU scale, and therefore this PSU is not carried forward in detailed analysis. This section summarizes a specialist's report on migratory birds available in the Project record.

3.25.6.3 Affected Environment

A report issued by several organizations and Federal agencies summarized the general condition of birds across the U.S. (National American Bird Conservation Initiative 2009, 2011). It described declines in multiple species across a variety of habitats. Climate change was one of the contributing factors to these declines, and is likely to continue impacting birds into the future. As the climate warms, breeding seasons and migrations are being altered. These activities may become out of sync with prey abundance, and climate change may also impact where and when those food items are available. This reinforces the need to have resilient habitat that is better able to handle climate change.

The following tables are included to provide a framework to focus the analysis in this EIS by focusing on migratory bird priority species and their habitats. Not all of these habitats and species occur within the analysis area.

Partners in Flight produced a North American Landbird Conservation Plan in 2004 (Rich *et al.* 2004). Their plan was broken down by "biomes" and the KNF is located within the Intermountain West Avifaunal Biome, which includes several Bird Conservation Regions and encompasses several western states. Their plan is very broad in scale. Table 250 displays the species they identified for continental importance within the Intermountain West Avifaunal Biome. Of these species, flammulated owl is analyzed elsewhere in the document.

Table 250. Species of Continental Importance Identified for the Intermountain West Avifaunal Biome in the Partners in Flight North American Landbird Conservation Plan.

Species	Primary Habitat	Is the KNF within the Range of the Species?[1]
	Management[2]	
Brewer's Sparrow	Western shrublands	Yes
Pinyon Jay	Woodland	No
Lewis's Woodpecker	Riparian	Yes
Cassin's Finch	Coniferous forest	Yes
Willow Flycatcher	Riparian	Yes
White-throated Swift	Various	Yes
Rufous Hummingbird	Western shrublands	Yes
Black Swift	Various	Yes
Olive-sided Flycatcher	Coniferous forest	Yes
Swainson's Hawk	Grassland	Yes
Grace's Warbler	Mixed forest	No
	Long-term Planning and Responsibility[2]	
Black Rosy-Finch	Tundra	No
Brown-capped Rosy-Finch	Tundra	No
Sage Thrasher	Western shrublands	No
Gray Flycatcher	Woodland	No
Calliope Hummingbird	Western shrublands	Yes
Red-naped Sapsucker	Mixed forest	Yes
Williamson's Sapsucker	Coniferous forest	Yes
Green-tailed Towhee	Western shrublands	No
Clark's Nutcracker	Coniferous forest	Yes
Dusky Flycatcher	Western shrublands	Yes
Sage Sparrow	Western shrublands	No
Mountain Bluebird	Western shrublands	Yes
Gray Vireo	Woodland	No
Virginia's Warbler	Woodland	No
Flammulated Owl	Coniferous forest	Yes
White-headed Woodpecker	Coniferous forest	Yes
McCown's Longspur	Grassland	No

[1]NatureServe Explorer http://www.natureserve.org/explorer/index.htm on 9/20/10 and AMS Technical Report (USDA 2003b). Includes accidental, migratory, or transient occurrences.
[2] Partners in Flight (PIF) categorized species by the level of immediacy of conservation attention. Those in the "management" category are identified because management/conservation actions are needed to halt long-term population declines or sustain vulnerable populations (Rich *et al*. 2004). The KNF is within the range of nine of these species. Those in the "long-term planning and responsibility" category are identified because planning is needed to maintain populations. The KNF is within the range of seven of these species.
Source: Rich *et al*. 2004.

PIF's North American Landbird Conservation Plan (Rich *et al*. 2004) does not contain a set of requirements that the KNF must follow, and the document was used to organize the discussion in this analysis by focusing on those species/habitats that have been identified at a broad scale as being important. It was essentially used to provide a framework, along with the following documents, to facilitate discussion of migratory landbirds within this analysis by focusing on key species and habitats.

The following two documents (USFWS 2008 and PIF 2000) provide a narrower focused look at key birds and habitats as those documents pertain on a smaller area (a single Bird Conservation Region or State). Again, these documents and the following tables were used as a framework to facilitate the discussion/analysis of migratory landbirds and their habitats within this specialist's report by focusing on key species and habitats.

In 2008 the USFWS released a report titled "Birds of Conservation Concern" in which they listed species of concern by Bird Conservation Regions (USFWS 2008). The report helps focus conservation effort on the species that need it. The KNF lies within BCR 10 (Northern Rockies). Table 251 lists below are the species of concern for that BCR, not all of which are found on the KNF. Three of these species are additionally analyzed elsewhere in this document: bald eagle, peregrine falcon, and flammulated owl.

Table 251. Birds of Conservation Concern in Bird Conservation Region 10, Northern Rockies.

Common Name	Scientific Name	Is the KNF w/in the range of species?*
Bald Eagle	*Haliaeetus leucocephalus*	Yes
Black Rosy-Finch	*Leucosticte atrata*	No
Black Swift	*Cypseloides niger*	Yes
Brewer's Sparrow	*Spizella breweri*	Yes
Calliope Hummingbird	*Stellula calliope*	Yes
Cassin's Finch	*Carpodacus cassinii*	Yes
Ferruginous Hawk	*Buteo regalis*	Yes
Flammulated Owl	*Otus flammeolus*	Yes
Lewis's Woodpecker	*Melanerpes lewis*	Yes
Loggerhead Shrike	*Lanius ludovicianus*	Yes
Long-Billed Curlew	*Numenius americanus*	Yes
McCown's Longspur	*Calcarius mccownii*	No
Olive-Sided Flycatcher	*Contopus cooperi*	Yes
Peregrine Falcon (b)	*Falco peregrinus*	Yes
Sage Sparrow	*Amphispiza belli*	No
Sage Thrasher	*Oreoscoptes montanus*	No
Swainson's Hawk	*Buteo swainsoni*	Yes
Upland Sandpiper	*Bartramia longicauda*	Yes
White-Headed Woodpecker	*Picoides albolarvatus*	Yes
Williamson's Sapsucker	*Sphyrapicus thyroideus*	Yes
Willow Flycatcher	*Empidonax traillii*	Yes
Yellow-Billed Cuckoo	*Coccyzus americanus*	No

b = breeding.
*NatureServe Explorer http://www.natureserve.org/explorer/index.htm and AMS Technical Report (USDA 2003). Includes accidental, migratory, or transient occurrences.

The KNF is within the Partners in Flight Montana Conservation Plan (PIF 2000). These conservation strategies are recommendations to use in management but they are not binding requirements. However, they provide a way to categorize and analyze important migratory bird habitat and species. The use of these plans supports the goal of maintaining long-term sustainability of migratory bird species and their habitats as specified by Executive Order and Migratory Bird Treaty Act (MBTA). The priority habitats and species are listed below. The use of this document and Table 252 was to provide a framework to focus the discussion/analysis in this specialist's report by focusing on priority species/habitats. Several of these birds are additionally analyzed elsewhere in the document: flammulated owl, black-backed woodpecker, common loon, harlequin duck, and peregrine falcon.

Table 252. Partners in Flight Priority Habitats/Species for Montana.

Habitat	Species	Priority Level[1]	Is the KNF w/in the range of species?[2]
Grasslands			
Mixed Grass Prairie	Mountain plover	I	No
	Burrowing owl	I	Yes
	Sprague's pipit	I	No
	Baird's sparrow	I	Yes
	Ferruginous hawk	II	Yes
	Long-billed curlew	II	Yes
	Lark bunting	II	Yes
	Grasshopper sparrow	II	Yes
	McCown's longspur	II	No
	Chestnut-collared longspur	II	No
	Northern harrier	III	Yes
	Short-eared owl	III	Yes
	Bobolink	III	Yes
Intermountain Grasslands	Columbian sharp-tailed grouse	II	Yes
Shrubland			
Sagebrush Shrubsteppe	Sage grouse	I	No
	Loggerhead shrike	II	Yes
	Brewer's sparrow	II	Yes
	Sage thrasher	III	No
	Lark sparrow	III	Yes
Montane Shrubland	Calliope hummingbird	II	Yes
	Nashville warbler	III	Yes
	MacGillivray's warbler	III	Yes
	Lazuli bunting	II	Yes
	Common poorwill	III	No
	Green-tailed towhee	III	No
	Clay-colored sparrow	III	Yes
Forest			
Dry Forest	Flammulated owl	I	Yes
	Lewis's woodpecker	II	Yes
	Blue grouse	III	Yes
	Chipping sparrow	III	Yes
	Cassin's finch	III	Yes
	Red crossbill	III	Yes
Cedar Hemlock	Brown creeper	I	Yes
	Vaux's swift	II	Yes
	Winter wren	II	Yes
	Chestnut-backed chickadee	III	Yes
	Golden-crowned kinglet	III	Yes
	Varied thrush	III	Yes
Burned Forest	Black-backed woodpecker	I	Yes
	Olive-sided flycatcher	I	Yes
	Three-toed woodpecker	II	Yes
	Townsend's solitaire	III	Yes
Moist Douglas-fir/Grand fir	Northern goshawk	II	Yes
	Williamson's sapsucker	II	Yes
	Sharp-shinned hawk	III	Yes
	Pileated woodpecker	II	Yes
	Plumbeous/Cassin's vireos	III	No/Yes
	Townsend's warbler	III	Yes

Habitat	Species	Priority Level[1]	Is the KNF w/in the range of species?[2]
Whitebark pine Aspen	Clark's nutcracker	III	Yes
	Ruffed grouse	II	Yes
	Red-naped sapsucker	II	Yes
	Ovenbird	III	Yes
Wet Subalpine fir (spruce/fir)	Great gray owl	III	Yes
	Boreal owl	III	Yes
Limber Pine/Juniper	N/A		
Dry Subalpine fir/Lodgepole pine	N/A		
Riparian			
Riparian Deciduous Forest (Cottonwood/Aspen)	Interior least tern	I	No
	Barrow's goldeneye	II	Yes
	Hooded merganser	II	Yes
	Bald eagle	II	Yes
	Black-billed cuckoo	II	No
	Yellow-billed cuckoo	II	No
	Red-headed woodpecker	II	No
	Cordilleran flycatcher	II	Yes
	Veery	II	Yes
	Red-eyed vireo	II	Yes
	Killdeer	III	Yes
	Eastern screech owl	III	No
	Western screech owl	III	Yes
	Downy woodpecker	III	Yes
	Least flycatcher	III	Yes
	American redstart	III	Yes
	MacGillivray's warbler	III	Yes
	Orchard oriole	III	Yes
Riparian Shrub	Willow flycatcher	II	Yes
	Rufous hummingbird	III	Yes
	Gray catbird	III	Yes
	Warbling vireo	III	Yes
	Song sparrow	III	Yes
Hardwood Draws	Swainson's hawk	III	Yes
Riparian Coniferous Forest	Harlequin duck	I	Yes
	Hammond's flycatcher	II	Yes
	American dipper	III	Yes
Wetlands			
Prairie Pothole	Piping plover	I	No
	Horned grebe	II	Yes
	White-faced ibis	II	Yes
	Marbled godwit	II	Yes
	Franklin's gull	II	Yes
	Forster's tern	II	Yes
	Black tern	II	Yes
	Clark's grebe	III	No
	Black-crowned night heron	III	No
	Black-necked stilt	III	Yes
	Willet	III	No
	Wilson's phalarope	III	Yes
	LeConte's sparrow	III	Yes
	Nelson's sharp-tailed sparrow	III	No
Intermountain Valley	Common loon	I	Yes

Habitat	Species	Priority Level[1]	Is the KNF w/in the range of species?[2]
Wetlands	Trumpeter swan	I	No
	Common tern	II	Yes
	American bittern	III	Yes
	Yellow-headed blackbird	III	Yes
Irrigation Reservoirs >640 ac	Caspian tern	II	Yes
	American white pelican	III	Yes
Irrigation Reservoirs <640 ac	Transient shorebirds	II	Yes
High Elevation Wetlands	N/A		
Unique Habitats			
	Peregrine falcon	II	Yes
	Black swift	II	Yes
	Black rosy finch	II	No
	White-tailed ptarmigan	III	Yes
	Chimney swift	III	No
	Red-winged blackbird	III	Yes
	Brewer's blackbird	III	Yes

[1]Montana Priority Levels. PIF uses a priority system rather than producing planning information about all species. Their assumption is that if conservation measures are focused on the identified species/habitats then other species will benefit as well (p. 23 in PIF 2000). The priority levels are: (I) Conservation Action – species with declining populations or high area importance, (II) Monitoring Species – species in need but with lesser threat or stable/increasing populations in Montana, (III) Local Concern – species of concern which are not in imminent risk or are near-obligates for high priority habitats, (IV) Non-priority – rare migrants, extremely peripheral occurrence, or lack of imminent risk and are not included in the PIF conservation planning effort (p. 24-25 in PIF 2000).
[2] NatureServe Explorer http://www.natureserve.org/explorer/index.htm and AMS Technical Report (USDA 2003). Includes accidental, migratory, or transient occurrences.
Source: Partners in Flight (2000).
The habitat requirements of the species listed above, as well as range information, can be found online at NatureServe Explorer's database: http://www.natureserve.org/explorer/index.htm. Population estimates can be found on the Partners in Flight online database: http://rmbo.org/pif_db/laped/.

Most of the habitats found on the KNF host one or more species of migratory birds. Generally speaking the birds arrive in the spring to set up territories for breeding purposes. Young are raised and fledged by mid-summer. Most species leave the KNF by mid- to late summer.

Table 253 displays the existing vegetation types within the planning subunits that contain the analysis area. The available vegetation data on the KNF was grouped into categories that matched the above listed priority landbird habitats as closely as possible. The vegetation types are categorized based on the dominant tree species, although those tree species may be found as a lesser component of other vegetation types. A review of the tables above from Rich *et al*. 2004, USFWS 2008, and PIF 2000 reveal that a variety of the habitats listed are present in the analysis area and may provide habitat for some of the bird species listed. Dry mixed conifer habitat provide habitat for species such as chipping sparrow, Cassin's finch, and red crossbills. Moist Douglas-fir/grand fir provides habitat for species such as Townsend's warblers, sharp-shinned hawks, and pileated woodpeckers. Cedar-hemlock habitats are used by species such as brown creeper, Vaux's swift, chestnut-backed chickadee, golden-crowned kinglet, and varied thrush. Clark's nutcracker use whitebark pine habitat. The riparian deciduous or hardwoods, particularly aspen, provide habitat for ruffed grouse, and red-naped sapsuckers, among others. Other species associated with riparian hardwoods and shrubs include McGillivray's warbler, rufous hummingbird, warbling vireo, song sparrow, and Hammond's flycatcher.

Table 253. Existing Vegetation Types in Analysis Area.

Existing Vegetation Type	Crazy	McElk	Riverview	Silverfish	Treasure
Cedar/Hemlock	4,893 (7%)	169 (<1%)	92 (<1%)	1,362 (2%)	3,668 (4%)
Dry Mixed Conifer	7,700 (11%)	38,309 (50%)	64,287 (61%)	10,764 (16%)	12,065 (15%)
Miscellaneous Forest	9,155 (13%)	9,462 (12%)	10,374 (10%)	10,519 (15%)	6,187 (7%)
Moist Douglas-Fir/Grand Fir	18,310 (27%)	19,603 (26%)	24,927 (24%)	11,866 (17%)	21,720 (26%)
Non Vegetated	4,968 (7%)	193 (<1%)	212 (<1%)	3,113 (4%)	3,410 (4%)
Riparian –Conifer	1,531 (2%)	12 (<1%)	28 (<1%)	105 (<1%)	1,533 (2%)
Riparian – Deciduous	94 (<1%)	320 (<1%)	369 (<1%)	33 (<1%)	3,180 (4%)
Riparian – Shrub/Hardwoods	5,637 (8%)	275 (<1%)	506 (<1%)	1,807 (3%)	3,831 (5%)
Sod (*e.g.*, grass, meadow)	0 (0%)	1,523 (2%)	442 (<1%)	0 (0%)	2,781 (3%)
Wet Subalpine Fir/Lodgepole Pine	15,809 (23%)	6,118 (8%)	3,854 (4%)	29,848 (43%)	24,310 (29%)
Whitebark Pine	84 (<1%)	7 (<1%)	0 (0%)	0 (0%)	134 (<1%)
Total	68,180	75,991	105,092	69,417	82,818

All units are acres and (% of habitat type in PSU).
Dry Mixed Conifer includes ponderosa pine and dry Douglas-fir; miscellaneous forests include larch, whitepine, whitebark/subalpine larch, mountain hemlock/subalpine fir.
Percentages and acres do not tally to 100 percent due to rounding.
Only one fire has occurred in the last 8 years within analysis area. The Parmenter fire occurred in 2008 in the Treasure PSU and burned about 137 acres, none of which overlap the project activities. More recent burns are more valuable for birds such as black-backed woodpeckers.
Aspen and other hardwoods also occur intermixed with the other stand types.

The area surveyed by Western Resource Development (1989f) and Westech (2005a) included the permit areas and road corridors for Alternative 2, and the transmission line corridor for Alternative B. The Westech study area extended to the SE all the way to the Sedlak Park Substation (Figure 1 in Westech 2005a), but the study area of Western Resource Development did no extent that far SE (Figure 2.2.2 in Western Resource Development 1989f). A complete list of birds observed in the analysis area during baseline studies is provided in Western Resource Development (1989f) and Westech (2005a). Similar species were recorded during both studies. Species observed were expected for the particular habitats surveyed. Western Resource Development (1989f) found that the number of bird species was greatest in riparian habitat, followed by shrubfield habitat. Studies conducted by Westech (2005a) yielded somewhat different results; the number of species observed was greatest in shrubfield habitat. Differences between the two studies in the number of species observed were likely due to differences in sampling methods and intensity (Westech 2005a).

A number of species from the tables above (Rich *et al*. 2004, USFWS 2008, PIF 2000) were detected by Western Resource Development (1989f) in the analysis area, such as: Cassin's finch, willow flycatcher, rufous hummingbird, black swift, olive-sided flycatcher, calliope hummingbird, Clark's Nutcracker, dusky flycatcher, mountain bluebird, Nashville warbler, MacGillivray's warbler, lazuli bunting, chipping sparrow, red crossbill, brown creeper, Vaux's swift, winter wren, chestnut-backed chickadee, golden crowned kinglet, varied thrush, three-toed woodpecker, Townsend's solitaire, northern goshawk, sharp-shinned hawk, pileated woodpecker, Townsend's warbler, ruffed grouse, veery, red-eyed vireo, downy woodpecker, least flycatcher, American redstart, gray catbird, warbling vireo, song sparrow, Hammond's flycatcher, American dipper, and Brewer's blackbird.

A number of species from the tables above (Rich *et al*. 2004, USFWS 2008, PIF 2000) were detected by Westech (2005a) in the analysis area, such as: rufous hummingbird, olive-sided flycatcher, red-naped sapsucker, dusky flycatcher, MacGillivray's warbler, chipping sparrow, red crossbill, chestnut-backed chickadee, golden crowned kinglet, varied thrush, Townsend's solitaire, Cassin's vireo, Townsend's warbler, warbling vireo, song sparrow, and Hammond's flycatcher.

There is an ongoing landbird monitoring effort within the Region, and one of these survey transects is located adjacent to project activities along the access route in the Crazy PSU (transect MT-BCR10-KO10). Several other transects are located within the analysis area. One is located in the Silverfish PSU (MT-BCR10-KR1), one in the McElk PSU (MT-BCR10-KO14), and four in the Riverside PSU (MT-BCR10-K06, MT-BCR10-KO22, MT-BCR10-KO18, and MT-BCR10-KO2). All of these transects have been surveyed at least once since 2010. A number of species from the tables above (Rich *et al*. 2004, USFWS 2008, PIF 2000) were detected on these transects, such as: Cassin's finch, rufous hummingbird, olive-sided flycatcher, calliope hummingbird, red-naped sapsucker, Clark's nutcracker, dusky flycatcher, mountain bluebird, Nashville warbler, MacGillivray's warbler, lazuli bunting, clay-colored sparrow, blue grouse, chipping sparrow, red crossbill, brown creeper, Vaux's swift, chestnut-backed chickadee, golden-crowned kinglet, varied thrush, black-backed woodpecker, three-toed woodpecker, Townsend's solitaire, sharp-shinned hawk, pileated woodpecker, Cassin's vireo, Townsend's warbler, ruffed grouse, killdeer, downy woodpecker, warbling vireo, song sparrow, Hammond's flycatcher, and red-winged blackbird.

Geographic features such as north-south-oriented riparian corridors, ridgelines, cliffs, and bluffs can funnel bird movements in localized areas. High mountain ridges that parallel flight paths offer updrafts to soaring birds (Lincoln *et al*. 1998). Although some birds may migrate along the Cabinet Mountains and some birds may use stream corridors in the analysis area to move between habitat areas, no major migratory corridors have been identified in the analysis area.

3.25.6.4 Environmental Consequences

3.25.6.4.1 Alternative 1 – No Mine

No effects would occur under this alternative. Natural disturbance processes and succession would be the main factors determining the types and amounts of habitat within the analysis area. Over time, with continued fire suppression and lack of active forest management, indirect effects of this alternative would include a continued trend toward later successional habitats

3.25.6.4.2 Alternative 2 – MMC's Proposed Mine

Most effects from Alternative 2 would come from loss of habitat within the disturbance area of the mine facilities such as the mill/plant, impoundment, conveyor, and access road. Within the disturbance area, habitat would be converted to an unusable condition until reclamation was completed. Clearing for mine facilities would remove forest habitat used by some species (*e.g.*, brown creeper, golden-crowned kinglet, Townsend's warbler, and Swainson's thrush) and shrub field habitat used by other species (*e.g.*, orange-crowned warbler, yellow warbler, and spotted towhee). While Alternative 2 would result in localized impacts on the availability of habitats, it would not result in widespread changes in bird communities within these planning subunits given the small footprint of the mine facilities.

Table 254 displays the acres impacted by Alternative 2. In all mine alternatives, very little impact would occur within the Treasure PSU due to clearing along the access road. Most of the habitat loss in the Crazy PSU would amount to only a small percentage (5 percent or less) of the

Table 254. Impacts on Migratory Bird Habitat in the Crazy and Treasure PSUs by Mine Alternative.

Existing Vegetation Type	[2] MMC's Proposed Mine		[3] Agency Mitigated Poorman Impoundment Alternative		[4] Agency Mitigated Little Cherry Creek Impoundment Alternative	
	Crazy	Treasure	Crazy	Treasure	Crazy	Treasure
Cedar/Hemlock	467 (10%)	0	141 (3%)	0	277 (6%)	0
Dry Mixed Conifer	6 (<1%)	3 (<1%)	6 (<1%)	3 (<1%)	6 (<1%)	3 (<1%)
Miscellaneous Forest	875 (10%)	0	520 (6%)	0	587 (6%)	0
Moist Douglas-Fir/Grand Fir	446 (2%)	1 (<1%)	369 (2%)	1 (<1%)	353 (2%)	1 (<1%)
Non Vegetated	15 (<1%)	0	19 (<1%)	0	15 (<1%)	0
Riparian-Conifer	1 (<1%)	0	1 (<1%)	0	1 (<1%)	0
Riparian-Deciduous	2 (2%)	0	3 (3%)	0	3 (3%)	0
Riparian-Shrub/Hardwoods	2 (<1%)	0	0	0	0	0
Wet Subalpine Fir/Lodgepole Pine	760 (5%)	4 (<1%)	496 (3%)	4 (<1%)	674 (4%)	4 (<1%)
Total	2,573 (4%)	8 (<1%)	1,556 (2%)	8 (<1%)	1,915 (3%)	8 (<1%)

All units are acres and (% of habitat type in PSU).
Dry Mixed Conifer includes ponderosa pine and dry Douglas-fir; miscellaneous forests include larch, whitepine, whitebark/subalpine larch, mountain hemlock/subalpine fir.
Ground disturbance in Treasure PSU would be for road upgrade work on the access road.

representative vegetation types within the PSU. The largest percent impact, although not large, would be to cedar/hemlock and miscellaneous forest (10 percent of those habitats within the PSU impacted). The loss of habitat within the footprint of the Alternative 2 disturbance footprint means that species using impacted habitats would no longer have that habitat available. In Alternative 2, at least 90 percent of cedar/hemlock and miscellaneous forest habitat in each PSU would remain undisturbed. Species such as brown creepers, Vaux's swift, golden-crowned kinglet, and varied thrush would still have most of the existing amounts of their habitat left within the PSU as a result of this alternative. The overall amount of migratory bird habitat impacted by Alternative 2, for all habitat types, would be 4 percent of the Crazy PSU and less than 1 percent of Treasure PSU. The overall bird species composition and abundance within the PSU would likely be unchanged at the PSU level due to the small relative footprint of this alternative, although localized shifts in species presence and distribution within the ground disturbance boundary is expected.

In the early stages after reclamation those sites would favor species adapted to open or early successional habitats. As the trees grow on those sites they will go through the different successional stages until possibly reaching late successional forest, assuming that a disturbance such as fire, insects, or disease doesn't disrupt the successional processes. In each stage a different collection of migratory birds would potentially use those stands.

As described in the old growth analysis in the Vegetation section, Alternative 2 would impact 367 acres of old growth in the Crazy PSU through removal of vertical structure. The 185 acres of designated old growth impacted would be less than 1 percent of the PSU and the overall percentage would remain above 10 percent (16.9 percent). Because the amount of old growth impacted would be minor, most of the old growth within the PSU would remain for migratory bird species that use this habitat type and impacts on migratory birds would be small. Species composition and abundance of migratory birds that use old growth would not likely change at the scale of the PSU. Additionally, 221 acres of old growth would be impacted by edge influence, thereby reducing the quality of those acres as habitat for some species. Again, this would be a small percentage of the overall acreage of old growth in the PSU and therefore the impacts to migratory birds would be correspondingly small.

About 40 acres of wetlands would be impacted by Alternative 2 in the Crazy PSU. An additional 3 acres or more may be affected by a pumpback well system, if installed at the impoundment site. Approximately 33,753 linear feet of streams would also be affected directly and indirectly by Alternative 2. Changes in wetlands and associated vegetation would likely change bird species use of these areas. In the case of the loss of wetlands associated with construction activities in this alternative, these sites would no longer provide wetland habitat. The feasibility of MMC's proposed Wetland Mitigation Plan to replace the lost functions of all potentially affected wetlands is uncertain. MMC's plan is conceptual and would be refined during the 404 permitting process. MMC did not update its mitigation plan for Alternative 2 to reflect new wetland and stream mitigation regulations and procedures. Section 3.23, *Wetlands and Other Waters of the U.S.*, discusses proposed wetland mitigation in more detail. Although there may be localized shifts in species presence, the overall species composition and abundance at the scale of the analysis area given the small footprint of the ground disturbance would likely remain consistent as a result of this alternative.

Most birds migrate at altitudes between 500 and 1,000 feet (Lincoln *et al*. 1998), although migrating birds often fly at lower altitudes on nights with inclement weather or low cloud cover (Able 1973, Ogden 1996). Nocturnally migrating songbirds can be attracted to steady-burning lights (Ogden 1996, Manville 2005, Gehring *et al*. 2009). Lighting from permanent facilities could attract nocturnally migrating birds, particularly on nights with low cloud cover (Longcore and Rich 2004, Kerns and Kerlinger 2004). Although no major migratory corridors have been identified in the analysis area, when the weather is inclement, lighting from mine facilities could disrupt movements of some nocturnally migrating birds. Effects of night lighting on nocturnally active birds, such as owls, are discussed in the flammulated owl section.

Woodland songbird use may decline when noise levels reach an average of 42 decibels (dB), and grassland birds may decline at average noise levels of 48 dB (Forman and Alexander 1998). Forman and Alexander (1998) described the noise effects from roadways on birds and gave several reasons for the effects. These included interference with communication during breeding and altered behaviors. Ambient noise levels in the vicinity of the Little Cherry Creek Impoundment Site and Ramsey Plant Site are below these levels (Table 168). Noise near activity areas during the Construction Phase under this alternative would exceed levels impacting birds. This includes noise from trucks/equipment, generators, and blasting. Depending on the activity, noise levels may exceed those in Forman and Alexander (1998) for several hundred feet or more from activities while they were ongoing. This may result in declines in bird use in habitats adjacent to construction activities. Noise levels during operation at mine facilities (*e.g.,* impoundment, plant site, conveyor, access road) would also exceed those levels in Forman and

Alexander (1998) for several hundred feet or more from those facilities/activities (see section 3.20.4.1, *Sound*). At the end of reclamation, noise levels are expected to return to pre-mine levels (see section 3.20.4.1, *Sound*). As during construction, bird use near mine facilities during operation may be less than existing conditions due to noise levels. The majority of the analysis area would remain near existing condition noise levels and therefore not impact bird use.

MMC would store mine, adit, or tailings water at the Ramsey Plant Site, a surge pond at the LAD Areas, and the tailings impoundment. The metals in the tailings water would be similar to what is found at the Troy Mine decant ponds (see Table 120 in the *Water Quality* section), where adverse effects on wildlife have not been observed (USDA Forest Service and DEQ 2012). Concentrations of metals in mine and adit water, which would be stored in mine/yard pond at the Ramsey Plant Site and in a surge pond at the LAD Areas, would be lower than tailings water (see Table 120 in the *Water Quality* section).

3.25.6.4.3 Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Impacts on migratory birds from Alternative 3 would be the similar to Alternative 2, except that less migratory bird habitat would be affected in Alternative 3 (Table 253). Most of the habitat loss in the Crazy PSU would amount to only a small percentage (3 percent or less) of the representative vegetation types within the PSU. The largest percent impact, although not large, would be to miscellaneous forest (6 percent of that habitat within the PSU impacted). This loss of habitat within the Alternative 3 disturbance footprint means that species using impacted habitats would no longer have that habitat available. In Alternative 3, 94 percent of the miscellaneous forest habitat in the Crazy PSU would remain undisturbed. Miscellaneous forest is a general habitat type and likely provides habitat for a variety of species such as hairy woodpecker, Clark's nutcracker, and pileated woodpeckers, although other, more specific habitat types may provide higher quality habitats for species with specific needs. The overall bird species composition and abundance within the PSU would likely be unchanged at the PSU level due to the small relative footprint of this alternative, although localized shifts in species presence and distribution within the ground disturbance boundary is expected.

As described in the old growth analysis in the Vegetation section, Alternative 3 would impact 236 acres of old growth in the Crazy PSU through removal of vertical structure. The 228 acres of designated old growth impacted would be less than 1 percent of the PSU, before mitigation, and the overall percentage would remain above 10 percent (16.8 percent). Additionally, 277 acres of old growth would be impacted by edge influence, thereby reducing the quality of those acres as habitat for some species. Again, this would be a small percentage of the overall acreage of old growth in the PSU and therefore the impacts to migratory birds would be correspondingly small. Mitigation would designate additional old growth, raising the percentage to 18.3 percent from 16.8 percent. Designation of additional areas of old growth would not create new old growth, but would ensure that these areas are managed to retain or develop old growth characteristics. Because the amount of old growth impacted would be minor, most of the old growth within the PSU would remain for migratory bird species that use this habitat type and impacts to migratory birds would be small. Species composition and abundance of migratory birds that use old growth would not likely change at the scale of the PSU.

About 13 acres of wetlands would be directly affected by Alternative 3 in the Crazy PSU; an additional 11 acres may be affected by a pumpback well system at the tailings impoundment. Approximately 19,059 linear feet of streams would be directly and indirectly affected by Alternative 3. Impacts on wetlands would be mitigated through implementation of the agencies'

Wetland Mitigation Plan, which would have a greater likelihood of replacing lost functions than the Alternative 2 Wetland Mitigation Plan. The effect would be the same as Alternative 2.

Effects on nocturnally migrating birds and nocturnally active bird species would be the same as Alternative 2, except that MMC would use fixture baffles and directional light sources to minimize ambient light emanating from the mine facilities during operations. Some ambient light would remain, however, and movements of some nocturnally migrating birds may be disrupted. Effects from noise would be similar to Alternative 2, although in different locations (*e.g.,* different plant site, access route, impoundment site).

Water management in Alternatives 3 and 4 would reduce the risk to wildlife from contaminant uptake from storage of mine, adit, and tailings water. All mine and adit water would be treated and discharged at the Libby Adit Water Treatment Plant and not stored in ponds. The LAD Areas would not be used and the surge ponds would not pose a risk to migratory birds. Tailings water quality would have lower metal concentrations than in Alternative 2; the factors leading to lower metal concentrations in tailings water quality in Alternatives 3 and 4 are discussed in section 3.13, *Water Quality*, p. 674.

3.25.6.4.4 Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Impacts on migratory birds from Alternative 4 would be similar to Alternative 2, except that less migratory bird habitat would be affected in Alternative 4 (Table 253). Most of the habitat loss in the Crazy PSU would amount to only a small percentage (4 percent or less) of the representative vegetation types within the PSU. The largest percent impact, although not large, would be to cedar/ hemlock and miscellaneous forest (6 percent of that habitat within the PSU impacted). This loss of habitat within the Alternative 4 disturbance footprint means that species using impacted habitats would no longer have that habitat available. In Alternative 4, 94 percent of the cedar/hemlock and miscellaneous forest habitat in the Crazy PSU would remain undisturbed. Species such as brown creepers, Vaux's swift, golden-crowned kinglet, and varied thrush would still have most of the existing amounts of their habitat left within the PSU as a result of this alternative. The overall amount of migratory bird habitat impacted by Alternative 4, for all habitat types, is only 3 percent of the Crazy PSU and 1 percent of the Treasure PSU. The overall bird species composition and abundance within the PSU would likely be unchanged at the PSU level due to the small relative footprint of this alternative, although localized shifts in species presence and distribution within the ground disturbance boundary is expected.

As described in the old growth analysis in the Vegetation section, Alternative 4 would impact 214 acres of designated and undesignated old growth in the Crazy PSU through removal of vertical structure. The 82 acres of designated old growth impacted would be less than 1 percent of the PSU, before mitigation, and the overall percentage would remain above 10 percent (17.1 percent). Mitigation would designate additional old growth, raising the percentage to 18.1 percent from 17.1 percent. Additionally, 214 acres of old growth would be impacted by edge influence, thereby reducing the quality of those acres as habitat for some species. Again, this is a small percentage of the overall acreage of old growth in the PSU and therefore the impacts to migratory birds would be correspondingly small. Designation of additional areas of old growth would not create new old growth, but would ensure that these areas are managed to retain or develop old growth characteristics. Because the amount of old growth impacted would be minor, most of the old growth within the PSU would remain for migratory bird species that use this habitat type and impacts to migratory birds would be small. Species composition and abundance of migratory birds that use old growth would not likely change at the scale of the PSU.

About 40 acres of wetlands would be directly or indirectly affected by Alternative 4 in the Crazy PSU. Approximately 34,063 linear feet of streams would also be directly or indirectly affected by Alternative 4. Impacts on wetlands would be mitigated through implementation of the agencies' Wetland Mitigation Plan, which would have a greater likelihood of replacing lost functions than the Alternative 2 Wetland Mitigation Plan. The effect would be the same as Alternative 2.

Effects from noise would be similar to Alternative 3, although in different locations (*e.g.,* different impoundment site).

3.25.6.4.5 Alternative A – No Transmission Line

Alternative A would have no impacts on migratory bird habitat.

3.25.6.4.6 Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

Alternative B would impact 313 acres of habitat (Table 255). Although more new roads would be built for Alternative B than other transmission line alternatives, direct impacts of road construction on vegetation communities would be relatively minor. At the end of operations, disturbed habitat would be revegetated. Roads would be redisturbed for transmission line decommissioning and reclaimed after transmission line removal. After reclamation, disturbed habitat would potentially be restored to pre-transmission line conditions in the long term through natural succession. Very little habitat loss/change would occur (less than 1 percent) for any of the representative vegetation types within the PSUs (Table 255). This small loss/change of habitat due to Alternative B means that species using impacted habitats would no longer have that habitat available. In Alternative B, at least 99 percent of all habitat types in the analysis area would remain undisturbed. Species such as brown creeper, Vaux's swift, golden-crowned kinglet, varied thrush, pileated woodpecker, Cassin's finch, and rufous hummingbird would still have most of the existing amounts of their habitat left within the PSUs as a result of this alternative. The overall amount of migratory bird habitat impacted by Alternative B, for all habitat types, is less than 1

Table 255. Impacts on Migratory Bird Habitat in the Analysis Area by Transmission Line Alternative B.

Existing Vegetation Type	Crazy	McElk	Riverview	Silverfish
Cedar/Hemlock	24 (<1%)	0 (0%)	0 (0%)	0 (0%)
Dry Mixed Conifer	<1 (<1%)	39 (<1%)	8 (<1%)	46 (<1%)
Miscellaneous Forest	7 (<1%)	14 (<1%)	8 (<1%)	7 (<1%)
Moist Douglas-Fir/Grand Fir	51 (<1%)	2 (<1%)	20 (<1%)	22 (<1%)
Non Vegetated	0 (0%)	<1 (<1%)	0 (0%)	0 (0%)
Riparian – Deciduous	0 (0%)	0 (0%)	1 (<1%)	0 (0%)
Riparian – Shrub/Hardwoods	4 (<1%)	1 (<1%)	0 (0%)	0 (0%)
Wet Subalpine Fir/Lodgepole Pine	27 (<1%)	0 (0%)	2 (<1%)	29 (<1%)
Total	114 (<1%)	55 (<1%)	39 (<1%)	105 (<1%)

All units are acres and (% of habitat type in PSU).
Dry Mixed Conifer includes ponderosa pine and dry Douglas-fir; miscellaneous forests include larch, whitepine, whitebark/subalpine larch, mountain hemlock/subalpine fir.
Most of this alternative is on National Forest System lands within Crazy and Silverfish PSUs and some Plum Creek land in Silverfish, and with the transmission line primarily running through Plum Creek land in Riverview and McElk PSUs. Within the McElk PSU, these acres include the portion of the transmission line extending to the Sedlak Park Substation and the substation itself.

percent of each PSU. The overall bird species composition and abundance in the PSUs would likely be unchanged at the PSU level due to the small relative clearing and disturbance areas, although localized shifts in species presence and distribution within the clearing and disturbance areas is expected.

As described in the old growth analysis in the Vegetation section, Alternative B would impact 27 acres of designated and undesignated old growth in the Crazy PSU through removal of vertical structure. The 20 acres of designated old growth impacted would be less than 1 percent of the PSU and the overall percentage would remain above 10 percent (17.2 percent). Alternative B would impact 2 acres of undesignated old growth in the Silverfish PSU through removal of vertical structure. The overall percentage of designated old growth would remain above 10 percent (13.6 percent). Mitigation would designate additional old growth, although the percentage would not increase in either PSU. Designation of additional areas of old growth would not create new old growth, but would ensure that these areas are managed to retain or develop old growth characteristics. Because the amount of old growth impacted would be minor, most of the old growth within the PSU would remain for migratory bird species that use this habitat type and impacts to migratory birds would be small. Species composition and abundance of migratory birds that use old growth would not likely change at the scale of the PSU. Additionally, 98 acres of old growth would be impacted by edge influence in the Crazy PSU and 23 acres in the Silverfish PSU, thereby reducing the quality of those acres as habitat for some species. Again, this is a small percentage of the overall acreage of old growth in the PSU and therefore the impacts to migratory birds would be correspondingly small.

About 4 acres of wetlands would be within the clearing area of Alternative B. Less than 0.1 acre of wetlands and streams would be in the disturbance area for new or upgraded roads. Approximately 5,111 linear feet of streams would also be within the Alternative B clearing area or the disturbance area for new or upgraded roads. Direct effects to wetlands are expected to be avoided by placement and location of transmission line facilities and roads outside of wetlands and streams. Species composition and abundance of migratory birds that use wetlands and streams would not likely change at the scale of the PSU.

Response of migratory birds to timber harvest depends upon their individual habitat preferences and needs. Clearing of forested areas for the transmission line would remove forest habitat used by some species (*e.g.*, brown creeper, golden-crowned kinglet, Townsend's warbler, and Swainson's thrush) and create grassland and shrubland habitat used by other bird species (*e.g.*, American kestrel, calliope hummingbird, and chipping sparrow). Clearing also would create edge habitat used by birds such as the dark-eyed junco, red-tailed hawk, and great-horned owl.

The risk of bird electrocutions potentially caused by the transmission line would be minimized through implementation of recommendations outlined in APLIC (2006), which are based on a minimum spacing of 60 inches between phases or between phase and ground wires. The potential for collisions of migratory birds with the transmission line would be reduced by constructing the transmission line according to recommendations outlined in APLIC (2012) and in compliance with MMC's Environmental Specifications (MMI 2005b). Applicable recommendations include locating the transmission line away from streams, mountain passes, and other potential flight corridors; placement of the lines below treeline or other topographical features; and installation of line marking devices. MMC indicated no aviation flight paths were identified for the preferred corridor and no markers or other warning devices were planned (MMI 2005b).

Woodland songbird use may decline when noise levels reach an average of 42 decibels (dB), and grassland birds may decline at average noise levels of 48 dB (Forman and Alexander 1998). Forman and Alexander (1998) described the noise effects from roadways on birds and gave several reasons for the effects. These included interference with communication during breeding and altered behaviors. Noise levels during clearing and construction activities on the transmission line would exceed these levels in the vicinity of the transmission line (see section 3.20.4.1, *Sound*). The transmission line itself would make enough noise during wet weather (see section 3.20.4.1, *Sound*) to exceed the noise levels described in Forman and Alexander (1998). The result may be less use by birds near the transmission line during construction. The noise levels during operation are generally expected to be less than those identified in Forman and Alexander (1998) except during wet weather, which is expected to occur about 10 percent of the time (see section 3.20.4.1, *Sound*). Given that most of the time the noise would be low, the operation of the transmission line would not be expected to greatly impact bird use near the line. Helicopter use to monitor the line may also temporarily and infrequently increase noise levels as well. Helicopters may be used in line stringing but would not be used during clearing activities or structure placement. Bird use near these activities while they are occurring would potentially decline temporarily due to the noise. Most of the PSUs would have noise levels near existing conditions given the small analysis area for this alternative, consequently allowing birds to have most of the analysis area relatively quiet.

3.25.6.4.7 Alternative C-R – Modified North Miller Creek Transmission Line Alternative

Impacts on migratory birds from Alternative C-R would be similar to Alternative B, except that less habitat would be affected in the Crazy and Riverview PSUs and more would be affected in the Silverfish and McElk PSUs (Table 256). Approximately 320 acres would be affected by Alternative C-R (Table 256). Very little habitat loss/change would occur (less than 1 percent) for any of the representative vegetation types in the analysis area. This small loss/change of habitat within Alternative C-R disturbance area means that species using impacted habitats would no longer have that habitat available. In Alternative C-R, at least 99 percent of all habitat types in the analysis area would remain undisturbed. Species such as brown creeper, Vaux's swift, golden-crowned kinglet, varied thrush, pileated woodpecker, Cassin's finch, and rufous hummingbird

Table 256. Impacts on Migratory Bird Habitat in the Analysis Area by Transmission Line Alternative C-R.

Existing Vegetation Type	Crazy	McElk	Riverview	Silverfish
Cedar/Hemlock	11 (<1%)	0 (0%)	0 (0%)	0 (0%)
Dry Mixed Conifer	<1 (<1%)	44 (<1%)	5 (<1%)	62 (<1%)
Miscellaneous Forest	9 (<1%)	7 (<1%)	0 (0%)	17 (<1%)
Moist Douglas-Fir/Grand Fir	36 (<1%)	21 (<1%)	2 (<1%)	62 (1%)
Riparian – Shrub/Hardwoods	0 (0%)	1 (<1%)	0 (0%)	1 (<1%)
Wet Subalpine Fir/Lodgepole Pine	17 (<1%)	0 (0%)	0 (0%)	26 (<1%)
Total	73 (<1%)	72 (<1%)	6 (<1%)	168 (<1%)

All units are acres and (% of habitat type in PSU).
Dry Mixed Conifer includes ponderosa pine and dry Douglas-fir; miscellaneous forests include larch, whitepine, whitebark/subalpine larch, mountain hemlock/subalpine fir.
Most of this alternative is on National Forest System lands within Crazy and Silverfish PSUs and some Plum Creek and State land in Silverfish, and with the transmission line primarily running through Plum Creek land in Riverview and McElk PSUs. Within the McElk PSU, these acres include the portion of the transmission line extending to the Sedlak Park Substation and the substation itself.

would still have most of the existing amounts of their habitat left within the PSUs as a result of this alternative. The overall amount of migratory bird habitat impacted by Alternative C-R, for all habitat types, is less than 1 percent of each PSU. The overall bird species composition and abundance in the PSUs would likely be unchanged at the PSU level due to the small relative clearing and disturbance areas, although localized shifts in species presence and distribution within the clearing and disturbance areas is expected. The location of the Alternative C-R transmission line alignment on an east-facing ridge immediately north of the Sedlak Park Substation would reduce the risks of migratory bird wire strikes and electrocutions relative to Alternative B in the Fisher River corridor. In addition, areas of high risk for bird collisions where line marking devices may be needed (*i.e.*, major drainage crossings) and recommendations for the type of marking device would be identified through a study conducted by a qualified biologist and funded by MMC.

As described in the old growth analysis in the Vegetation section, Alternative C-R would not impact designated or undesignated old growth in the Crazy PSU through removal of vertical structure. The overall percentage of designated old growth in the Crazy PSU would remain above 10 percent (17.3 percent). Alternative C-R would impact approximately 2 acres of undesignated old growth and 4 acres of designated old growth in the Silverfish PSU through the removal of vertical structure. The overall percentage of designated old growth in the Silverfish PSU would remain above 10 percent (13.6 percent). Mitigation would designate additional old growth, although the percentage would not increase in either PSU. Designation of additional areas of old growth would not create new old growth, but would ensure that these areas are managed to retain or develop old growth characteristics. Because the amount of old growth impacted would be minor, most of the old growth within the PSU would remain for migratory bird species that use this habitat type and impacts to migratory birds would be small. Species composition and abundance of migratory birds that use old growth would not likely change at the scale of the PSU. Additionally, 17 acres of old growth would be impacted by edge influence in the Silverfish PSU, thereby reducing the quality of those acres as habitat for some species in the Silverfish PSU. Again, this is a small percentage of the overall acreage of old growth in the PSU and therefore the impacts to migratory birds would be correspondingly small. Edge effects to old growth would not occur in the Crazy PSU.

Approximately 2 acres of wetlands, all jurisdictional, would be within the Alternative C-R clearing area. Less than 0.1 acre of wetlands and streams would be affected by new or upgraded road construction. Approximately 1,922 linear feet of streams would also be within the Alternative C-R clearing area or the disturbance area for new or upgraded roads. Direct effects to wetlands are expected to be avoided by placement and location of transmission line facilities and roads outside of wetlands and streams. Species composition and abundance of migratory birds that use wetlands and streams would not likely change at the scale of the PSU.

The effects from noise are expected to be similar to Alternative B, although in different locations given the different transmission line alignment. More helicopter use would occur than in Alternative B given that helicopters may be used for structure placement and vegetation clearing in addition to line stringing and monitoring/maintenance. This would result in more noise while these activities are ongoing and therefore more (temporary) impacts to birds in the areas adjacent to the activities. Most of the noise levels in the analysis area would remain near existing conditions, therefore most of the analysis area would be relatively quiet for bird use.

3.25.6.4.8 Alternative D-R – Miller Creek Transmission Line Alternative

Impacts on migratory birds from Alternative D-R would be similar to Alternative C-R, except that more habitat would be disturbed due to the longer length of Alternative D-R (Table 257). Approximately 334 acres would be affected by Alternative D-R. Very little habitat loss/change would occur (less than 1 percent) for any of the representative vegetation types in the analysis area. This small loss/change of habitat in the Alternative D-R disturbance area means that species using impacted habitats would no longer have that habitat available. In Alternative D-R, at least 99 percent of all habitat types in the PSUs would remain undisturbed. Species such as brown creeper, Vaux's swift, golden-crowned kinglet, varied thrush, pileated woodpecker, Cassin's finch, and rufous hummingbird would still have most of the existing amounts of their habitat left within the PSUs as a result of this alternative. The overall amount of migratory bird habitat impacted by Alternative D-R, for all habitat types, is less than 1 percent of each PSU. The overall bird species composition and abundance in the PSUs would likely be unchanged at the PSU level due to the small relative clearing and disturbance areas, although localized shifts in species presence and distribution within the clearing and disturbance areas is expected.

Table 257. Impacts on Migratory Bird Habitat in the Analysis Area by Transmission Line Alternative D-R.

Existing Vegetation Type	Crazy	McElk	Riverview	Silverfish
Cedar/Hemlock	13 (<1%)	0 (0%)	0 (0%)	0 (0%)
Dry Mixed Conifer	0 (0%)	44 (<1%)	5 (<1%)	21 (<1%)
Miscellaneous Forest	22 (<1%)	7 (<1%)	0 (0%)	72 (<1%)
Moist Douglas-Fir/Grand Fir	10 (<1%)	21 (<1%)	2 (<1%)	43 (<1%)
Riparian – Shrub/Hardwoods	0 (0%)	1 (<1%)	0 (0%)	0 (0%)
Wet Subalpine Fir/Lodgepole Pine	27 (<1%)	0 (0%)	0 (0%)	48 (<1%)
Total	72 (<1%)	72 (<1%)	6 (<1%)	184 (<1%)

All units are acres and (% of habitat type in PSU).
Dry Mixed Conifer includes ponderosa pine and dry Douglas-fir; miscellaneous forests include larch, whitepine, whitebark/subalpine larch, mountain hemlock/subalpine fir.
Most of this alternative is on National Forest System lands within Crazy and Silverfish PSUs and some Plum Creek and State land in Silverfish, and with the transmission line primarily running through Plum Creek land in Riverview and McElk PSUs. Within the McElk PSU, these acres include the portion of the transmission line extending to the Sedlak Park Substation and the substation itself.

As described in the old growth analysis in the Vegetation section of this EIS, Alternative D-R would not impact designated or undesignated old growth in the Crazy PSU. The overall percentage of designated old growth in the Crazy PSU would remain above 10 percent (17.3 percent). Alternative D-R would impact approximately 4 acres of designated old growth in the Silverfish PSU through the removal of vertical structure. The overall percentage of designated old growth in the Silverfish PSU would remain above 10 percent (13.6 percent). Mitigation would designate additional old growth, although the percentage would not increase in either PSU. Designation of additional areas of old growth would not create new old growth, but would ensure that these areas are managed to retain or develop old growth characteristics. Because the amount of old growth impacted is so little, most of the old growth within the analysis area would remain for migratory bird species that use this habitat type and impacts to migratory birds would be small. Species composition and abundance of migratory birds that use old growth would not likely change at the scale of the PSU. Additionally, 4 acres of old growth would be impacted by edge influence in the Crazy PSU, thereby reducing the quality of those acres as habitat for some species. Again, this is a small percentage of the overall acreage of old growth in the PSU and therefore the impacts to migratory birds would be correspondingly small. Edge effects to old growth in the Silverfish PSU would not occur.

Approximately 2 acres of wetland, all jurisdictional, would be within the Alternative D-R clearing area. Less than 0.1 acre of wetlands and streams would be affected by new or upgraded road construction. Approximately 2,935 linear feet of streams would also be within the Alternative D-R clearing area or the disturbance area for new or upgraded roads. Direct effects to wetlands are expected to be avoided by placement and location of transmission line facilities and roads outside of wetlands and streams. Species composition and abundance of migratory birds that use wetlands and streams would not likely change at the scale of the PSU.

The effects from noise are expected to be similar to Alternative B and C-R, although in different locations given the different alignment for the transmission line. More helicopter use may occur compared to Alternative B given that helicopters may be used for structure placement and vegetation clearing in addition to line stringing, annual monitoring, and periodic maintenance. This would result in more noise while these activities are ongoing and therefore more (temporary) impacts to birds in the areas adjacent to the activities. Most of the noise levels in the analysis area would remain near existing conditions, therefore most of the analysis area would be relatively quiet for bird use.

The effect on migratory birds that use old growth and wetlands would be the same as Alternative B. The effects from noise are expected to be similar to Alternative C-R, although in different locations given the different alignment for the transmission line. The mitigation described for Alternative C-R would be implemented and reduce effect on migratory birds.

3.25.6.4.9 Alternative E-R – West Fisher Creek Transmission Line Alternative

Impacts on migratory birds from Alternative E-R would be similar to Alternatives C-R and D-R except that more habitat would be disturbed due to the longer length of Alternative E-R. Alternative E-R would have the largest clearing and disturbance areas, affecting 367 acres (Table 258). Very little habitat loss/change would occur (less than 1 percent) for any of the representative vegetation types in the analysis area. This small loss/change of habitat in the Alternative E-R disturbance area means that species using impacted habitats would no longer have that habitat available. In Alternative E-R, at least 99 percent of all habitat types in the analysis area would remain undisturbed. Species such as brown creeper, Vaux’s swift, golden-crowned kinglet, varied thrush, pileated woodpecker, Cassin’s finch, and rufous hummingbird would still have most of the existing amounts of their habitat left within the PSUs as a result of this alternative. The overall amount of migratory bird habitat impacted by Alternative E-R, for all habitat types, is less than 1 percent of each PSU. The overall bird species composition and abundance within the PSUs would likely be unchanged at the PSU level due to the small relative clearing and disturbance areas, although localized shifts in species presence and distribution within the clearing and disturbance areas is expected.

Table 258. Impacts on Migratory Bird Habitat in the Analysis Area by Transmission Line Alternative E-R.

Existing Vegetation Type	Crazy	McElk	Riverview	Silverfish
Cedar/Hemlock	13 (<1%)	0 (0%)	0 (0%)	0 (0%)
Dry Mixed Conifer	0 (0%)	44 (<1%)	5 (<1%)	64 (1%)
Miscellaneous Forest	22 (<1%)	7 (<1%)	0 (0%)	49 (<1%)
Moist Douglas-Fir/Grand Fir	10 (<1%)	21 (<1%)	2 (<1%)	84 (1%)
Riparian – Shrub/Hardwoods	0 (0%)	1 (<1%)	0 (0%)	0 (0%)
Wet Subalpine Fir/Lodgepole Pine	27 (<1%)	0 (0%)	0 (0%)	19 (<1%)
Total	72 (<1%)	72 (<1%)	6 (<1%)	216 (<1%)

All units are acres and (% of habitat type in PSU).
Dry Mixed Conifer includes ponderosa pine and dry Douglas-fir; miscellaneous forests include larch, whitepine, whitebark/subalpine larch, mountain hemlock/subalpine fir.
Most of this alternative is on National Forest System lands within Crazy and Silverfish PSUs and some Plum Creek and State land in Silverfish, and with the transmission line primarily running through Plum Creek land in Riverview and McElk PSUs. Within the McElk PSU, these acres include the portion of the transmission line extending to the Sedlak Park Substation and the substation itself.

As described in the old growth analysis in the Vegetation section of this EIS, Alternative E-R would not impact designated or undesignated old growth in either the Crazy or the Silverfish PSU through the removal of vertical structure. The overall percentage of designated old growth in the Crazy PSU would remain above 10 percent in both PSUs (17.3 percent for the Crazy PSU and 13.6 percent for the Silverfish PSU). Because the amount of old growth impacted is so little, most of the old growth within the analysis area would remain for migratory bird species that use this habitat type and impacts to migratory birds would be small. Species composition and abundance of migratory birds that use old growth would not likely change at the scale of the PSU. Additionally, 4 acres of old growth would be impacted by edge influence in the Crazy PSU and 2 acres in the Silverfish PSU, thereby reducing the quality of those acres as habitat for some species. Again, this is a small percentage of the overall acreage of old growth in the PSU and therefore the impacts to migratory birds would be correspondingly small.

Approximately 2 acres of wetland, all jurisdictional, would be within the Alternative E-R clearing area. Less than 0.1 acre of wetlands and streams would be affected by new or upgraded road construction. Approximately 3,380 linear feet of streams would also be within the Alternative E-R clearing area or the disturbance area for new or upgraded roads. Direct effects to wetlands are expected to be avoided by placement and location of transmission line facilities and roads outside of wetlands and streams. Species composition and abundance of migratory birds that use wetlands and streams would not likely change at the scale of the PSU.

The effects from noise are expected to be similar to Alternative B and C-R, although in different locations given the different alignment for the transmission line. More helicopter use may occur compared to Alternative B given that helicopters may be used for structure placement and vegetation clearing in addition to line stringing, annual monitoring, and periodic maintenance. This would result in more noise during these activities and therefore more temporary impacts to birds in the areas adjacent to the activities. Most of the noise levels in the analysis area would remain near existing conditions, therefore most of the analysis area would be relatively quiet for bird use.

3.25.6.4.10 Combined Mine- Transmission Line Effects

The combined alternatives would not have large impacts to migratory bird habitat, particularly because the transmission line alternatives impact so few acres (1 percent or less). The mine alternatives also do not have large impacts to migratory bird habitats within the footprint of the ground disturbance, as discussed previously for each alternative. Alternative 3 has the least wetland acres impacted, so any transmission line alternative combined with Alternative 3 would be least impacting for wetlands compared to other alternative combinations (mitigation would replace impacted wetlands, making the end result of alternatives similar). At mine closure, disturbed habitat would be reclaimed (revegetated through seeding/planting), and habitat would potentially be restored to pre-mine conditions in the long term through successional processes. Roads would be redisturbed for transmission line decommissioning and reclaimed after transmission line removal.

Response of migratory birds to timber harvest depends upon their individual habitat preferences and needs. Clearing of forested areas for transmission lines would remove forest cover used by some species (*e.g.*, brown creeper, golden-crowned kinglet, and hermit thrush) and create grassland and shrubland habitat used by other bird species (*e.g.*, American kestrel, calliope hummingbird, and chipping sparrow). Clearing associated with all alternatives, both mine and transmission line, also would create edge habitat used by birds such as the dark-eyed junco, western tanager, Townsend's warbler, red-tailed hawk, and great-horned owl. For additional discussion of edge effects related to old growth, see the old growth analysis in the Vegetation section. Edge habitat favors some species while diminishing habitat for interior forest species. Given that the edge effects to old growth habitat impacts relatively few acres within the PSUs, the overall impact on interior forest birds that use old growth would be minimal.

The construction of some mine facilities, such as the plant, access road, impoundment, conveyor, and adits, would not provide habitat for any species as discussed above in the effects from Alternatives 2, 3, and 4 until reclamation occurred and those facilities were reclaimed. While all combined action alternatives would result in localized changes in species composition, they would not result in widespread changes in bird communities in the analysis area.

Lands would be acquired to improve grizzly bear habitat in all alternatives. These parcels would likely provide migratory bird habitat, although the exact type would not be known until purchase. Whether the parcels have open habitats, open canopied stands, closed canopy stands, late successional forests, or riparian areas, they would likely provide habitat for some species of migratory birds. Over the long term, land acquisition would reduce the likelihood that those parcels would be developed, thus maintaining habitat for migratory birds on those parcels. In the mine alternatives, impacted wetlands would be replaced with similar type wetlands, thus maintaining riparian/wetland habitats for migratory birds using those habitats. The agencies' Wetland Mitigation Plan would have a greater likelihood of replacing lost functions than the Alternative 2 Wetland Mitigation Plan.

The amount of snags and downed wood resulting from the mine and transmission line alternatives, as described in the Snags and Downed Wood section would provide sufficient quality and quantity of those habitat features to maintain habitat for wildlife, including migratory birds.

3.25.6.4.11 Cumulative Effects

Introduction

The Affected Environment/Existing Condition section describes the migratory bird species found on the KNF and the variety of habitat types they utilize. This cumulative effects section summarizes the past actions as well as further describes ongoing and other reasonably foreseeable contributions potentially impacting migratory birds.

As described under the section "Data Sources, Methods, Assumptions, Bounds of Analysis," the planning subunits overlapping the project were chosen for the cumulative effects analysis as localized alteration of habitat could affect the use of the impacted stand as well as affect the availability of habitats within the surrounding area.

Past Actions

Migratory birds represent a wide range of preferences and habitat use. Past harvest has had both positive and negative impacts depending on the activity and species of bird being considered. Harvest has occurred in the analysis area over the last 60+ years and has provided a variety of age classes and successional stages across the analysis area. Regeneration harvests would have benefitted species that prefer more open habitats while at the same time reduced habitat for those species that prefer heavily forested habitat. Past harvest would have also reduced snags, down woody materials, late successional habitats, and riparian habitats that are important to many species. Road construction would have also contributed to the reduction of these habitat types and components. A more detailed list of previous vegetation and road management activities are found in Appendix E. In unharvested areas, natural disturbances such as wildfire would have contributed to this mosaic of habitats and forage conditions. In contrast, fire suppression since the early 1900s has altered stand structure resulting in more homogenous stands with greater canopy closure in some areas, which has favored those species that prefer heavily forested habitats.

Since the 1990s, application of KFP standards has resulted in better retention of snags and down woody materials and protection of old growth and riparian habitats. Also, more reliance on intermediate harvest that leaves more forest structure (including large old trees), snags, and cover has since provided more intermediate or edge conditions than the extremes of open and heavily forested habitats.

To a lesser extent, habitat changes have occurred as a result of other activities, such as mining, in these planning subunits, although the footprint of these activities is relatively small compared to the factors listed above. The results were either a conversion of habitat into unvegetated conditions, or into openings with early successional habitats that in some cases have progressed through natural succession to again provide forested habitats.

Alternative 1 – No Mine; Alternative A – No Transmission Line

No direct effects from federal actions would occur; therefore, these alternatives would not contribute to cumulative effects to migratory bird habitat. Implementation of these alternatives would maintain existing vegetative condition on the landscape and migratory bird use would continue at current levels.

Action Alternatives for the Mine and Transmission Line: Ongoing and Reasonably Foreseeable Actions

Reasonably foreseeable actions include those federal, state, or private activities that are ongoing or scheduled to occur during the life of the mine/reclamation, independent of this federal action. Chapter 3 identifies those current and foreseeable actions in the analysis area that were determined to be appropriate for inclusion in the analysis of environmental effects.

Miller-West Fisher Vegetation Management Project will occur within the Silverfish PSU. Only the transmission line alternatives would occur within this PSU. Miller-West Fisher will treat 5,000 acres in addition to temp road construction, road storage, decommissioning, and road conversion to trail. The vegetation management would improve the availability of open habitats. The openings created under the transmission line alternatives for Montanore would be longer lasting (the life of the mine) than Miller-West Fisher due to maintenance of those openings under the lines. Loss of closed forest habitat and gain in open forest habitat would occur with Miller-West Fisher, and that improves conditions toward providing more open habitats similar to what would have been found in the analysis area historically under natural disturbance processes. Ecosystems Research Group found that, in general, early successional stage habitats are less than Historic Range of Variation on the KNF (Ecosystems Research Group 2012). This means that early successional habitats (*e.g.,* openings, seedling/saplings) are less available for migratory birds on the KNF than they would have been historically under natural disturbance processes.

The Coyote Improvement vegetation management project is in the planning stages and would take place within the Crazy PSU. The project would harvest 240 acres to increase stand resiliency to mountain pine beetles. This project would contribute to open canopy habitat/openings within the analysis area. As mentioned above, this habitat component is generally lacking on the landscape and Coyote Improvement project would contribute toward improving its availability within these planning subunits. The transmission line alternatives in Montanore would contribute openings as well, although they are expected to be maintained longer before natural succession is allowed to occur compared to Coyote Improvement.

Silverbutte Bugs timber sale is in the Silverfish PSU and would be a small project like Coyote. Similar to the timber sales mentioned above, it would contribute some openings/open-canopied habitat within this PSU. If Silverbutte Bugs mainly treats stands already impacted by insects/disease, those stands may already be in an open-canopied condition.

Flower Creek timber sale is in the Treasure PSU and only has minimal overlap with the project with a small amount of the access road for Montanore located within this PSU. Flower Creek timber sale, like the timber sales mentioned above, would contribute openings or open-canopied habitat as well. Approximately 900 acres are proposed for treatment. Due to the minimal overlap, cumulative effects would be minimal.

Increased use of public lands is likely with population growth and development, but use is expected to be gradual and focused on areas along or near roads open to motorized traffic. Activities include firewood cutting which removes snags and down wood that may provide habitat for migratory birds. Loss would be limited to individual trees and logs and to areas within about 150-200 feet of open roads and has been accounted for in available snag habitat. Also, the Montanore Project proposes no change in the amount of roads open for public motorized use. However, new clearings within viewing distance of the open roads may make existing snags more visible for cutting. Therefore, cumulatively there would be a negligible increase in the expected loss of snags and down wood due to proposed activities and firewood gathering within the analysis area.

Development of private land within the analysis area likely altered migratory bird habitat by both permanently removing forested habitats and converting them to non-vegetated sites, or by changing stand structure. Timber harvest on corporate timberlands also impacted the amount and distribution of stand types within the analysis area. Opening up canopies likely favored birds that use those conditions and did not favor those species preferring closed canopied stands.

Given that many of the activities included in the list of cumulative effects impact relatively few acres compared to natural disturbance processes, and that those natural disturbance processes largely determine the amounts and pattern of habitats on the landscape (Ecosystems Research Group 2012), Montanore is expected to have only a small contribution to cumulative effects.

Cumulatively, when other activities including the Montanore project and all past, present, and reasonably foreseeable activities are considered, habitat on federal lands is considered to provide sufficient habitat to maintain migratory birds.

3.25.6.4.12 Regulatory/Forest Plan Consistency

Organic Administration Act and Forest Service Locatable Minerals Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources and to take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations. All mine and transmission line alternatives would comply with 36 CFR 228.8.

National Forest Management Act/Kootenai Forest Plan

Forest Plan Consistency: All action alternatives meet KFP guidelines and standards as they apply to migratory birds and include:

p.II-1 #7. *Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species*: Compared to the amounts of habitat within the analysis area, the footprint of the mine activities would remove a relatively small amount of habitat and convert it to a non-vegetated condition. Other components of the project, particularly the transmission line, would convert some areas from closed canopy forests to open habitats, which are generally less than Historic Range of Variation (Ecosystems Research Group 2012) on the landscape. Reclamation would revegetate sites and succession would begin again, moving these impacted acres from early successional habitats to late successional forested habitats over time, depending on the influence of natural disturbance processes.

Statement of Findings

All action alternatives would result in small changes to migratory bird habitat within the analysis area. The alternative disturbance areas are small compared to the analysis area. Some alternative components, such as the plant site and impoundment, would result in a small loss of habitat until reclamation. The transmission line would result in conversion of habitat from forested to open habitat, which would shift the bird species composition within the clearing footprint during construction/operation. After reclamation when natural succession is allowed to occur, these areas may shift back toward forested habitats. ***Due to the small disturbance area compared to the analysis area, none of the action alternatives are expected to measurably change overall migratory bird species composition or abundance in the analysis area.***

Migratory Bird Treaty Act and Executive Order 13186

All alternatives would comply with the Migratory Bird Treaty Act, Executive Order 13186 and associated MOU by evaluating the effects of federal actions on migratory birds as part of the NEPA process and promoting conservation of and minimizing adverse impacts on migratory birds.

State Requirements

Alternatives 3 and 4 would comply with the MMRA regarding disturbed lands being reclaimed to a post-mining land use with stability and utility comparable to that of the pre-mining landscape. Draft findings regarding compliance with MFSA requirements are discussed in the Summary, beginning on p. S-53. All alternatives would comply with the Nongame and Endangered Species Act.

3.25.7 Other Species of Interest

3.25.7.1 Regulatory Framework

The National Forest Management Act requires the Secretary of Agriculture to promulgate regulations specifying guidelines for land management plans that "provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives…" The "specific land area" (scale) for providing diversity is established in the framework as the area covered by the Forest Plan, or the entire KNF. One of the KFP goals is to "maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species… and in sufficient quality and quantity to maintain habitat diversity representative of existing conditions" (II-1 #7). The KFP (KFP Vol. 1, II-1 #3 and #7, II-7; and II-22-23) provides guidance for moose management concerning motorized access and maintenance of old growth and other age classes of vegetation.

The MFSA directs DEQ to approve a facility if, in conjunction with other findings, DEQ finds and determines that the facility minimizes adverse environmental impact, considering the state of available technology and the nature and economics of the alternatives. An assessment of effects on moose winter range and state species of concern is part of the transmission line certification process. In addition, FWP has also expressed concerns about potential impacts of the Montanore Project on moose.

3.25.7.2 Moose

3.25.7.2.1 Analysis Area and Methods

The analysis area for the moose is described in section 3.25.1, *Introduction* (Figure 96). The boundaries for determination of population trend and contribution toward population viability are the FWP moose HD number 105 and the KNF, respectively.

Moose occurrence data come from District wildlife observation records, Forest historical data (NRIS Wildlife), and other agencies (MNHP, FWP). Moose winter range was derived from FWP and Western Resource Development (1989f) mapping and modified based on KNF and FWP biologists' knowledge of moose habitat use. Because their habitat requirements are similar, the same criteria used to evaluate project impacts on elk in the KNF were used for moose, with the following exceptions:

- Direct impacts on mapped moose winter range were calculated

- Cover to forage ratios were calculated for moose winter range, based on the mapping described above
- The recommended cover-to-forage ratio in moose winter range is 50 percent cover to 50 percent forage habitat
- The recommended proportion of cover in MAs 15, 16, and 17 is 30 percent, which is the same as white-tailed deer (MA designations, goals, and standards are described in detail in section 3.15, *Land Use*)
- Similar to white-tailed deer, the number of openings greater than 20 acres was evaluated
- Movement areas evaluated were the same as white-tailed deer

MMC's proposed Alternatives 2 and B include an access change in NFS road #4724 from April 1 to June 30 and a yearlong access change in a segment of NFS road #4784 to mitigate for impacts on grizzly bears. NFS road #4784 is proposed for an access change by the Rock Creek Project. The access change on NFS road #4784 would be implemented for all action alternatives only if it was not already implemented as part of the Rock Creek Project mitigation. The agencies' alternatives would include additional yearlong access changes through the installation of barriers or gates in several roads to mitigate for the loss of big game security and impacts (Table 28 and Table 29 and Figure 35). These road access changes are taken into account in road density calculations.

Additional road access changes may also occur on land acquired as part of the grizzly bear mitigation proposed by MMC or the agencies (see mitigation plan descriptions in sections 2.4, *Alternative 2- MMC's Proposed Mine*, and section 2.5, *Alternative 3—Agency Mitigated Poorman Impoundment Alternative*). Road density calculations do not take into account the effect of land acquisition requirement for grizzly bear mitigation.

Other mitigation measures incorporated into MMC's or the agencies' alternatives that could benefit moose include implementation of wetland mitigation plans for MMC's proposed alternative and the agencies' alternative, winter construction timing restrictions in moose winter range, prohibiting employees from carrying firearms, and monitoring road-killed animals along mine access roads to determine if improved access resulted in increased wildlife mortality.

Impacts on moose on private and State lands from the transmission line corridor were evaluated based on FWP-derived winter habitat mapping (Figure 96); security habitat generated from KNF roads data; FWP hunting and population data, research, and plans; KNF and FWP information on wildlife linkage areas; and mapping of broad vegetation types shown on Figure 85.

3.25.7.2.2 Affected Environment

The moose is a large ungulate that occupies mountain meadows, river valleys, swampy areas, and clearcuts in the summer; and willow flats or mature coniferous forests in the winter. Due to their large size and long limbs, moose negotiate deep snow better than other ungulates. Conifer stands composed of uneven-aged classes and willows are important components of cover for moose (MNHP 2014).

Moose use riparian habitat throughout the year along the various creeks in the analysis area. They also use drier mid-elevation areas during summer. Their food consists primarily of shrubs, with some forbs during summer. In the analysis area, moose concentrate along riparian areas, in 15- to

20-year-old clearcuts with shrubby understories, in shrubfields, and in forested areas with shrubby understories. Moose prefer to live well up the Libby Creek and Ramsey creek drainages, as well as the other drainages along the east face of the Cabinet Mountains. They move out of these areas to the east and down the drainages only when forced to do so by increasing snowpack. They return to the upper portions of these drainages as early in the late winter/early spring as snow hardness allows (FWP 2009; Chilton and Newby 2014). During some years, they remain high in the drainages into late January and early February. Moose could be expected to occupy areas around proposed impoundment and plant sites for 8 to 10 months of the year, depending on winter severity (Brown, pers. comm. 2008; Chilton and Newby 2014). Moose winter range occupies 27,889 acres of the Crazy PSU and 22,358 acres of the Silverfish PSU and 4,666 acres on State and private lands.

The area near Little Cherry Creek and Bear Creek is a very productive moose calving area in HD 105 (Williams, pers. comm. 2006). During late fall and winter, moose concentrate along Little Cherry Creek, Poorman Creek, Ramsey Creek, Miller Creek, West Fisher Creek, and on Big Hoodoo Mountain and west-facing slopes above the Fisher River (Figure 96) (Brown, pers. comm. 2008).

HD 105 is one of seven hunting districts in Region 1 selected by FWP for long-term moose population trend monitoring, based on its importance to moose. A standard “trend route” along the east slope of the Cabinet Mountains in HD 105 is surveyed annually to collect moose population composition and trend monitoring data (FWP 2007b). Trends in population, size, and composition are evaluated based on total moose, calf/cow ratios, and bull/cow ratios observed during trend area surveys. Harvest data and hunter effort data for HD 105 are also taken into consideration in the evaluation of population trends (Brown, pers. comm. 2008). Based on trend area data collected since 1990, harvest data collected since 1985, and 2014 radio tracking and GIS monitoring, the moose population in in the east Cabinet Mountains in HD 105 may be declining, although a high degree of uncertainty is associated with population trend estimates derived from these data (Chilton and Newby 2014). During moose surveys of HD 105 conducted in 2007, moose were observed in the highest concentrations on south- and west-facing slopes of the Little Hoodoo and Big Hoodoo mountains in the Big Cherry Creek and Bear Creek drainages, and on west-facing slopes of the Libby Creek drainage near Horse Mountain (Brown, pers. comm. 2008). FWP did not conduct a moose survey in HD 105 in December, 2008 due to inadequate snow cover, surveying instead in April 2009. During the 2009 survey, 12 moose were observed, primarily in the upper drainages of the Cabinet Mountains (FWP 2009).

As described for elk in section 3.25.3.2, *Management Indicator Species*, a wildlife approach area has been identified in the Fisher River Valley between the Barren Peak and Teeters Peak areas to the west of US 2, and the Kenelty Mountain and Fritz Mountain areas to the east of US 2 (see Project records). US 2 in the Fisher River Valley between Raven and Brulee creeks is a crossing area for moose moving between the Cabinet Mountains and the Salish Mountains (Brown, pers. comm. 2008).

Cover to forage ratios in the Crazy and Silverfish PSUs indicate that while cover is abundant, forage habitat is below recommended levels and may be lacking. Moose forage habitat may be underestimated because moose will forage in harvested areas currently mapped as cover that have a shrub component.

Most forage habitat occurs in lower elevation areas of the Little Cherry Creek drainage and the mouths of its tributaries, or in isolated patches of past disturbance. Most past harvest areas have recovered to the point they are no longer considered openings and contribute to the high cover to forage ratio in the Crazy and Silverfish PSUs. Historically, wildfire would create a mosaic of successional stages and result in vegetative diversity in this area. In contrast, fire suppression and past timber management has resulted in a trend toward homogenous stand composition and structure consisting of high density stands of shade-tolerant species (see section 3.22, *Vegetation*) that reduce the presence and productivity of understory forage species. In summary, the analysis area is does not currently meet the desired conditions for moose and other big game species with high cover and limited forage availability.

3.25.7.2.3 Environmental Consequences

Impacts on moose winter range and percent cover in the analysis area are shown in Table 259 and Table 260 and described in the following subsections. None of the mine alternatives would affect moose in the Silverfish PSU. Impacts on percent cover in summer range and MAs 15, 16, and 17; movement areas; road densities; percent security habitat, habitat effectiveness, and the creation of new openings would be the same as white-tailed deer in the Crazy PSU, and the same as elk in the Silverfish PSU. Impacts on white-tailed deer and elk are described in section 3.25.3, *Management Indicator Species*. Habitat effectiveness and security were not determined for elk in the Crazy PSU but are shown in Table 262 for combined mine-transmission line alternatives.

Table 259. Impacts on Moose Winter Range in the Crazy PSU by Mine Alternative.

Habitat Component	[1] No Mine/ Existing Conditions	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Tailings Impoundment Alternative	[4] Agency Mitigated Little Cherry Creek Tailings Impoundment Alternative
Moose Winter Range (acres)	27,889	25,553 (2,336/8)	26,478 (1,411/5)	26, 183 (1,706/6)
Cover in Winter Range impacted (acres)	0	2,011	1,284	1,391/8
Percent Cover/Forage in Moose Winter Range[1] Guide is 50/50	90/10	80/20	84/16	83/17

Number in parentheses is the reduction in habitat acres/percent in habitat area compared to existing conditions.
[1]Percent forage habitat is likely underestimated because moose will forage in shrubfields that may be mapped as cover.
Source: GIS analysis by ERO Resources Corp. using KNF data and moose winter range derived from FWP and Western Resource Development (1989f) mapping as modified based on KNF and FWP biologists' knowledge of moose habitat use.

Alternative 1 – No Mine

Alternative 1 would not have direct impacts on moose. Over time, with continued fire suppression and lack of active forest management, indirect effects of this alternative would include a continued trend toward later successional habitats. Forage habitat would decrease over time unless harvest or other stochastic events, such as a wildfire or windstorm, creating additional forage. Large-scale fires could potentially occur in the analysis area. Although vegetative succession would reduce forage openings over time, openings created following large fires would likely be relatively large, with long distances between hiding cover. Until hiding cover developed (about 15 to 20 years, depending on site conditions), individual animals may be more vulnerable to predation and hunting mortality in areas where large openings develop following wildfire.

Alternative 2 – MMC's Proposed Mine

Alternative 2 would remove 2,336 acres, or 8 percent, of moose winter habitat in the Crazy PSU, mostly as a result of the tailings impoundment and the LAD Areas (Table 259). This loss of habitat also would include key calving habitat. Alternative 2 would likely result in the displacement of moose to adjacent winter range and calving sites. Moose may occupy a home range of a few hundred acres during the winter, and certain individuals could be completely or partially displaced from their traditional wintering sites. If moose populations in surrounding areas subsequently exceed carrying capacity as a result of this habitat loss, the local moose population in the Crazy PSU may be adversely affected. However, because considerable moose winter range habitat is available in the analysis area (Figure 96), Alternative 2 would not likely affect the viability of the moose population in HD 105 or the KNF.

Cover to forage ratios would shift toward the KFP-recommended conditions due to clearing of cover, but most cleared areas would not provide forage habitat until after they were reclaimed. Some areas would be reclaimed during mine operations and would provide foraging habitat once vegetation was established. In the long term, after reclamation success criteria are achieved, areas disturbed by Alternative 2 would provide forage for moose, thereby moving toward KFP objectives for forage habitat.

Widening, improvement, and yearlong access of the Bear Creek Road would lead to increased vehicle volumes and speed. Estimates of increased annual traffic volume range from 187 percent to 234 percent during operations (Table 172 in section 3.21, *Transportation*). The increase in traffic in Alternative 2 would substantially increase the risk of increased moose mortality on the access road. MMC would limit concentrate haulage to daylight hours during the day shift (0800 to 1630), which would minimize vehicular-moose collisions during the early morning, evening and night time-periods. MMC would provide transportation to employees using buses, vans, and pickup trucks, thereby limiting the use of personal vehicles. MMC would report road-killed animals to the FWP as soon as road-killed animals were observed. The FWP would either remove road-killed animals or direct MMC how to dispose of them. When the mill ceased operations in the Closure Phase, mine traffic volume would be substantially less than shown in Table 172 in section 3.21, *Transportation*. Future traffic volume when all activities at the mine are completed in the Post-Closure Phase would be higher than in Alternative 1 because of reconstruction of Bear Creek Road and loss of the Little Cherry Loop Road beneath the impoundment. Mortality risk to the moose would decrease on the Bear Creek Road compared to operations, but the permanently improved road conditions (increased road width, improved sight distance, paving) and higher traffic speeds would result in a permanently higher moose mortality risk compared to pre-mine conditions. At mine closure, all new roads (except the Bear Creek access road) constructed for the project would be reclaimed, which would include grading to match the adjacent topography and obliterating the road prism. After reclamation success criteria are achieved, areas disturbed by Alternative 2 would provide forage for moose.

Impacts on moose winter range would be at least partially reduced through MMC's proposed land acquisition. Acquired parcels would be managed for grizzly bear use in perpetuity, and could improve or contribute suitable moose winter habitat if the acquired parcels potentially provided winter range characteristics and were managed to improve winter moose habitat through road access changes or other means.

About 39 acres of wetlands providing water and high-quality forage would be impacted by Alternative 2 in the Crazy PSU. An additional 3 acres or more may be affected by a pumpback well system, if installed at the impoundment site. The feasibility of MMC's proposed Wetland Mitigation Plan to replace the lost functions of all potentially affected wetlands is uncertain. MMC's plan is conceptual and would be refined during the 404 permitting process. MMC did not update its mitigation plan for Alternative 2 to reflect new wetland and stream mitigation regulations and procedures. Section 3.23, *Wetlands and Other Waters of the U.S.*, discusses proposed wetland mitigation in more detail.

MMC would store mine, adit, or tailings water at the Ramsey Plant Site, a surge pond at the LAD Areas, and the tailings impoundment. The metals in the tailings water would be similar to what is found at the Troy Mine decant ponds (see Table 120 in the *Water Quality* section), where adverse effects on wildlife have not been observed (USDA Forest Service and DEQ 2012). Concentrations of metals in mine and adit water, which would be stored in mine/yard pond at the Ramsey Plant Site and in a surge pond at the LAD Areas, would be lower than tailings water (see Table 120 in the *Water Quality* section). The Ramsey Plant Site would be fenced, restricting moose access.

Alternative 3 – Agency Mitigated Poorman Impoundment Alternative

Impacts on moose from Alternative 3 would be similar to Alternative 2, except that less moose winter range and calving habitat would be impacted. In Alternative 3, about 1,411 acres, or 5 percent, of moose winter range would be removed in the Crazy PSU, mostly as a result of the tailings impoundment (Table 259). Alternative 3 would include more road access changes and more habitat acquisition, and would more effectively reduce potential effects on moose. The effect of increased traffic on the Bear Creek Road would be the same as Alternative 2, except that in Alternative 3, MMC would remove big game animals killed by any vehicles daily from road rights-of-way within the permit area and along roadways used for access or hauling ore for the life of the mine and monitor the number of big game animals killed by vehicle collisions on these roads and report findings annually. Highway safety signs such as "Caution – Truck Traffic" would help slow public traffic speeds in anticipation of meeting oncoming trucks. Staging shipments of supplies in a general location prior to delivery to the mine site would reduce traffic and moose mortality risk.

About 13 acres of wetlands providing water and high-quality forage would be directly affected by Alternative 3 in the Crazy PSU; an additional 16 acres may be affected by a pumpback well system at the tailings impoundment. Impacts on wetlands would be mitigated through implementation of the agencies' Wetland Mitigation Plan, which would have a greater likelihood of replacing lost functions than the Alternative 2 Wetland Mitigation Plan.

Water management in Alternatives 3 and 4 would reduce the risk to wildlife from contaminant uptake from storage of mine, adit, and tailings water. All mine and adit water would be treated and discharged at the Libby Adit Water Treatment Plant and not stored in ponds. The LAD Areas would not be used and the surge ponds would not pose a risk to moose. Tailings water quality would have lower metal concentrations than in Alternative 2; the factors leading to lower metal concentrations in tailings water quality in Alternatives 3 and 4 are discussed in section 3.13, *Water Quality*, p. 674.

Alternative 4 – Agency Mitigated Little Cherry Creek Impoundment Alternative

Impacts on moose from Alternative 4 would be similar to Alternative 3, except that more moose winter range and calving habitat would be affected. In Alternative 4, about 1,706 acres, or 6 percent, of moose winter range in the Crazy PSU would be affected, mostly as a result of the tailings impoundment (Table 259).

About 43 acres of wetlands providing water and high-quality forage would be directly or indirectly affected by Alternative 4 in the Crazy PSU. Impacts on wetlands would be mitigated through implementation of the agencies' Wetland Mitigation Plan, which would have a greater likelihood of replacing lost functions than the Alternative 2 Wetland Mitigation Plan.

Alternative A – No Transmission Line

Alternative A would have no direct impacts on moose. Over time, with continued fire suppression and lack of active forest management, indirect effects of this alternative would include a continued trend toward later successional habitats. Forage habitat would decrease over time unless harvest or other stochastic events, such as a wildfire or windstorm, created additional forage. Large-scale fires could potentially occur in the analysis area. Although vegetative succession would reduce forage openings over time, openings created following large fires would likely be relatively large, with long distances between hiding cover. Until hiding cover develops (about 15 to 20 years, depending on site conditions), individual animals may be more vulnerable to predation and hunting mortality in areas where large openings develop following wildfire.

Alternative B – MMC's Proposed Transmission Line (North Miller Creek Alternative)

For Alternative B, some winter range would be disturbed in both the Crazy and Silverfish PSUs, but not enough to change the cover-to-forage ratio. About 108 acres, or less than 1 percent, of winter range on National Forest System lands in the analysis area would be disturbed, chiefly in the Crazy and Silverfish PSUs. On state and private lands, including the Sedlak Park Substation and loop line, 127 acres, or 3 percent, of moose winter range in the analysis area would be disturbed (Table 260). All disturbed areas, such as access roads, pulling and tensioning sites, and transmission line clearing areas, would be seeded with grass and shrub species after transmission line construction. Areas where trees were trimmed, but otherwise not disturbed, would be allowed to establish naturally as grassland or shrubland. Once vegetation is re-established, disturbed areas of winter range would provide additional forage habitat as forage species become established, thereby moving moose habitat conditions in the Silverfish PSU toward KFP objectives. After the transmission line was removed, all newly constructed roads would be redisturbed during blading and contouring, before being seeded. Impacts on moose winter range would be at least partially minimized through MMC's proposed land acquisition. Acquired parcels would be managed for grizzly bear use in perpetuity, and could improve or contribute suitable moose winter habitat if the acquired parcels potentially provided winter range characteristics and were managed to improve winter moose habitat.

Table 260. Impacts on Moose Winter Range in the Analysis Area by Transmission Line Alternative.

Habitat Component	[A] No Trans-mission Line	[B] North Miller Creek	[C-R] Modified North Miller Creek	[D-R] Miller Creek	[E-R] West Fisher Creek
Crazy PSU					
Cover in Winter Range Impacted (acres)	0	42	30	16	16
Percent Cover/Forage Moose Winter Range[1] Guide is 50/50	90/10	90/10	90/10	90/10	90/10
Silverfish PSU					
Cover in Winter Range Impacted (acres)	0	60	114	131	114
Percent Cover/Forage Moose Winter Range[1] Guide is 50/50	97/3	97/3	96/4	96/4	96/4
National Forest System Lands					
Moose Winter Range (acres)	50,257	50,149 (108/<1)	50,093 (164/<1)	50,091 (166/<1)	50,110 (147/<1)
State and Private Lands					
Moose Winter Range (acres)[2]	4,666	4,539 (127/3)	4,566 (100/2)	4,566 (100/2)	4,515 (151/3)

Number in parentheses is the reduction in habitat acres/percent in habitat area compared to existing conditions
[1] Percent forage habitat is likely underestimated because moose will forage in shrubfields that may be mapped as cover.
Source: GIS analysis by ERO Resources Corp. using KNF data and moose winter range derived from FWP and Western Resource Development (1989f) mapping as modified based on KNF and FWP biologists' knowledge of moose habitat use.
[2] For Alternative A, includes analysis area for all transmission line alternatives combined.

Helicopter use could contribute to short-term displacement of individual moose from the transmission line corridor. Helicopter use for line stringing would occur during a relatively short period (about 10 days). Except for annual inspection and infrequent maintenance operations, helicopter use and other construction activities would cease after transmission line construction until decommissioning. Helicopter use and other activities could result in short-term disturbance of moose during line decommissioning. Overall, moose populations would not likely be affected by helicopter activity because sufficient winter range habitat would be available for any moose displaced due to short-term disturbance, and because construction timing restrictions would reduce the extent of potential displacement effects.

The eastern segment of the Alternative B transmission line alignment would occur within the wildlife approach area in the Fisher River Valley. Impacts of Alternative B on moose in the wildlife approach area would be the same as described for elk in section 3.25.3, *Management Indicator Species*.

About 4 acres of wetlands providing water and high-quality forage would be within the clearing area of Alternative B in the Crazy PSU. Direct effects to wetlands are expected to be avoided by placement and location of transmission line facilities and roads outside of wetlands and streams. Less than 0.1 acre of wetlands and streams would be affected by new or upgraded road construction.

Current populations of moose would likely be maintained in Alternative B because a very small proportion of winter range would be disturbed, cover to forage ratios would not change, sufficient winter range habitat would be available for any moose displaced due to short-term helicopter disturbance and reclaimed areas would provide additional forage.

Alternative C-R – Modified North Miller Creek Transmission Line Alternative

Impacts of Alternative C-R on moose would be similar to Alternative B, except that impacts on winter range would be slightly greater and more winter range would be impacted on National Forest System lands (164 acres) than on state and private lands (100 acres), including the Sedlak Park Substation and loop line (Table 260). Alternative C-R would include more road access changes and more habitat acquisition, and would more effectively minimize potential effects on moose. Also, in Alternatives C-R, D-R, and E-R, two seasons of helicopter construction would occur and the total duration of helicopter use each season would be about 2 months because helicopters would be used for vegetation clearing and structure construction. The type and duration of impacts from helicopter use for line stringing would be the same as Alternative B (about 10 days). Avoidance of wetlands would be the same as Alternative B. Overall, moose populations would not likely be affected by helicopter activity because sufficient winter range habitat would be available for any moose displaced due to short-term disturbance, and because construction timing restrictions would reduce the extent of potential displacement effects.

A relatively small segment of the Alternative C-R transmission line would cross the Fisher River Valley in the wildlife approach area, potentially discouraging moose movement in a localized area due to transmission line construction activities. Impacts of Alternative C-R on moose in the wildlife approach area would be the same as described for elk in section 3.25.3, *Management Indicator Species*.

Current populations of moose would likely be maintained in Alternative C-R because a very small proportion of winter range would be disturbed, cover to forage ratios would not change, sufficient winter range habitat would be available for any moose displaced due to short-term helicopter disturbance and reclaimed areas would provide additional forage.

Alternative D-R – Miller Creek Transmission Line Alternative

Impacts of Alternative D-R would be similar to Alternative C-R. Impacts of Alternative D-R on moose in the wildlife approach area in the Fisher River Valley would be the same as Alternative C-R. Avoidance of wetlands would be the same as Alternative B.

Alternative E-R – West Fisher Creek Transmission Line Alternative

Impacts of Alternative E-R would be similar to Alternative C-R, except that Alternative E-R would disturb the most (151 acres) moose winter range on state and private lands, including the Sedlak Park Substation and loop line (Table 260). Impacts of Alternative E-R on moose in the wildlife approach area in the Fisher River Valley would be the same as Alternatives C-R and D-R. Avoidance of wetlands would be the same as Alternative B.

Combined Mine-Transmission Line Effects

Impacts on moose winter range and percent cover in moose winter range in the analysis area are shown in Table 261. Impacts on percent security habitat and percent habitat effectiveness in the Crazy and Silverfish PSUs are shown in Table 262. Combined impacts on percent cover in summer range and MAs 15, 16, and 17; movement areas; road densities; and the creation of new openings would be the same as white-tailed deer in the Crazy PSU, and the same as elk in the Silverfish PSU. Impacts on white-tailed deer and elk are described in section 3.25.3, *Management Indicator Species*.

Alternative 2B would affect the most moose winter range of all combined mine-transmission line alternatives, resulting in impacts on 2,652 acres, or 5 percent of the analysis area, while Alternative 3C-R would impact the least moose winter range, impacting 1,732 acres, or 3 percent of the analysis area. For all combined action alternatives, the greatest loss of moose habitat would occur within the disturbance areas for the impoundment sites, and in Alternative 2B, LAD Areas. Habitat loss would likely result in the displacement of moose to adjacent winter range and calving sites. Moose may occupy a home range of a few hundred acres during the winter, and certain individuals could be completely or partially displaced from their traditional wintering sites. If moose populations in surrounding areas subsequently exceed carrying capacity as a result of this habitat loss, the local moose population in the Crazy PSU may be adversely affected.

In all combined action alternatives, cover-to-forage ratios would shift toward the KFP-recommended conditions due to clearing of cover, but most areas cleared for the mine components would not provide forage habitat until after they were reclaimed. Some mine disturbance areas would be reclaimed during mine operations and would provide foraging habitat once vegetation was established. In the long term, after reclamation success criteria are achieved, mine disturbance areas would provide forage for moose, thereby moving toward KFP objectives for forage habitat. In all combined mine-transmission line alternatives, areas disturbed for transmission line construction would be seeded with grass and shrub species after transmission line construction and could provide additional forage habitat as shrubs become established.

Alternative 2B would reduce the percent security habitat in the Crazy PSU by 4 percent during construction and operations. Due to access changes associated with mitigation, none of the combined agencies' alternatives would affect percent security habitat in the Crazy PSU. All action alternatives would reduce moose security habitat in the Silverfish PSU by 1 to 3 percent during transmission line construction. Percent security habitat would return to existing levels following transmission line construction.

Overall, Alternative 2B would affect habitat effectiveness the most. Alternative 2B would decrease habitat effectiveness in the Crazy PSU by 3 percent during construction and 2 percent during operations. None of the agencies' combined mine-transmission line alternatives would affect habitat effectiveness in the Crazy PSU. All of the action alternative would reduce habitat effectiveness in the Silverfish PSU during construction by 3 percent, but following transmission line construction, habitat effectiveness would return to existing levels.

Table 261. Impacts on Moose Winter Range in the Analysis Area by Combined Mine-Transmission Line Alternative.

Measurement Criteria	[1] No Mine/ Existing Conditions[2]	[2] MMC's Proposed Mine	[3] Agency Mitigated Poorman Impoundment Alternative			[4] Agency Mitigated Cherry Creek Impoundment Area		
	TL-A	TL-B	TL-C-R	TL-D-R	TL-E-R	TL-C-R	TL-D-R	TL-E-R
Crazy PSU								
Cover in Winter Range Impacted (acres)	0	2,052	1,310	1,296	1,296	1,417	1,403	1,403
Percent Cover/Forage Moose Winter Range[1] Guide 50/50	90/10	80/20	84/16	84/16	84/16	83/17	83/17	83/17
Silverfish PSU								
Cover in Winter Range Impacted (acres)	0	60	114	131	114	114	131	114
Percent Cover/Forage Moose Winter Range[1] Guide 50/50	97/3	97/3	96/4	96/4	96/4	96/4	96/4	96/4
All Lands in Analysis Area								
Moose Winter Range (acres)	54,923	52,271 (2,652/5)	53,191 (1,732/3)	53,191 (1,734/3)	53,157 (1,766/3)	52,893 (2,030/4)	52,891 (2,032/4)	52859 (2,064/4)

Number in parentheses is the reduction in habitat acres/percent in habitat area compared to existing conditions.
Impacts shown are for the transmission line Construction Phase, which represents maximum estimated impacts.
[1]Percent forage habitat is likely underestimated because moose will forage in shrubfields that may be mapped as cover.
Source: GIS analysis by ERO Resources Corp. using KNF data and moose winter range derived from FWP and Western Resource Development (1989f) mapping as modified based on KNF and FWP biologists' knowledge of moose habitat use.
[2] For Alternative 1A, includes analysis area for all transmission line alternatives combined.

Table 262. Percent Moose Security Habitat and Habitat Effectiveness in the Crazy and Silverfish PSUs by Combined Mine-Transmission Line Alternative.

Measurement Criteria	[1] No Mine/ Existing Condi-tions	[2] MMC's Proposed Mine		[3] Agency Mitigated Poorman Impoundment Alternative						[4] Agency Mitigated Little Cherry Creek Impoundment Alternative					
		TL-B		TL-C-R		TL-D-R		TL-E-R		TL-C-R		TL-D-R		TL-E-R	
		Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]	Const[1]	Ops[2]
Crazy PSU															
Percent Security Habitat[3] Guide for moose > 30	40	36	36	40	40	40	40	40	40	40	40	40	40	40	40
Habitat Effectiveness[4] Guide for moose > 68	53	50	51	53	53	53	53	53	53	53	53	53	53	53	53
Silverfish PSU															
Percent Security Habitat[3] Guide for moose > 30	57	55	57	54	57	56	57	56	57	54	57	56	57	56	57
Habitat Effectiveness[4] Guide for moose > 68	72	69	72	69	72	69	72	69	72	69	72	69	72	69	72

[1] Const = during mine construction.
[2] Ops = during transmission line operations.
[3] Security habitat is calculated by buffering all roads open during the fall (October 15 to November 30) by 0.5 mile. The remaining area equals the effective habitat. No security habitat occurs on private or State land in the analysis area.
[4] Habitat Effectiveness is based on the relationship between open road density and habitat effectiveness, as described in Appendix H of Johnson (2004a).
Source: GIS analysis by ERO Resources Corp. using KNF data.

In all combined mine-transmission line alternatives, widening, improvement, and yearlong access of the Bear Creek Road would lead to increased vehicle volumes and speed. Estimates of increased annual traffic volume range from 187 percent to 234 percent (Table 172 in section 3.21, *Transportation*). The increase in traffic in the combined mine-transmission line alternatives would substantially increase the risk of increased moose mortality. MMC would provide transportation to employees using buses, vans, and pickup trucks, thereby limiting the use of personal vehicles. MMC would report road-killed animals to the FWP as soon as road-killed animals were observed. The FWP would either remove road-killed animals or direct MMC how to dispose of them. In the agencies' combined mine-transmission line alternatives, MMC would remove big game animals killed by any vehicles daily from road rights-of-way within the permit area and along roadways used for access or hauling ore for the life of the mine and monitor the number of big game animals killed by vehicle collisions on these roads and report findings annually. When the mill ceased operations in the Closure Phase, mine traffic volume would be substantially less than shown in Table 172 in section 3.21, *Transportation*. Future traffic volume when all activities at the mine are completed in the Post-Closure Phase would be higher than in Alternative 1 because of reconstruction of Bear Creek Road and loss of the Little Cherry Loop Road beneath the impoundment. Mortality risk to the moose would decrease on the Bear Creek Road compared to operations, but the permanently improved road conditions (increased road width, improved sight distance, paving) and permanently higher traffic speeds would result in a higher moose mortality risk compared to pre-mine conditions. At mine closure, all new roads (except the Bear Creek access road) constructed for the project would be reclaimed, which would include grading to match the adjacent topography and obliterating the road prism. After reclamation success criteria are achieved, areas disturbed by the combined mine-transmission line alternatives would provide forage for moose.

For all combined mine-transmission line alternatives, helicopter and other transmission line construction activities could result in short-term displacement of moose from the transmission line corridor and surrounding habitat. Disturbance from helicopter use and other transmission line construction activities are described for Alternatives B and C-R above. For all combined action alternatives, impacts on moose winter range during transmission line construction would be minimized through the application of construction timing restrictions.

The eastern segment of the Alternative 2B transmission line corridor would occur within the wildlife approach area in the Fisher River Valley. Relatively small segments of all combined action alternatives would cross the Fisher River Valley in the wildlife approach area. The segments of the combined agencies' alternative transmission lines that would parallel US 2 would be located upslope and out of the Fisher River Valley, and would not likely affect moose movement in the approach area. Impacts of the combined mine-transmission line alternatives, including the Sedlak Park Substation and loop line, on moose in the Fisher River Valley wildlife approach area are the same as described for elk in section 3.25.3, *Management Indicator Species*.

Winter range impacts also would be at least partially minimized through land acquisition. Acquired parcels would be managed for grizzly bear use in perpetuity, and could improve or contribute suitable moose winter habitat if the acquired parcels potentially provided winter range characteristics and were managed to improve winter moose habitat. The agencies' Wildlife Mitigation Plan (section 2.5.7, *Mitigation Plans*) would include more road access changes and more habitat acquisition, and would more effectively minimize potential effects on moose.

MMC would create or enhance from 22.0 to 51.8 acres, depending on the alternative, of wetland habitat to mitigate for impacts to wetlands. For all combined mine-transmission line alternatives, implementation of the respective wetland mitigation plan would slightly reduce the effects of lost moose habitat. The feasibility of MMC's proposed Wetland Mitigation Plan to replace the lost functions of all potentially affected wetlands is uncertain.

In Alternative 2B, MMC would store mine, adit, or tailings water at the Ramsey Plant Site, a surge pond at the LAD Areas, and the tailings impoundment. The metals in the tailings water would be similar to what is found at the Troy Mine decant ponds (see Table 120 in the *Water Quality* section), where adverse effects on wildlife have not been observed (USDA Forest Service and DEQ 2012). Concentrations of metals in mine and adit water, which would be stored in mine/yard pond at the Ramsey Plant Site and in a surge pond at the LAD Areas, would be lower than tailings water (see Table 120 in the *Water Quality* section). The Ramsey Plant Site would be fenced, restricting moose access.

Water management in the agencies' combined mine-transmission line alternatives would reduce the risk to wildlife from contaminant uptake from storage of mine, adit, and tailings water. All mine and adit water would be treated and discharged at the Libby Adit Water Treatment Plant and not stored in ponds. The LAD Areas would not be used and the surge ponds would not pose a risk to moose. Tailings water quality would have lower metal concentrations than in Alternative 2B; the factors leading to lower metal concentrations in tailings water quality in Alternatives 3 and 4 are discussed in section 3.13, *Water Quality*, p. 674.

Although the local moose population in the Crazy PSU may be affected by the loss of habitat, the combined mine-transmission line alternatives would not likely affect the viability of the moose population in HD 105 for several reasons: considerable moose winter range habitat is available in the analysis area (Figure 96); construction timing restrictions would reduce transmission line disturbance effects; changes to cover to forage ratios would be relatively small (10 percent or less); while cover would decrease relative to forage, the Crazy and Silverfish PSUs provide an abundance of cover; and road densities, percent security habitat and habitat effectiveness would likely continue to improve through land acquisition associated with grizzly bear mitigation.

Cumulative Effects

Past Actions and the Existing Condition

Past actions, including detailed descriptions of previous vegetation and road management activities, are described in section 3.2, *Past and Current Actions*, shown on Figure 50, and listed in Appendix E.

Forest management practices and other human activities (*e.g.*, hunting, wood consumption, and motorized recreation) have had influential cumulative impacts on moose and other big-game security, as well as measurable fluctuations in cover to forage ratios. Harvest has occurred in the analysis area since the 1950s and resulting in a diversity of age classes and successional stages which provide forage and cover for moose and other big game species; however, most past harvest areas have recovered to the point they are no longer considered openings and contribute to the high cover to forage ratio in the Crazy and Silverfish PSUs. Historically, wildfire would create a mosaic of successional stages and result in vegetative diversity in this area. Since the mid-1990s, there has also been a greater use of intermediate harvest methods which results in both hiding cover and foraging opportunities occurring in close proximity. Although more recent logging and prescribed burning has helped cycle forest cover through successional communities, fire suppression and past timber management has resulted in a trend toward homogenous stand composition and structure consisting of high density stands of shade-tolerant species (see section 3.22, *Vegetation*) that reduce the presence and productivity of understory forage species. The current conditions of various white-tailed deer habitat components are displayed in Table 261 and Table 262.

New roads decrease moose and other big-game security (increasing vulnerability or risk of mortality), decrease habitat availability via temporary displacement, and can increase stress levels of resident species. KFP standards for open and total road densities shown in the elk and deer subsections of section 3.25.3, *Management Indicator Species*, have been and will continue to be an important tool to mitigate the associated cumulative impacts to moose and other big-game. Activities affecting moose habitat have changed in recent years, with a trend toward reduced motorized access as a result of decisions intended to facilitate grizzly bear recovery. This in turn has benefited moose with the resulting decrease in ORD.

Development of private lands within the analysis area, including commercial timber harvest, land clearing, home construction, and road construction has contributed to increased disturbance of moose and a loss or reduction in quality of foraging and winter habitat, and is expected to continue.

Areas previously impacted by special use permits such as mineral material sites (pits quarries, borrow, roadsides), water developments, utility corridors, private land access routes, and outfitter/guide trails/camps, would continue to be used. The ground disturbance on resources such as moose winter range and cover is described previously for the affected environment and would have no additional impacts. Other public uses such as wildlife viewing, berry picking, firewood gathering, camping, snowmobiling, etc. have negligible impacts on moose given their limited scope (time and space). Infra-structure, such as roads and campgrounds, that facilitate these activities have already been accounted in the description of the affected environment.

Effects of Current and Reasonably Foreseeable Actions

Reasonably foreseeable actions and current actions are described in section 3.3, *Reasonably Foreseeable Future Actions or Conditions* and section 3.2, *Past and Current Actions* and shown on Figure 50.

The Miller-West Fisher Vegetation Management Project will occur entirely in the Silverfish PSU and will include intermediate harvest of 1,206 acres, regeneration harvest of about 692 acres, precommercial thinning of 351 acres, and prescribed burning of 2,830 acres of National Forest System lands in the Silverfish PSU. The Coyote Improvement Vegetation Management Project is in the planning stages and would take place within the Crazy PSU. The project would harvest 240 acres to increase stand resiliency to mountain pine beetles. Silverbutte Bugs timber sale is in the Silverfish PSU and would be a small project like Coyote. Other reasonably foreseeable actions located in the Crazy and Silverfish PSUs include the Libby Creek Venture Drilling Plan, the Poker Hill Rock Quarry, the Bear Lakes Access Project, the Wayup Mine/Fourth of July Road Access Project, and Plum Creek activities.

Surface impacts from reasonably foreseeable actions would be minimal, and would not result in any measurable changes in cover or forage habitat. As shown in the elk and deer subsections of section 3.25.3, *Management Indicator Species*, new roads and roads closed for mitigation associated with reasonably foreseeable actions such as the Miller-West Fisher Vegetation Management project, the Rock Creek Project and the Wayup Mine/Fourth of July Road Access Project, would contribute to cumulative effects on ORD in the Crazy and Silverfish PSUs.

Road management actions such as road maintenance and administrative use associated with permit administration, data collection and monitoring of National Forest System lands are not likely to affect moose habitat because they generally do not result in vegetation removal. Moose and other large ungulates will typically simply avoid the disturbance area until human activities terminate, which usually comprises of a few hours. Although water restoration projects may temporarily displace moose and other wildlife from a localized area, they typically benefit wildlife in the long-term by providing pulses of foraging when seeded or by stabilizing soils where certain habitat components can remain available.

With population growth and development, it is reasonable to assume that some corresponding increase in human use of National Forest System lands is likely to occur. Recreational activities such as sightseeing, hiking, cross-country skiing, camping, snowmobiling, fishing, and firewood cutting are ongoing and expected to increase over the next 10 years. This increase is likely to be gradual and incremental and tend to be focused on areas along or near roads open to motorized traffic. Moose may, over time, experience more frequent disruption of their daily activities if they are in proximity to roads.

Activities on private land, such as timber harvest, land clearing, home construction, road construction, and livestock grazing, are likely to continue on private lands within the Crazy and Silverfish PSUs and would likely slightly impact moose cover and security. Potential effects depend on the magnitude, type and location of developments and include the loss of secure habitat and localized disturbance on moose and other big game species. Private lands occupy 10 percent of the Crazy PSU and 12 percent of the Silverfish PSU and are intermixed with public and corporate/State land. Because the proportion of moose habitat in the Crazy and Silverfish PSUs on private lands is small, development of private lands is expected to have minor cumulative impacts on moose and other big game species within the analysis area over the next 10 years.

No Action Alternative

The Montanore Project No Action alternatives (Alternative 1 and Alternative A) would not contribute to cumulative impacts on moose.

Combined Mine-Transmission Line Action Alternatives

Cumulative effects of the combined mine-transmission line alternatives, in combination with past, present, and reasonably foreseeable actions, on road densities, cover and forage, and habitat security in the Crazy and Silverfish PSUs are discussed in the deer and elk subsections, respectively, of section 3.25.3, *Management Indicator Species*. In summary, with the exception of Alternative 2B, for all combined mine-transmission line alternatives, cumulative ORD in the Crazy PSU would be less than existing ORD. In Alternative 2B, during construction cumulative ORD in MAs 15, 16, 17, and 18 would increase by 0.3 mi/mi^2. In the Silverfish PSU, ORD would increase and percent elk security habitat would decrease for all combined mine-transmission line alternatives, but increases would be primarily due to other reasonably foreseeable actions, especially after the transmission line was built. ORD in MAs 15, 16, 17, and 18 would return to existing levels during Alternative 3D-R and 4D-R operations.

The eastern segment of the Alternative 2B transmission line corridor would occur within the wildlife approach area in the Fisher River valley and relatively small segments of all combined mine-transmission line action alternatives would cross the Fisher River valley in the wildlife approach area. The proximity of the Alternative 2B alignment to US 2 would result in a widening of disturbed area and could potentially discourage moose movement within the approach area by decreasing cover. The Miller-West Fisher Vegetation Management Project could also perturb moose movement within the approach area by decreasing cover and contributing to human disturbance. Given that most of the approach area potentially affected by Alternative B and the Miller-West Fisher vegetation Project is generally heavily roaded and has been logged in the past 20 to 30 years, and because of the short-term nature of human-caused disturbance, it is likely that the cumulative effects of the two projects on moose movement within the approach area would be minimal. The segments of the combined agencies' alternative transmission lines that would parallel US 2 would be located upslope and out of the Fisher River valley, and would not likely contribute to any cumulative effects on moose movement in the approach area.

All combined mine-transmission line action alternatives, in combination with other reasonably foreseeable actions, especially the Miller-West Fisher Vegetation Management Project, would result in cumulative impacts on moose winter range on all lands in the analysis area, resulting in a reduction in cover and, once disturbed areas were revegetated, an increase in forage habitat. Cumulative impacts of all combined mine-transmission line action alternatives would be minor due to construction timing restrictions in moose winter range.

The combined mine-transmission line action alternatives, in combination with timber harvest or residential development on Plum Creek land, would result in cumulative disturbance to moose on private lands in the analysis area, and could displace of elk away from areas of disturbance. Cumulative disturbance to moose on private lands are expected to be minimal because private lands are generally heavily roaded and moose in these areas may be habituated to higher levels of disturbance than on National Forest System lands.

Regulatory/Forest Plan Consistency

Organic Administration Act and Forest Service Locatable Minerals Regulations

36 CFR 228.8 requires that mining operators minimize, where feasible, adverse environmental impacts on National Forest surface resources and to take all practicable measures to maintain and protect fisheries and wildlife habitat that may be affected by the operations. Mine Alternative 2 and Transmission Line Alternative B would not fully comply with 36 CFR 228.8. In the proposed action, MMC did not propose to implement feasible measures to minimize effects on the moose or all practicable measures to maintain and protect wildlife habitat. The agencies' alternatives (Mine Alternatives 3 and 4 and Transmission Line Alternatives C-R, D-R, and E-R) would comply with 36 CFR 228.8. The agencies' alternatives would incorporate additional feasible and practicable measures to minimize adverse environmental impacts on wildlife habitat that benefit moose, including minimizing disturbance in moose winter range, implementing a wetland mitigation plan more likely to provide moose habitat, implementing yearlong access changes through the installation of barriers or gates in several roads to reduce ORD and mitigate for impacts to big game, increasing land acquisition requirements that would likely provide protection of moose habitat, and revising water management to reduce the potential for contaminant uptake.

National Forest Management Act/Kootenai Forest Plan

1. Forestwide Management Direction – KFP II-1 #3, #7, II-2 #12, #17, II-7, 22, 23

#3 – *Maintain a balance of open and closed road… (to) insure big-game habitat security…:* In all combined mine-transmission line alternatives, although during transmission line construction some restricted, impassable/barriered, and temporary roads would be opened and some new access roads would be needed, road access changes to mitigate for impacts on grizzly bear would be implemented. The agencies' alternatives would also include access changes in numerous roads to mitigate for the loss of big game security (Table 28 and Table 29 and Figure 35). In all combined mine-transmission line alternatives, percent security habitat would be better than recommended levels during all project phases. In the Crazy PSU, Alternative 2B would reduce the percent security habitat by 4 percent during construction and operations but the agencies' combined mine-transmission line alternatives would not affect percent security habitat. In the Silverfish PSU, in all combined mine-transmission line alternatives, percent security habitat would return to existing levels following construction.

#7 – *Maintain diverse age classes of vegetation for viable populations of all existing native, vertebrate, wildlife species:* Cover to forage ratios in the Silverfish and Crazy PSUs indicate that the proportion of forage habitat is below recommended levels. Most impacts on moose winter range from the combined action alternatives would result in losses of moose habitat within the disturbance areas for the impoundment sites and LAD Areas (Alternative 2B only), and would likely result in the displacement of moose to adjacent winter range and calving sites. If moose populations in areas surrounding mine disturbance areas exceeded carrying capacity as a result of habitat loss due to the mine, the moose population in the Crazy PSU may be adversely affected. However, because considerable moose winter range habitat is available in the analysis area (Figure 96); changes to cover to forage ratios would be relatively small (10 percent or less); while cover would decrease relative to forage, the Crazy and Silverfish PSUs provide an abundance of cover; and road densities, percent security habitat and habitat effectiveness would likely continue to improve through land acquisition associated with grizzly bear mitigation the combined mine-transmission line alternatives would not likely affect the viability of the moose population in HD 105 or the KNF.

#12 – *Maintain big-game habitat to support the recreational hunting demand for resident big-game species:* Same as numbers 3 and 7 above. In all combined mine-transmission line alternatives, percent security habitat would be better than recommended levels during all project phases. Habitat effectiveness would be better than recommended levels during all project phases in the Silverfish PSU. In the Crazy PSU, only Alternative 2B would reduce habitat effectiveness. Levels of habitat effectiveness and security throughout the Crazy and silverfish PSUs would provide for habitat conditions maintaining the existing populations of moose for local hunting demand. Overall, road densities, percent security habitat and habitat effectiveness would likely continue to improve through land acquisition associated with grizzly bear mitigation.

#17 – *Use prescribed fire to simulate natural ecological processes… create habitat diversity for wildlife…* None of the alternatives would include prescribed burns.

p.II-7 – *Habitat to support huntable populations of all other big game species will be maintained. All endemic vertebrate species will have sufficient habitat to maintain viable population levels:* See justification for compliance with #7 and #12 above.

p.II-22, 23 – *Maintenance of viable populations of existing native and desirable non-native vertebrate species, as monitored through indicator species, attained through the maintenance of a diversity of plant communities and habitats*: See justification for compliance with #7 and #12 above.

2. Applicable Management Area Direction (MAs 10, 11, 12, 15, 17, and 18) –KFP III-39, 44/45, 48/49/51, 65, and 75.

MA 10 (Big Game Winter Range) – *Maintain or enhance the habitat effectiveness for winter use by big game species through cover/forage ratios, prescribed fire, and maintenance of wildlife movement patterns:* In all combined action alternatives, cover-to-forage ratios would shift toward the KFP-recommended conditions due to clearing of cover. Changes to cover to forage ratios would be relatively small (10 percent or less), and while cover would decrease relative to forage, the Crazy and Silverfish PSUs provide an abundance of cover. In the long term, after reclamation success criteria are achieved, mine disturbance areas would provide forage for moose, thereby moving toward KFP objectives for forage habitat. In all combined mine-transmission line alternatives, areas disturbed for transmission line construction would be seeded with grass and shrub species after transmission line construction and could provide additional forage habitat as shrubs become established. Combined mine-transmission line alternative effects on wildlife movement patterns, key habitat, open road densities, and the creation of new openings would be the same as white-tailed deer in the Crazy PSU, and the same as elk in the Silverfish PSU. Impacts on white-tailed deer and elk are described in section 3.25.3, *Management Indicator Species*.

MA 11 (Timber/Big Game Winter Range) – *Maintain or enhance the winter range habitat effectiveness for big game species (while also achieving timber and visual goals) through prescribed fire, maintenance of wildlife movement patterns/corridors, management of key habitat components as riparian areas, and utilizing harvest to achieve desired cover/forage ratios, a variety of seral stages, and maximization of edge effect in units generally not exceeding 40 acres:* See description for MA 10 above.

MA 12 (Timber/Big Game Summer Range) – *Maintain or enhance non-winter big game habitat (while also achieving timber goals) through habitat diversity, maximization of edge effect in units generally not exceeding 40 acres, maintaining hiding cover between openings, management of key habitat components as riparian areas, managing open roads to no more than ¾ miles per square mile:* See description for MA 10 above.

MA 15 (Timber Production) - *Produce timber using various standard silvicultural practices while providing for other resource values such as wildlife, including big game, through maintenance of habitat effectiveness and security by limiting ORD to a maximum of 3 miles per square mile and management of key habitat components, such as riparian areas:*

In all combined mine-transmission line alternatives, although during transmission line construction some restricted, impassable/barriered, and temporary roads would be opened and some new access roads would be needed, road access changes to mitigate for impacts on grizzly bear would be implemented. The agencies' alternatives would also include access changes in numerous roads to mitigate for the loss of big game security (Table 28 and Table 29 and Figure 35). In all combined mine-transmission line alternatives, percent security habitat would be better than recommended levels during all project phases. In the Crazy PSU, Alternative 2B would reduce the percent security habitat by 4 percent during construction and operations but the agencies' combined mine-transmission line alternatives would not affect percent security habitat. In the Silverfish PSU, in all combined mine-transmission line alternatives, percent security habitat would return to existing levels following construction.

Effects Alternative 2B would reduce habitat effectiveness in the Crazy PSU. None of the agencies' combined mine-transmission line alternatives would reduce habitat effectiveness in the Crazy PSU. In the Silverfish PSU, where percent habitat effectiveness is better than the standard, all of combined mine-transmission line alternatives would slightly reduce habitat effectiveness during construction, but during operations, habitat effectiveness' would return to existing levels.

Combined mine-transmission line alternative effects on key habitat and open road densities would be the same as white-tailed deer in the Crazy PSU, and the same as elk in the Silverfish PSU. Impacts on white-tailed deer and elk are described in section 3.25.3, *Management Indicator Species*.

MA 16 (Timber with Viewing) - *Produce timber while providing for a pleasing view. Manage wildlife habitat to provide for viable populations of existing native species, including big game, through maintenance of habitat effectiveness and security by limiting ORD to a maximum of 3 miles per square mile and management of key habitat components, such as riparian areas:* See MA 15 above.

MA 17 (Viewing with Timber) - *Provide landscapes that are pleasing to the viewer, while producing a level of timber production that is compatible with visual resource protection. Manage wildlife habitat to provide for viable populations of existing native wildlife species, including big game, through maintenance of habitat effectiveness and security by limiting ORD to a maximum of 3 miles per square mile and management of key habitat components, such as riparian areas:* See MA 15 above.

MA 18 (Regeneration Problem Areas; Steep Slopes) – *Maintain existing vegetation (future timber production) and viable populations of existing native wildlife species, including big game, through maintenance of habitat effectiveness and security by limiting ORD to a maximum of 3 miles per square mile and management of key habitat components, such as riparian areas:* See MA 15 above.

State Requirements

Alternatives 3 and 4 would comply with the MMRA regarding disturbed lands being reclaimed to a post-mining land use with stability and utility comparable to that of the pre-mining landscape. Draft findings regarding compliance with MFSA requirements are discussed in the Summary, beginning on p. S-53. Moose and other ungulate populations are managed by FWP. Proposed actions would not prevent the state from continuing to manage these species as harvestable populations.

3.25.8 Other Required Disclosures

3.25.8.1 Unavoidable Adverse Environmental Effects

In the preceding wildlife analysis subsections, the direct, indirect, and cumulative environmental effects of the alternatives are discussed in detail. Impacts that cannot be avoided are summarized below. Depending upon the action alternative and species affected, the severity of the effects would be minimized by adhering to the required mitigation, including mitigation measures for vegetation removal, compensatory wetland mitigation, road access changes and habitat acquisition. Other features of the alternatives, such as adhering to BMPs and other KFP standards also would minimize effects. If management activities occur however, some effects cannot be avoided. The preceding wildlife subsections provide a detailed analysis of effects and description of these impacts. For the wildlife subsections, short-term effects were considered to be 2 to 5 years, while long-term effects would last for the life of the mine (30 years) or longer.

The action alternatives would impact a range of wildlife habitat throughout the analysis area during both construction and operations. The wildlife resources would be impacted by direct surface disturbance, noise, vibration, light, dust, increased human activity, and increased traffic. Unavoidable adverse impacts on wildlife habitat would vary by the acres of habitat removed or affected by each action alternative. Activities would include construction of mine facilities and associated roads, the transmission line and associated new roads, and Sedlak Park Substation and loop line. Adverse impacts that cannot be avoided include changes in available habitat within an individual animal's home range, physical removal of habitat such as wetlands or winter range habitat resulting in permanent displacement, changes in cover, changes in foraging efficiency and success, changes in reproductive success, changes in survival or growth rates of young, changes in predator-prey relationships, increased habitat fragmentation and disruption of dispersal and movement patterns for species. Some long-term unavoidable adverse effects on wildlife populations would potentially occur as a result of mortalities during construction and operation activities. Areas successfully reclaimed would provide wildlife habitat post-mining over time.

3.25.8.2 Short-term Uses and the Long-term Productivity

The intensity and duration of the effects described for the wildlife resource would vary by alternative. Refer to the wildlife subsections for detailed analysis of effects and description of these short- and long-term impacts. Impacts to wildlife and wildlife habitat would include removal of habitat for mine and facility construction, disturbance from mining and associated activities, and direct mortality from increased mine related traffic. Most impacts to wildlife resources would initially result from construction activities, including losses of cover, increases in road densities, decreases in habitat security, and increases in disturbance and displacement. Physical removal and losses of habitat, including winter range or calving habitat for big game, wetlands, or snags and downed wood due to mine associated activities would be long-term, lasting until reclamation or beyond. Mine associated disturbance resulting in long-term displacement (lasting the life of the mine, or longer) of a species from the area may result in a post-reclamation delay in the reestablishment of use. Other disturbances associated with human activity may be short term and temporary in duration, such as displacement from helicopter use associated with the transmission lines, or blasting associated with the underground development.

Disturbance and any direct mortality would cease when mine closure occurred and reclamation would eventually allow wildlife habitat to re-establish through vegetation succession. However, this could take decades or longer, and considering cumulative impacts of climate change and human population increase, it is not certain that current habitat conditions on the affected lands would be re-established. Depending upon the alternative, incorporated mitigation would reduce the total amount of roads in the project area over time, providing for long-term benefits for many species.

3.25.8.3 Irreversible or Irretrievable Commitments

Specific impacts of the proposed alternatives are described in the various preceding wildlife subsections. Habitat for some species, such as snags and downed wood may not be provided until forest communities re-established and matured, a process that could require more than 100 years following disturbance for those species. This also includes old growth habitat, which provides habitat components used by certain species, including pileated woodpecker.

Protected and general wildlife species within the analysis area may be subject to irretrievable commitment of resources with regard to the following types of disturbance associated with the action alternatives: disquieting and excessive noise, increased human disturbance, physical habitat loss to habitat such as winter range or calving habitat used by big game such as moose, wetlands, riparian, old growth, general forest, disruption of movement patterns, habitat fragmentation, and increased roads and vehicle traffic, for the life of the action alternatives. Recovery of habitat loss would not occur after mine closure and reclamation, whereas recovery of other habitat features affected by the transmission line could occur after construction. The disturbance associated with the action alternatives can cause species to avoid nearby habitat, resulting in both short term and long-term displacement effects. For example, some cavity-nesting species could avoid nearby habitat, or species sensitive to human disturbance such as mountain goats may be displaced for the duration of the disturbance.

Areas successfully reclaimed would provide wildlife habitat post-mining over time, but success may vary between alternatives.

3.26 Other Required Disclosures

3.26.1 Environmental Justice

Executive Order 12898, Environmental Justice requires federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on minority and low-income populations when implementing their respective programs, including American Indian programs. The lead agencies' analysis of Environmental Justice follows the CEQ's guidance on Environmental Justice, (CEQ 1997), the EPA's guidance on Environmental Justice (EPA 1998, 1999) and the U.S. Department of Agriculture's regulation on Environmental Justice (USDA 1997b). These documents suggest a step-wise evaluation of Environmental Justice: identification of minority and low-income populations; assessment of effects and determination if the effects would be disproportionately high and adverse, and mitigation. The U.S. Department of Agriculture's regulation indicates an effect on a minority or a low-income population is disproportionately high and adverse if the adverse effect is appreciably more severe or greater in magnitude than the adverse effect that will be suffered by the non-minority population and/or non-low-income population.

Minority or low-income populations would not be disproportionately affected by the Montanore Project. American Indians are a minority population, and although the proposed mine is not located within or adjacent to any tribal reservations, it is located within the boundaries of land covered by the Hell Gate Treaty (see section 3.5, *American Indian Consultation*). All action alternatives would restrict access to mine facility sites to all members of the public, including tribal members. Proposed mitigations in all action alternatives would reduce the effects of access restrictions. The access restrictions would not be disproportionately high and adverse on any minority and low-income population.

3.26.2 Important Farmland

The Farmland Protection Policy Act and USDA Departmental Regulation No. 9500-3 provide protection for important farmland. The USDA regulation, 7 CFR 658, implements the Farmland Protection Policy Act. None of the alternatives analyzed in detail would affect any important farmland.

3.26.3 Energy Requirements and Conservation Potential

Alternatives requiring the most construction would have the least potential for conserving energy. The maximum annual energy consumed by all alternatives is estimated at 406,000 megawatts, using a peak demand of 50 megawatts. The amount of energy required to implement any of the action alternatives, in terms of petroleum products, would be insignificant when viewed in light of the production costs and effects of the national and worldwide petroleum reserves.

3.26.4 Urban Quality and the Design of the Built Environment

Implementation of any of the action alternatives would not affect urban quality. No buildings or other forms of man-made structures would be affected by any of the alternatives.

3.26.5 Intentional Destructive Acts

Intentional destructive acts, that is, acts of sabotage, terrorism, vandalism, and theft, sometimes occur at power facilities, including transmission lines and substations. Vandalism and thefts are most common, especially theft of metal and other materials that can be sold. BPA has seen a significant increase in metal theft from its facilities over the past few years. Thefts increase when the price of metal is high on the salvage market. In the last 10 years, BPA has experienced over 200 thefts or burglaries. BPA estimates that the average monetary damage for each crime is $150,000, but the actual amount is likely much higher since this number does not factor in all the labor-related costs associated with repairing the damage.

The impacts to the transmission system from vandalism and theft, though expensive, have not generally caused service disruptions to BPA's service area. Stealing equipment from electrical substations, however, can be extremely dangerous. Nationwide, many thieves have been electrocuted while attempting to steal equipment from energized facilities. Recent examples include the July 2011 electrocution death of a man attempting to steal copper from a Duke Energy substation in South Carolina, the August 2011 electrocution death of a man attempting to steal copper from an Entergy substation in Louisiana, the August 2011 severe burning of a woman attempting to steal copper from a Puget Sound Energy substation in Washington, the October 2011 electrocution death of a man attempting to steal copper from a Duke Energy substation in North Carolina, and the December 2011 electrocution death of a man attempting to steal copper from a Memphis Light Gas & Water substation in Tennessee.

Federal and other utilities use physical deterrents such as fencing, cameras, warning signs, rewards, etc., to help deter theft, vandalism, and unauthorized access to facilities. BPA also is in the process of replacing much of its solid copper wire with copper-coated steel wire, posting signage that indicates a trade has been made, and installing surveillance cameras to deter future break-ins. Transmission towers and overhead transmission conductors, however, are mostly on unfenced utility rights-of-way. Although towers are constructed on footings in the ground and are difficult to dislodge, they remain vulnerable to potential vandalism. In an effort to help prevent intentional destructive acts, BPA established a Crime Witness Program that offers up to $25,000 for information that leads to the arrest and conviction of individuals committing crimes against BPA facilities. Anyone having such information can call BPA's Crime Witness Hotline at 1-800-437-2744. The hotline is confidential, and rewards are issued in such a way that the caller remains anonymous.

Acts of sabotage or terrorism on electrical facilities in the Pacific Northwest are rare, though some have occurred. In the past, these acts generally focused on attempts to destroy large steel transmission line towers. For example, in 1999, a large transmission line steel tower in Bend, Oregon, was toppled. In June 2011, at BPA's Alvey Substation near Eugene, Oregon, almost $1 million in damages was incurred when unknown individuals were able to breach a security fence and damage equipment in the substation yard during an attempt to disrupt transmission service.

Depending on the size and voltage of the line, destroying towers or other equipment could cause electrical service to be disrupted to utility customers and other end-users. The effects of these acts would be as varied as those from the occasional sudden storm, accident or blackout, and would depend on the particular configuration of the transmission system in the area. For example, when a storm affects transmission lines, residential customers can lose power for heating, cooking, refrigeration, lighting, etc. and can experience impacts related to those functions unless they have backup generators. Similarly, commercial, industrial and municipal customers can experience impacts when infrastructure such as machinery, traffic signals, light rail, or elevators stops functioning.

In some situations intentional destructive acts would have no noticeable effect on electrical service as power can be rerouted around an area because of redundancies built into the transmission system. In other situations, service could be disrupted in the local area, or, if an intentional destructive act caused damage to a major piece of transmission system equipment or a large part of the transmission system, a much greater area could be left without power.

During scoping, the agencies received comments about the increased risk of terrorism to the transmission system and to nearby landowners if a new line and substation was built next to an existing line or lines. The agencies also received comments about the increased risk to landowners if a new line is built on new right-of-way in areas where no lines exist now.

It is difficult to predict the likelihood of, and increased risk for, terrorist or sabotage acts from building the project near, next to, or far from existing transmission system facilities. New transmission towers, overhead conductor, and new substation facilities would increase the risk incrementally on BPA's 15,000 circuit-mile transmission system. Placing a new line next to an existing line may increase the risk more than building the line far from existing facilities. However, given the extensive security measures that BPA, public and private utilities, energy resource developers, and federal agencies such as the U.S. Department of Homeland Security have and are continuing to implement to help prevent such acts and protect their facilities, along with the inherent difficulty in significantly affecting such large and well-constructed facilities as transmission towers and substation sites, it is considered extremely remote and unlikely that a significant terrorist or sabotage act would occur. Accordingly, the incremental increase in risk to landowners from the presence of the proposed transmission line and substation would be minimal. If such acts did occur, the problem area would be isolated quickly and electricity rerouted as much as possible to keep the system functioning. In addition, it is expected that federal, state, and local agencies would respond quickly if any such act posing any human or natural resource risks occurs.

3.26.6 Evaluation of Restrictions on Private Property

The MEPA requires state agencies to evaluate, in their MEPA documents, any regulatory restrictions proposed to be imposed on private property rights (75-1-201(1)(b)(iv)(D), MCA). MMC's use of its private property is subject to this requirement. MMC's private properties evaluated in this analysis are at the Libby Adit Site and the Little Cherry Creek Impoundment Site.

The Proposed Action evaluated in this EIS would allow MMC to mine on lands owned privately by MMC as well as on public lands owned by the United States. Federal and state laws that would regulate MMC's activities associated with the Montanore Project are described in section 1.6, *Agency Roles, Responsibilities, and Decisions.* The No Action Alternative would not allow MMC to mine. The agencies' action alternatives would allow mining with numerous modifications and mitigations that have been developed as part of this EIS. These alternatives would alter and restrict the way mining and reclamation would be conducted on private and public lands at the proposed mine site to protect environmental, cultural, and social resources.

Alternatives comprised of modifications and mitigation measures designed to make the project meet minimum environmental standards specifically required by federal or state laws and regulations are not required to be evaluated if the agencies are required to impose them in a certain manner. Those alternatives and mitigations are considered to be nondiscretionary. If the agencies are not required to impose them or have discretion as to the manner in which the purpose of the modifications and mitigations are to be achieved, then the modifications or mitigations are considered discretionary and must be analyzed for regulatory restrictions. Components of the alternatives that are taken from permits, such as the MPDES permit, are not considered discretionary. Once a permit is approved, the various components (modifications and mitigations) comprising the permit conditions then become mandatory for compliance purposes under both state and federal regulations. No such restrictions are placed on federal agencies. The agencies developed the cost estimates in Table 263 in cooperation with MMC.

Analyzed in this section are the costs of various components or mitigations measures that would be increased costs from MMC's proposal (Alternatives 2 and B). The action alternatives evaluated with their modifications and mitigation measures would not prohibit development of the proposed project, but could require MMC to spend additional funds. The higher the costs associated with regulatory compliance, the less the economic benefit gained from the use of the property, and the more restrictive the regulatory action is to the use of private property.

The agencies have determined that each of the modifications and mitigations would be the least restrictive means of accomplishing the purpose of the modifications and mitigations. Due to changes in state law in 2001, the state may no longer condition a permit based on alternatives developed through the MEPA/NEPA impact analysis process unless they also are required under state laws. The modifications and mitigations allowed by state law will be specified in the state's Record of Decision should DEQ decide to approve revisions to the already approved operating permit and issue a transmission line certificate under the Major Facilities Siting Act; generally excluded are those mitigating impacts on wildlife, aesthetics (visual and sound), fisheries, and threatened and endangered species.

The No Action Alternative would prohibit development of the proposed Montanore Mine. The benefits of this alternative would be the elimination of predicted impacts caused by implementation of mine development and construction. The costs include a possible decrease in MMC's property value, a potential decrease in the value of the company's stock, and a loss of potential economic benefits. This alternative would restrict MMC's private property rights. The agencies identified a number of modifications and mitigations that would eliminate or reduce impacts in a less restrictive manner. These modifications and mitigations are analyzed in Table 263. The costs cited are those that are necessary to comply with discretionary restrictions over and above the costs of the Proposed Action.

None of the transmission line alternatives would affect MMC's private land and are therefore not included in this analysis.

Table 263. Estimated Costs of Discretionary Restrictions.

Project Facility or Mitigation	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment	Estimated Costs Associated with Implementation
Above-ground conveyor	1,200 feet long between Ramsey Adit portal and mill	6,000 and 7,500 feet long (depending on the option) between Libby Adit Site and Libby Plant Site mill; 1,400 feet on MMC's private land.	Same as Alternative 3	1,400 feet on MMC property * $702/ft (Mine and Quarry Engineering Services, Inc. 2011, Table 18-5) = $983,000
New adits: length, grade, and portal elevation	Ramsey Adits: 16,000 feet long, 8% decline; Elevation: 4,400 feet Rock Lake Ventilation Adit: Elevation: 5,560 feet	Upper Libby Adit: 13,700 feet long, 7% decline; Elevation: 4,100 feet New Libby Adit: 17,000 to 18,500 feet long, depending on option; 5% decline; Elevation: 3,960 feet Rock Lake Ventilation Adit	Same as Alternative 3	Libby conveyor adit portal on MMC property 17,207 feet (Mine and Quarry Engineering Services, Inc. 2011, Table 18-5) – 16,000 feet = 1,207 feet * $702/ft (Mine and Quarry Engineering Services, Inc. 2011, Table 18-5) = $847,314
Scenery	Not specified	Develop final regrading plans for each facility to reduce visual impacts of reclaimed mine facilities	Same as Alternative 3	Total cost = $12,000 Alt. 3: 1% of disturbed area is MMC land = $120 Alt. 4: 14% of disturbed area is MMC land = $1,680
Sound	Not specified	Adjust intake and exhaust ventilation fans in the Libby Adits so that they generate sounds less than 82 dBA measured 50 feet downwind of the portal	Same as Alternative 3	Total cost = $130,000 One portal is on MMC land = $65,000

Project Facility or Mitigation	Alternative 2 MMC's Proposed Mine	Alternative 3 Agency Mitigated Poorman Impoundment Alternative	Alternative 4 Agency Mitigated Little Cherry Creek Impoundment	Estimated Costs Associated with Implementation
Vegetation Removal and Disposition	As proposed in Plan of Operations	Prepare a Vegetation Removal and Disposition Plan for lead agencies' approval	Same as Alternative 3	Total cost = $6,000 Alt. 3: 1% of disturbed area is MMC land = $60 Alt. 4: 14% of disturbed area is MMC land = $840
Revegetation Seed Mixtures	Native and introduced species	Native species only, to the extent they were commercially available	Same as Alternative 3	Total cost = $333,450 Alt. 3: 1% of disturbed area is MMC land = $3,335 Alt. 4: 14% of disturbed area is MMC land = $46,683
Tree and Shrub Density After 15 Years	283 trees/acre (assumes a 65 percent survival rate of 435 trees/acre planted) Unspecified (200 shrubs/acre planted)	400 trees/acre 200 shrubs/acre	Same as Alternative 3	Total cost = $712,500 Alt. 3: 1% of disturbed area is MMC land = $71,250 Alt. 4: 14% of disturbed area is MMC land = $99,750
Wildlife Forest Sensitive Birds and State Bird Species of Concern	Not specified	Complete surveys to locate active nests in appropriate habitat and avoid during nesting, or not remove vegetation in the nesting season	Same as Alternative 3	Total cost = $12,750 Alt. 3: 1% of disturbed area is MMC land = $128 Alt. 4: 14% of disturbed area is MMC land = $1,785

Chapter 4. Consultation and Coordination

4.1 Preparers and Contributors

4.1.1 Forest Service

Name	Responsibilities	Education	Experience
Ague, Susan	GIS/Editorial Assistant (2005-2006)		14
Anderson, Jeremy	Wildlife Biology(2014)	Master-Natural Resources B.S. Wildlife Resources	14
Bond, Deb	Vegetation/Sensitive Plants	B.S., Forestry Resource Management	32
Bouma, Janis	NEPA (2009 to present)	M.A., Anthropology B.A., Forestry/Resource Conservation B.A., Anthropology/Archaeology	18
Bratkovich, Al	Wildlife (2005-2009)	B.S., Forest Science	31
Bones, Stan	Explosives (2005-2006)	B.S., Forest Management	37
Brundin, Lee	Wildlife (2005-2009)	B.S., Fisheries & Wildlife Management	34
Carlson, John	Fisheries	M.S., Fisheries B.S., Fisheries	28
Dueker, Annie	Wildlife (2009-2010)	B.S., Wildlife Science	32
Dzomba, Thomas	Air Quality	M.S.P.H., Public Health B.S., Chemistry	23
Edwards, Malcolm	Ranger (2005-2013)	B.S., Soils/Range	37
Ehmann, Cheryl	Resource Technician (2013 to present)		18
Gebert, Krista	Socio-Economics(2012-present)	B.A. Economics	18
Grupenhoff, Doug	Fisheries(2014)	B.S. Forestry/Wildlife Management	26
Ferguson McDougall, Leslie	NEPA (2005-2009)	B.S., Forestry	30
Grabinski, Tom	Lands (2005-2006)	B.S., Civil Engineering	41
Gubel, John	NEPA (2005-2009)	B.S., Forestry	32
Gurrieri, Joe	Hydrology	M.S., Geology B.A., Geography/Geology	29
Hagarty, Lynn	Project Coordinator (2009 to present)	B.S., Geology	28
Holifield, Jennifer	Wildlife Biology (2011 to present)	B.S., Wildlife Biology; B.S., Forestry/Range Management & B.S., Resource Conservation	27
Hooper, Paul	Fisheries	B.S., Fisheries Biology	22
Jeresek, Jon	Recreation	M.S., Forest Pathology	37
Johnson, Cindy	Resource Technician (2008 to 2013)		22
Johnson, Wayne	Wildlife (2005-2009)	B.S., Wildlife Management	38*

Name	Responsibilities	Education	Experience
Johnsen, Steve	Wildlife(2014)	M.S. Wildlife Biology B.S. Wildlife Biology	22
Lacklen, Bobbie	Project Coordinator	B.A., Geology	27
Lampton, Linda	GIS (2005-2010)	A.A., Business	30*
Laws, Mary	Recreation (2013-present)	B.S. Forestry	26
Leavell, Dan	Ecology (2005-2009)	Ph.D., Ecology M.S., Forest Ecology B.S., Forestry Resource Management	40*
McKay, John	Geology (2005-2009)	B.A., Geology	32*
Niccolucci, Michael	Socioeconomics (2005-2008)	M.A., Economics B.A., Economics	27
Novak, Lis	Scenery (2009 to present)	B.S., Landscape Architecture	31
Odor, Ann	Weeds (2005-2009)	B.S., Forestry Resource Management	26
Rockwell, Mandy	Wildlife (2014)	Master-Natural Resources B.A. Biology	10
Romero, Stephen	Geotechnical (2005-2007)	M.S., Civil Engineering B.S., Environmental Engineering B.A., Mathematics	10
Smith, Lawrence	Forester	A.A., Forestry	39
Stantus, Paul	Engineer (2005-2011)	B.S., Civil Engineering	34
Stockmann, Keith	Socioeconomics (2008 to present)	Ph.D., Forestry M.S., Environmental Studies B.A., Economics	19
TeSoro, Ray	Minerals	B.S., Geology	33
Thomas, Pat	Scenery (2005-2008)	B.S., Landscape Architecture	34
Timmons, Becky	Heritage/American Indian (2005-2013)	M.A., Anthropology B.A., Anthropology	33
Werner, Peter	Geotechnical	M.S., Mining Engineering Double B.S., Civil Engineering and Geology	23
Young, Barb	GIS	M.S., Work, Soils B.A., Geology	26
Wegner, Steve	Hydrology	B.S., Watershed Management	31
White, Mark	Heritage (2005-2010)	Double B.S., Anthropology and History	25

* includes time working as contractor in field of profession

4.1.2 Department of Environmental Quality

Name	Responsibilities	Education	Experience
Blend, Jeff	Socioeconomics	Ph.D., Agricultural Economics M.S., Economics B.S., Economics	15
Boettcher, Lisa	Hydrogeology Overall Resource Review (2005 to 2011)	M.S., Geology and Geological Engineering B.S., Geology	25
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Name	Responsibilities	Education	Experience
Corsi, Emily	Project Coordinator (2009 to 2011)	M.S., Natural Resources Conservation B.A., Politics	8
Dreesbach, Catherine	Engineering (2009 to 2011)	M.S., P.E., Mining Engineering M.S., Environmental Engineering B.S., Physics	16
Freshman, Charles	Engineering (2005-2009, 2011 to present)	M.S., Geological Engineering B.A., Geology B.S., Environmental Engineering	30
Furniss, George	Hydrogeology (2005-2008)	M.S., Geology B.S., Geology	39
Griffeth, Tommy	MPDES Permit (2014 to present)	M.S., Biological Resources Engineering B.S., Biology	14
Jepson, Wayne	Hydrology	M.S., Geology B.A., Earth Sciences	21
Johnson, Kathleen	Project Coordinator (2005-2007)	M.S., Land Rehabilitation B.S., Landscape Architecture	25
Johnson, Nancy	Transmission Line – Major Facility Siting Act (2005-2013)	M.L.A., Landscape Architecture M.S., Education B.S., Education	31
Jones, Craig	Transmission Line	B.A., Political Science	8
Lovelace, Bonnie	Project Coordinator and Document Review (2007 to 2009)	M.S., Geology B.S., Geology B.S., Mathematics	30
McCullough, Warren	Document Review	M.S., Economic Geology B.A., Anthropology	37
O'Mara, Jenny	Air Quality Permit and Review (2007 to 2014)	B.S., Environmental Engineering	18
Plantenberg, Patrick	Overall Resource Review	M.S., Range Science/Reclamation Research B.S., Plant & Soil Science/Recreation Area Management	40
Ponozzo, Kristi	Project Coordinator (2011 to present)	M.S., Environmental Policy B.S., Journalism	13
Ridenour, Rebecca	MPDES Permit and Water Quality Review (2007-2009)	M.S., Geoscience - Geochemistry B.S., Geological Engineering, Hydrogeology Emphasis	15
Ring, Tom	Major Facility Siting Act Certificate Coordination (2005-2013)	Double B.S., Fish and Wildlife Management and Earth Science	32
Rolfes, Herb	Operating Permit Supervisor and Document Review	M.S., Land Rehabilitation B.A., Earth Space Science, A.S., Chemical Engineering	25
Ryan, Jeff	318 Permit and 401 Certification (2005-2014)	B.S., Environmental Science	40
Skubinna, Paul	MPDES Permit and Water Quality Review (2005–2007)	M.S., Geology B.S., Earth Science	10
Smith, Garrett	Geochemistry (2014 to present)	M.S., Geoscience- Geochemistry, B.S., Chemistry	4

Name	Responsibilities	Education	Experience
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Thunstrom, Eric	Air Quality Permit and Review (2005–2007)	B.A., Environmental Engineering	7
Wadhams, John	MPDES Permit and Water Quality Review (2009 to 2013)	B.A., Biology	31

4.1.3 EIS Consultant Team

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Baud, Karen ERO Resources Corp.	Assistant Project Manager (2006 to present); Wildlife	M.A., Biology B.A., Biology	18
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Bergstedt, Lee GEI Consultants, Inc.	Aquatic Life and Fisheries (2007 to present)	M.S., Fishery and Wildlife Biology B.A., Fish and Wildlife Management	18
Buscher, Dave	Soils and reclamation	M.S., Ecological Engineering B.S., Geological Engineering B.S., Wildlife Biology	34
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Cole, Andy ERO Resources Corp.	Socioeconomics	M.F.S., Forest Science M.A., German B.A., German/Physics	18
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Galloway, Barbara ERO Resources Corp.	Hydrology	M.S., Water Resources Double B.A., Biology and Environmental Studies	28
Galloway, Michael ERO Resources Corp.	Hydrogeology	M.S., Geology B.S., Geology	42
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Hambley, Doug Agapito and Associates, Inc.	Mine Engineering	Ph.D., Earth Sciences MBA, Finance and Operations Management B.S., Mining Engineering	39
Hesker, David ERO Resources Corp.	Graphics	B.F.A., Graphic Design	23
Hereim, Scott HDR Engineering, Inc.	Electrical Engineering	B.S., Electrical Engineering	14

Name/Firm	Responsibilities	Education	Experience
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Holdeman, Mark Holdeman Landscape Architecture, Inc.	Visual	B.L.A., Landscape Architecture	31
Kirk, Lisa Enviromin, Inc.	Geochemistry (2005-2013)	Ph.D., Microbial Geochemistry M.S., Aqueous Geochemistry B.S., Geology and Environmental Science	28
Larmore, Sean ERO Resources Corp.	Cultural Resources	M.A., Archaeology B.A., Anthropology	16
Lynch, Jeniffer GEI Consultants, Inc.	Aquatic Life and Fisheries	M.S., Environmental Science B.S., Biology	7
Lyons, Carol Bridges Unlimited, LLC.	Air Quality	M.S., Chemical Engineering Double B.S., Chemistry and Physics	35
Mangle, Bill ERO Resources Corp.	Land Use, Recreation, Wilderness, and Inventoried Roadless Areas (2007 to present)	M.S., Natural Resource Policy and Planning B.S., History/Political Science	17
Olmsted, Brian ERO Resources Corp.	Hydrology/ Geochemistry	M.S., Geochemistry B.S., Geology	12
Poulter, Don Glasgow Engineering Group, Inc.	Geotechnical (2005-2013)	M.S.C.E., Geotechnical Engineering B.S., Civil Engineering	34
Rouse, Leigh ERO Resources Corp.	Wetlands and Vegetation (2009 to present)	M.S., Botany B.A., Biology	18
Sheppard, Asher Asher Sheppard Consulting	Electric and Magnetic Fields	Ph.D., Physics M.S., Physics B.A., Science	35
Smith, Garth ERO Resources Corp.	Geographic Information Systems	M.A., Geography B.S., Geography	19
Stanwood, Mike ERO Resources Corp.	Socioeconomics	M.S., Mineral Economics B.A., Psychology	33
Trenholme, Richard ERO Resources Corp.	Project Management	B.S., Agronomy	35
Trujillo, Cindy ERO Resources Corp.	Wetlands and Vegetation (2005-2008)	B.S., Biology	13
Vandergrift, Tom Agapito and Associates, Inc.	Mine Engineering	M.S., Mining Engineering B.S., Mining Engineering	25
Wall, Kay ERO Resources Corp.	Technical Editor (2009 to present)	B.A., Behavioral Science	34
Worah, Moneka	Project Assistant (2011 to present)	B.A., Environmental Science	9

The Forest Service and DEQ consulted the following individuals, federal, state, and local agencies and agency personnel during the development of this EIS.

4.1.4 Other Federal, Tribal, State, and Local Agencies

Name/Agency or Tribe	Responsibilities
Brown, Jerry Montana Fish, Wildlife, and Parks	Wildlife
Clark, Dick Environmental Protection Agency	Wetlands and 404 Permit
Conard, Ben U.S. Fish and Wildlife Service	Wildlife and Threatened & Endangered Species
Hafferman, Kurt Montana Department of Natural Resources and Conservation	Water Rights
Hanley, Jim Environmental Protection Agency	Mine Engineering
Kasworm, Wayne U.S. Fish and Wildlife Service	Wildlife and Threatened & Endangered Species
Konzen, John Lincoln County Commissioner	Document Review
LaForest, Joe Montana Department of Commerce, Hard Rock Mining Impact Board	Hard Rock Impact Plan Socioeconomics
Laidlaw, Tina Environmental Protection Agency	Water Quality
Lynard, Gene Bonneville Power Administration	Sedlak Park Substation and Loop Line
Pierce, Maggie Environmental Protection Agency	NEPA
Peter, Chandler U.S. Army Corps of Engineers	Wetlands and 404 Permit (2005-2009)
Pierce, Kathy Bonneville Power Administration	Sedlak Park Substation and Loop Line (2014 to present)
Pittman, Marc Montana Department of Natural Resources and Conservation	Water Rights
Potts, Steve Environmental Protection Agency	NEPA (2009 to 2013)
Riley, Jean Montana Department of Transportation	State Highways
Roose, Marianne Lincoln County Commissioner	Document Review
Russell, Carol Environmental Protection Agency	Water Quality
Sandman, Robert Department of Natural Resources and Conservation	Trust Lands
Schroeder, Christina Army Corps of Engineers	Wetlands and 404 Permit (2009 to present)
Steg, Ron Environmental Protection Agency	Water Quality

Name/Agency or Tribe	Responsibilities
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Svoboda, Larry Environmental Protection Agency	NEPA
Tillinger, Todd Army Corps of Engineers	Wetlands and 404 Permit
Williams, Jim Montana Fish, Wildlife, and Parks	Wildlife
Wilson, Mark USDI Fish and Wildlife Service	Wildlife and Threatened & Endangered Species
Windom, Rita Lincoln County Commissioner	Document Review
Winters, Jim Army Corps of Engineers	Wetlands and 404 Permit (2009 to 2012)
Wireman, Mike Environmental Protection Agency	Hydrology (2009 to 2013)

4.2 List of Agencies, Organizations, and Persons to Whom Copies of the Final EIS Have Been Distributed

This EIS or its Summary has been distributed to individuals who specifically requested a copy of the document either in hard or electronic copy. In addition, copies have been sent to the federal agencies, tribal governments, state and local governments, and organizations representing a wide range of views regarding the proposed Montanore Project. The mailing list was compiled using the names and addresses of the following:

- Parties who participated in public meetings or who submitted written comments
- Parties who have requested copies of the EIS
- Agencies, governments, tribes, and companies potentially affected by the proposed operation
- Agencies and groups consulted during the EIS preparation

A copy of this Final EIS can be reviewed at the following locations or via the Internet on the Forest Service web page (http://www.fs.fed.us/r1/kootenai/projects/projects/montanore/index.shtml) or the DEQ web page (http://www.deq.state.mt.us/eis.asp):

- Supervisor's Office, Kootenai National Forest, Libby, MT
- Libby Ranger Station, Libby, MT
- Montana Department of Environmental Quality, Helena, MT
- Montana State Library
- Mansfield Library, University of Montana, Missoula, MT
- Lincoln County Library, Libby, MT
- Thompson Falls Public Library, Thompson Falls, MT
- Laurie Hill Library, Heron, MT

Copies of this document are also available on request from:

Kootenai National Forest 31374 U.S. 2 West Libby, MT 59923-3022 (406) 293-6211	Montana Department of Environmental Quality PO Box 200901 Helena, MT 59620-0901 (406) 444-1760	Bonneville Power Administration PO Box 3621 Portland, OR 97208-3621 (503) 230-7334

The following agencies, organizations, and individuals received a copy of the EIS or summary:

4.2.1 Federal, State, and Local Agencies

Advisory Council on Historic Preservation
Army Corps of Engineers
Bonneville Power Administration
Boundary County Commissioner
British Columbia Ministry of Energy, Mines and Petroleum Resources
British Columbia Ministry of Environment
City of Libby
Coeur D'Alene Tribe
Confederated Salish and Kootenai Tribes of the Flathead Nation
Consulate General of Canada
Environmental Protection Agency
Environmental Protection Agency Region 10
Environmental Protection Agency Region 8
Federal Aviation Administration
Federal Energy Regulatory Commission
Federal Highway Administration
Federal Railroad Administration
Forest Service Governors Office
ID Dept of Agriculture
ID Dept of Environmental Quality
ID Dept of Fish and Game
ID Dept of Lands
ID Office of Species Conservation
ID State Historic Preservation Office
Kalispel Natural Resources
Kalispel Tribe of Indians Natural Resources
Kootenai National Wildlife Refuge
Kootenai Tribe of Idaho
Legislative Consumer Council
Libby City Council
Lincoln County Weed and Rodent Program
Mineral County Board of Commissioners
Montana Fish Wildlife & Parks
MT Dept of Agriculture
MT Dept of Commerce
MT Dept of Revenue
MT Dept of Transportation
MT Fish Wildlife and Parks
MT Governor Steve Bullock
MT St Representative Jerry Bennett
MT St Representative Mike Cuffe
MT State Historic Preservation Office
National Agricultural Library
Natural Resources Conservation Service
Northwest Indian Fisheries Commission
Office of NEPA Policy and Compliance
Public Service Commission
Sanders County Board of Commissioners
U.S. Army Corps of Engineers
U.S. Dept. of Agriculture
U.S. Dept. of Labor
U.S. Dept. of the Interior
U.S. Dept. of Transportation
U.S. Coast Guard
U.S. Senator Jim Risch
U.S. Senator Jon Tester
USDA APHIS PPD/EAD
USDA Forest Service
USDA Natural Resources Conservation Service
USDI Fish and Wildlife Service
USDI Office of Environmental Policy and Compliance
WA Dept of CTED
WA Dept of Natural Resources

4.2.2 Organizations and Businesses

Organizations

Alliance for the Wild Rockies
Alliance for Wild Rockies
Alternative One, Inc.
American Forest and Paper Assn
American Sportfishing Assn
Avery Area Property Owners Assn
Back Country Houndsmen
Backcountry ATV
Backcountry Horsemen
Backcountry Hunters and Anglers
BlueRibbon Coalition
Boone and Crockett Club
Boundary Backpackers - Idaho Conservation League
Bull River Watershed Council
Cabinet Back Country Horsemen
Cabinet Mountains Pika Club
Cabinet Resource Group
Capital Trail Vehicle Assn
Center For Justice
Center for Science in Public Participation
Clark Fork Coalition

Clark Fork Pend Oreille Conservancy
Colorado St University Libraries
Committee For Idahos High Desert
Concerned About Grizzlies
Cottonwood Env. Law Center
Cutthroat Trout Foundation Inc.
Defenders of Wildlife
Earthworks
Elk Unlimited
Estuary Corporation
Eureka Dune Runners
Five Valleys Audubon Society
Flathead Lutheran Bible Camp
Flathead Wildlife, Inc.
Foundation For N American Wild Sheep
Friends of Clearwater
Friends of Scotchmans Pk Wldrns
Friends of the Clearwater
Gonzaga Spokane Mountaineers
Great Bear Foundation
Great Burn Study Group
Great Old Broads For Wilderness
Healthy Communities Initiative
High Mountain ATV Assn
Idaho Conservation Data Center
Idaho Conservation League
Idaho Environmental Council
Idaho Forest Owners Assn
Idaho Forest Owners Association
Idaho Outfitters and Guides Licensing Board
Idaho Rivers United
Idaho State Snowmobile Assn
Idaho Trout Unlimited
Idaho Women In Timber
Independent Forest Products Assn
International Assn of Fish and Wildlife Agencies
International Mountain Bicycling Association
Kettle Range Conservation Group
Klamath Alliance For Resources and Environment
Kootenai Environmental Alliance
Kootenai Ridge Riders ATV
Kootenai River Development Council
Kootenai River Network
Kootenay Lake Forest District
Libby Area Chamber of Commerce
Libby Rod and Gun Club
Libby Tomorrow
Libby Video Club
Libby Volunteer Fire Department
Lincoln County Recreation Assn & Troy Snowmobile Club
Lincoln County Sno Kats
Lincoln County Sno-Kats
Lower Clark Fork Watershed Group
Marion Co Humane Society Inc.
Militia of MT
Missoula Bicycle Club
Montana Env. Info. Center
Montanans for Multiple Use
MT Chapter American Fisheries Society
MT Conservation Corps
MT Native Plant Society
MT Petroleum Assn
MT Pilots Assn
MT Snowmobile Assn
MT Trail Vehicle Riders Assn
MT Wilderness Assn
MT Wilderness Association
MT Wildlife Federation
MT Wood Products Assn
N ID Backcountry Horsemen
N ID Trailblazers
National Audubon Society
National Resources Defense Council
National Rifle Assn
National Wild Turkey Federation
National Wildlife Federation
Nitha
North Fork Forestry
Northwest Access Alliance
Northwest Coalition for Alt To Pesticides
Northwest Environmental Defense Center
Northwest Mining Association
Northwest Power Planning Council
Oregon State Snowmobile Assn
Pacific Legal Foundation
Pacific Rivers Council
Pantra
People For Wyoming
Pilik Ridge RUA
Predator Conservation Alliance
Priest Lake Groomer Committee
Priest Lake Trails and Outdoor Rec Assn
Priest River Valley Back Country Horseman
Public Lands Foundation
Recreational Boating and Fishing Foundation
Rock Cr Subdivision RUA
Rock Creek Alliance
Rocky Mountain Elk Foundation
Sanders County Winter Recreation
Sandpoint Winter Riders
Save our Cabinets
Sci First For Hunters
Selkirk Conservation Alliance
Sierra Club
Sierra Club-Montana
Smoky Mountains Hiking Club
Snow Riders
Snowmobile Alliance of Western States
Society of American Foresters
Spokane Mountaineers Conservation Committee
St Joe Cycle Club City of St Maries Council
St Joe Snow Riders
Stenros Brothers Outdoor Adventures
Ten Lakes Snowmobile Club
The Lands Council
The Nature Conservancy
The Wilderness Society
Theodore Roosevelt Conservation Partnership
Tobacco Valley Resource Group
Tobacco Valley Study Group
Trout Unlimited
Troy & Libby Snowmobile Clubs
Vital Ground Foundation

Western Mining Action Project
Western MT Bldg and Construction Trades Council
Western MT Building Trades
Wilderness Watch
Wildlands CPR
Winter Riders Inc.
Winter Wildlands Alliance
Wyoming Wilderness Assn
Yaak Valley Forest Council

Businesses

10 Lakes Forestry and Excavation
1st Natl. Bank
Ameritech
Associated Logging Contractors, Inc.
Avista Corp.
Big Sky Lumber Supply
BKS Environmental Associates, Inc.
Boliden Resources, Inc.
C&D Pest Control
Cabinet Mountain Chevrolet-Pontiac
CalPro Promotional Products
Calvert Ranch
Camp, Dresser & McKee, Inc.
Canavan Logging
Carter Lake Consulting, LLC
CBS News 60 Minutes
Cecil Goff Clipping
Chalkstream Capital Group
Charlie Carvey Logging
Citizens Telecom of MT
CityService Valcon
Columbia Helicopters Inc.
Cominco American Resources Inc.
Conservation Research and Management Consulting Services
Daily Interlake
Diversified House Logs Inc.
ECO Star Energy Systems
Edlund and Hayes
Environmental Strategies Inc.
Environomics Inc.
Erickson Air Crane Inc.
Eureka Rural Dev Partners
FH Stoltze Land and Lumber Co.
Flathead Electric Cooperative, Inc.
Franklin and Associates
Gaetz, Madden & Dunn
Genesis Inc.
Golden Sunlight Mines
Granite Concrete Co., Inc.
Harding Lakes Ranch
Hecla Mining Co.
Highland Logging
Hollingsworth Ranch LLC
Holme Roberts & Owen
Hydra Project
Kovar Properties LLC
Lance and Posten
Land Letter
Libby Creek Ventures, LLC
Libby Placer Mining Company
Libby Volunteer Ambulance Service, Inc.
Lightning Excavating
Lincoln County Board of Realtors
Line Layers Inc
Lisa Bay Planning and Resource Mgmt.
Little Bitterroot Special Services, Inc.
Mines Management Inc.
Molly Montana Real Estate
Montana Machine and Fabrication
Morrison Motl & Sherwood
Mountain View Productions
N.A. Degerstrom, Inc.
Napa Auto Parts
Nerco Exploration Co.
Noranda Inc Falconbridge Ltd.
Northern Lights, Inc.
Owens and Hurst Lumber Co Inc.
Payne Machinery, Inc.
Plum Creek Timber Co.
Poore, Roth, & Robinson
PRC Environmental Management, Inc.
Raviv & Patricio Associates, Inc.
Revett Silver Company
Riley Creek Lumber
RLK Hydro
Rosauers Supermarket
Rovig Minerals, Inc.
Rusher Air Conditioning
Sanders County Ledger
Sherry Guzzi Architect
Silver Bow Outfitters
Silver Butte Ranch Corp.
Solar/Wind Energy Conversion and Mental Seminaries
St. John's Lutheran Hospital
Stimson Lumber Co.
T B C Timber Inc.
T I M B E R
Tetra Tech
The Missoulian
The Montanian
The Western News
Thomas J. Wood Insurance Agency
Timber Tech, Inc.
Timberline Auto Center, Inc.
Tungsten Holdings Inc
Westech, Inc.
Western News
Western Woods
W-I Forest Products
William Faulkner and Associates

4.2.3 Individuals

The names of individuals are available upon request from the KNF or the DEQ.

Chapter 5. Index

Chapter 6. List of Acronyms

Acronym	Acronym Description
ABA	Acid-Base Accounting
ABP	Acid-Base Potential
ACSR	Aluminum Core Steel Reinforced
AERMIC	American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee
AERMOD	Air Dispersion Model
ALS	Aquatic Life Standard
ANC	Acid-Neutralizing Capability
AP	Acid Potential
APE	Area of Potential Effect
APLIC	Avian Power Line Interaction Committee
AQRV	Air Quality Related Values
ARD	Acid Rock Drainage
ARM	Administrative Rules of Montana
ARMB	Montana Air Resources Management Bureau
BA	Biological Assessment
BACT	Best Available Control Technology
BCF	Bioconcentration factor
BCI	Biotic Community Index
BCR	Bird Conservation Region
BDL	Below detection limit
BE	Biological Evaluation
BFW	Bank full width
BHES	Board of Health and Environmental Sciences
BLM	Bureau of Land Management
BMP	Best Management Practice
BMU	Bear Management Unit
BORZ	(Grizzly) Bear Outside the Recovery Zone
BPA	Bonneville Power Administration
CEM	Cumulative effects model
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CMP	Corrugated metal pipe
CMW	Cabinet Mountains Wilderness
CO	Carbon Monoxide
Corps	U.S. Army Corps of Engineers
CSKT	Confederated Salish and Kootenai Tribes
CWD	Coarse woody debris
CYE	Cabinet-Yaak Ecosystem
CYRZ	Cabinet-Yaak Ecosystem Recovery Zone
dB	decibel
DBH	diameter at breast height
dBmV/m	decibel-microvolts per meter
DCF	Discounted cash flow

DEQ	Montana Department of Environmental Quality
DHES	Montana Department of Health and Environmental Sciences (now DEQ)
DNRC	Montana Department of Natural Resources and Conservation
DOC	Montana Department of Commerce
DPS	Distinct Population Segment
Draft EIS	Draft Environmental Impact Statement
DSL	Montana Department of State Lands (now DEQ)
EA	Environmental Assessment
Eagle Act	Bald and Golden Eagle Protection Act
ECA	Equivalent Clearcut Acres
ECAC	Equivalent Clearcut Acres Calculator
EIS	Environmental Impact Statement
ELGs	Effluent Limitations Guidelines
ELGs	Effluent Limitations Guidelines
EMF	Electric Field and Magnetic Field
EMU	Elk Management Unit
EPA	Environmental Protection Agency
EPT	Ephemeroptera, Plecoptera, and Trichoptera
ER	Enrichment Ratio
ESA	Endangered Species Act
FACTS	Forest Activity Tracking System
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
Final EIS	Final Environmental Impact Statement
FLAG	Federal Land Managers' Air Quality Related Values Workgroup
FLM	Federal Land Managers
FMEA	Failure Modes and Effects Analysis
FOS	Factors of Safety
FSH	Forest Service Handbook
FSM	Forest Service Manual
FWP	Montana Fish, Wildlife, and Parks
FY	Fiscal Year
GDE	Groundwater Dependent Ecosystem
GHGs	Greenhouse gas emissions
GIS	Geographic Information System
gpm	gallons per minute
GPS	Global Positioning System
H&H	Hydraulic and Hydrologic
HABS	Historic American Building Survey
HAER	Historic American Engineering Record
HAP	Hazardous Air Pollutant
HCP	Habitat Conservation Plan
HD	Hunting District
HDPE	high density polyethylene
HE	Habitat Effectiveness
HR	Hayes Ridge
HRMIB	Hard Rock Mining Impact Board
HU	Habitat Unit
HUC	Hydrologic Unit Code

Hz	hertz
IGBC	Interagency Grizzly Bear Committee
IMBCR	Integrated Monitoring in Bird Conservation Regions
Impact Plan	Hard-Rock Mining Impact Plan
INFS	Inland Native Fish Strategy
IRA	Inventoried Roadless Area
IRIS	Integrated Risk Information System
KFP	Kootenai Forest Plan
KIPZ	Kootenai-Idaho Panhandle Plan Revision Zone
KNF	Kootenai National Forest
KOP	Key Observation Point
KTOI	Kootenai Tribe of Idaho
kV	kilovolt
kV/m	1,000 volts per meter
kw	kilowatt
kwh	kilowatt-hour
LAD	Land application disposal
LAU	Lynx Analysis Unit
LCAS	Lynx Conservation Assessment and Strategy
LOS	Level of Service
LWD	Large woody debris
M bcy	million bank cubic yards
MA	Management Area
MAAQS	Montana Ambient Air Quality Standards
MAC	Mineral Activity Coordination
MAC Report	Mineral Activity Coordination Report
MAGIC	Model of Acidification of Groundwater in Catchments
MAQP	Montana Air Quality Permit
MBBR	Moving bed biofilm reactor
MBEMP	Montana Bald Eagle Management Plan
MBEWG	Montana Bald Eagle Working Group
MBTA	Migratory Bird Treaty Act
MCA	Montana Code Annotated
MCE	Maximum Credible Earthquake
MDT	Montana Department of Transportation
MEPA	Montana Environmental Policy Act
MFISH	Montana Fisheries Information System
MFSA	Montana Major Facility Siting Act
mG	milligauss
MIS	Management Indicator Species
mmbf	million board feet
MMC	Montanore Minerals Corporation
MMI	Mines Management, Inc.
MMRA	Metal Mine Reclamation Act
MNHP	Montana Natural Heritage Program
MOU	Memorandum of Understanding
MP	Milepost
MPDES	Montana Pollutant Discharge Elimination System
mph	miles per hour

MS	Management situation
MSMLS	multistory late successional
MT	Million tons
N	Nitrogen
NA	Not applicable
NAAQS	National Ambient Air Quality Standards
NC	Not counted
NCDE	Northern Continental Divide Ecosystem
ND	No data
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NFS	National Forest System
NHPA	National Historic Preservation Act
NM	No measurement
NMC	Noranda Minerals Corporation
NO_2	Nitrogen dioxide
NOI	Notice of Intent
NP	Neutralization potential
NPS	National Park Service
NPV	Net present value
NRHP	National Register of Historic Places
NRIS	Natural Resource Information System
NRLMD	Northern Rocky Lynx Management Direction
NS	Not suspected
NTU	Nephelometric turbidity unit
NWLO	Northwest Land Office
OG	Effective old growth
OHV	Off Highway Vehicle
OLM	Ozone Limiting Method
OMRD	Open Motorized Route Density
ORD	Open Road Density
pcf	Pounds per cubic foot
PGA	Peak Ground Acceleration
PHABSIM	Physical Habitat Simulation System
PIF	Partners in Flight
Plum Creek	Plum Creek Timber Company
PM_{10} and $PM_{2.5}$	particulate matter less than 10 and 2.5 microns
PMOA	1997 Programmatic Memorandum of Agreement
PMP	Probable maximum precipitation
PPI	Potential Population Index
PPL	Potential Population Level
PRISM	Parameter-elevation Regressions on Independent Slopes Model
PSD	Prevention of Significant Deterioration
PSU	Planning Sub-Unit
QA	Quality assurance
QC	Quality control
RCR	RC Resources, Inc.
RHCA	Riparian Habitat Conservation Area
RMO	Riparian Management Objective

ROD	Record of Decision
ROG	Replacement Old Growth
ROS	Recreation Opportunity Spectrum
SAG	Semi-autogenous grinding
SC	specific conductance
SCORP	State Comprehensive Outdoor Recreation Plan
SCYE	Selkirk Cabinet Yaak Ecosystem
SHPO	State Historic Preservation Office
SOX	Sulfur oxides
SPLP	Synthetic Precipitation Leaching Procedure
SPT	Standard Penetration Test
SSH	Snowshoe Hare
SWPPP	Stormwater Pollution Prevention Plan
TAG	Technical Advisory Group
TBEL	Technology-Based Effluent Limit
TCLP	Toxicity Characteristics Leaching Procedure
TCP	Traditional Cultural Property
TDS	total dissolved solid
TIN	Total inorganic nitrogen
TMDL	Total Maximum Daily Load
TMRD	Total Motorized Route Density
TN	Total nitrogen
tpd	Tons per day
tpy	Tons per year
TRB	Transportation Research Board
TSMRS	Timber Stand Management Record System
TSP	Total suspended particulate
TSS	Total suspended solid
TWSC	Two-Way, Stop Controlled
USC	United States Code
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USFWS	USDI Fish and Wildlife Service
USGS	U.S. Geological Survey
V/m	Volt per meter
VMS	Visual Management System
VQO	Visual Quality Objective
VRU	Vegetation Response Units
WEPP	Water Erosion Prediction Project
WMA	Wildlife Management Area
WQB	Water Quality Bureau
WQBEL	Water Quality-Based Effluent Limit

Chapter 7. Glossary

acid-base potential	A laboratory method to determine the acid-generating potential of sulfide minerals.
adit	A nearly horizontal passage, driven from the surface, by which a mine may be entered, ventilated, and dewatered.
alluvium	Soil and rock that is deposited by flowing water.
altered waste zones	Zones of changed mineralogy that occur around the ore deposit, containing chalcopyrite-calcite, pyrite-calcite, and galena-calcite mineralization.
ambient	Surrounding, existing.
appropriation	To divert, impound, or withdraw, including by stock for stock water, a quantity of water for a beneficial use. Appropriations by the FWP and USDA Forest Service has slightly different meaning.
aquifer	Rock or sediment which is saturated with water and sufficiently permeable to transmit quantities of water.
area of potential effect (APE)	The geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist.
baseflow	The contribution of near-channel alluvial groundwater and deeper bedrock groundwater to a stream channel. Does not include any direct runoff from rainfall or snowmelt into the stream.
bear management unit (BMU)	Land area containing sufficient quantity and quality of all seasonal habitat components to support a female grizzly.
Bears Outside Recovery Zone (BORZ)	Delineated areas outside of the Grizzly Bear Recovery Zone where recurring grizzly bear use has been documented.
Best Management Practices	Structural, non-structural, and managerial techniques that are recognized to be the most effective and practical means to control non-point source pollutants.
bioavailable	The state of a toxicant such that there is increased physicochemical access to the toxicant by an organism. The less the bioavailability of a toxicant, the less its toxic effect on an organism.
bioconcentration	Chemicals that increase in living organisms resulting in concentrations greater than those found in the environment.
biodiversity	A term that describes the variety of lifeforms, the ecological role they perform, and the genetic diversity they contain.
blasting	To remove, open, or form by or as if by an explosive.
borrow materials	Soil or rock dug from one location to provide fill at another location.
broadcast seeding	A means of planting where seed is distributed on the ground surface mechanically or by hand.
carbonate	A sedimentary rock composed chiefly of carbonate minerals (*e.g.*, limestone and dolomite).
carcinogenic parameters	Parameters listed as carcinogens in DEQ Circular WQB-7.
carrying capacity	The maximum number of animals that can be sustained over the long term on a specified land area.

catchment	A geographic area that collects rain or snowfall.
clastic	Consisting of fragments of rocks that have been removed individually from their places of origin.
coarse woody debris	Sound and rotting logs and stumps that provide habitat for plants, animals and insects and a source of nutrients for soil development. Material generally greater than 8 to 10 cm in diameter.
colluvial	Rock detritus and soil accumulated at the foot of a slope.
colluvium	Fragments of rock carried and deposited by gravity.
complexation	The formation of complex chemical species.
concentrate	To make less dilute.
confluence	The point where two streams meet.
core grizzly bear habitat	An area of high quality habitat within a Bear Management Unit that is greater than or equal to 0.31 miles from any road (open or restricted), or motorized trail. Core habitat may contain restricted roads, but such roads must be effectively closed with devices, including but not limited to, earthen berms, barriers, or vegetative growth.
corridor	A defined tract of land, usually linear, through which a species must travel to reach habitat suitable for reproduction and other life-sustaining needs.
Cretaceous	The third and latest of the periods included in the Mesozoic Era. Also, the system of strata deposited in the Cretaceous period and related most commonly to the age of the dinosaurs.
critical habitat	The specific area within the geographic area, occupied by a listed species at the time it is listed, on which are found those physical or biological features essential to conserve the species and that may require special management considerations or protection; and specific areas outside the geographic area occupied by the species at the time it is listed upon a determination that such areas are essential to conserve the species.
Cumulative Effects Model	Vegetation mapping for the KNF based on 1992 satellite imagery and updated for harvest activities through 1995.
cutoff	A clay-filled trench beneath a dam to cut off water seeping beneath the dam.
cyclone	Centrifugal classifying device.
dBA or decibels A scale	A logarithmic unit for measuring sound intensity, using the decibel A weighted scale, which approximates the sound levels heard by the human ear at moderate sound levels, with a 10 decibel increase being a doubling in sound loudness.
deep rip	Breaking up compacted soil or overburden, to a depth below normal tillage.
degradation	A process by which the quality of water in the natural environment is lowered.
dendritic	The branching of natural drainage systems.
deposition analysis threshold	The additional amount of nitrogen or sulfur deposition within an FLM area, below which estimated impacts from a proposed new or modified source are considered negligible.

dilatant	Increasing in viscosity and setting to a solid as a result of deformation by expansion, pressure, or agitation.
dilution	A process in which the chemical concentration of constituents in a stream decreases as a result of mixing with cleaner water.
dispersal	The movement, usually one way, and on any time scale, of plants or animals from their point of origin to another location where they subsequently produce offspring.
dispersed recreation	Recreation that occurs outside of developed sites in the unroaded and roaded environment (*e.g.*, hunting, backpacking, and berry picking).
downgradient	A direction characterized by lower fluid potential or hydraulic head.
drift	A nearly horizontal mine passageway driven on or parallel to the course of a vein or rock stratum.
drill seeding	A mechanical method for planting seed in soil.
drilling	To bore or drive a hole in.
edge effects	The boundary, or interface, between two biological communities or between different landscape elements. Edges exist, for instance, where older forested patches border newly harvested units. The intensity of edge microclimatic gradients, or the edge contrast, depends on how sharply the two adjacent habitats differ. Edge effects, broadly defined, are the influences of one patch type on a neighboring patch type. Edge effects on organisms are both positive and negative; they cause some species to increase and others to decrease.
effective old growth	Old growth that not only meets all the age and size class requirements along with typical habitat components such as snags and dead and down logs, but also is large enough or with appropriate shape to allow species dependent on forest interiors to flourish. This is a subjective term with many variables, particularly with regards to the wildlife or plant species affected. Also see old growth areas managed by the KNF Forest Plan.
effluent	Waste water discharge.
embeddedness	The degree to which rocks are covered up by the substrate material (sand, clay, silt, etc.).
endangered	Any species, plant or animal that is in danger of extinction throughout all or a significant portion of its range. Endangered species are identified by the Secretary of the Interior in accordance with the 1973 Endangered Species Act.
ephemeral stream	A stream that flows only as a direct response to rainfall or snowmelt events; having no baseflow from groundwater.
evaporation	The physical separation of a liquid from a dissolved or suspended solid. Energy is applied to the system to volatize the liquid leaving the solids behind.
evapotranspiration	The water lost from an area through the combined effects of evaporation from the ground surface and transpiration from the vegetation.

face	The part of an adit or mine that is actively being excavated; the end of the adit being excavated.
facies	A distinctive group of characteristics within part of a rock body (such as composition, grain size, or fossil assemblages) that differ as a group from those found elsewhere in the same rock unit.
factor-of-safety	Forces causing sliding divided by forces resisting sliding; for example, at a factor-of-safety of 1.0, the forces causing sliding are the same as those resisting sliding.
fault	A fracture or fracture zone where there has been displacement of the sides relative to one another.
flotation	A mineral recovery process where individual mineral grains are selectively floated and skimmed off the top of an agitated water/chemical bath.
forb	Any herbaceous plant, usually broadleaved, that is not a grass or grass-like plant.
fragmentation	Process of reducing size and connectivity of stands that comprise a forest. In more general terms, fragmentation can refer to the state of two or more similar habitat locations separated by a land use or type that is incompatible with the species in question's ability to traverse it.
freeboard	The height above the recorded high-water mark of a structure (as a dam) associated with the water.
genus	A group of related species used in the classification of organisms (plural = genera).
glacial moraine	Mounds and ridges of broken rock and soil particles deposited by glacial action.
glaciofluvial	Pertaining to the meltwater streams flowing from wasting glacier ice and especially to the deposits and landforms produced by such streams.
glaciolacustrine	Refers to sediments or processes involving a lake that received meltwater from glacial ice.
granodiorite	A rock roughly equivalent to granite, which is formed deep within the earth at high temperatures and pressures.
gangue	The commercially worthless mineral matter associated with economically valuable metallic minerals in a deposit.
habitat displacement	The avoidance or reduction in use of suitable habitat due to disturbance from human activities.
habitat effectiveness	The ability of the habitat to be used to its fullest extent for the biological needs of a given species. Habitat effectiveness can be reduced by several factors, such as disturbance or proximity of inappropriate habitat, which may reduce the use of some of the area even though all the necessary habitat components are present.
habituate	Become accustomed to.
hardness	A measure of the amount of calcium, magnesium, and iron dissolved in the water.
harmful parameters	Parameters listed as harmful in DEQ Circular WQB-7.

Hard Rock Mining Impact Plan	An impact plan that identifies the local government services and facilities that will be needed as a result of the mineral development. The developer of each proposed new large-scale hard rock mine in Montana is required to prepare an impact plan.
heavy metals	Metallic elements with high molecular weights, generally toxic in low concentrations to plants and animals.
home range	An area in which an individual animal spends most of its time doing normal activities.
hydraulic conductivity	A measure of the ease with which water moves through soil or rock; permeability.
hydric soil	A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic (waterloving) vegetation. Hydric soils that occur in areas having positive indicators of hydrophytic vegetation and wetland hydrology are wetland soils.
hydrophytic	A plant that grows either partly or totally submerged in water.
hydrostratigraphic	A body of rock having considerable lateral extent and composing a geologic framework for a reasonably distinct hydrologic system.
indicator species	Species of fish, wildlife, or plants which reflect ecological changes. Forest Service has identified animal species that are used to monitor the effects of planned management activities on viable populations of wildlife and fish. The indicator species for the KNF are: grizzly bear, gray wolf, bald eagle, peregrine falcon, elk, white-tailed deer, mountain goat, and pileated woodpecker.
interfinger (intertongue(ing))	A boundary that forms distinctive wedges, fingers or tongues between two different rock types
interim reclamation	Reclamation conducted during operations to reduce erosion, sedimentation, noxious weed invasion, and visual impacts. The reclamation may or may not be redisturbed at mine closure.
intermittent stored service	A Forest Service designation for roads that are closed to motorized traffic and pose little risk when not maintained; typically require some work to return them to a drivable condition.
intermittent stream	A stream that flows for several weeks or months in response to precipitation; the source is direct runoff and groundwater discharge.
intervisible	Mutually visible, or in sight, the one from the other, as stations.
intervisible turnout	An area designed to allow vehicles to pass and so spaced to provide visibility between the turnouts.
inventoried roadless area	Areas identified in a set of inventoried roadless area maps, contained in the Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000, and any subsequent update or revision of those maps through the land management planning process.
joint	Fracture in rock, generally more or less vertical or transverse.
kilovolt	One kilovolt equals 1,000 volts
kilowatt	One kilowatt equals 1,000 watts
kilowatt-hour	One kilowatt of power supplied to or taken from an electrical circuit for one hour

land application disposal	A method of disposing of waste water that relies on sprinkler application over a large area and/or percolation ponds. Disposed water may evaporate, be used by vegetation, or infiltrate to the groundwater system.
leachate	A solution obtained by leaching, as in the downward percolation of water through tailings materials, and containing soluble substances.
liquefaction	When an earthquake occurs, energy released by rupturing in the earth's crust causes cyclic waves to travel through the rock and soil mass. Saturated soils can then experience enough pressure between the individual grains that the soil loses its cohesion (shear strength) and behaves as a liquid.
lithologic (lithology)	The character of a rock formation.
loading	Pertaining to the contribution of material or chemicals to a receiving stream.
loess	Wind blown soil deposits.
long term	A period greater than the life of the mine (*i.e.*, post closure).
macroinvertebrate	Small animals without backbones that are visible without a microscope, for example, insects, small crustaceans, and worms.
macrophytes	Plants visible to the unaided eye. In terms of plants found in wetlands, macrophytes are the conspicuous multicellular plants.
mainstem	The primary channel in a stream or river.
make-up water	Additional water required to supplement water lost during the milling process.
management area	Geographic areas, not necessarily contiguous, which have a common set of management requirements set by the KNF Forest Plan requirements and land allocations.
management indicator species	Any species, group of species, or species habitat element selected to focus management attention for the purpose of resource production, population recovery, or ecosystem diversity.
management situations	Areas of grizzly bear or mountain goat habitat that due to their characteristics, have specific Forest Service management goals and directions.
maximum modification VQO	Management activities may be dominant, but appear natural when seen as background.
mean	The average number of a set of values.
median	A numerical value in the midpoint of a range of values with half the value points above and half the points below.
mesic	Intermediate or moderate moisture or temperature; or reference to organisms adapted to moderate climates.
mesothelioma	Form of cancer that is almost always caused by previous exposure to asbestos.
metapopulation	Multiple populations of an organism within an area in which interbreeding could occur, but does not due to geographic barriers.
metasedimentary	A rock type that is composed of formerly small-sized particles (sedimentary, like the grains of sands on lakeshores) that are then exposed to high pressures and temperatures and become compacted into solid stone and are altered chemically.

metric	A value calculated from existing data and used for summarization purposes.
microseismic	A feeble rhythmically and persistently recurring earth tremor.
mitigation	An action to avoid, minimize, reduce, eliminate, replace, or rectify the impact of a management practice.
mixing zone	An area established in a permit or final decision on nondegradation issued by the DEQ where water quality standards may be exceeded, subject to conditions that are imposed by the DEQ and that are consistent with the rules adopted by the Board of Environmental Review and a limited area of a surface water body or a portion of an aquifer, where initial dilution of a discharge takes place and where water quality changes may occur and where certain water quality standards may be exceeded.
modification VQO	Management activities in foreground and middle-ground may be dominant, but appear natural.
montane	Pertaining to mountainous regions.
monzonite	An intermediate igneous intrusive rock composed of about equal amounts of sodic to feldspars
moving windows	A technique for measuring road densities on a landscape using a computerized Geographic Information System (GIS). The results are displayed as a percent of the analysis area in relevant route density classes.
mucking	To move or load muck.
mycorrhizae	Fungus root and the association, usually symbiotic, of specific fungi with the roots of higher plants.
nitrification/denitrification	A biological process for the conversion of ammonia compounds to nitrogen gas. The process is carried out in two steps. In the first step, nitrification, the ammonia compound is aerobically converted to nitrate by bacteria. In the second step, denitrification, nitrate is aerobically converted to nitrogen gas.
noxious weed	Any exotic plant species established or that may be introduced in the state that may render land unfit for agriculture, forestry, livestock, wildlife, or other beneficial uses or that may harm native plant communities.
old growth areas managed by the KFP	Areas are managed as MA 13. The goal of MA 13 is to maintain 10 percent on National Forest System lands below 5,500 feet within a major drainage in old growth condition. The KFP direction is to provide a diversity of types of old growth units located throughout a drainage, ranging in size from 100 to 1,200 acres, with occasional units as small as 50 acres. Also see effective old growth.
old growth dependent species	Those species that can only survive in old growth habitats, or that need old growth for some critical portion of their life cycle.

old growth ecosystems	Old growth ecosystems can be defined by elements of structure, function, and composition. Structure includes large live and dead old-growth trees, and fallen dead trees on land and in streams. Function refers to the mechanisms and rates of ecological processes, including high primary productivity (photosynthesis), high respiratory rates relative to younger stands, a shifting-mosaic steady state of living biomass, and large accumulations of dead organic matter. Composition refers to the species of plants and animals present in old growth ecosystems, including old growth dependent or associated species.
ore	A naturally occurring mineral containing a valuable constituent for which it is mined and worked.
overburden	Geologic material of any nature that overlies a deposit of ore or coal.
palustrine system wetland	Palustrine system wetlands are traditionally called marshes, swamps, bogs, or fens. They include all non-tidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 percent.
partial retention VQO	Management activities remain visually subordinate.
patio	The level area immediately outside the adit portal, built of fill to provide a work area, and access to the mine area.
peak flow	The greatest attained water flow in a specified period of time.
perennial stream	A stream that flows from source to mouth throughout the year; the source is groundwater and surface runoff.
periphyton	Organisms (as some algae) that live attached to underwater surfaces.
permeable	Allowing the passage of fluids.
phreatic surface	The boundary between saturated and unsaturated soil zone in an aquifer.
physiography	A branch of geography that deals with the exterior features and changes of the earth.
piezometer	A small well used to locate the groundwater surface.
pillar	A column of rock retained for structural support in a mine.
piping	Creation of tunnels or cavities from the movement of water in soil.
planning sub-unit	An analysis area based on watersheds to be used for certain wildlife species in the Forest Plan and NEPA analysis.
planning unit	A geographic area based on sub-basins or fourth level hydrologic units, as recognized by the U.S. Geological Survey, used by the Forest Service for natural resources planning.
Pleistocene	The first epoch of the Quaternary Period in the Cenozoic Era with respect to the age of the earth. Characterized by the spreading and recession of the ice sheets, and by the appearance of modern man.
pluton	A body of intrusive igneous rock that crystallized from magma slowly cooling below the Earth's surface
population	A collection of individuals that share a common gene pool. In this document, local population refers to those breeding individuals within the analysis area.

portal	Surface entrance to a mine, particularly to a tunnel or adit.
potentiometric surface	An imaginary surface representing the total head of groundwater in a confined (often bedrock) aquifer that is defined by the level to which water will rise in a well.
Precambrian	All rocks formed before Cambrian time.
preservation VQO	Only ecological or minimal changes permitted.
probable maximum flood	The flood resulting from Probable Maximum Precipitation; the largest flood event theoretically possible.
proposed species	Any species of fish, wildlife, or plant that is proposed by the Secretary of the Interior in the Federal Register to be listed under Section 4 of the Endangered Species Act.
quartzite	A rock that has formed as a result of the hardening of sediments by pressure and heat. A granular metamorphic rock consisting essentially of sand-sized particles and quartz.
rain-on-snow event	A meteorological occurrence in the months of December through February during which the heat contained in rainfall melts the existing snow cover producing large amounts of runoff and high streamflow in a short time frame.
raise	A vertical underground tunnel.
raise	Incremental increases in the height of a dam.
reach	An extended portion of river with uniform characteristics.
reagents	A substance used (as in detecting or measuring a component, in preparing a product, or in developing photographs) because of its chemical or biological activity.
reclamation	The concept of reclamation of land has been defined as including all desirable and practical methods for: (a) designing and conducting a surface disturbance in a manner that minimizes the effect of the disturbance and enhances the reclamation potential of the disturbed lands; (b) handling surficial material in a manner that ensures a root zone that is conducive to the support of plant growth where required for future use; and contouring the surface to minimize hazardous conditions, to ensure stability, and to protect the surface against wind or water erosion.
redd	A fish spawning nest.
regeneration	Regrowth of a tree crop, or other vegetation, whether by natural or artificial means.
regeneration harvest	Removal of an existing stand to prepare the site for regeneration. Clearcut, shelterwood and seed tree harvests are examples of regeneration treatments.
replacement old growth	Older age class stands that have some of the characteristics of old growth but not all of them. Used for stands that are managed as old growth in compartments that lack the minimum amount of old growth.
reporting values	Values listed as reporting values in DEQ Circular WQB-7, and are the detection levels that must be achieved in reporting ambient monitoring results to the department unless otherwise specified in a permit, approval or authorization issued by DEQ.

resistivity	The thermal resistance of unit area of a material of unit thickness to heat flow caused by a temperature difference across the material. (m^2K/W)
retention VQO	Management activities are not visually evident to the casual observer.
riparian	Areas with distinct resource values and characteristics that are comprised of an aquatic ecosystem, and adjacent upland areas that have direct relationships with the aquatic system. This includes floodplains, wetlands, and lake shores.
ripped	To tear, split apart, or open.
riprap	A foundation or sustaining wall of stones or chunks of concrete thrown together without order to prevent erosion.
rock fragment	Rock that is larger than 2 millimeters (about 1/16 inch) in diameter.
salmonid	Member of the fish family Salmonidae; includes salmon and trout.
scree	An accumulation of broken rock fragments lying on a slope or at the base of a hill or cliff.
sedge	A grass-like plant, often associated with moist or wet environments.
seepage collection system	The system of drains, ponds, and pumps to collect and return tailings dam embankment seepage.
segregation	The separation of water from sources of contamination in a mine.
seismic	Of, or produced by, earthquakes.
sensitive species	Those species, plant and animal identified by the Regional Forester for which population viability is a concern, as evidenced by: 1) significant current or predicted downwards trend in population numbers or density or 2) significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.
short term	A period of time less than 35 (*i.e.*, operational period).
side slope	The slope of an embankment or waste dump.
siltite	A hard, metamorphic rock, intermediate between shale and slate, was originally silts.
slurry	A mixture of fine-grained solid material and water used to allow pumping as a way to transport the solid material over long distances.
soil erodibility	A measure of the inherent susceptibility of a soil to erosion, without regard to topography, vegetation cover, management, or weather conditions.
sorb	Remove solutes from the fluid phase and concentrate them on the solid phase of a medium either by absorption or adsorption.
stability	The ability of a population to remain at about the same population size over time through stable natality and mortality rates.
stem exclusion structural stage	Habitat where trees initially grow fast and quickly occupy all of the growing space, creating a closed canopy. Because little light reaches the forest floor, many understory plants grow more slowly or become dormant and species requiring full sunlight die.

starter dam	Earthen dams built of borrow material to initiate construction of the tailings impoundment.
stope	Step-like underground excavation for removal of ore in successive layers.
stratabound	A mineral deposit confined to a single stratigraphic unit.
stratigraphy	The arrangement of strata.
stratum	A section of a formation that consists of primarily the same rock type.
stream order	A method of numbering streams as part of a drainage basin network. The smallest unbranched tributary is a first order stream, the stream receiving that tributary is a second order stream, and so on, with the main stream always of the highest order.
subpopulation	A well-defined set of interacting individuals that comprise a portion of a larger, interbreeding population.
subsidence	The sudden sinking or gradual downward settling of the earth's surface with little or no horizontal motion.
sustainability	The ability of a population to maintain a relatively stable population size over time.
syncline	A sharply arched fold of stratified rock from whose central axis the strata slope upward in opposite directions: opposed to anticline.
tackifier	An agent that binds seed, fertilizer, and mulch to a site, often used when seeding slopes.
taxon	Any formal taxonomic group such as genus, species, or variety.
Tertiary	The earlier of two geologic periods comprised in the Cenozoic Era, in the classification generally used. Also, the system of strata deposited during that time period.
threatened species	Any species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range, as identified by the Secretary of the Interior.
trigger value	Values listed as trigger values in DEQ Circular WQB-7 for parameters categorized as toxic, and are used to determine if proposed activities will cause degradation
total suspended solids	Undissolved particles suspended in liquid.
toxic parameter	Parameters listed as toxins in DEQ Circular WQB-7
transect	A line, strip, or series of plots from which biological samples, such as vegetation, are taken.
unconsolidated	Loose or soft.
upgradient	A direction characterized by higher fluid potential or hydraulic head.
unroaded area	Lands that are unroaded and are contiguous to inventoried roadless areas (IRAs).
viability	Ability of a population to maintain sufficient size so that it persists over time in spite of normal fluctuations in numbers; usually expressed as a probability of maintaining a specific population for a specific period.
viewshed	The portion of the surrounding landscape that is visible from a single observation point or set of points.

visual absorption level	A classification used in the Forest Service Scenery Management System to denote the relative ability of a landscape to accept human alterations without loss of character of scenic quality.
visual quality objective	A desired level of scenic quality based on physical and sociological characteristics of an area. Refers to the degree of acceptable alterations of the characteristic landscape.
waste rock	Rock that does not contain a valuable constituent at concentrations suitable for mining.
waterbars	A shallow ditch dug across a road at an angle to prevent excessive flow down the road surface and erosion of road surface materials.
waters of the U.S.	Waters that include the following: all interstate waters; intrastate waters used in interstate and/or foreign commerce; tributaries of the above; territorial seas at the cyclical high tide mark; and wetlands adjacent to all the above.
Wetlands	Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.
wetted area	The area at a stream cross section that contains streamflow.

Chapter 8. References

Note: The firm Geomatrix Consultants, Inc. prepared a number of reports on behalf of Mines Management, Inc. and Montanore Minerals Corp. In 2008, AMEC plc acquired Geomatrix Consultants, and after the acquisition, prepared reports with the name AMEC Geomatrix on them. All reports prepared by Geomatrix Consultants or AMEC Geomatrix are cited as Geomatrix to assist in a consistent project record.

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Figures For
Environmental Impact Statement For The Montanore Project

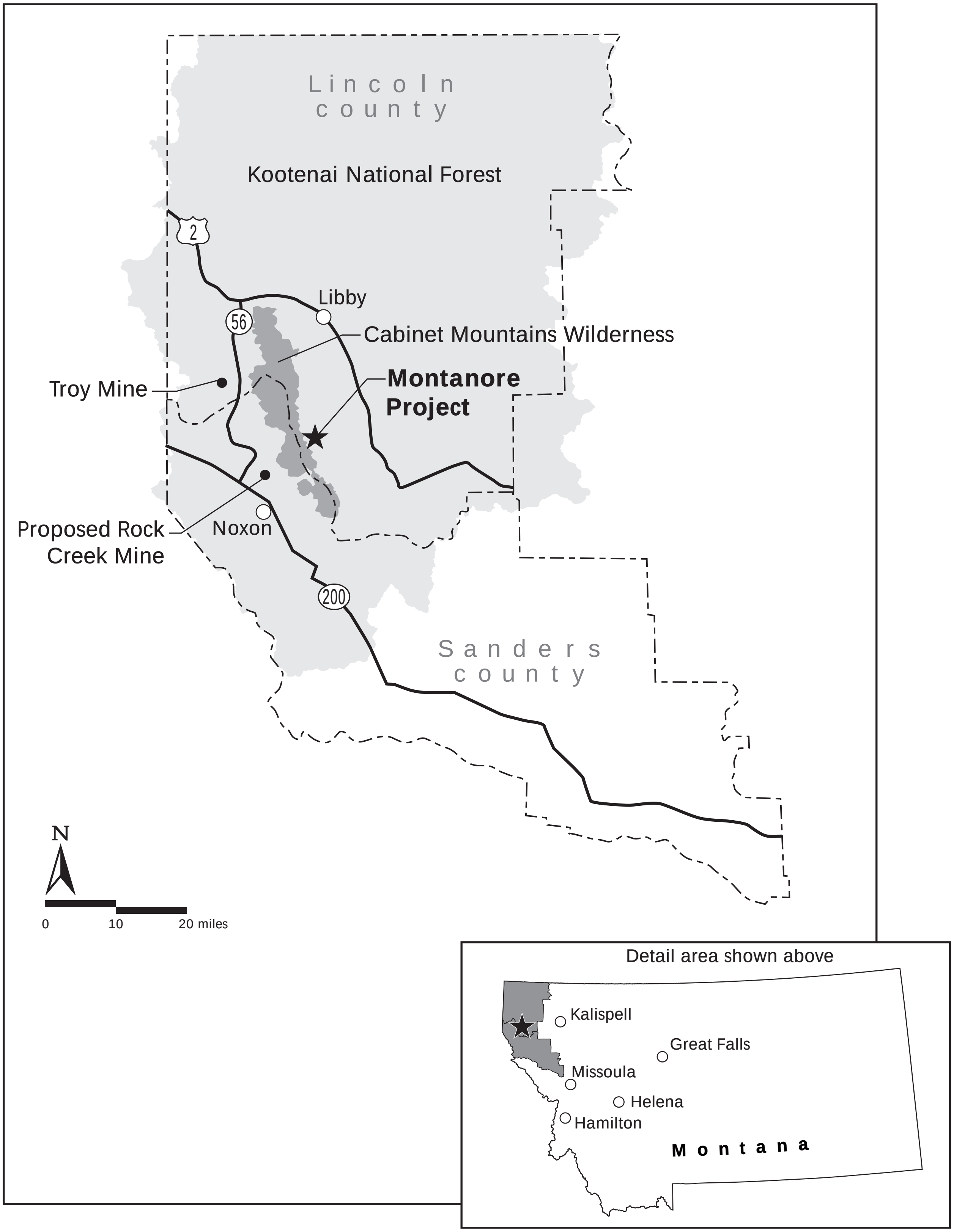


Figure 1. Location Map, Montanore Project, Kootenai National Forest.

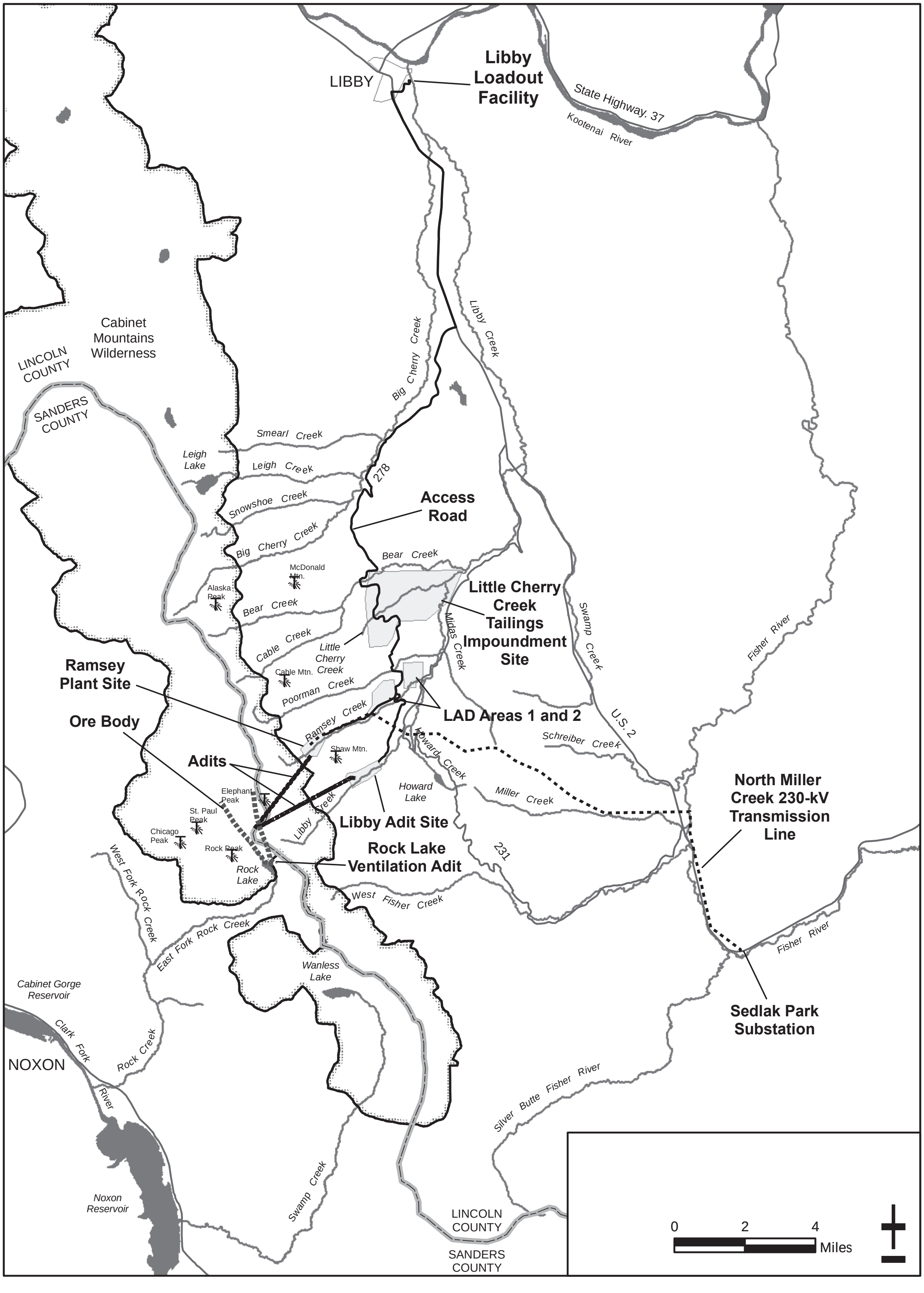


Figure 2. Location of Montanore Project Facilities, Alternative 2

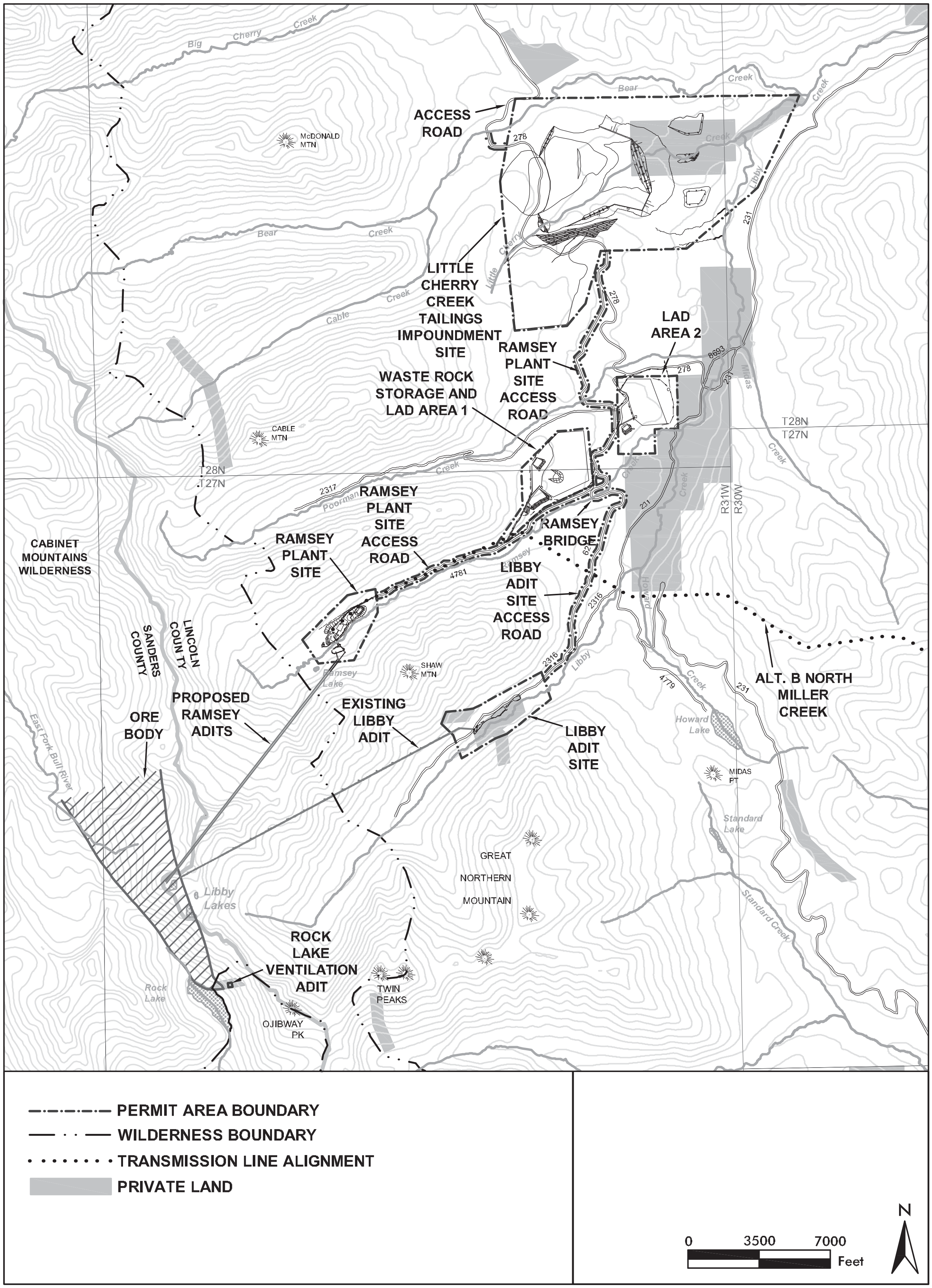


Figure 3. Mine Facilities and Permit Areas, Alternative 2

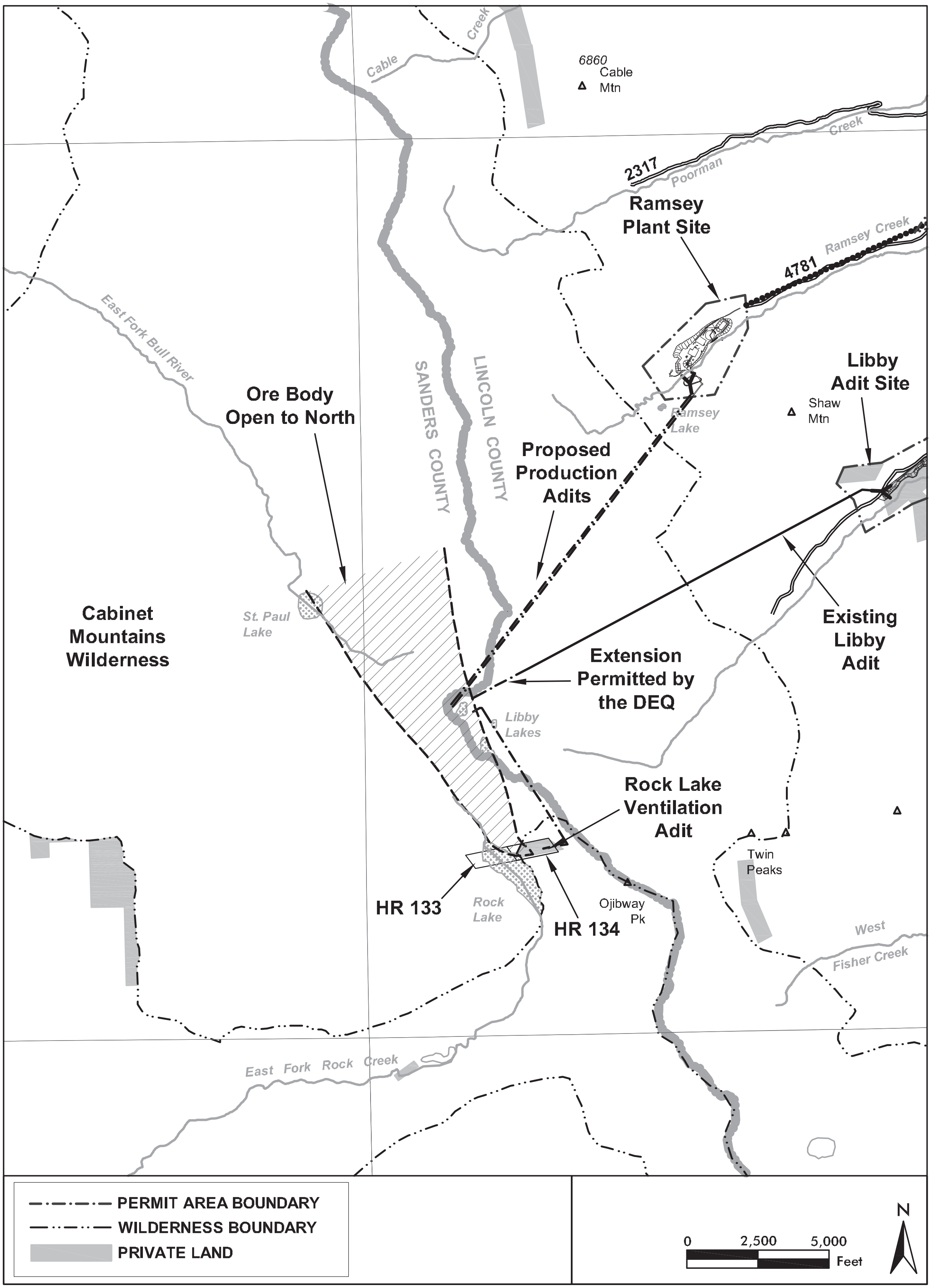


Figure 4. Existing Libby Adit and Proposed Ramsey Adits, Alternative 2

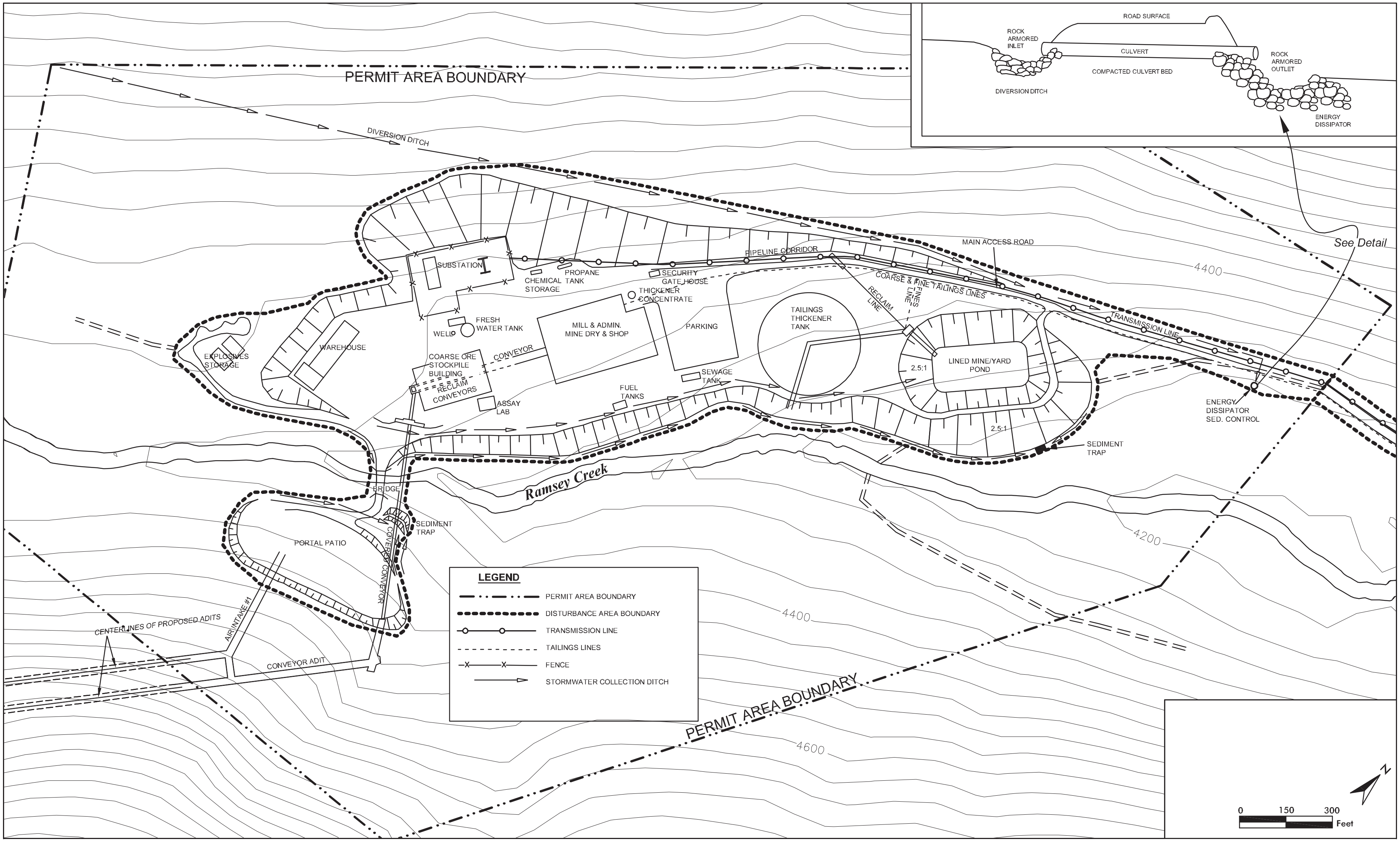


Figure 5. Ramsey Plant Site, Alternative 2

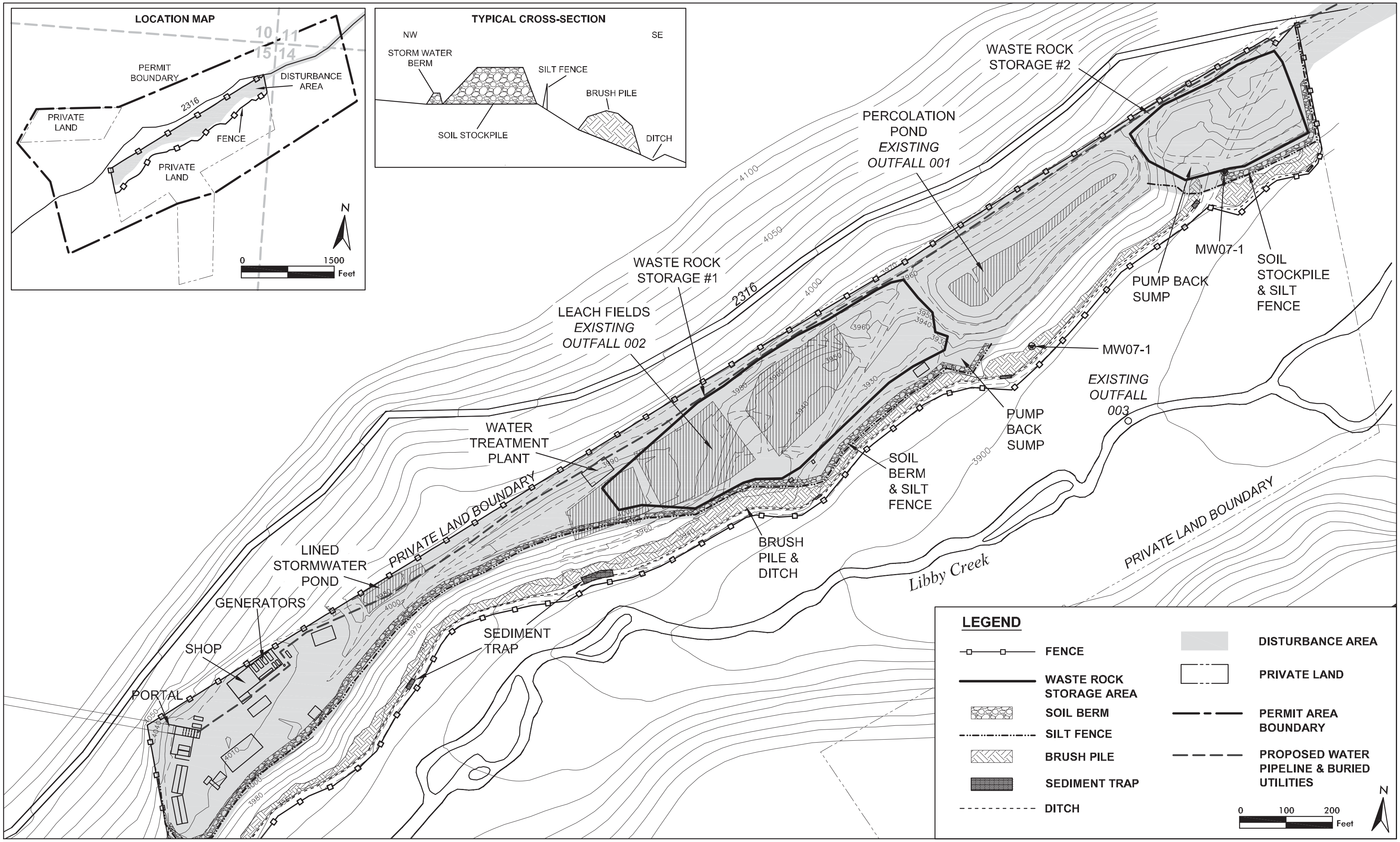


Figure 6. Existing and Proposed Libby Adit Site

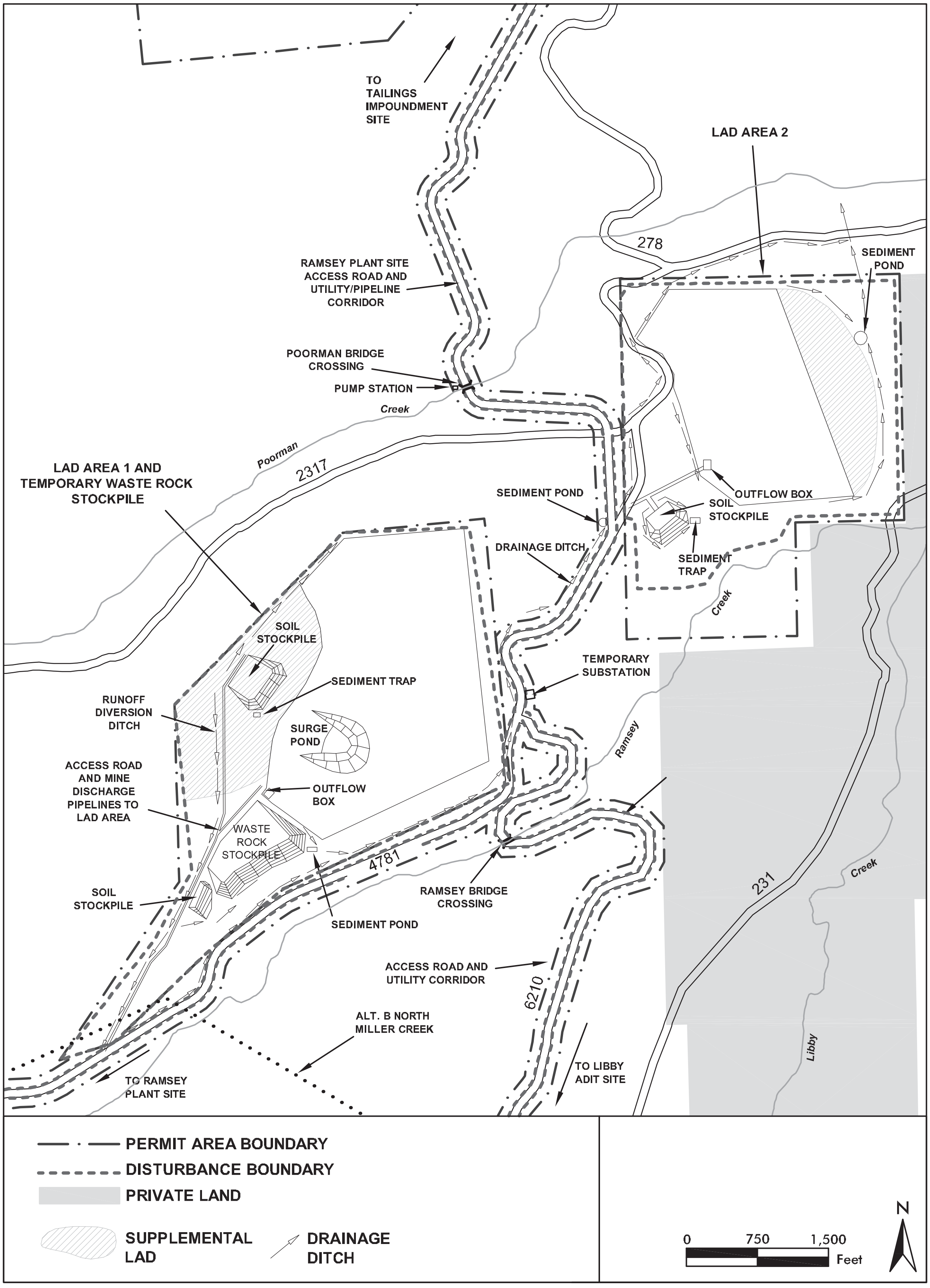


Figure 7. LAD Areas 1 and 2 and Waste Rock Stockpile, Alternative 2

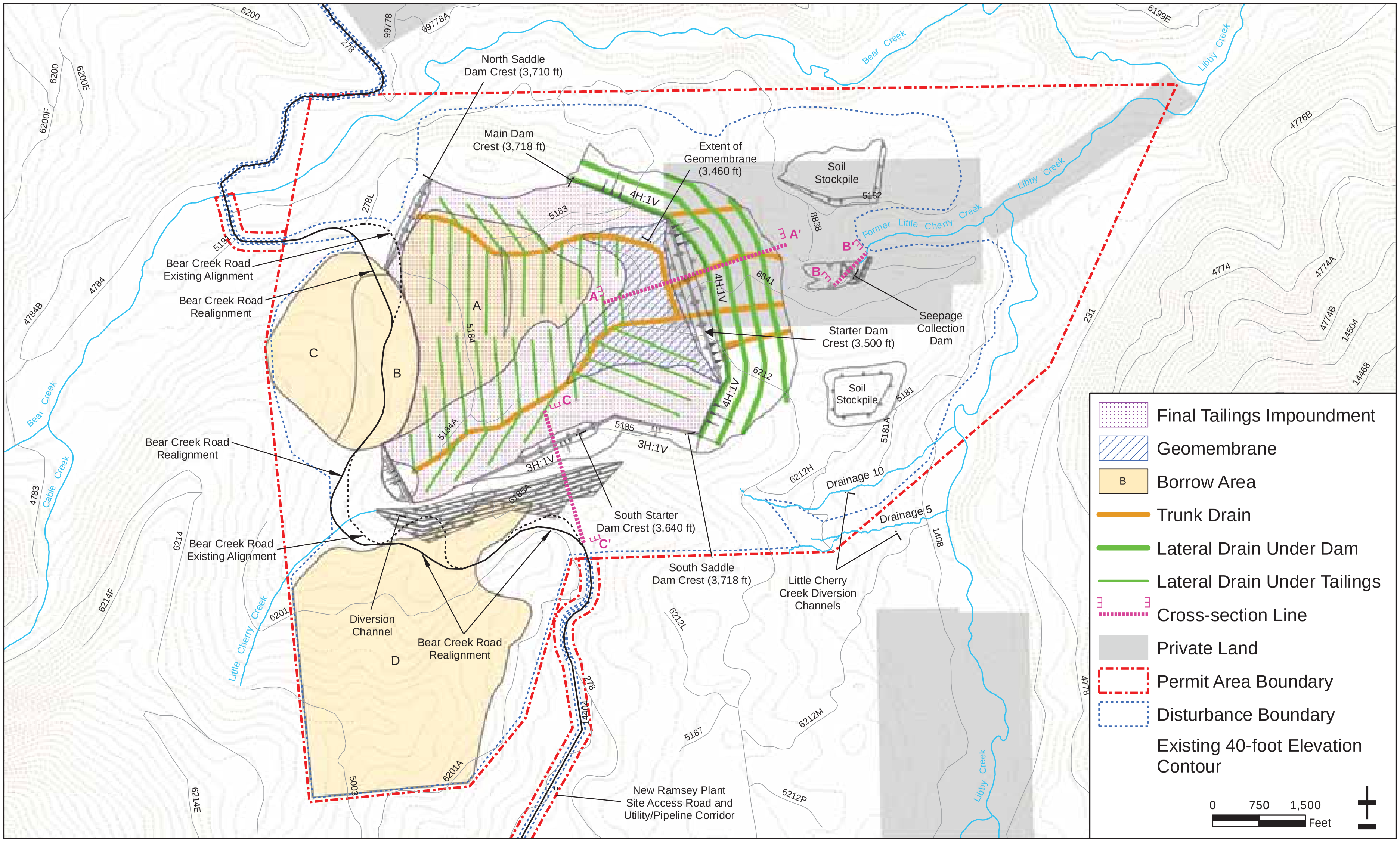
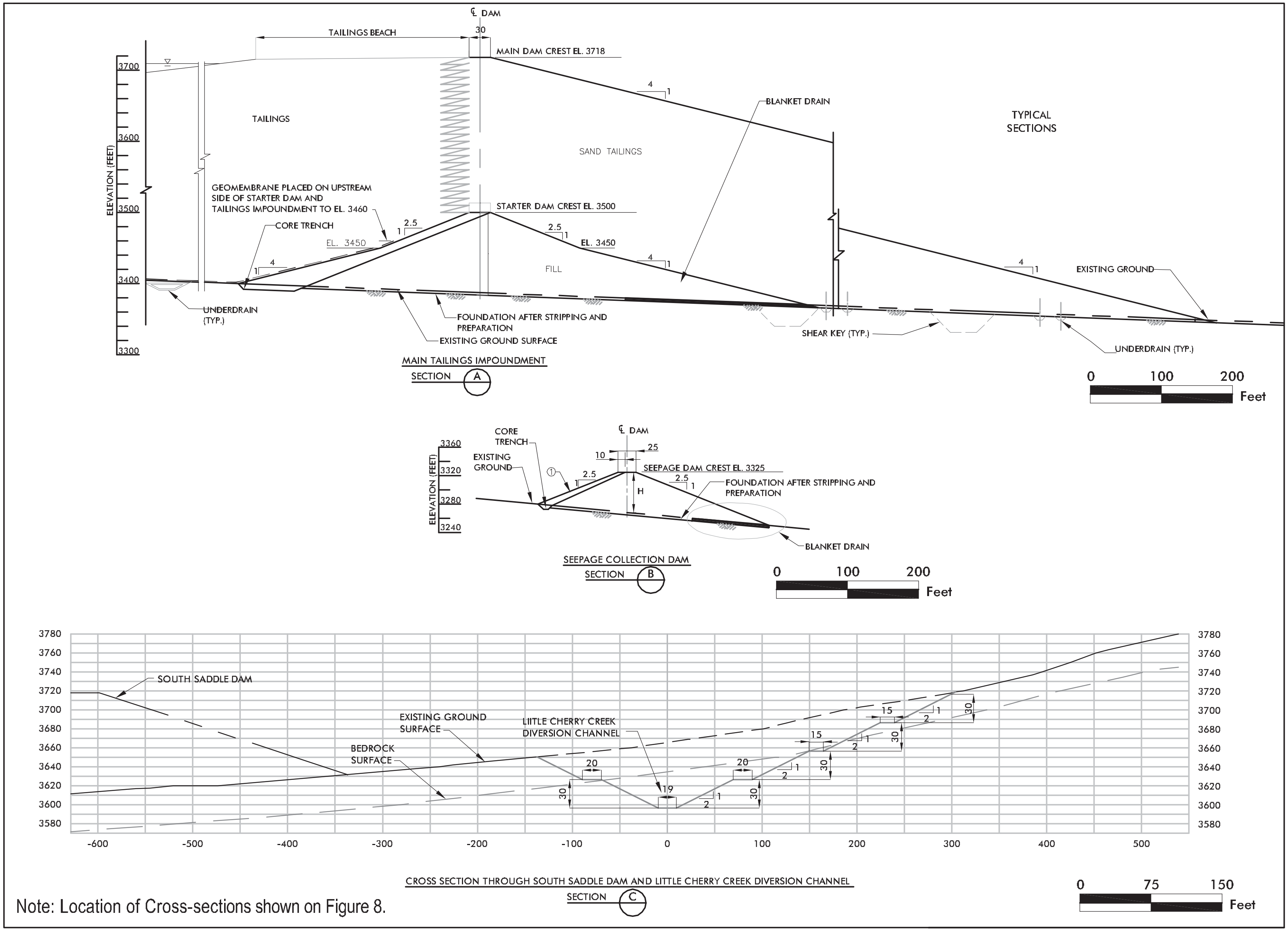


Figure 8. Little Cherry Creek Tailings Impoundment Site, Alternative 2



Note: Location of Cross-sections shown on Figure 8.

Figure 9. Little Cherry Creek Tailings Impoundment Cross Sections

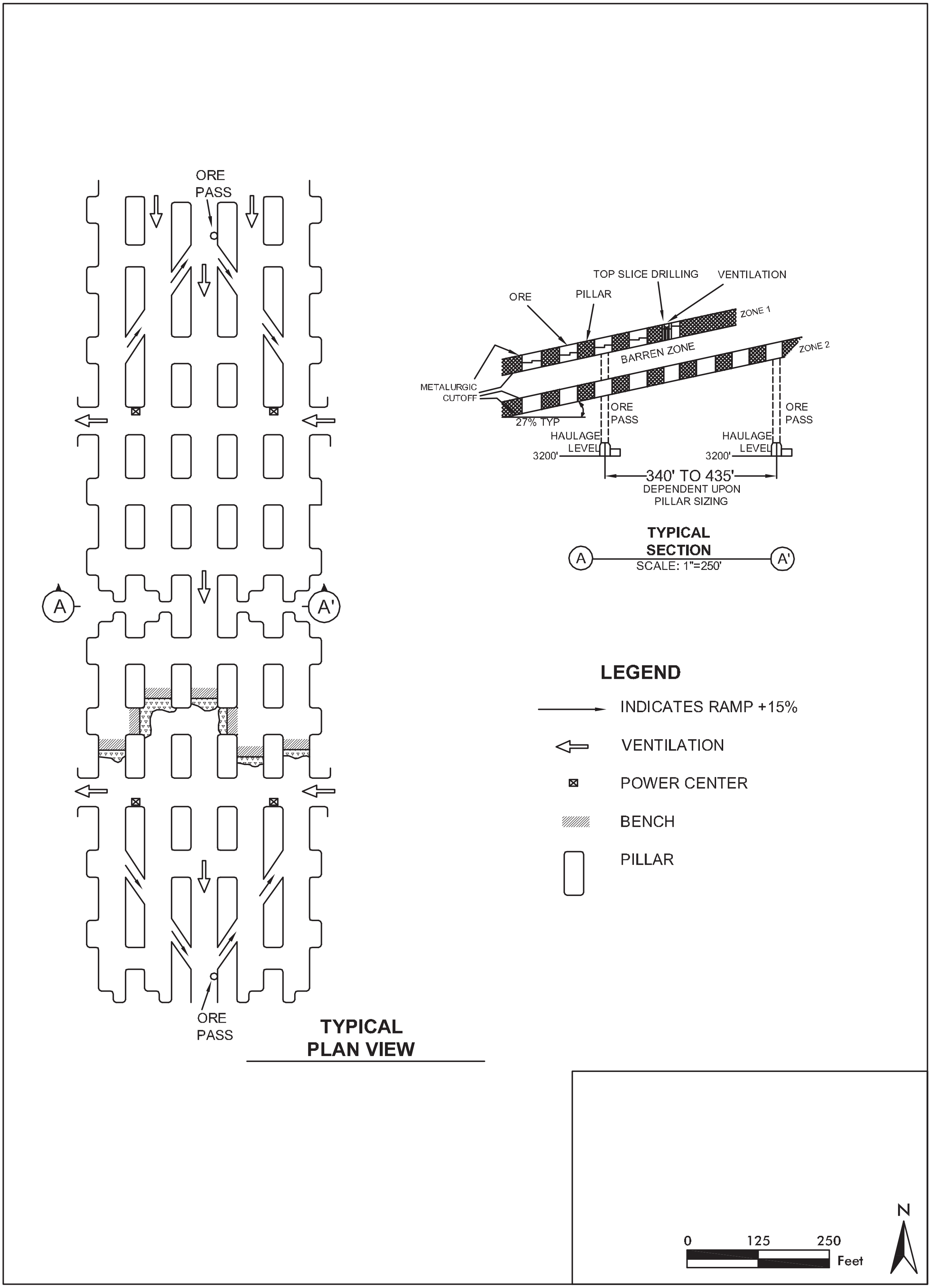


Figure 10. Room and Pillar Mining

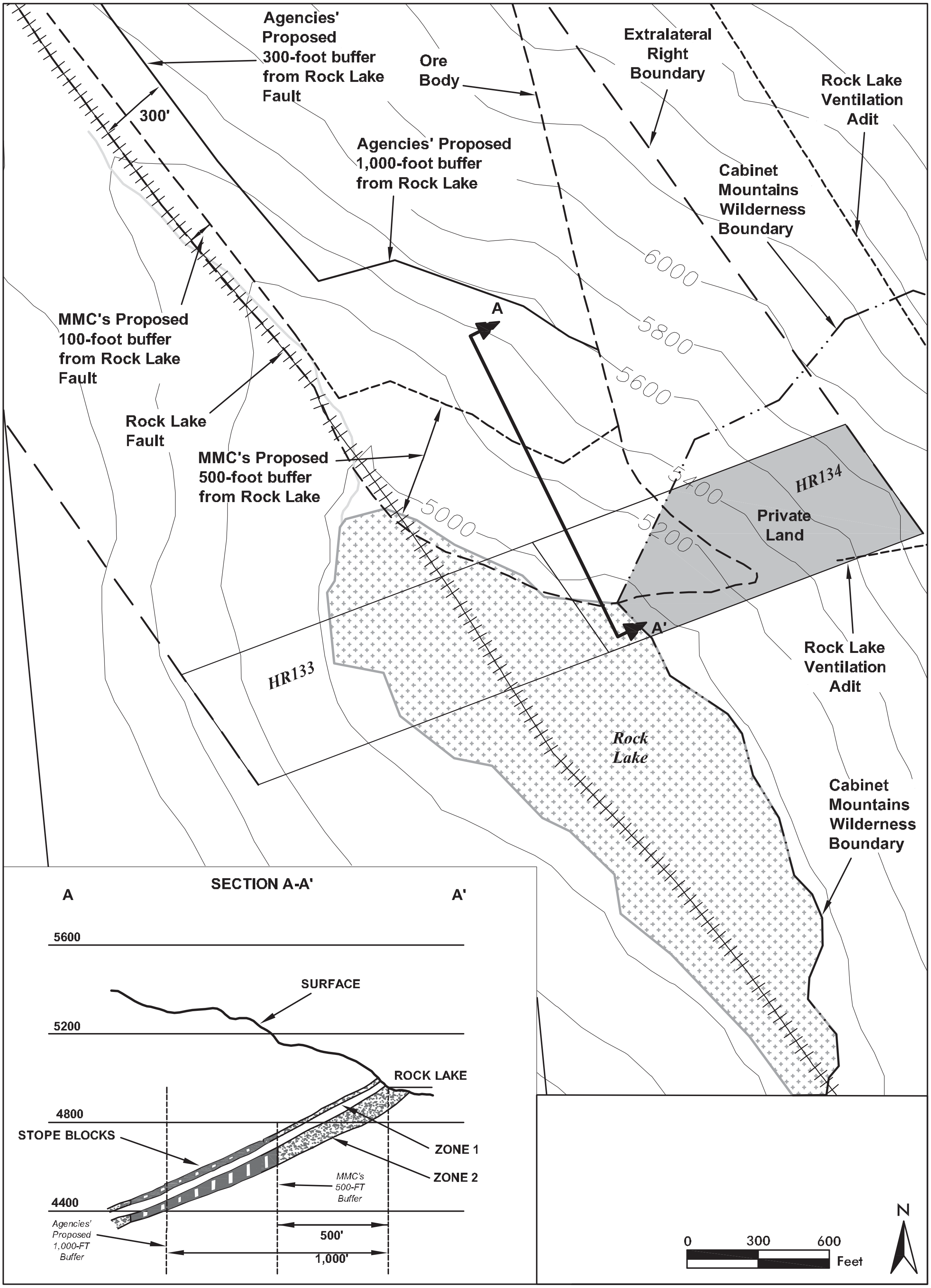


Figure 11. Relationship of the Ore Body to Rock Lake

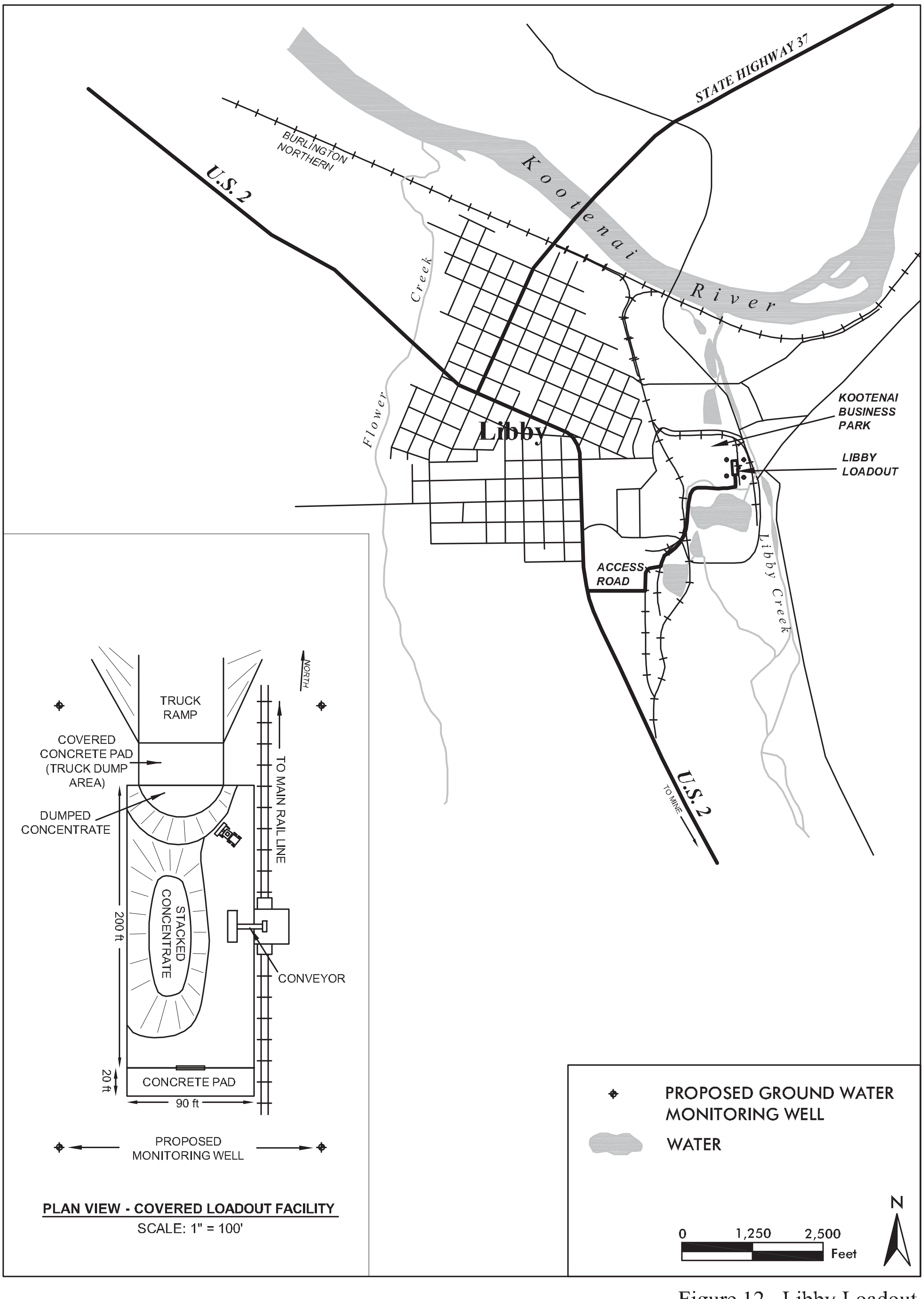


Figure 12. Libby Loadout

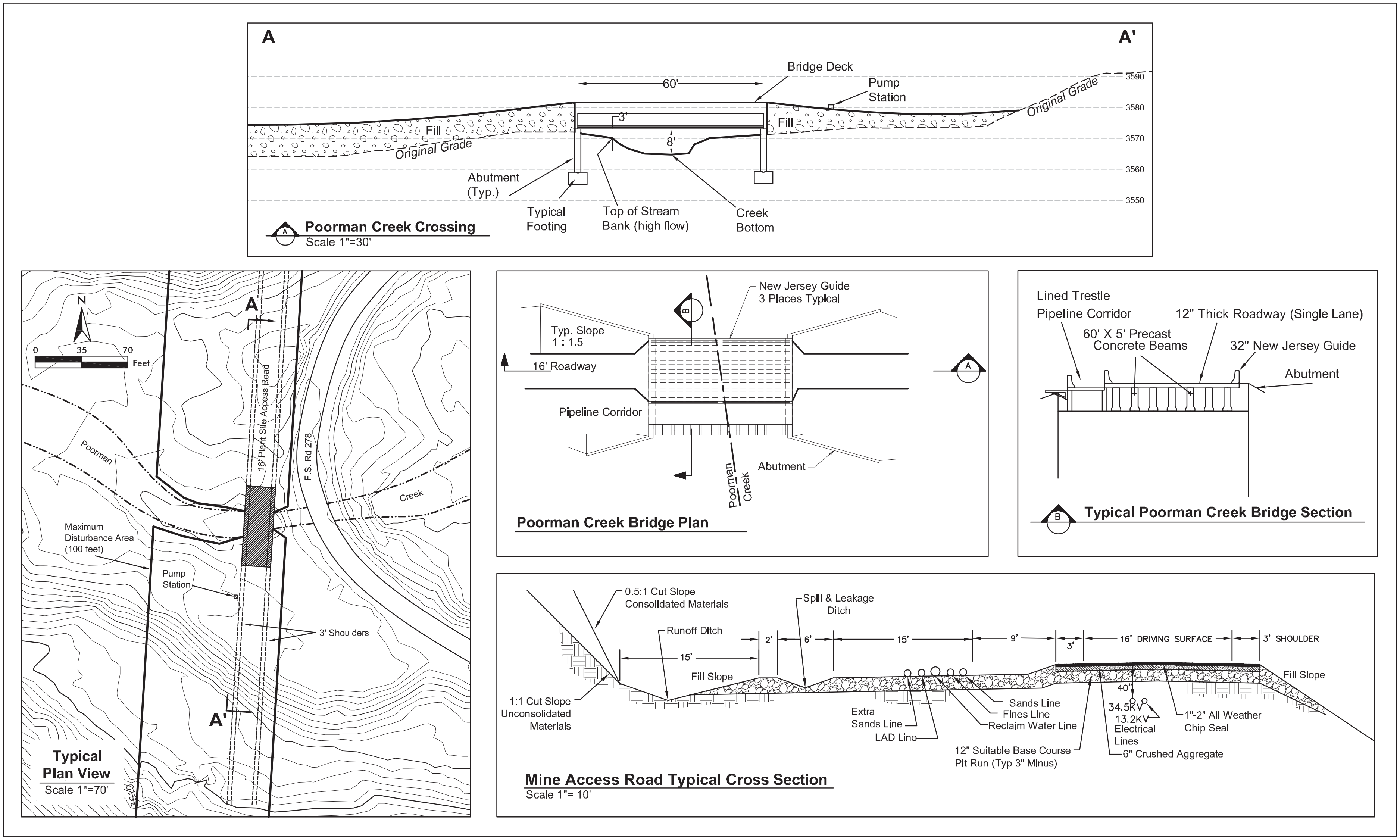


Figure 13. Details of Tailings Pipelines, Utility, and Access Road Corridor, Alternative 3

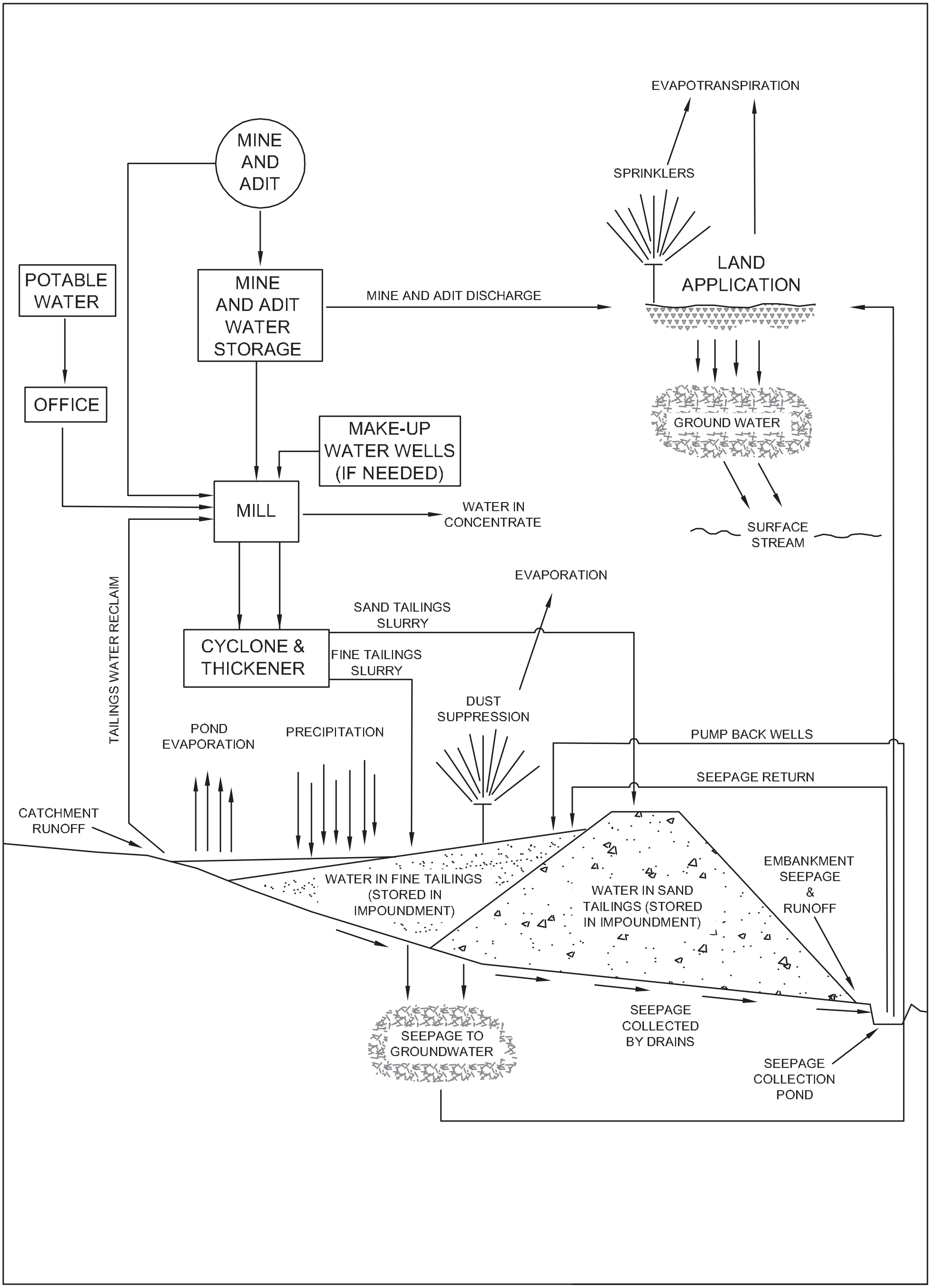


Figure 14. Proposed Water Management, Alternative 2

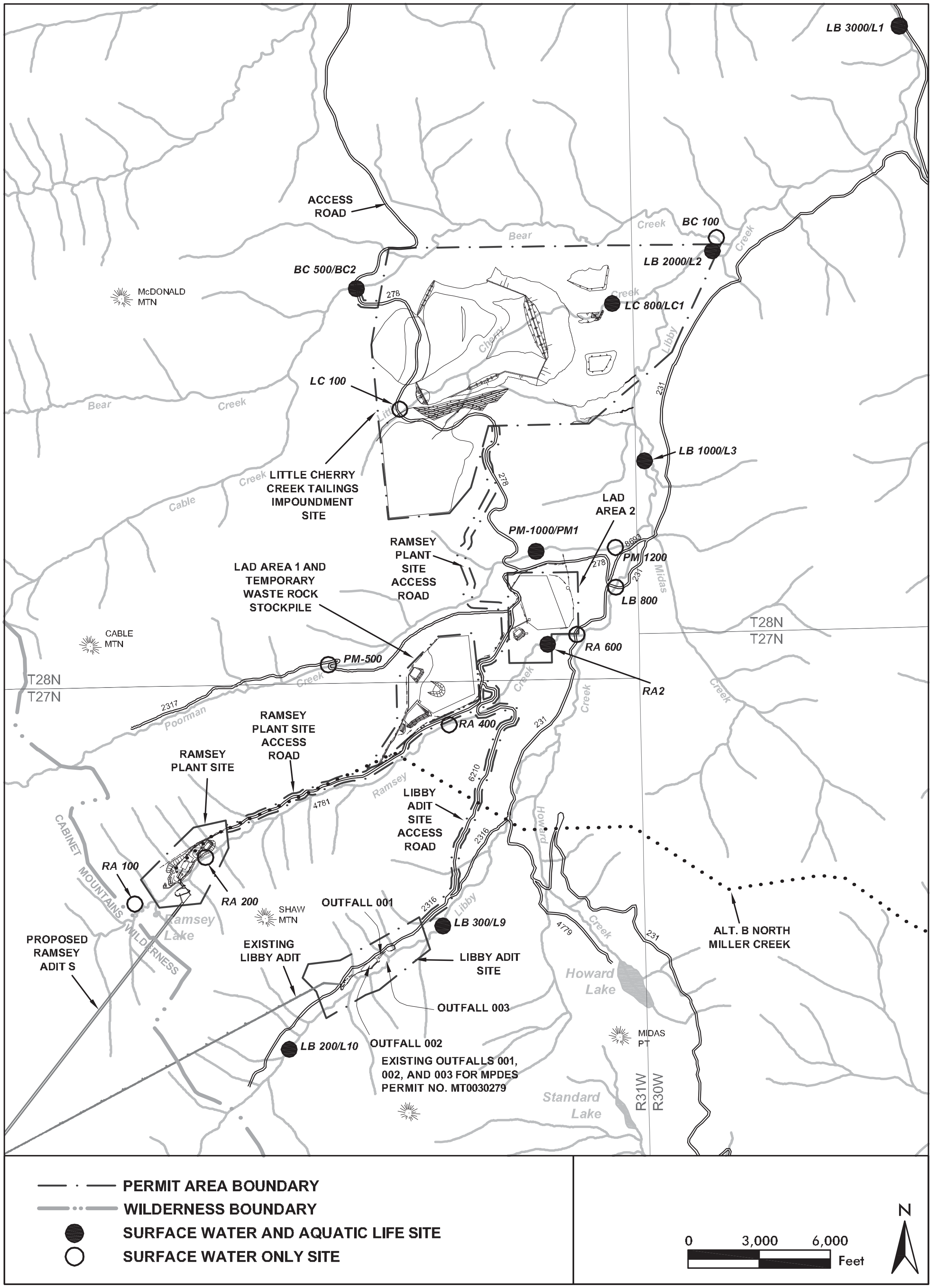


Figure 15. Existing Outfalls and Surface Water Monitoring Locations, Alternative 2

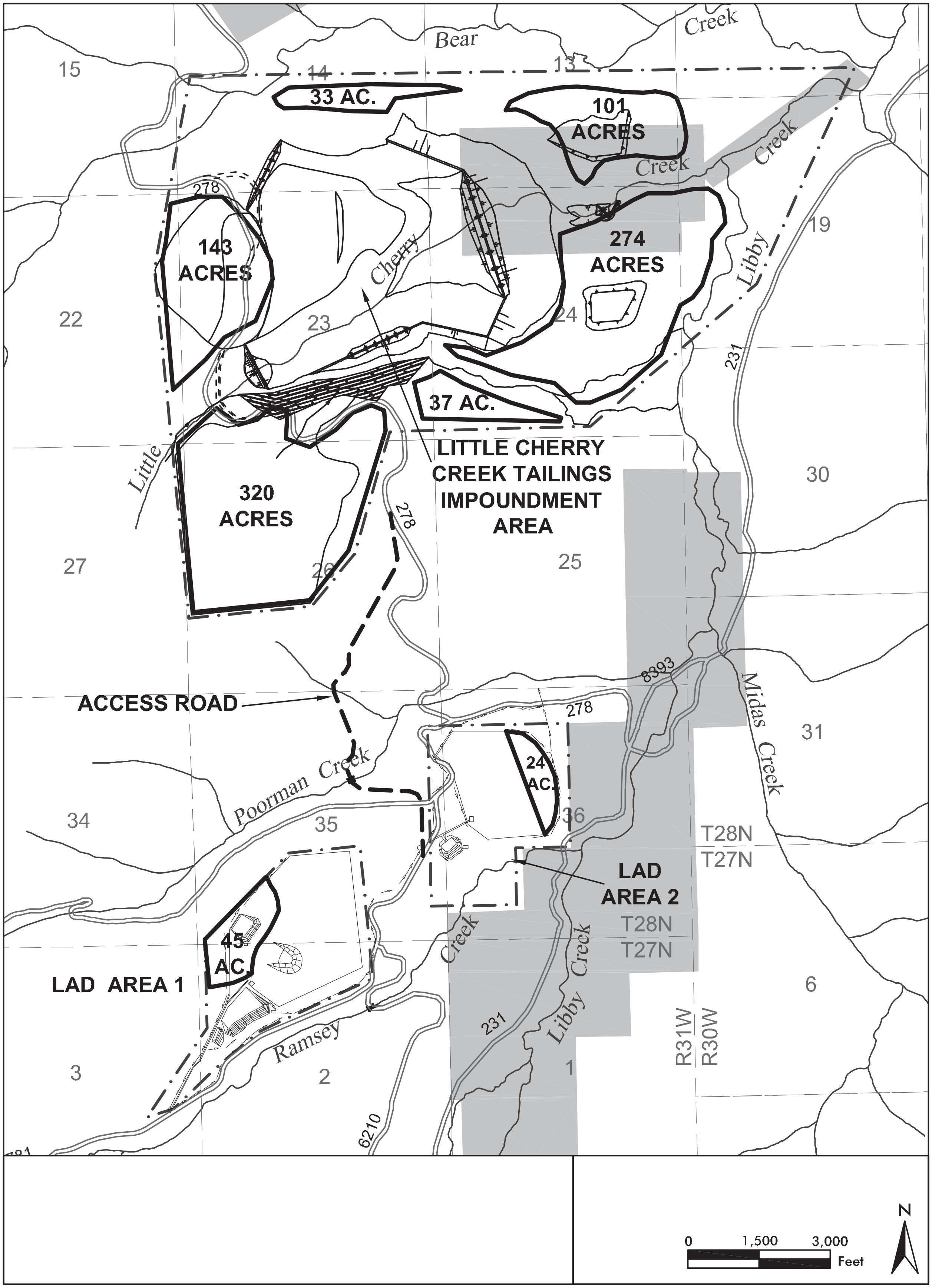


Figure 16. Supplemental LAD Areas, Alternative 2

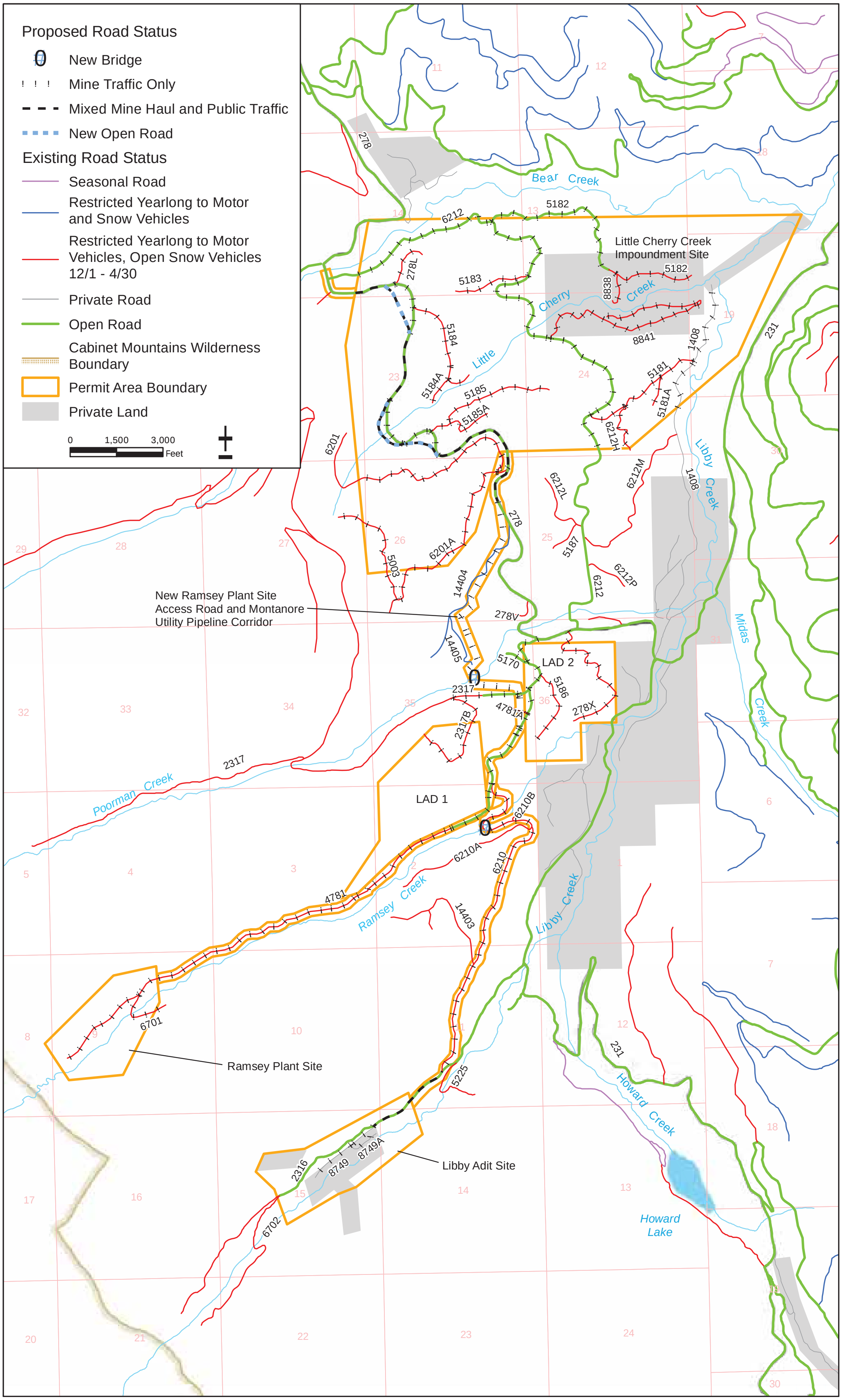


Figure 17. Roads Proposed for Use in Alternative 2

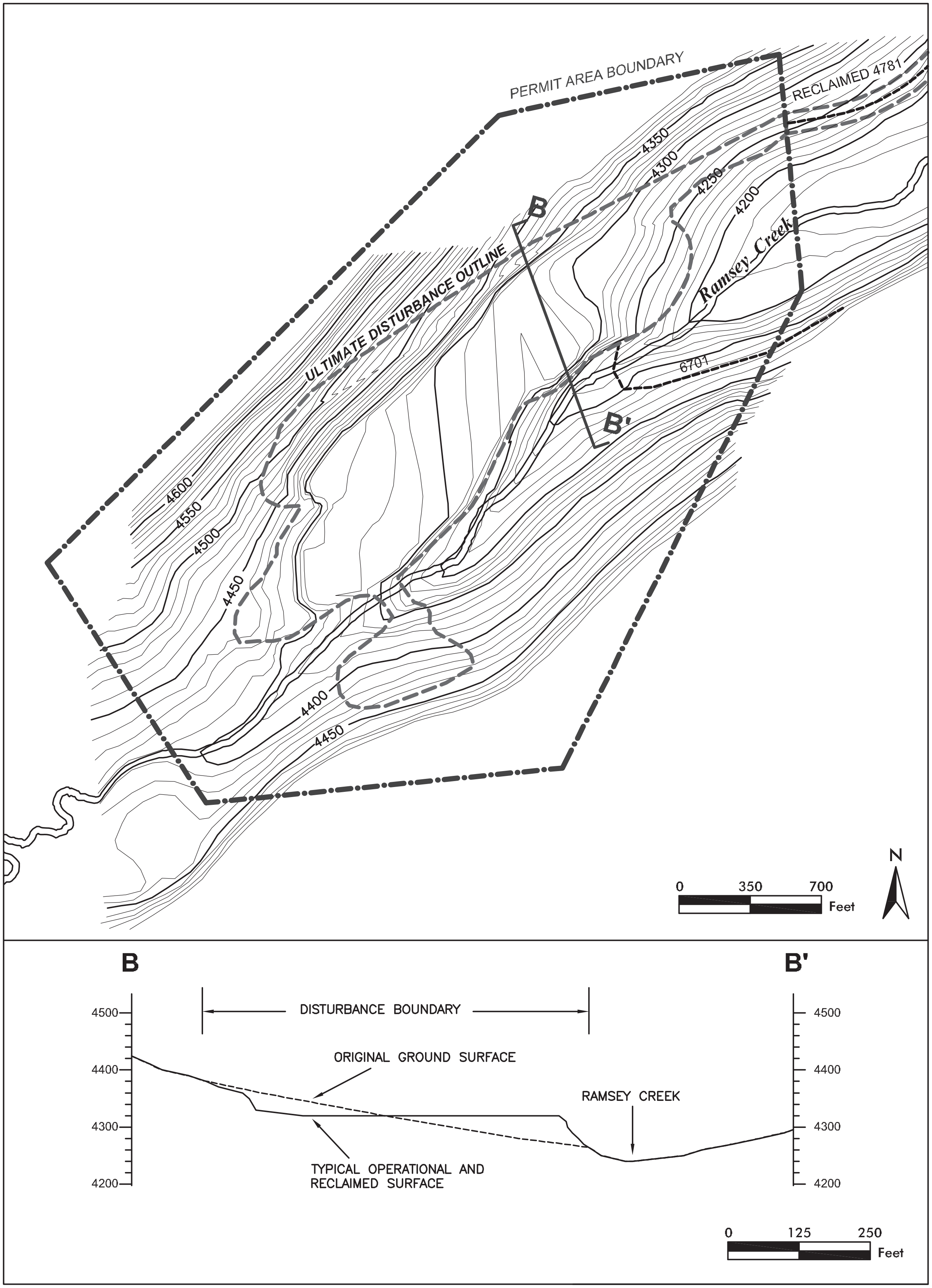


Figure 18. Post-mining Topography, Ramsey Plant Site, Alternative 2

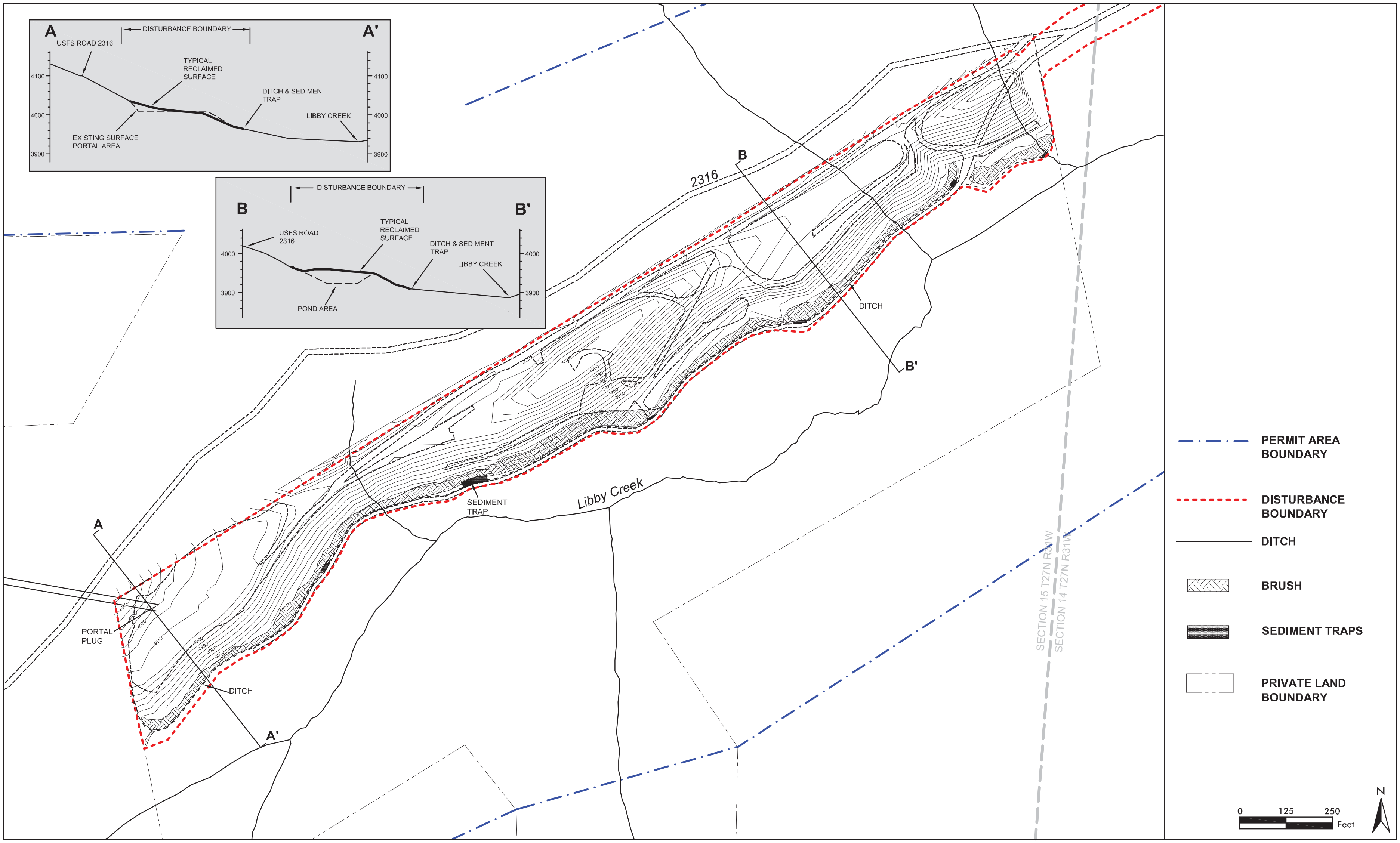


Figure 19. Post-mining Topography, Libby Adit Site

Figure 20. Post-mining Topography, Little Cherry Creek Tailings Impoundment Site, Alternative 2

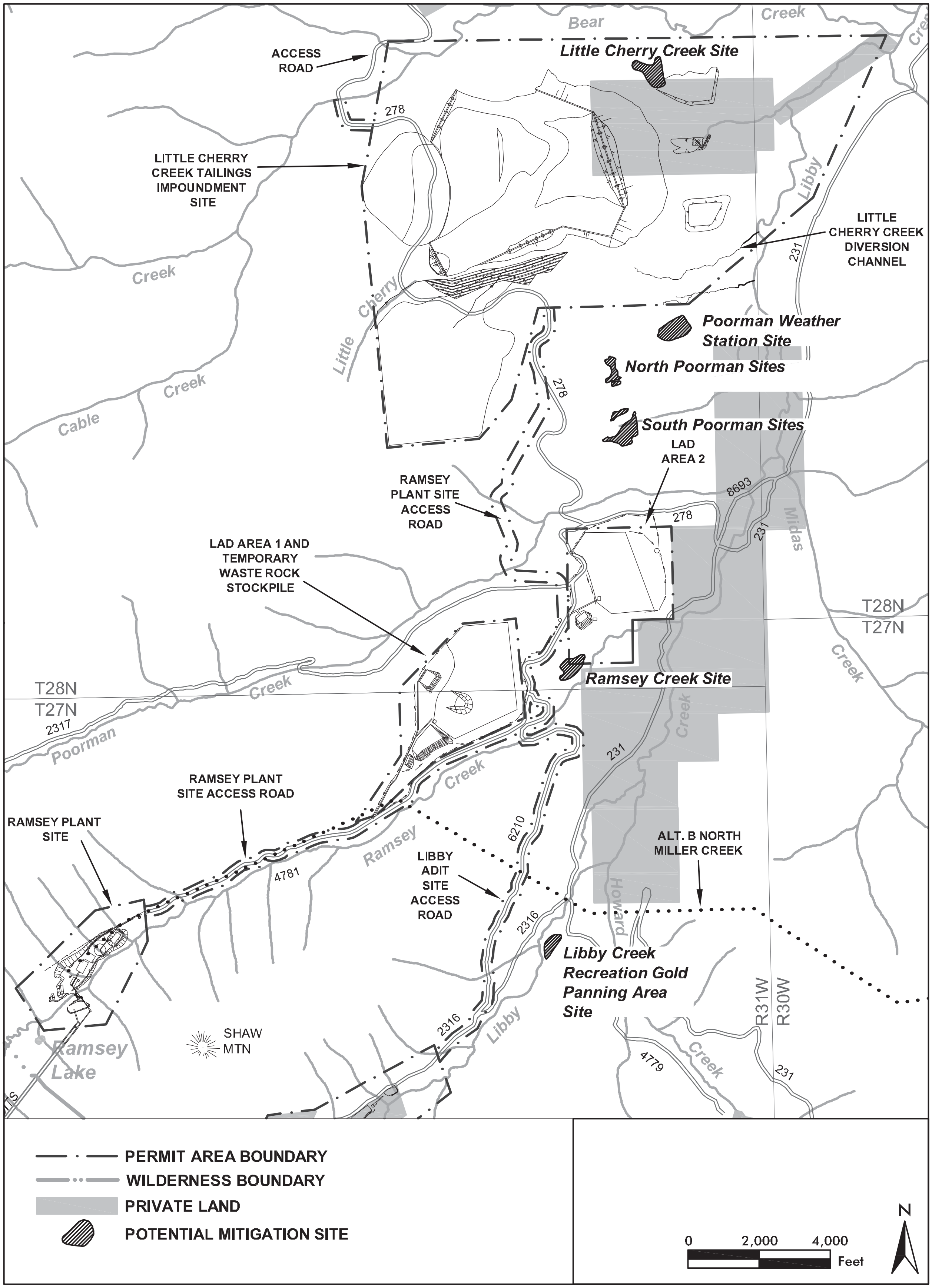


Figure 21. Potential Wetland Mitigation Sites, Alternative 2

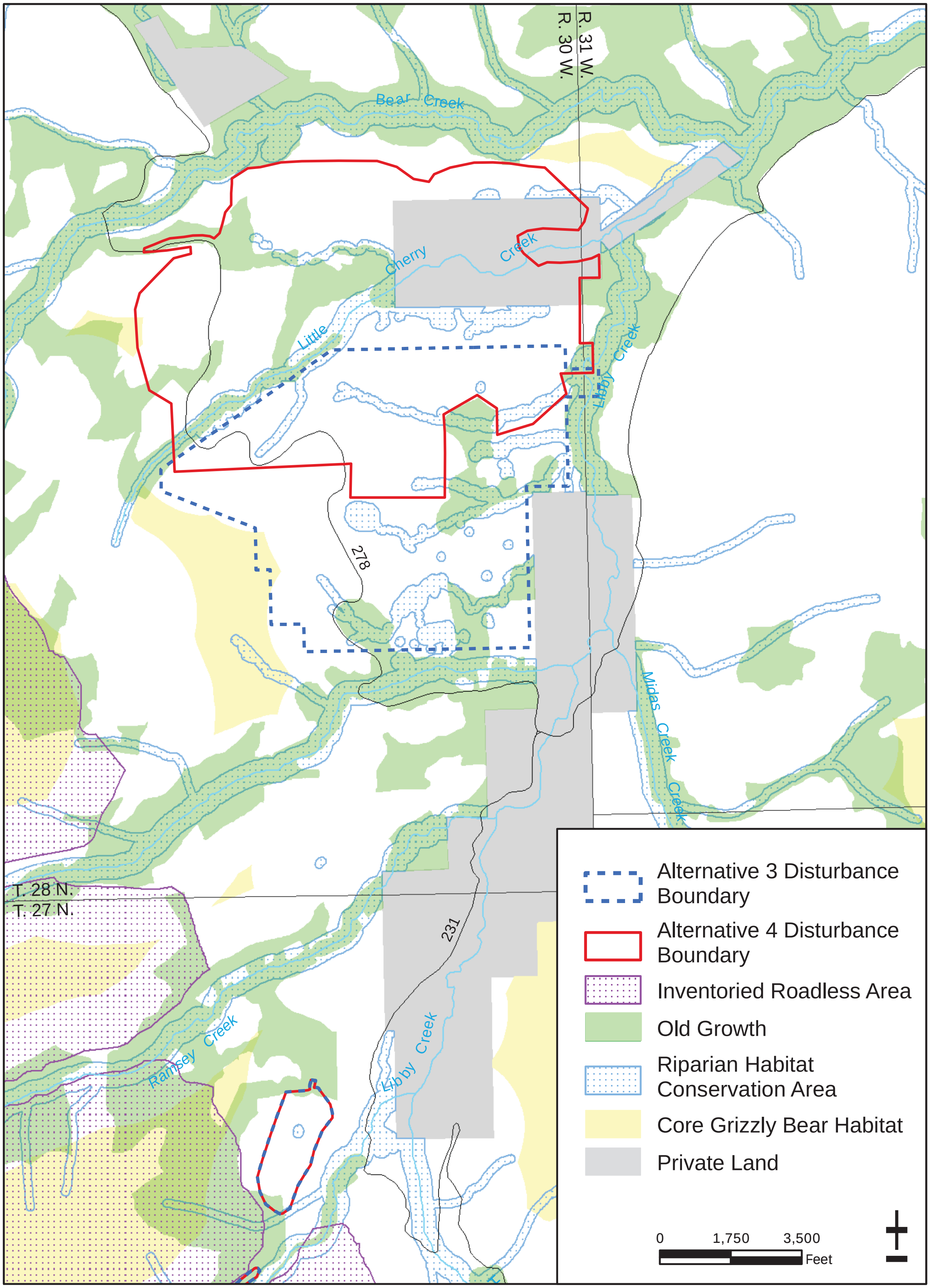


Figure 22. Key Resources Avoided by Alternatives 3 and 4

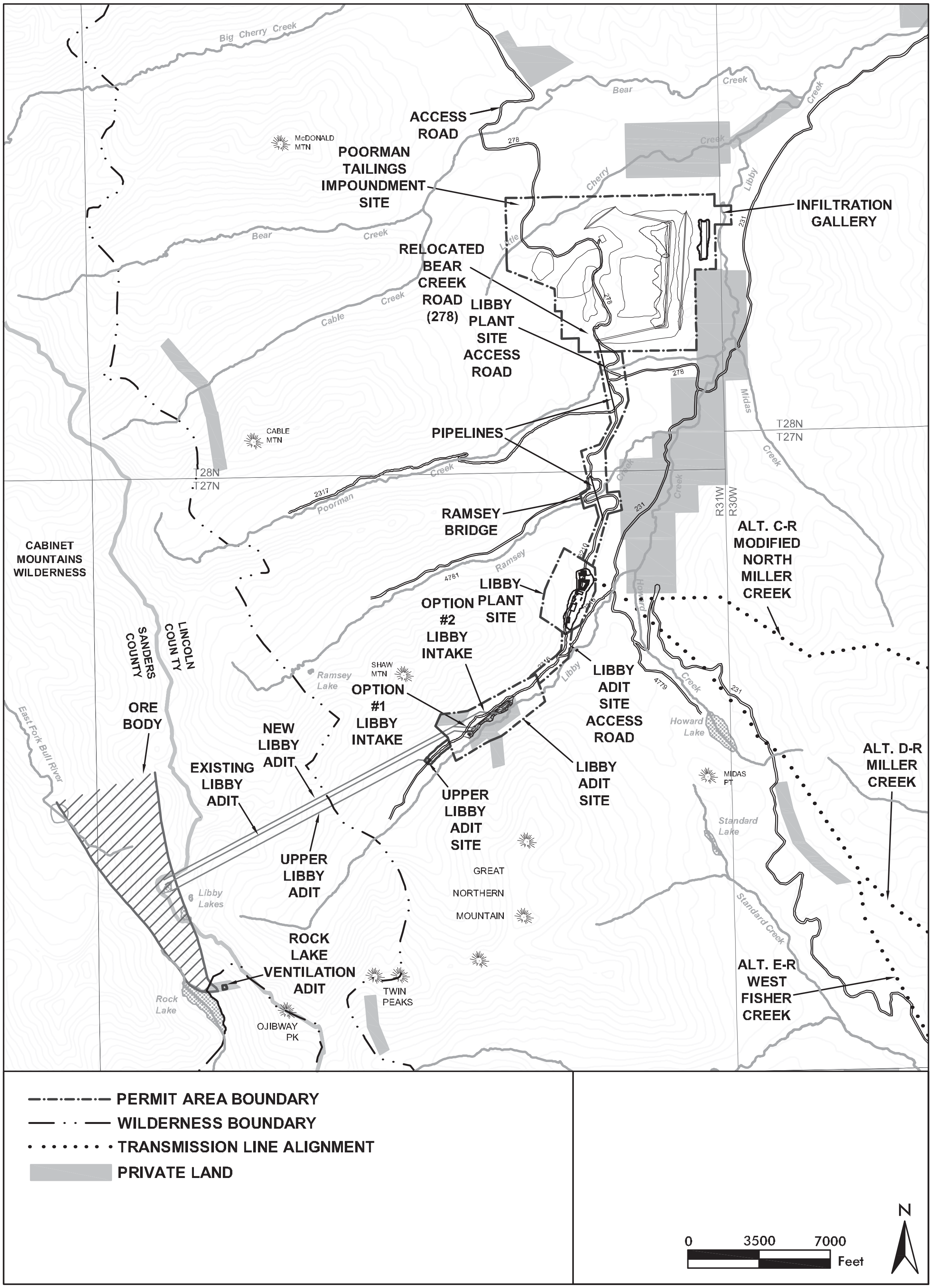


Figure 23. Mine Facilities and Permit Areas, Alternative 3

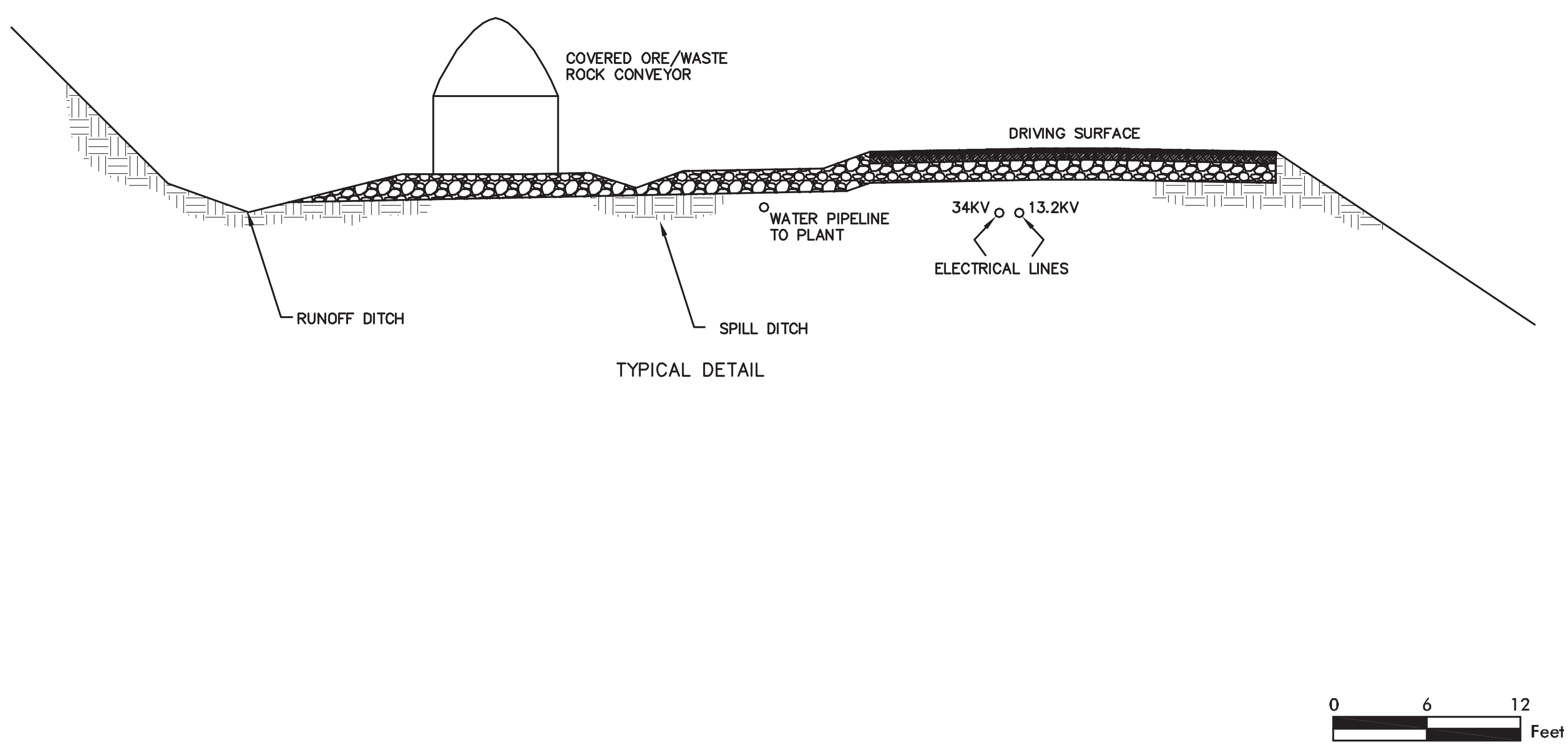


Figure 24. Detail of Overland Conveyor and Libby Adit Access Road, Alternatives 3 and 4

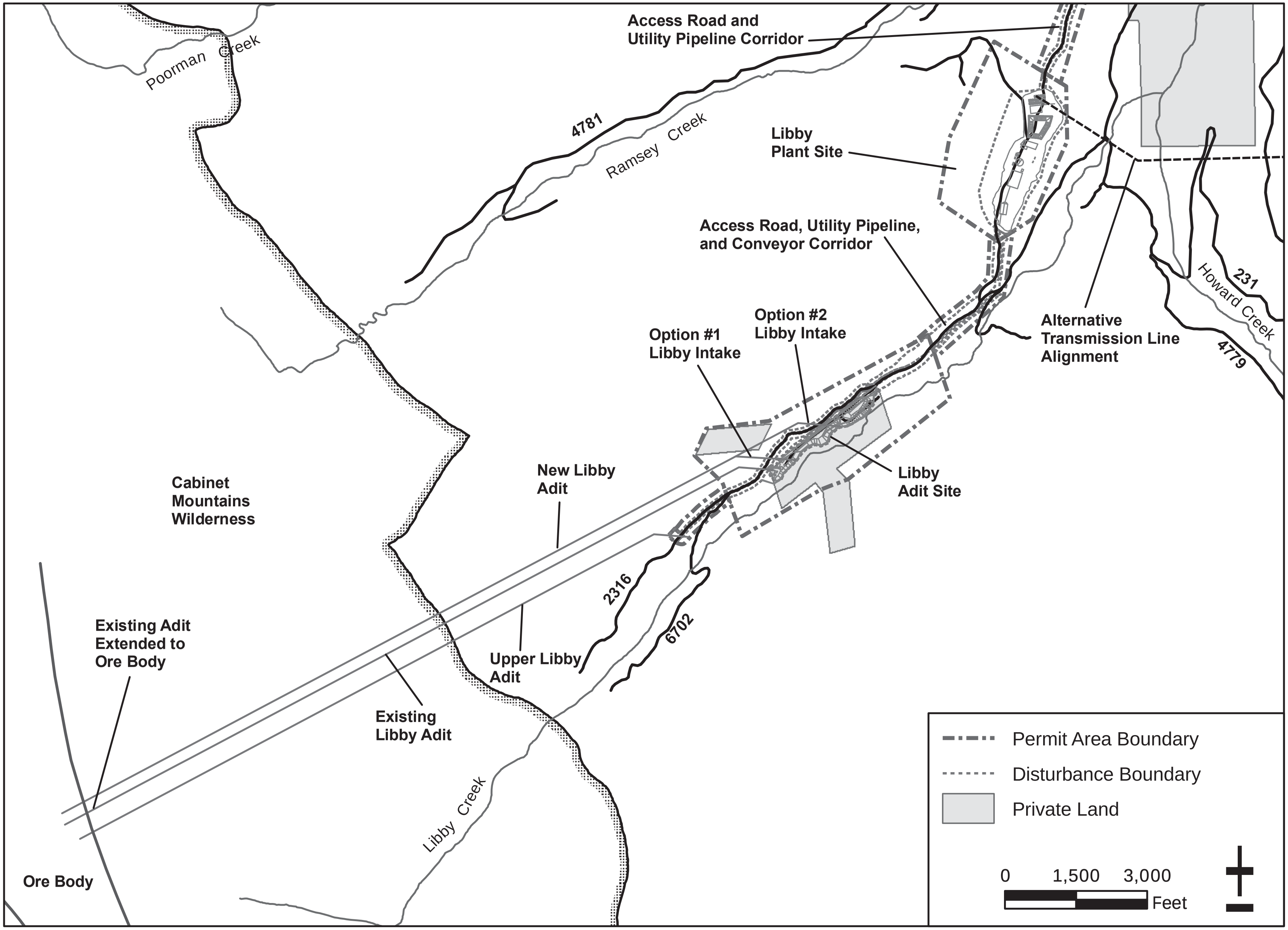


Figure 25. Libby Plant Site and Adits, Alternatives 3 and 4

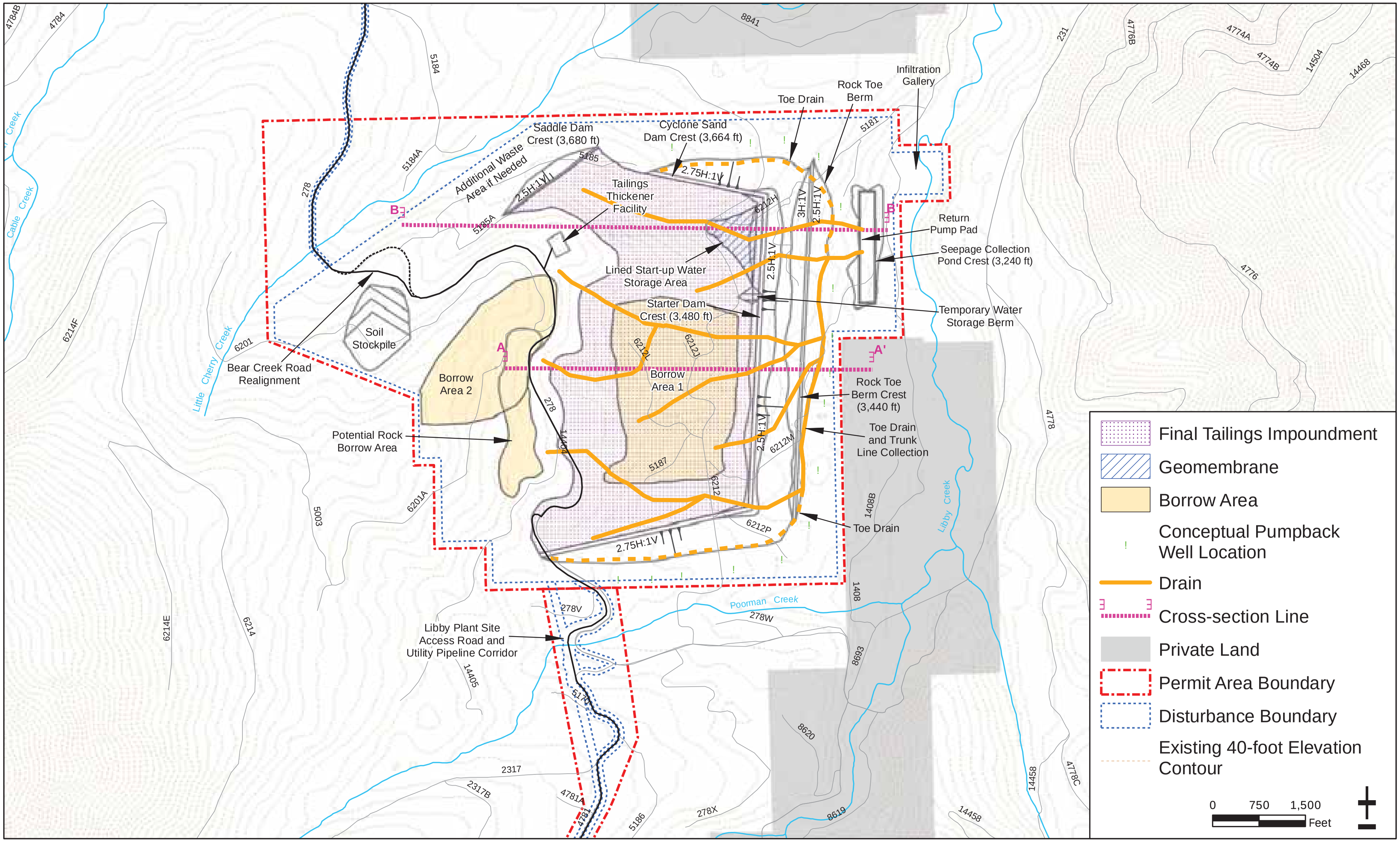
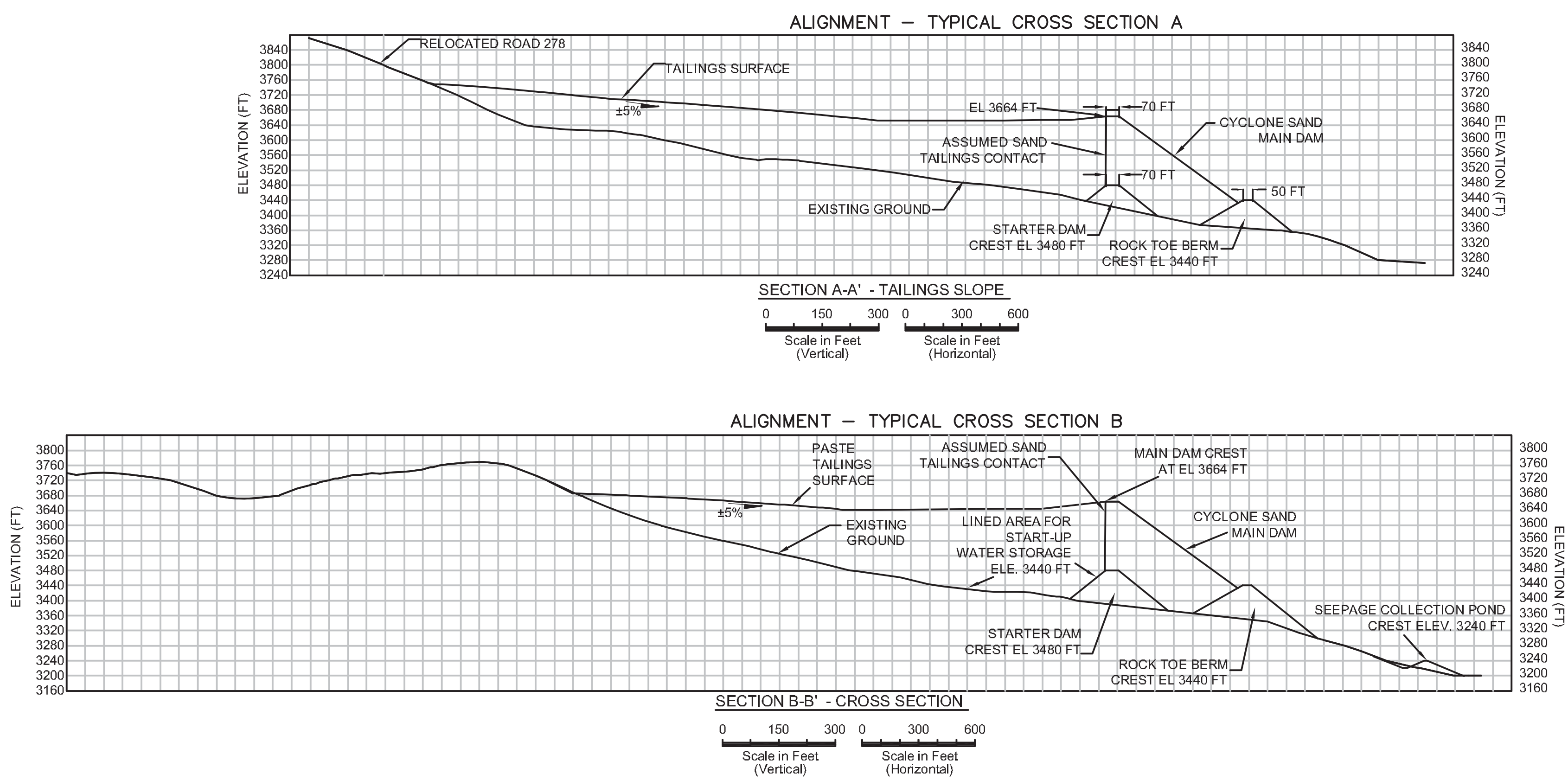


Figure 26. Poorman Tailings Impoundment Site, Alternative 3



Note: Location of Cross-sections shown on Figure 26.

Figure 27. Poorman Tailings Impoundment Cross Sections

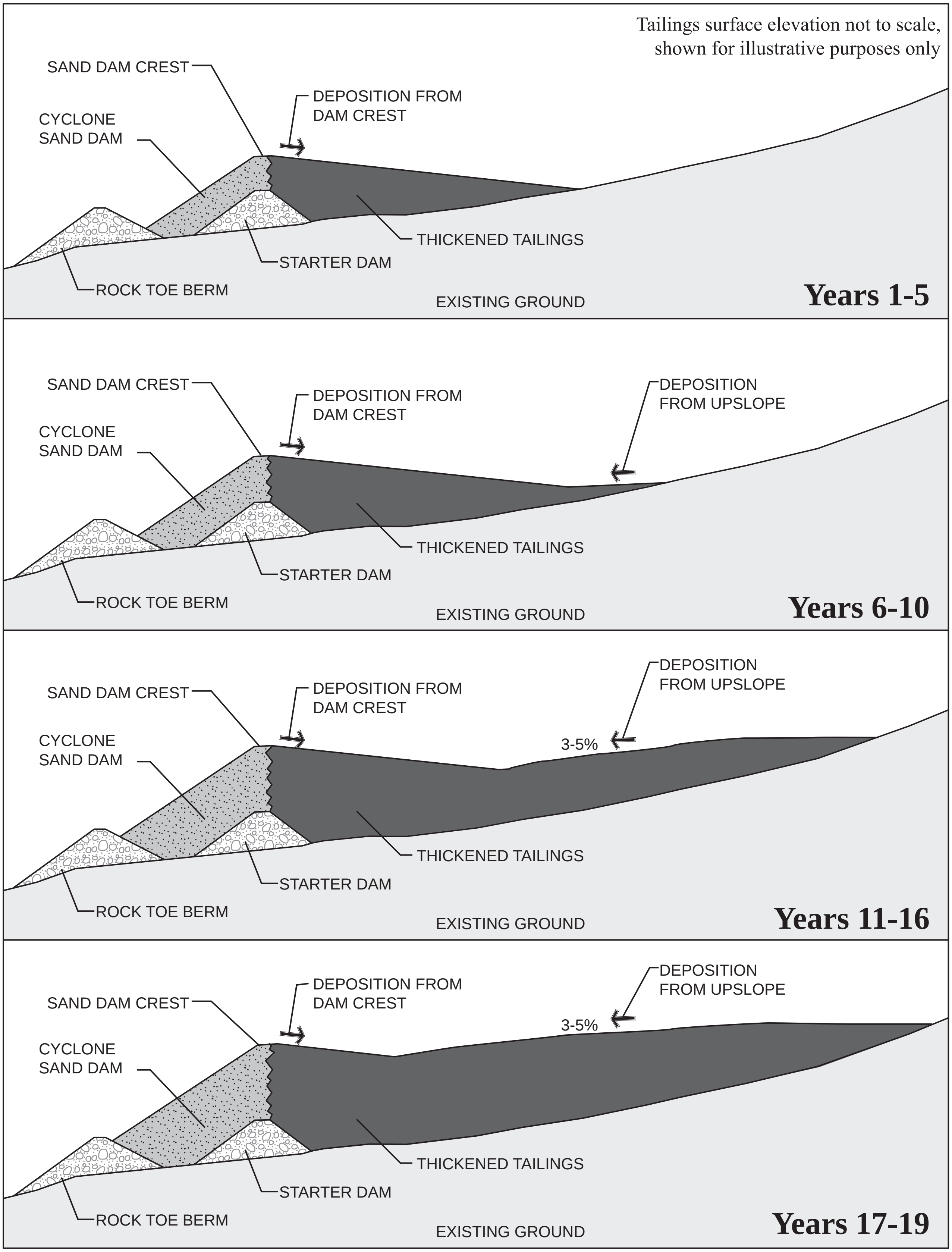


Figure 28. Tailings Deposition over Time, Alternative 3

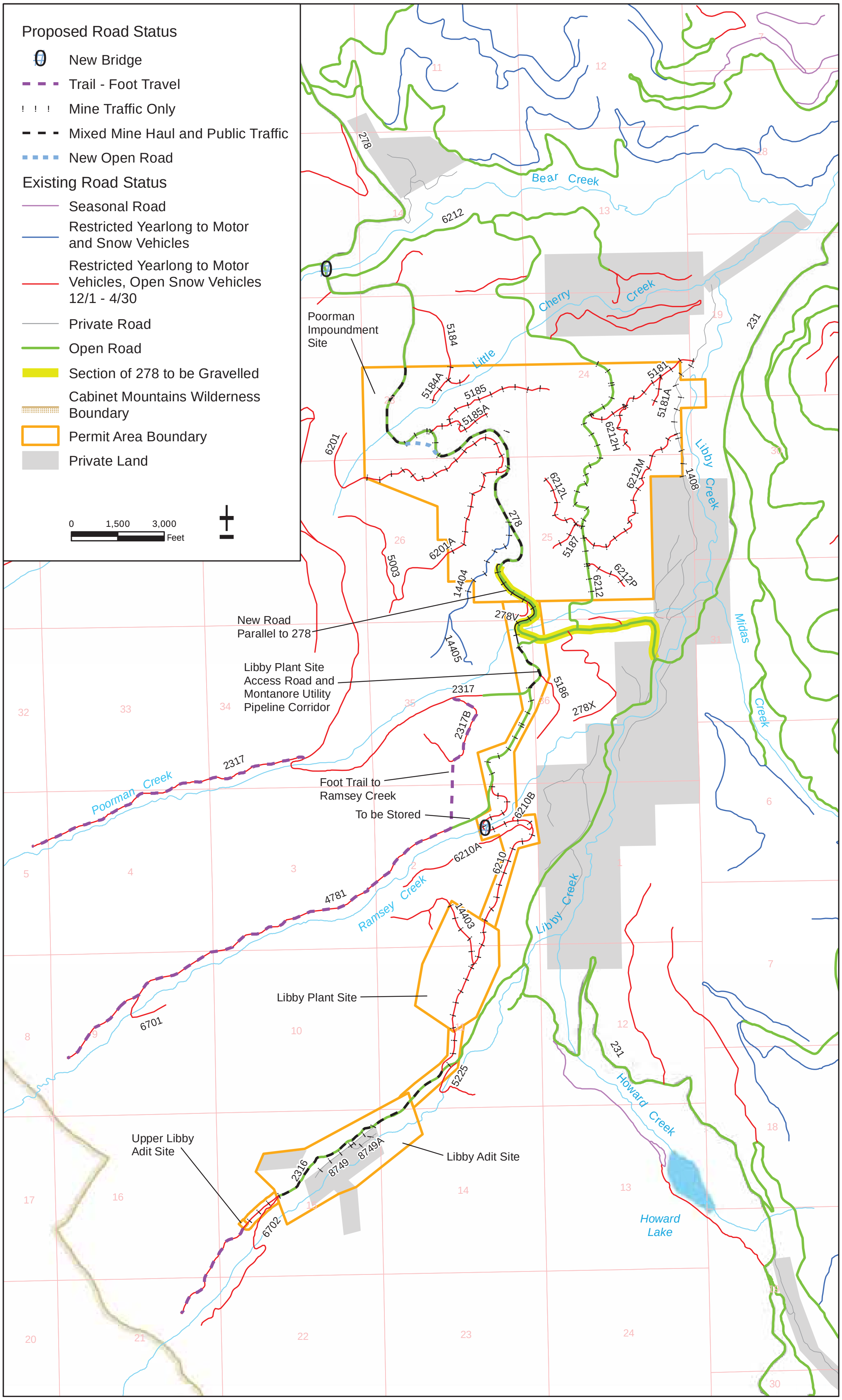


Figure 29. Roads Proposed for Use in Alternative 3

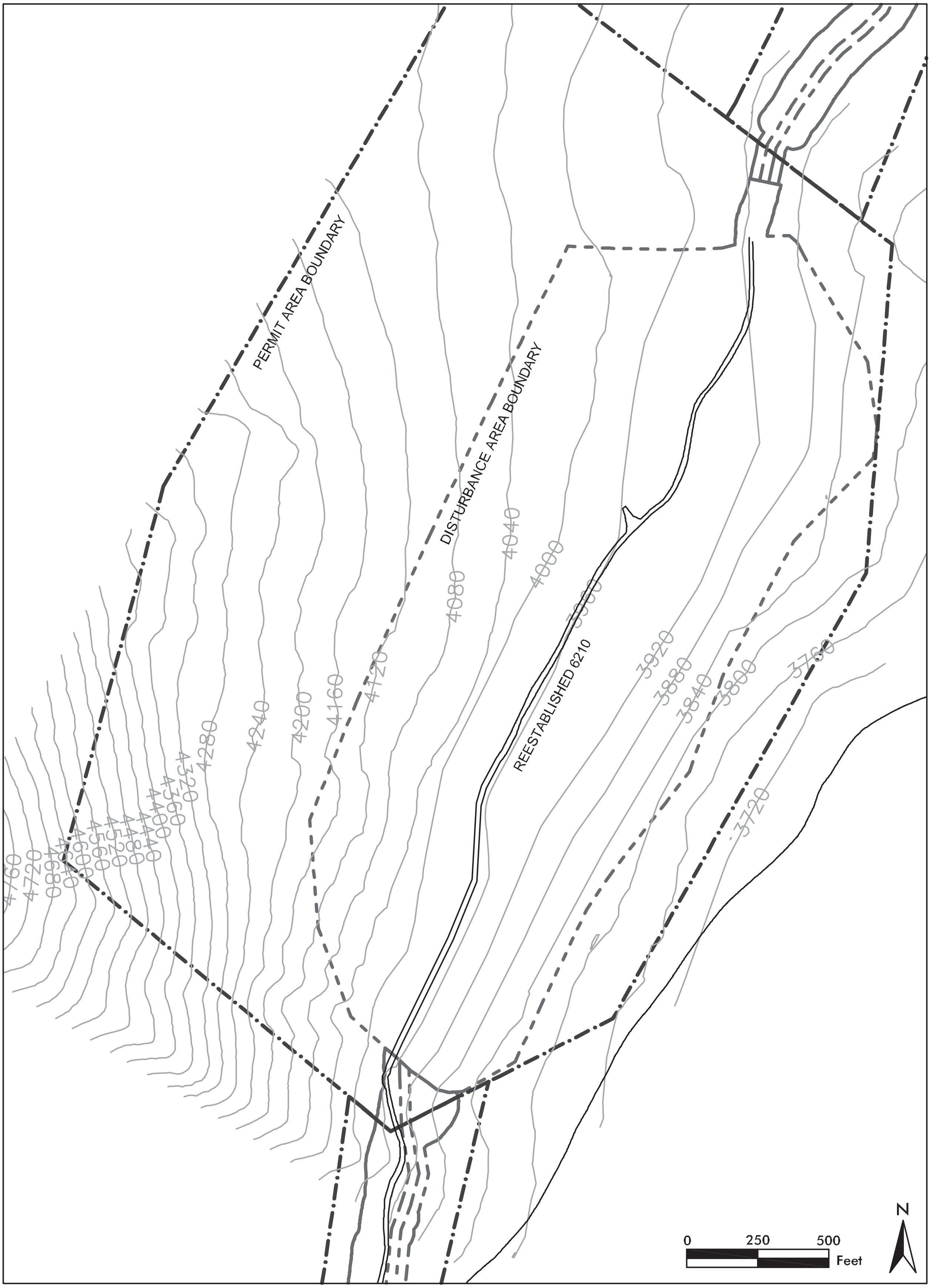


Figure 30. Post-mining Topography, Libby Plant Site, Alternatives 3 and 4

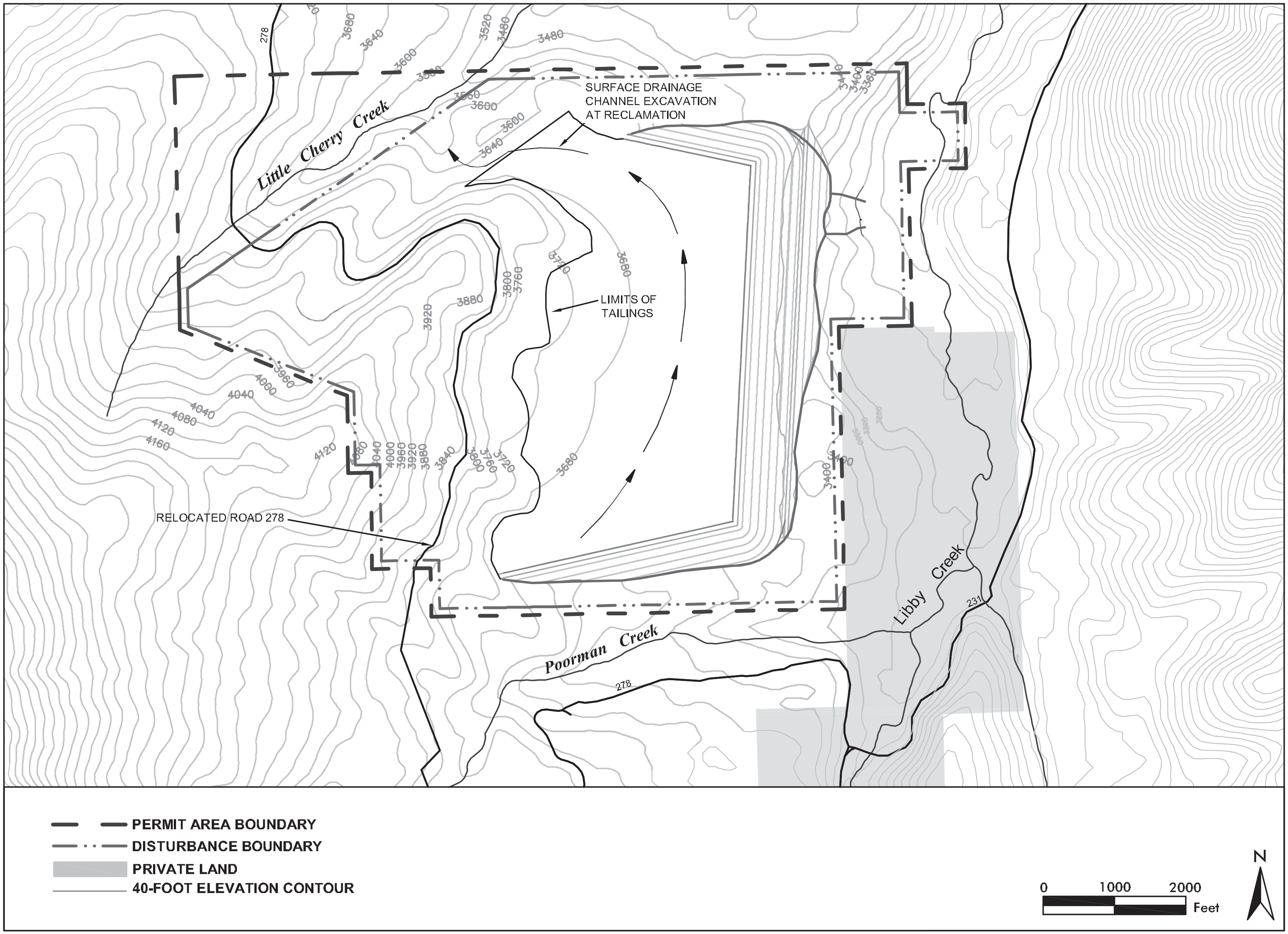


Figure 31. Post-mining Topography, Poorman Tailings Impoundment Site, Alternative 3

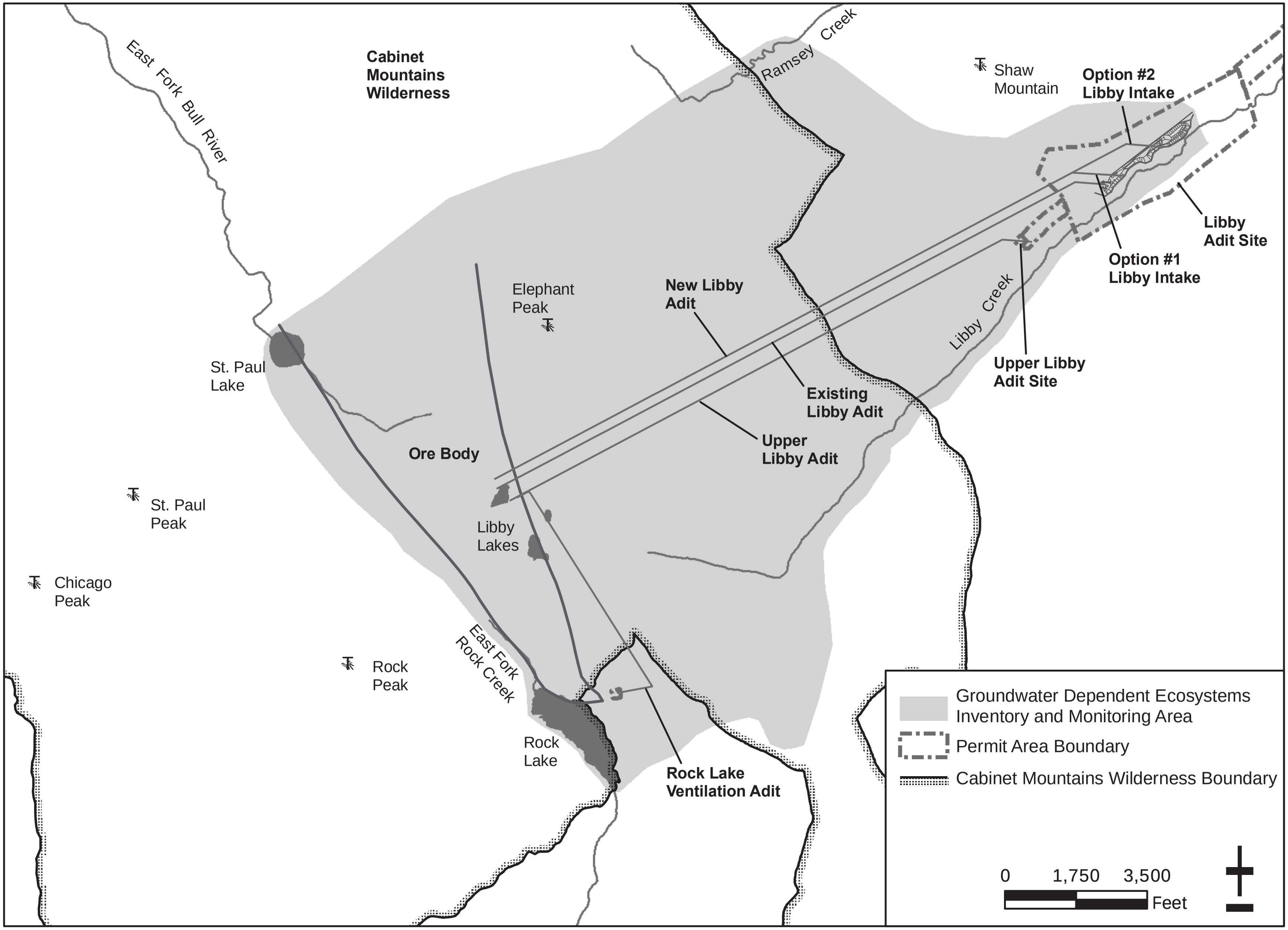


Figure 32. Groundwater Dependent Ecosystems Inventory and Monitoring Area

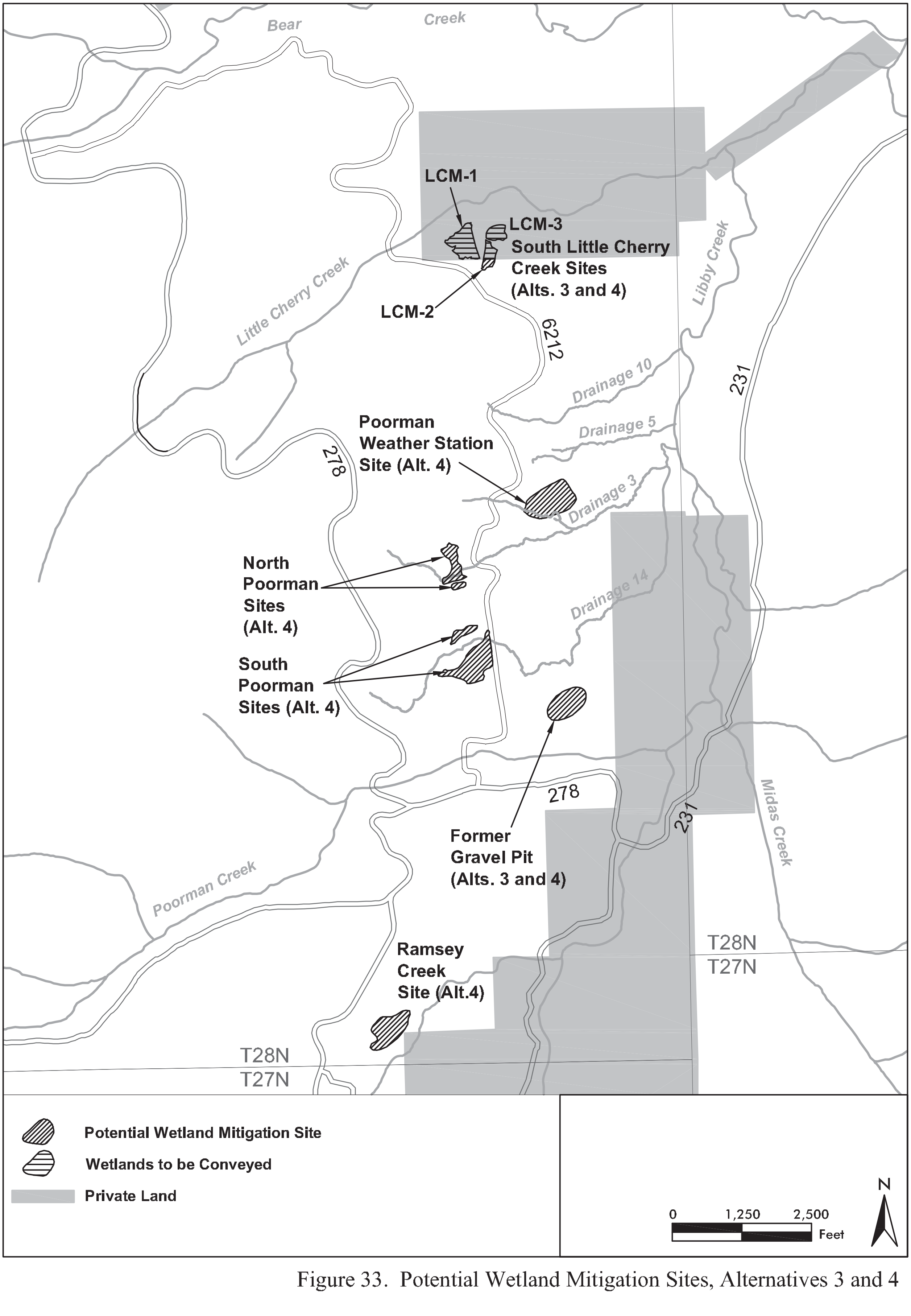


Figure 33. Potential Wetland Mitigation Sites, Alternatives 3 and 4

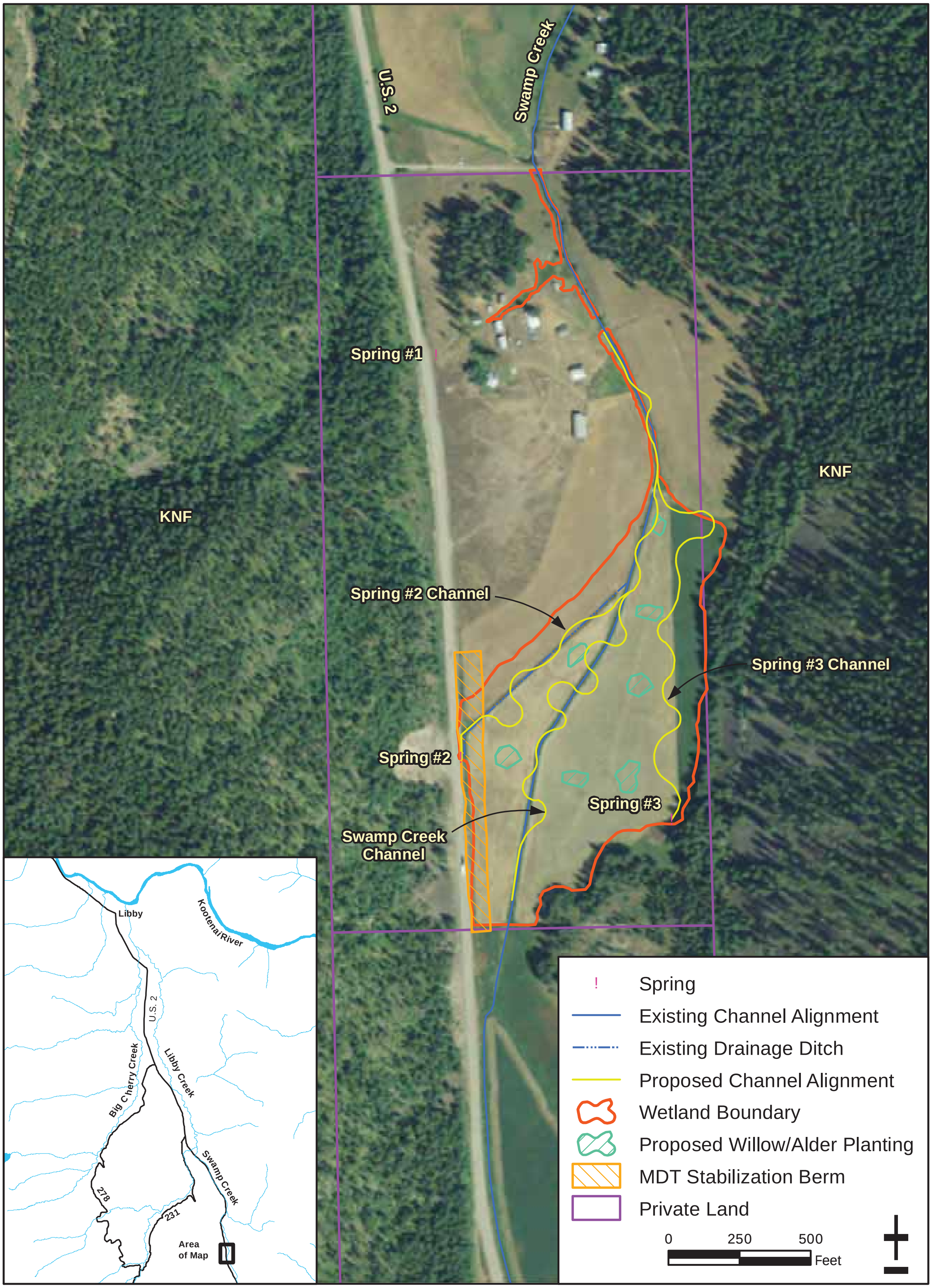


Figure 34. Potential Swamp Creek Wetland Mitigation Site, Alternatives 3 and 4

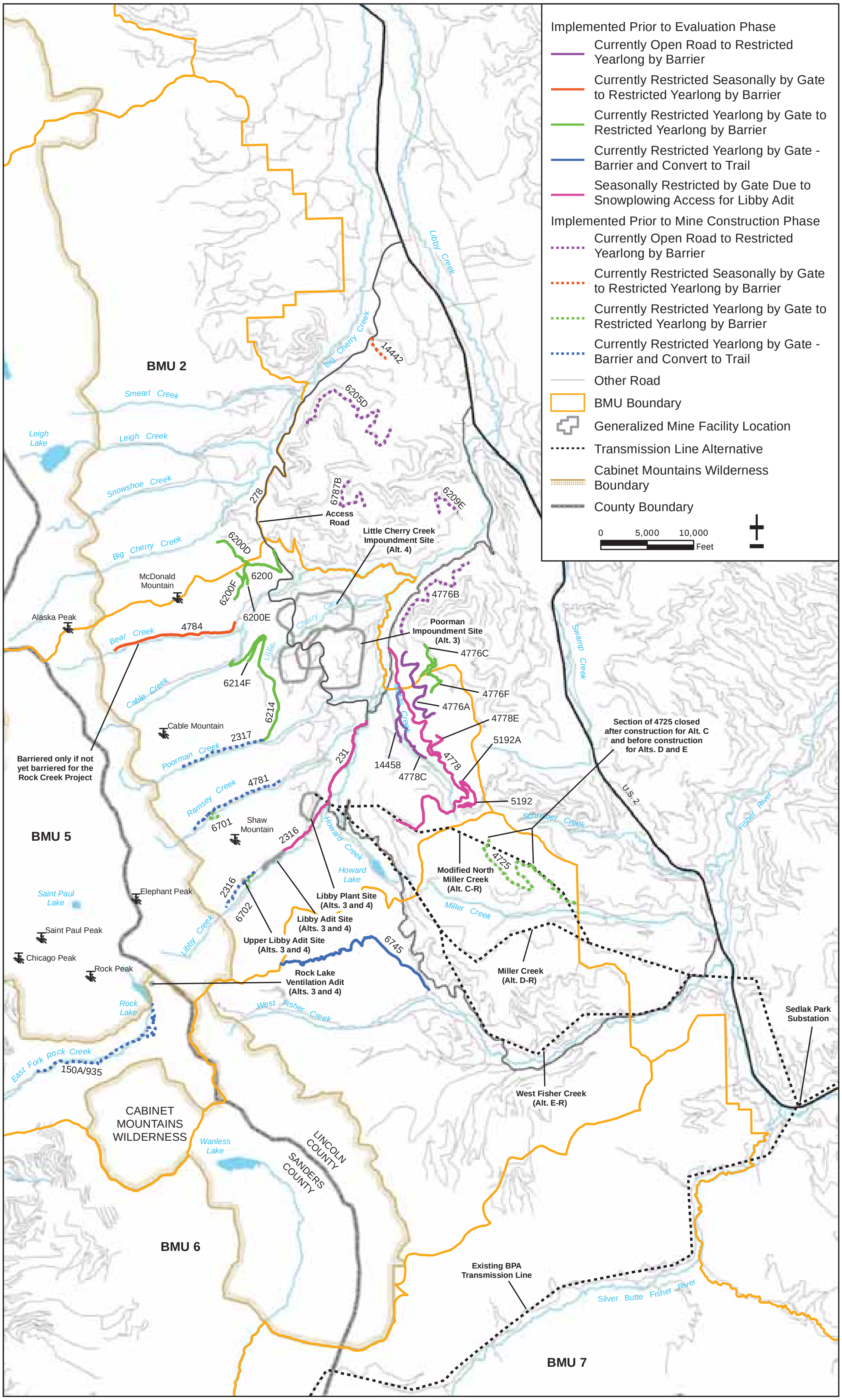


Figure 35. KNF Proposed Road and Trail Access Changes for Wildlife Mitigation, Alternatives 3, 4, C-R, D-R, and E-R

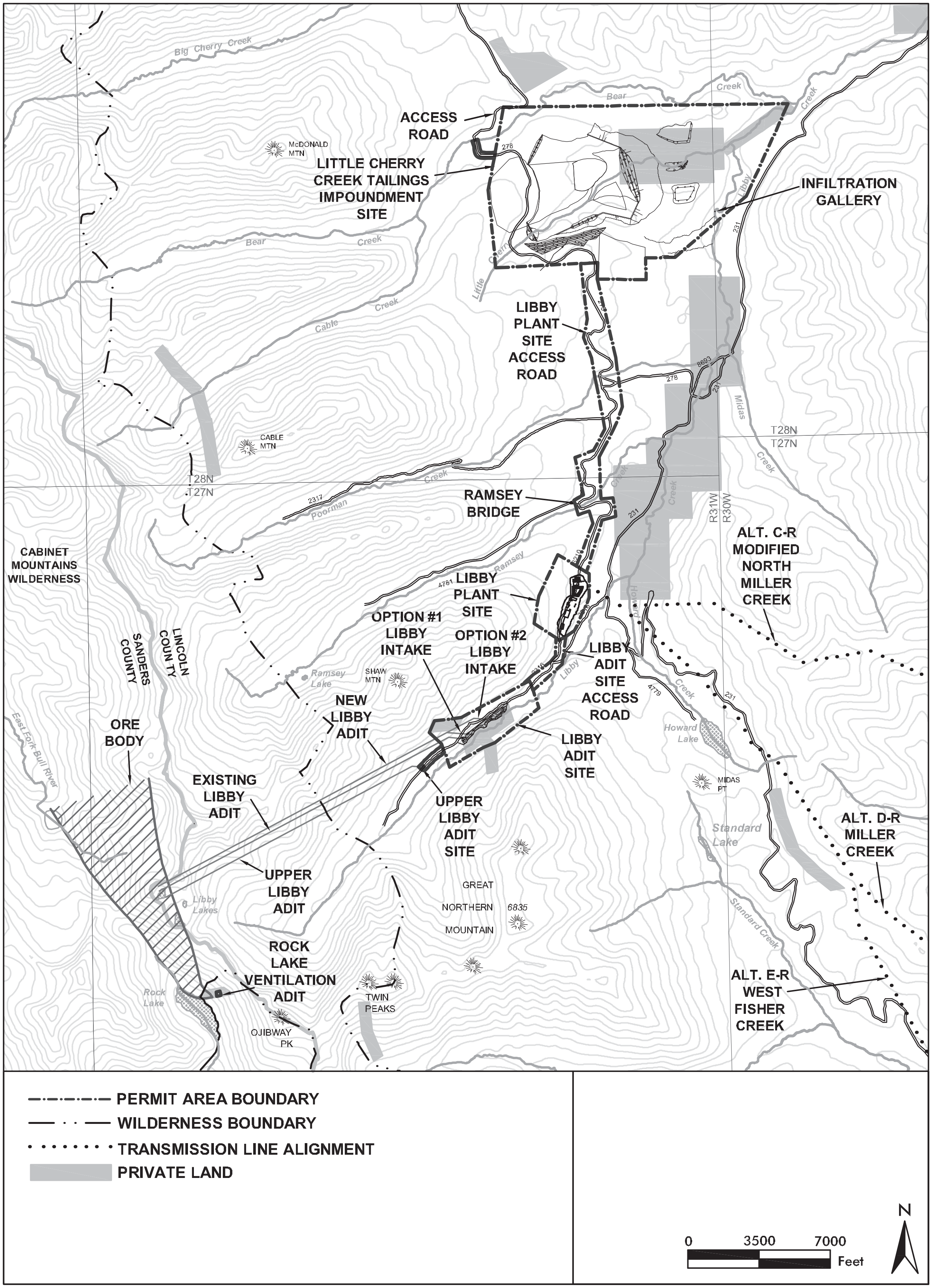


Figure 36. Mine Facilities and Permit Areas, Alternative 4

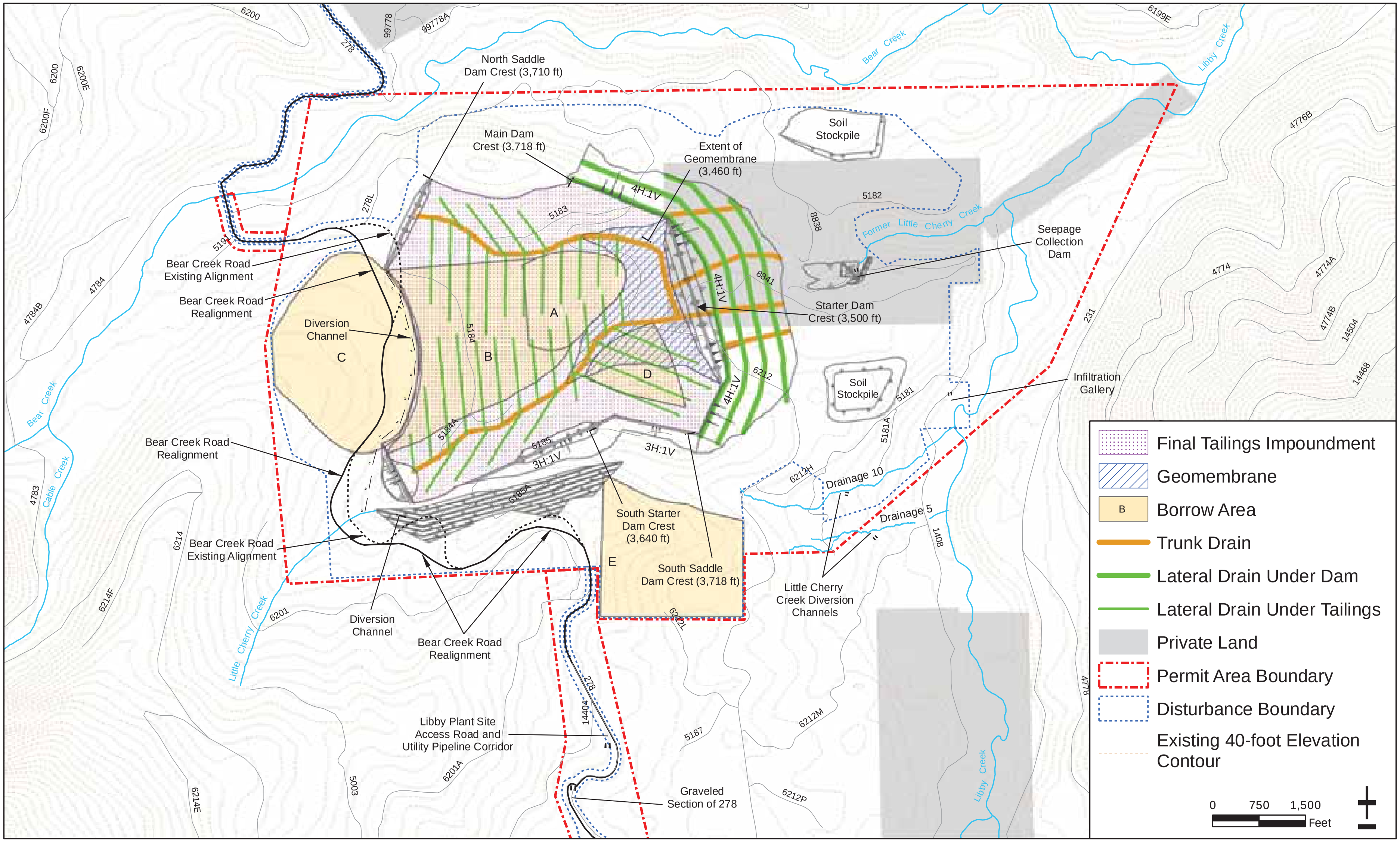


Figure 37. Little Cherry Creek Tailings Impoundment Site, Alternative 4

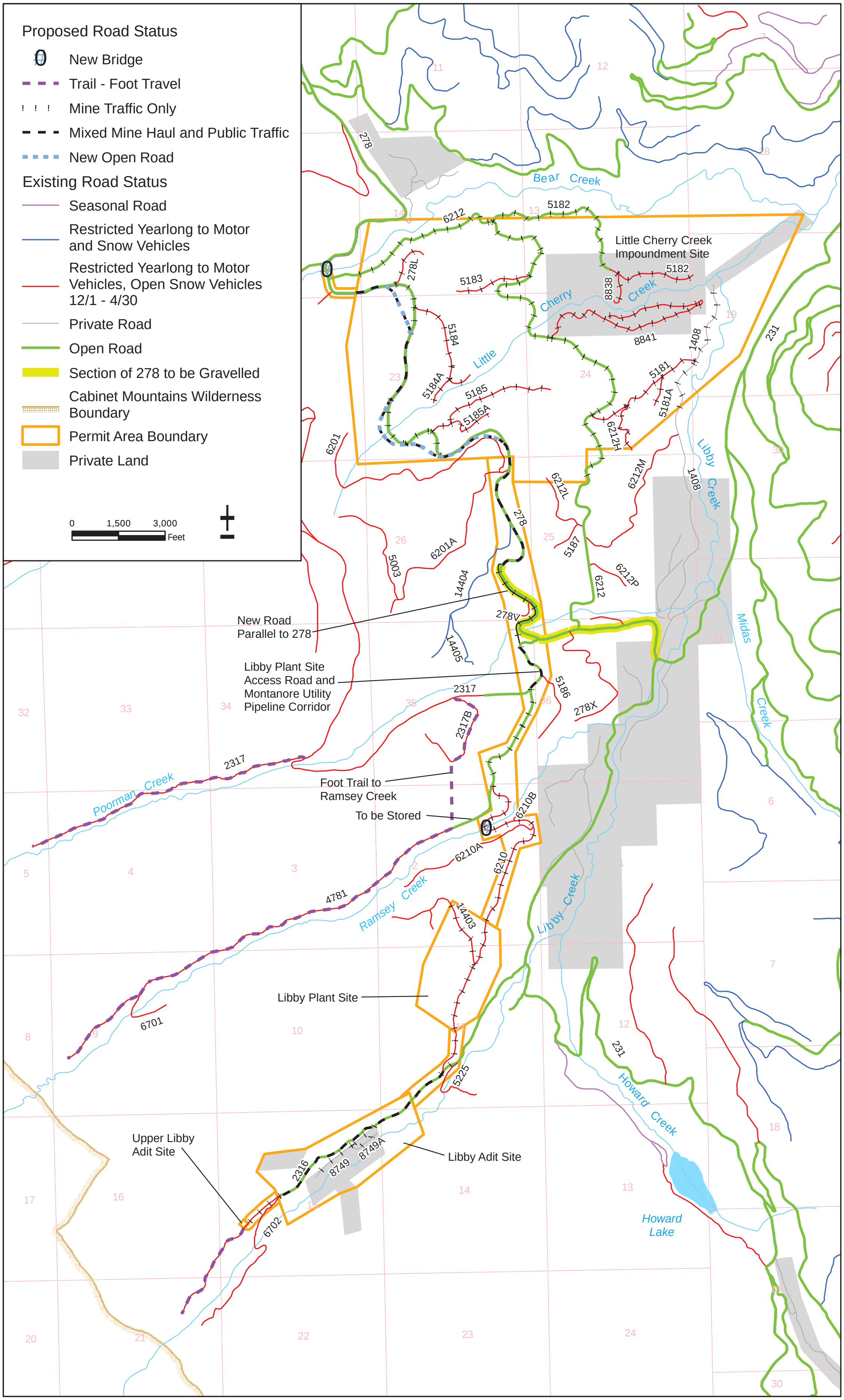


Figure 38. Roads Proposed for Use in Alternative 4

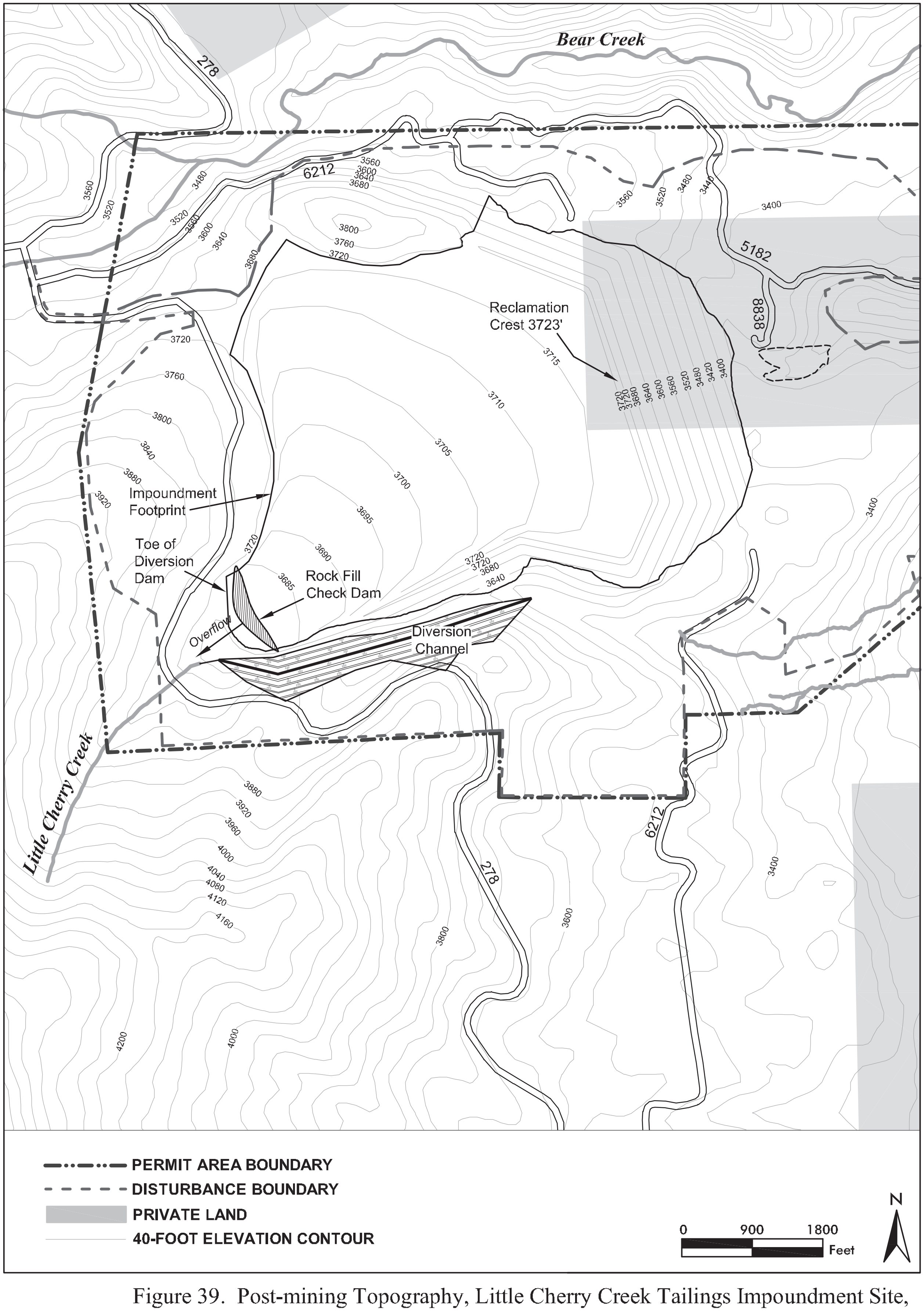


Figure 39. Post-mining Topography, Little Cherry Creek Tailings Impoundment Site, Alternative 4

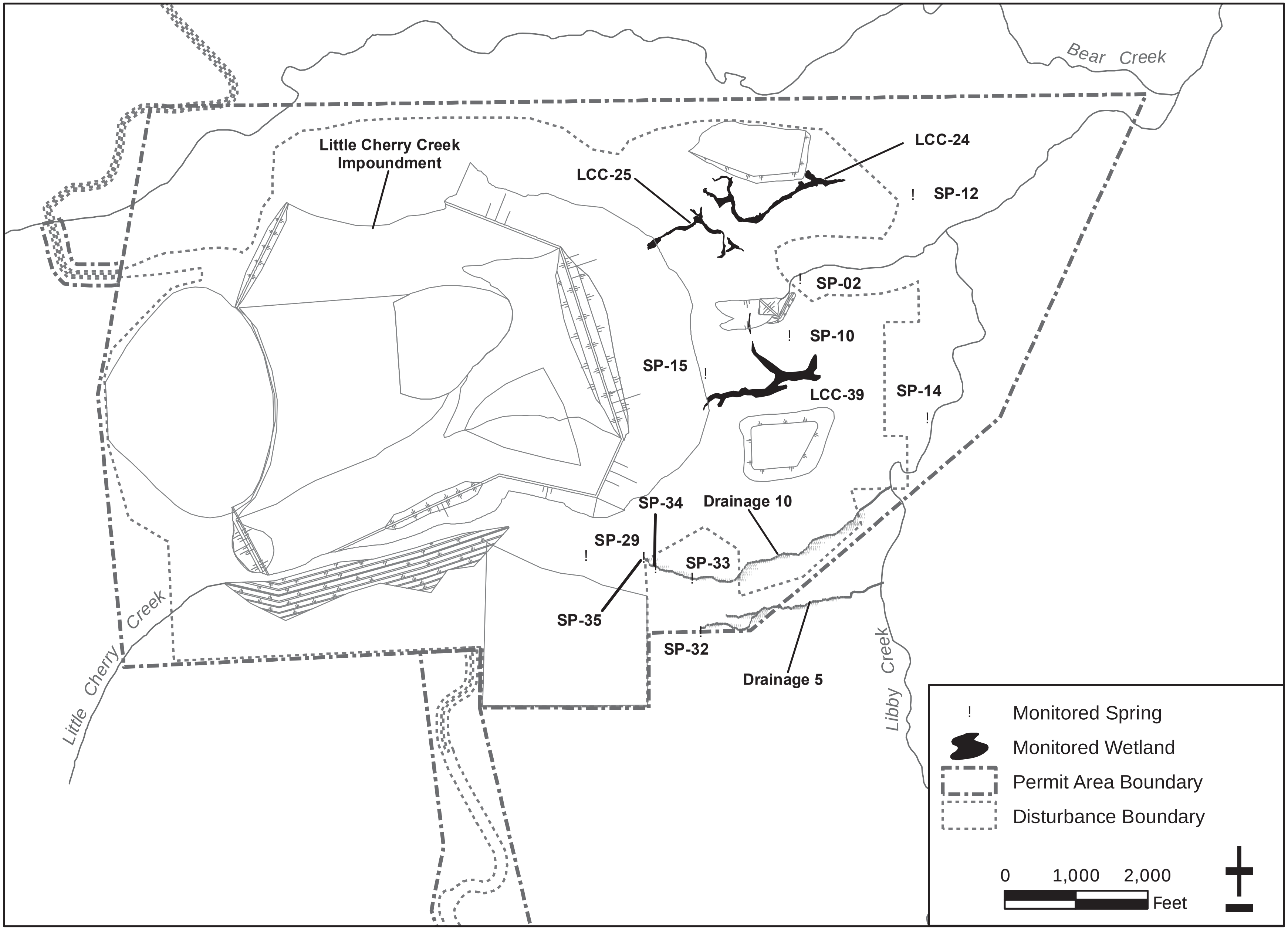


Figure 40. Spring and Wetland Monitoring Locations in the Impoundment Area, Alternative 4

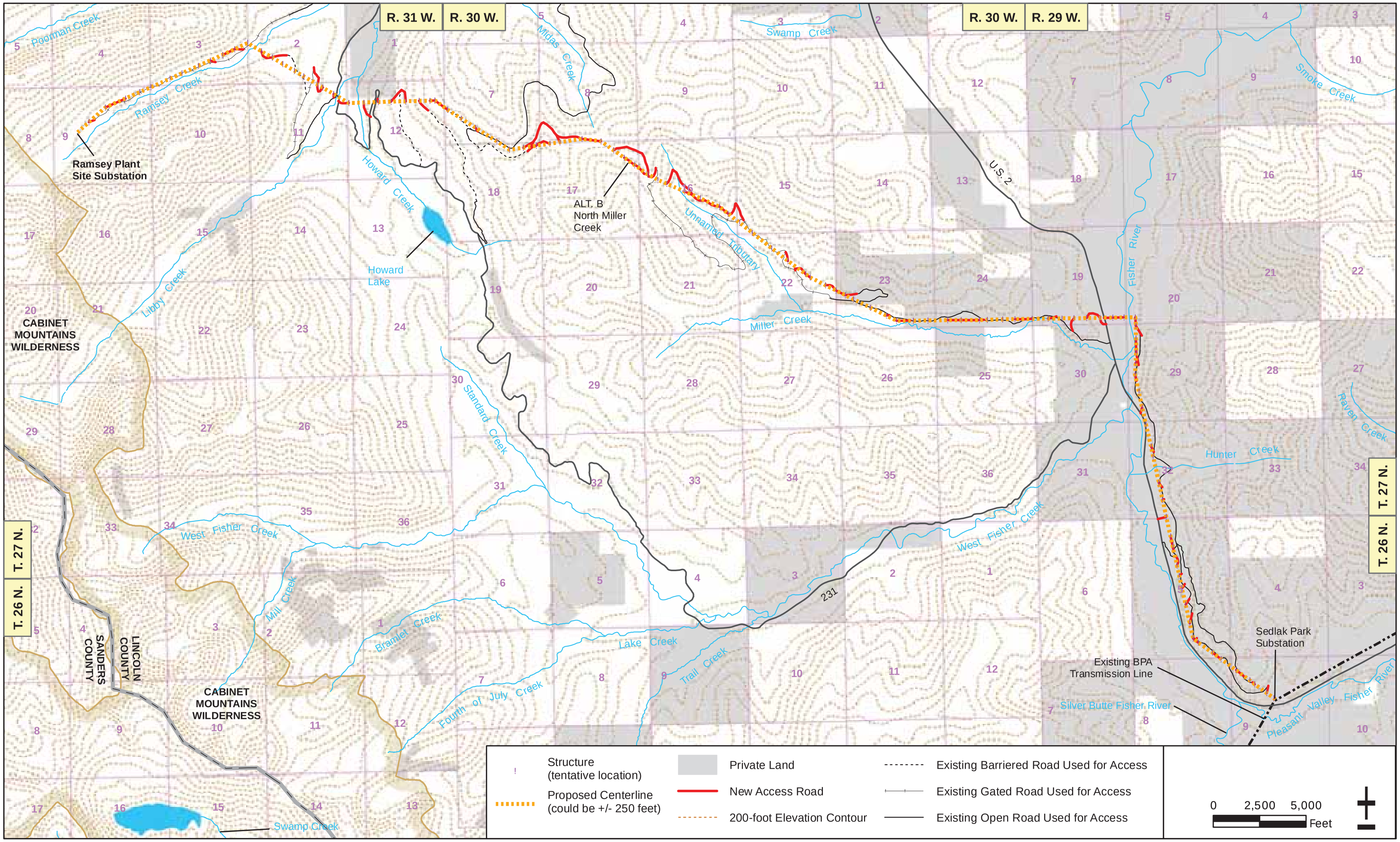


Figure 41. North Miller Creek Alignment, Structures, and Access Roads, Alternative B

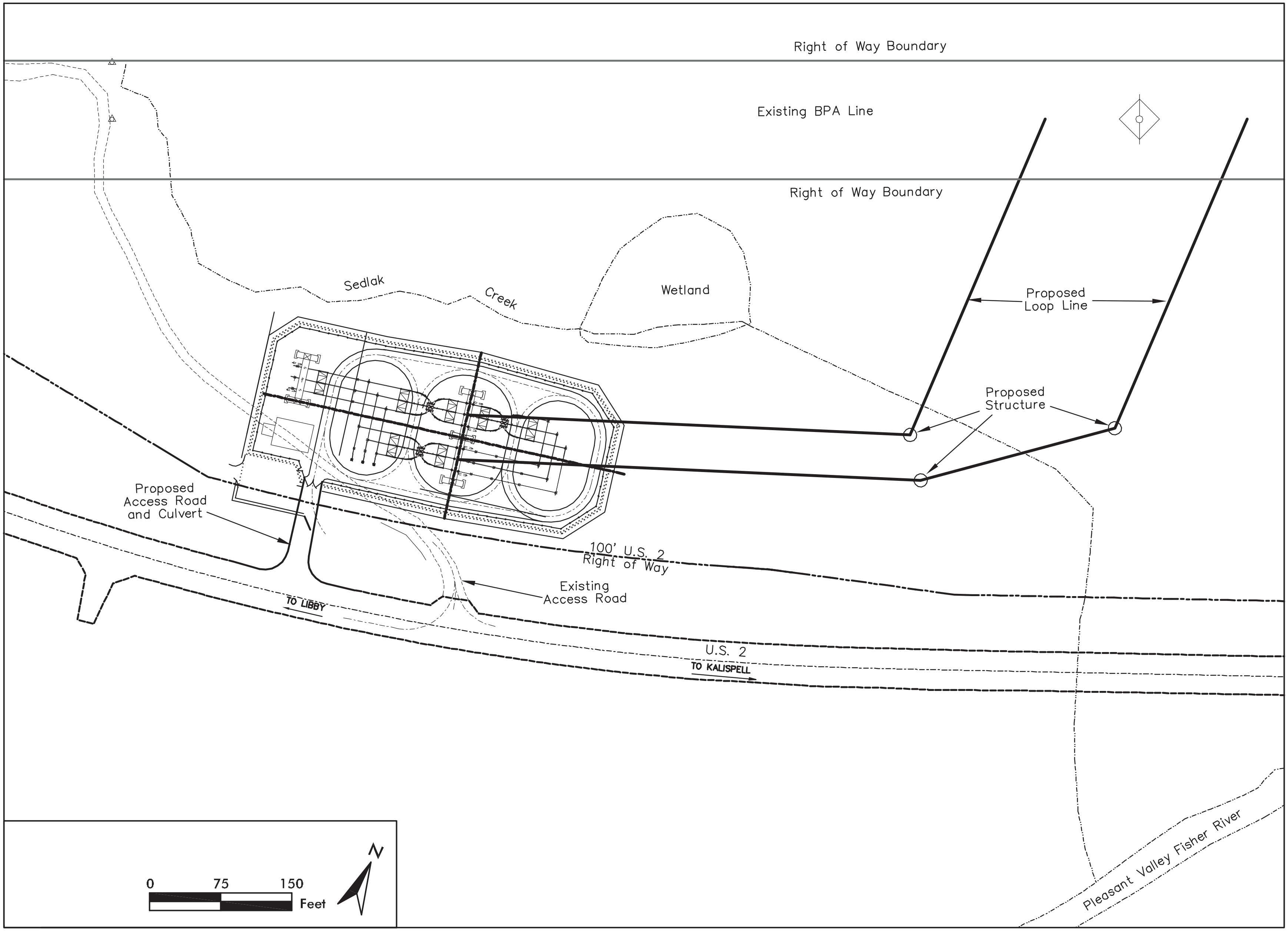


Figure 42. Sedlak Park Substation

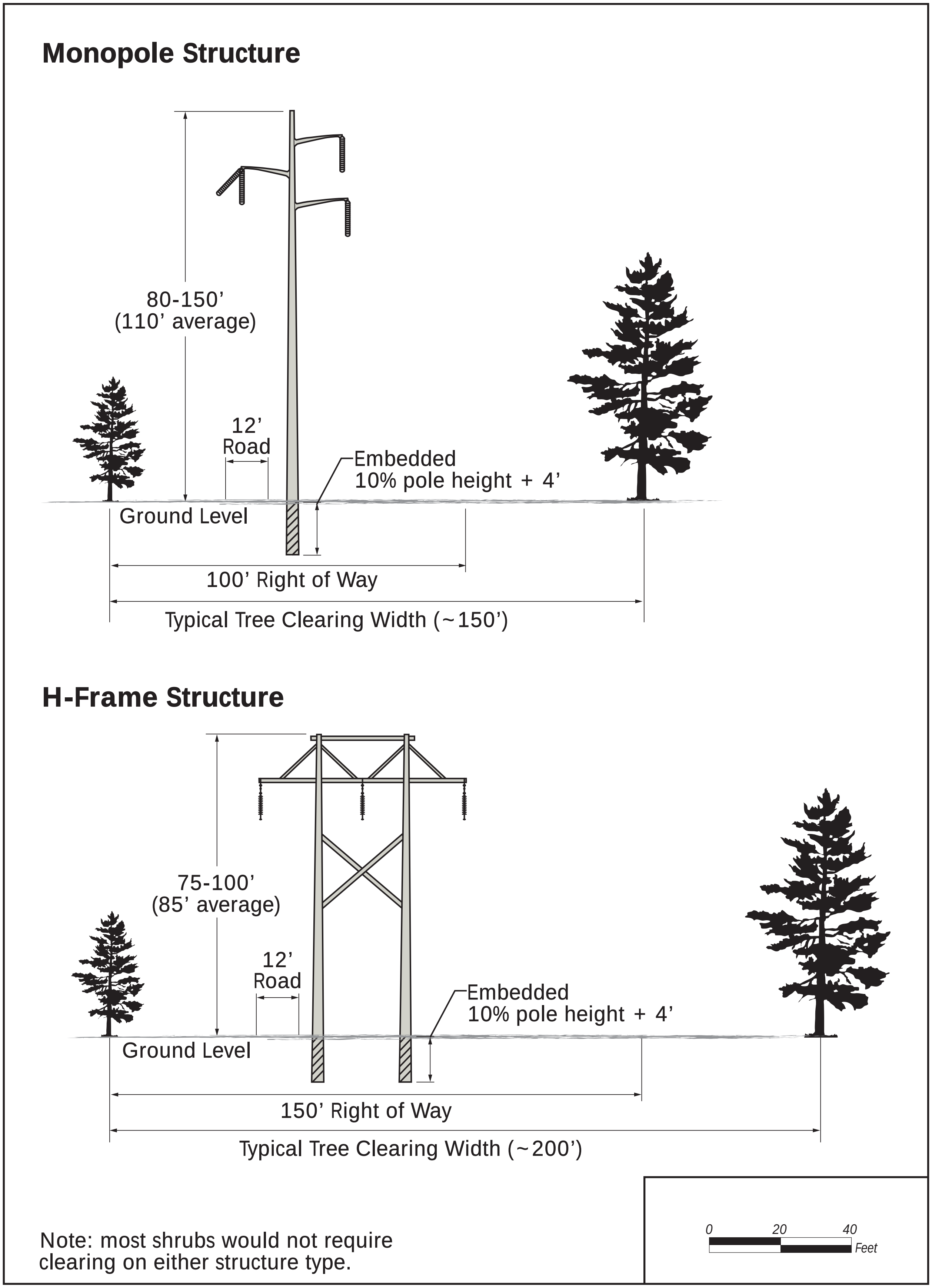


Figure 43. Transmission Line Right-of-Way and Clearing Requirements

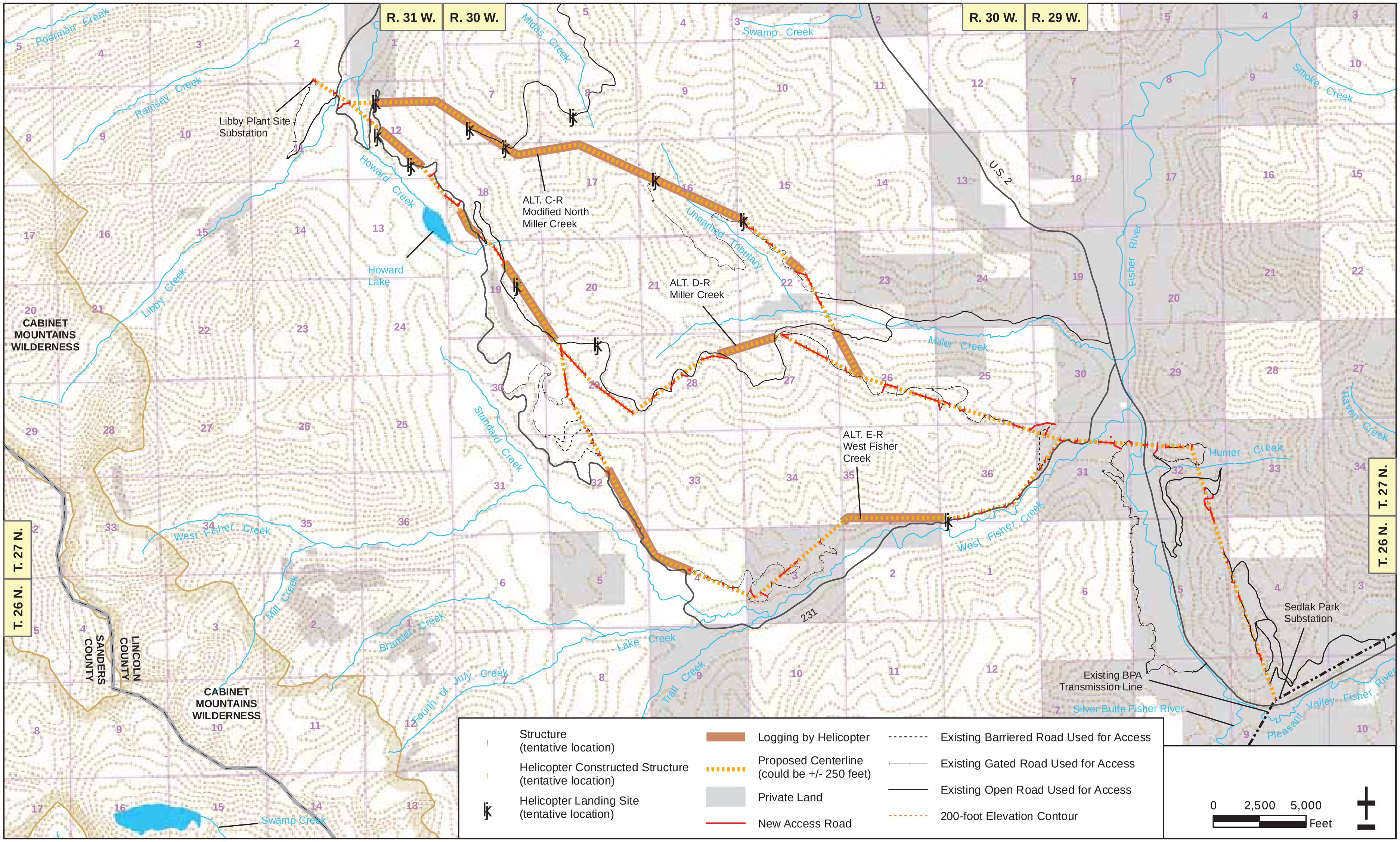


Figure 44. Transmission Line Alignment, Structures, and Access Roads, Alternatives C-R, D-R, E-R

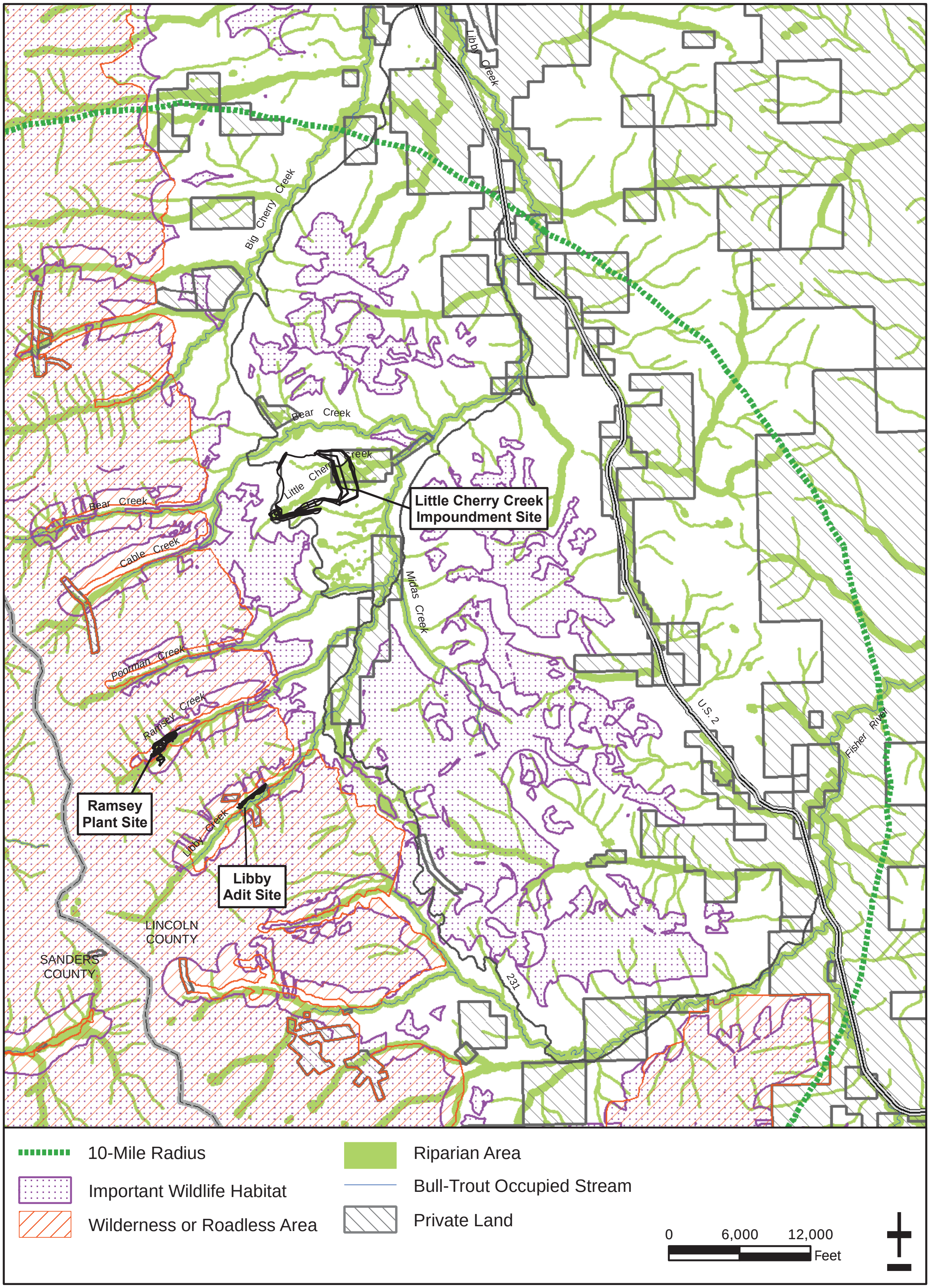


Figure 45. Key Resources Evaluated in the 2005-2011 Alternatives Analysis

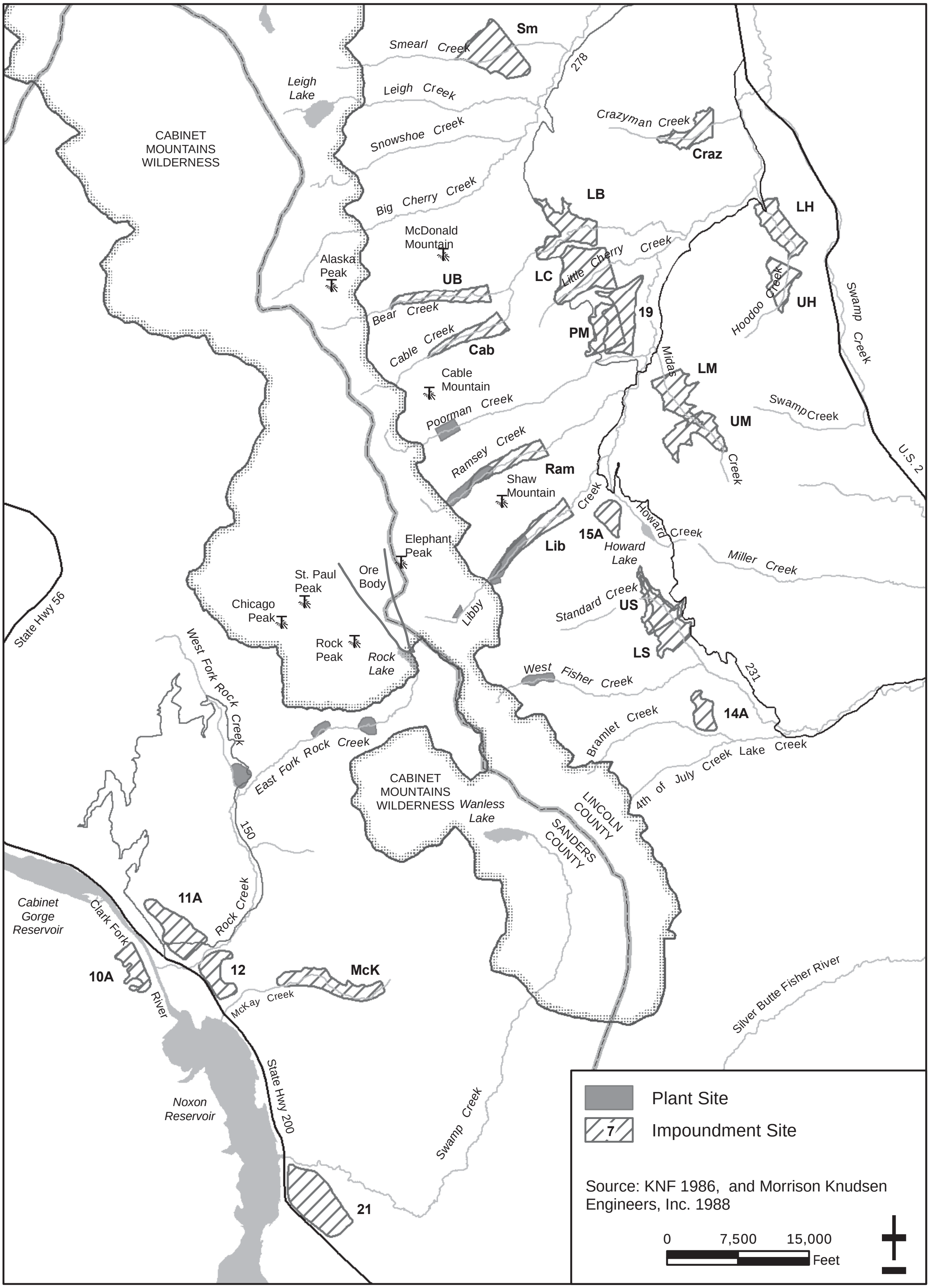


Figure 46. Plant and Impoundment Sites Evaluated in the Initial Screening

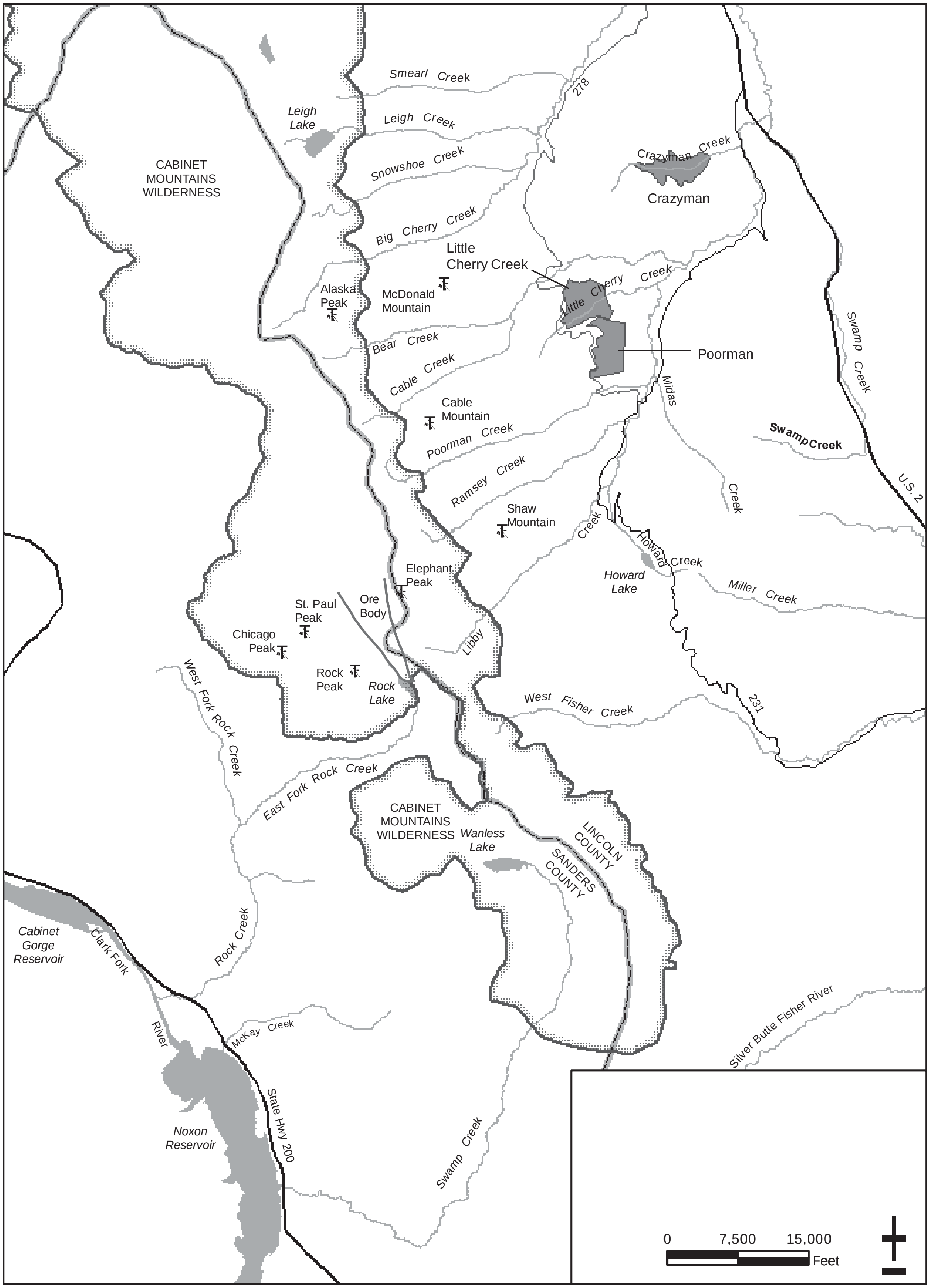


Figure 47. Tailings Impoundment Sites Evaluated in the Detailed Screening

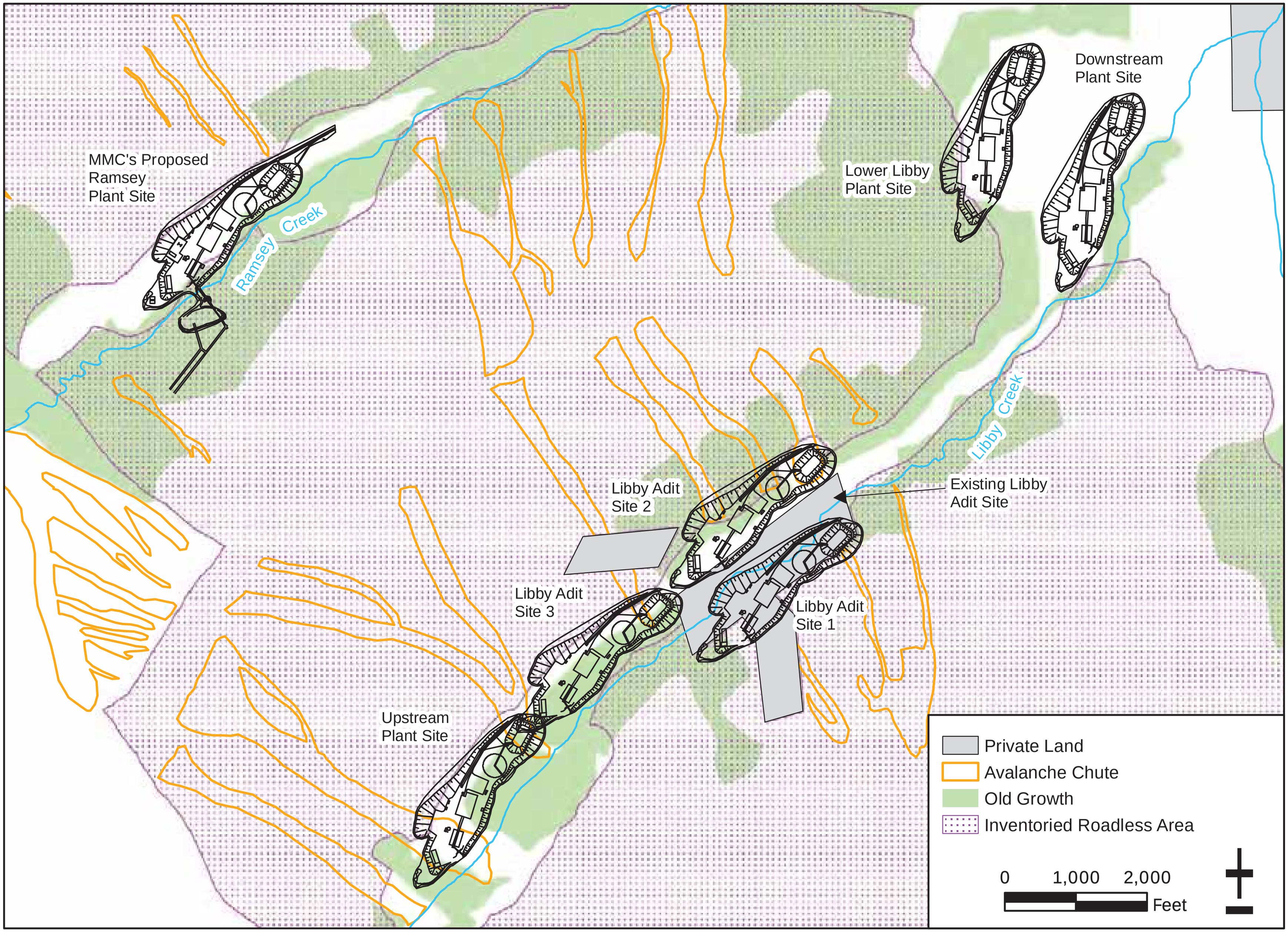


Figure 48. Plant Sites Evaluated in Upper Libby Creek for this EIS

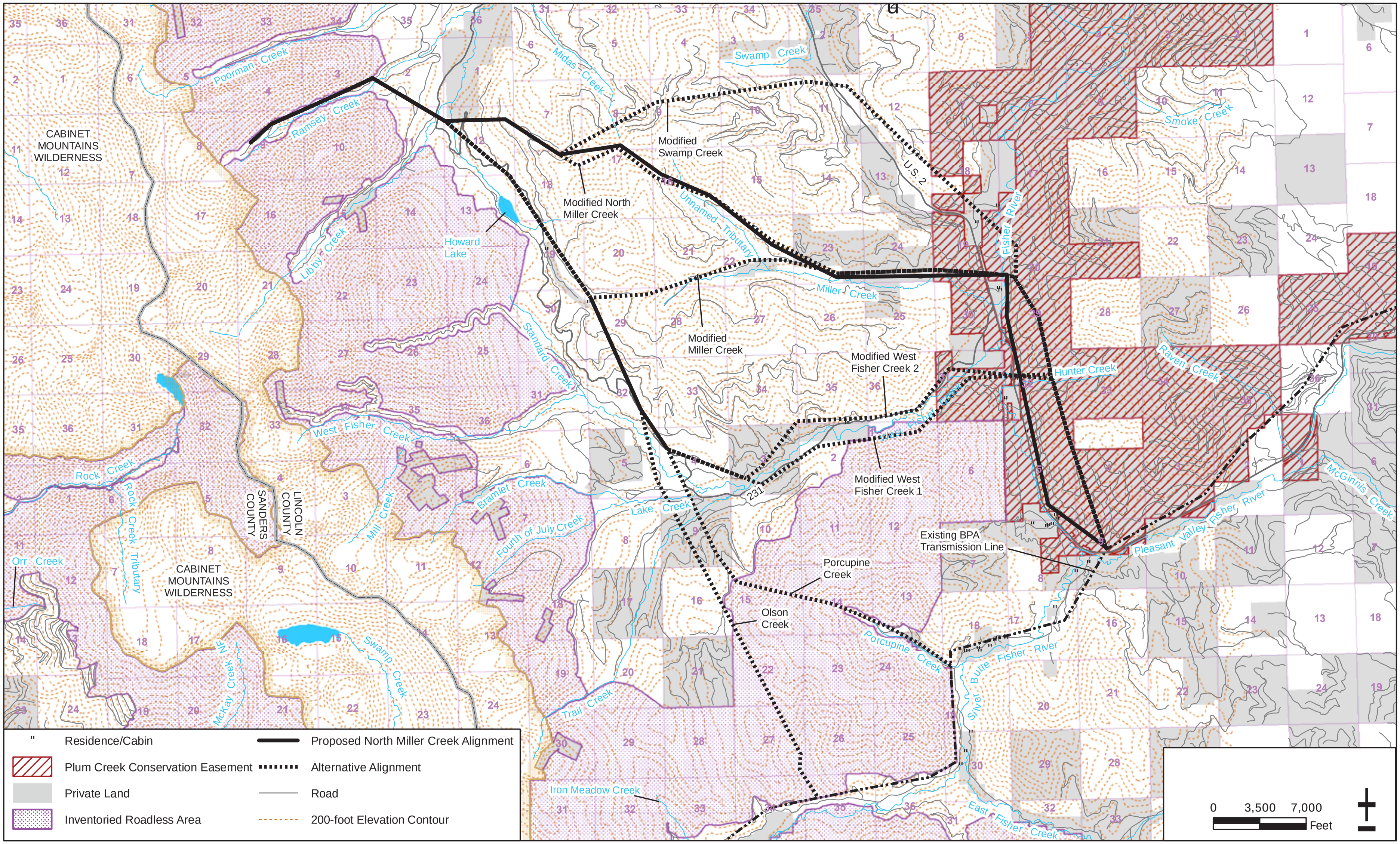


Figure 49. Transmission Line Alignment Alternatives Evaluated for this EIS

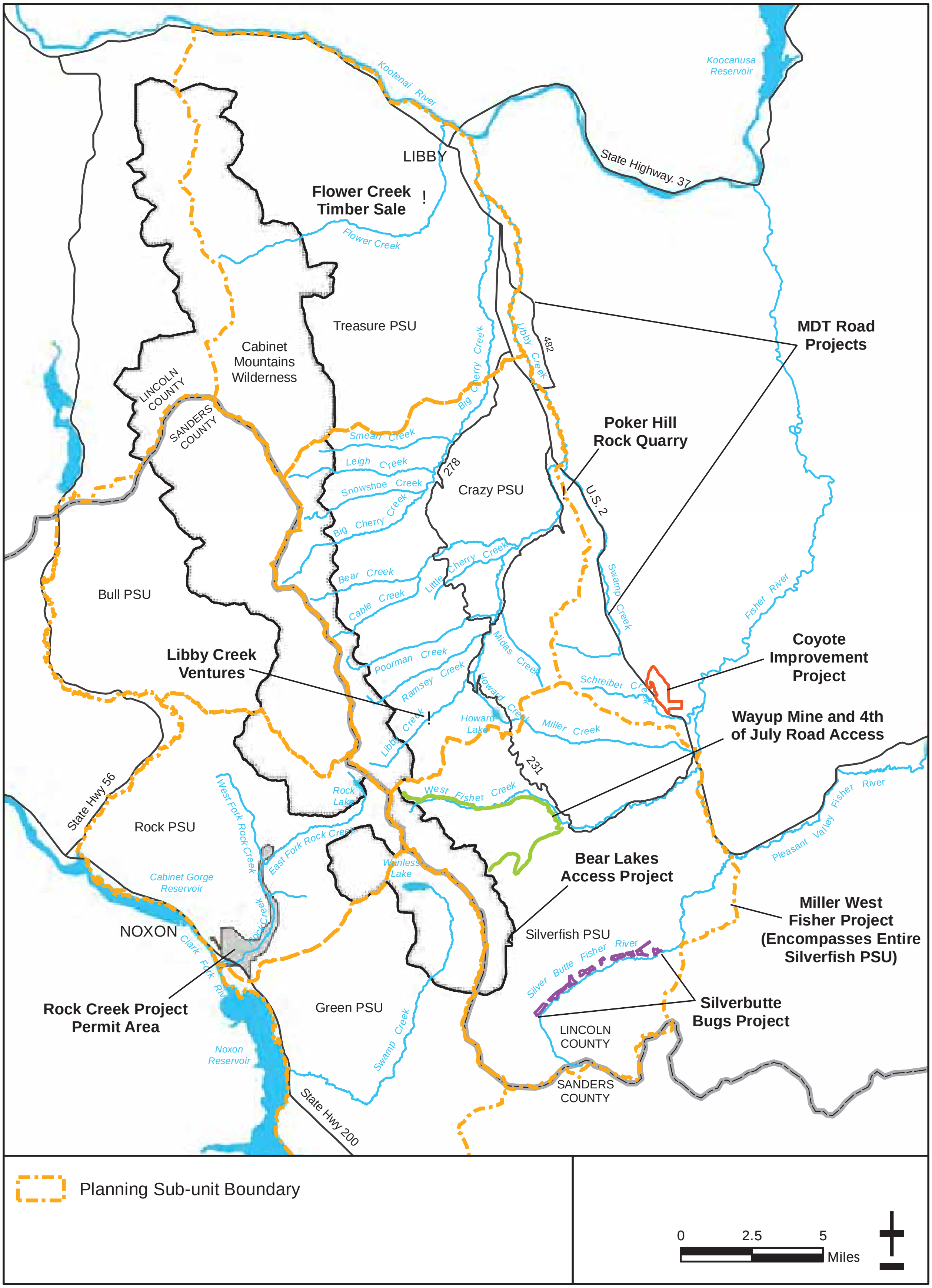


Figure 50. Reasonably Foreseeable Actions for the Proposed Montanore Project

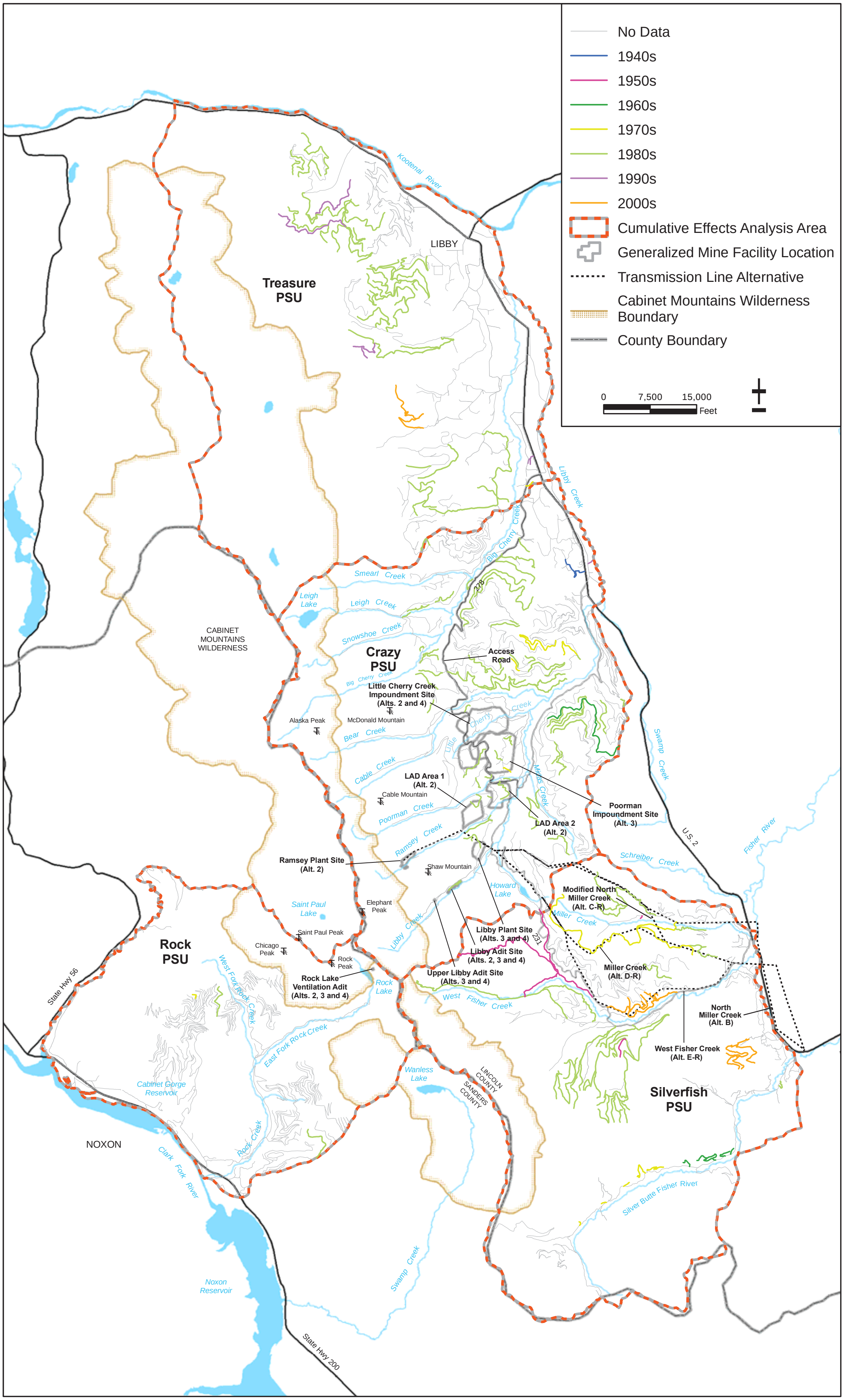


Figure 51. Road Construction by Decade in the Montanore Cumulative Effects Analysis Area

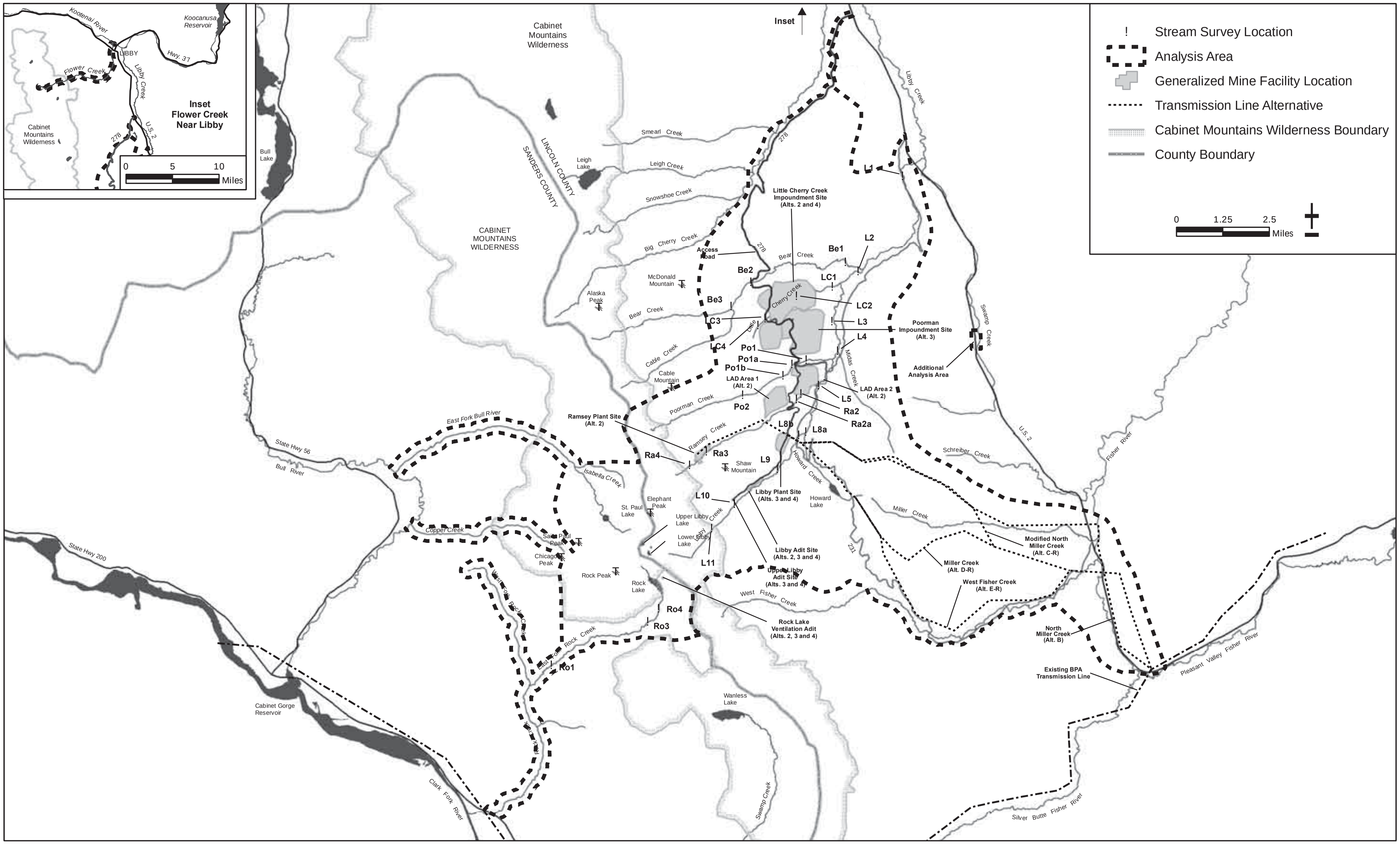


Figure 52. Stream Survey Locations in the Analysis Area

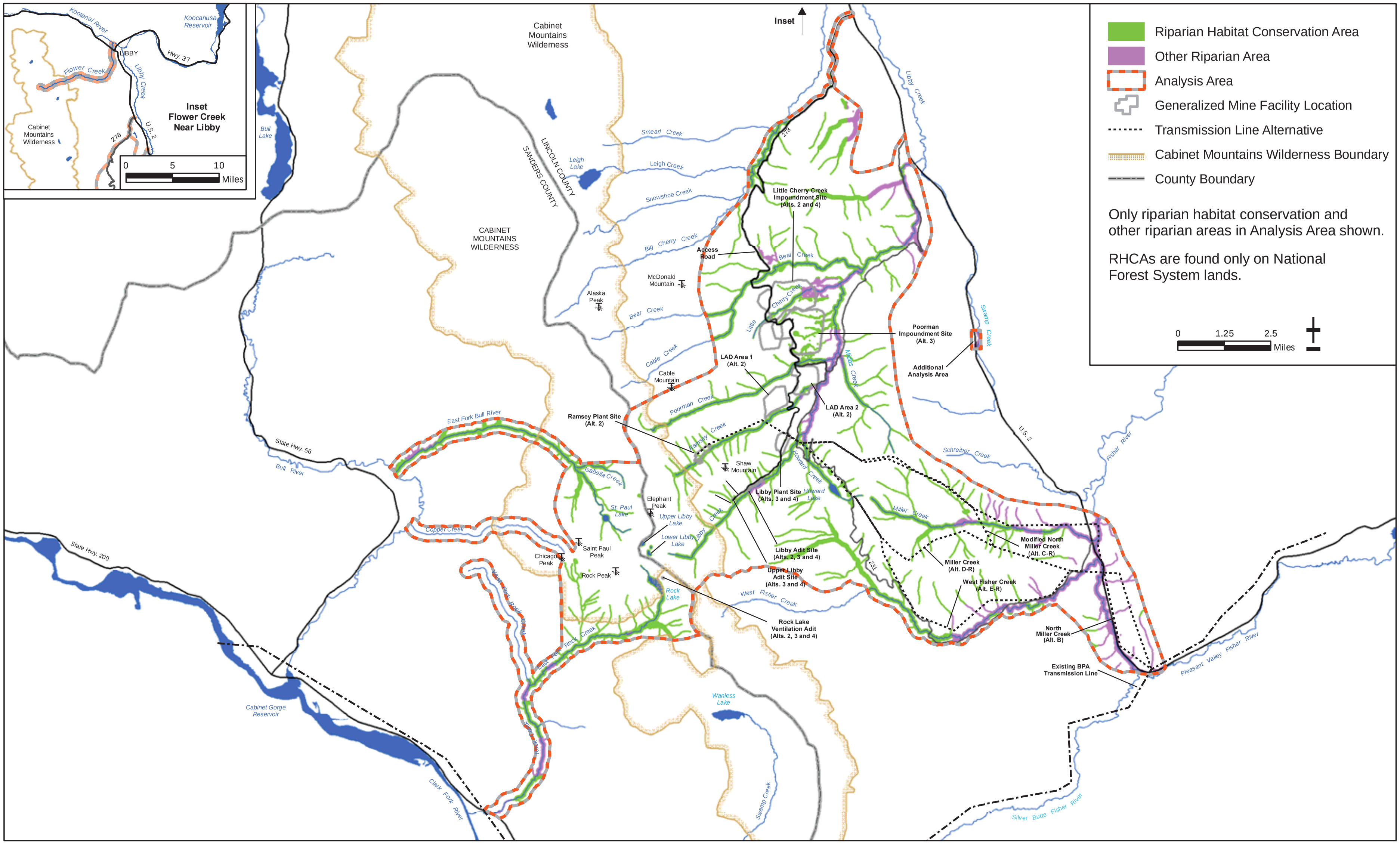


Figure 53. Riparian Habitat Conservation Areas and Other Riparian Areas in the Analysis Area

General Reach Type	Fisheries Use	Reach Description	Rosgen Morphology Type
Source Reach	None or low	Steep to very steep, deeply entrenched, high debris transport, very stable if bedrock or boulder dominated, rapids and waterfalls common	A, A+
Stable Transport Reach	High	Moderate relief, moderate entrenchment, riffle, step/pool morphology with stable banks	B, E
Unstable Transport Reach	Moderate	Moderate relief, generally entrenched with laterally unstable banks, riffle/pool morphology, can be a sediment source if the channel is in a laterally mobile cycle	F, G
Stable Depositional/ Transport Reach	High	Slightly entrenched, low gradient, meandering riffle/pool morphology in well-defined floodplains with stable banks	C
Unstable Depositional Reach	Low	Braided channels in depositional fans, active lateral adjustment with large sediment supply, high bedload and bank erosion and deposition	D, D+

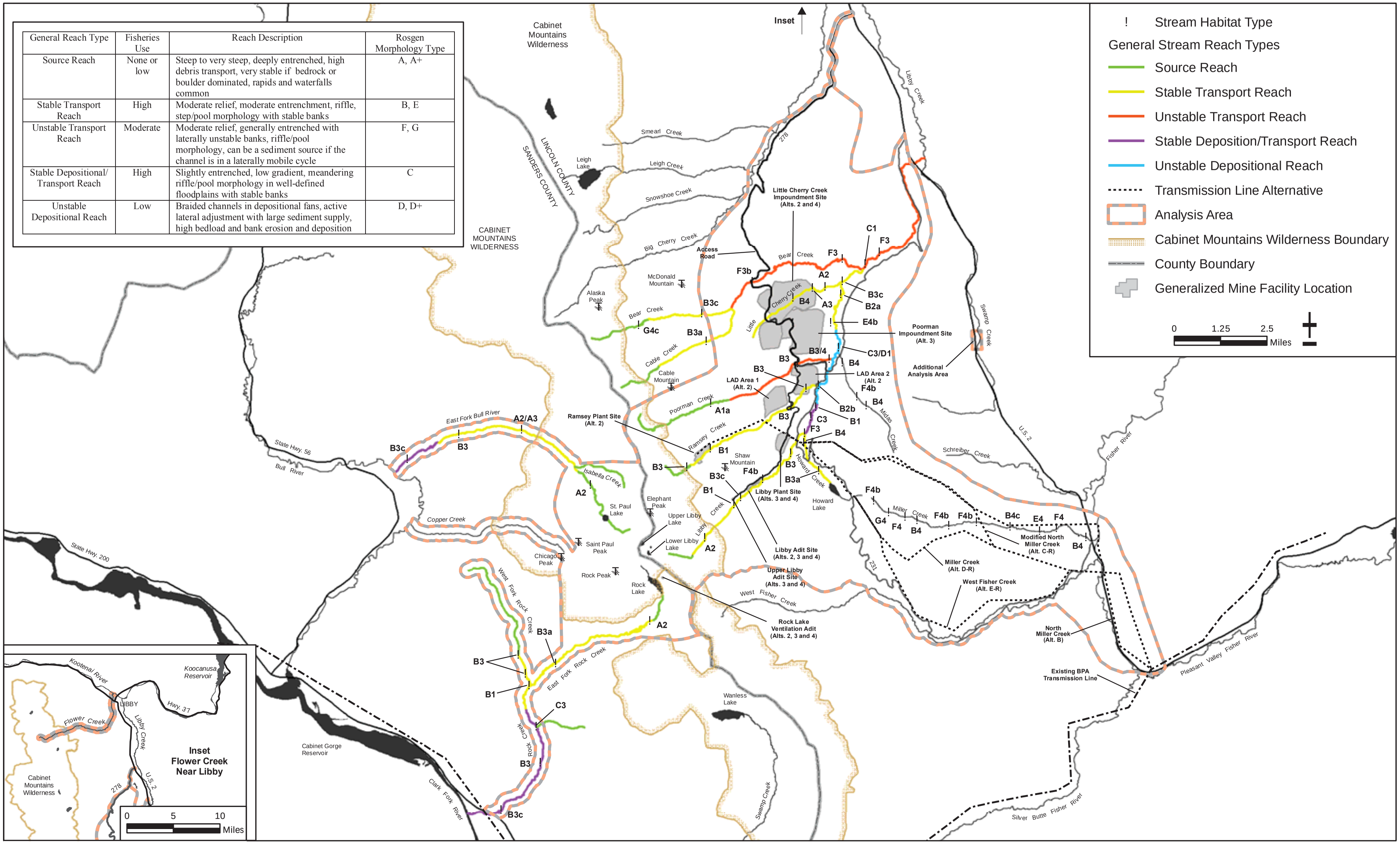


Figure 54. Stream Habitat Types of the Analysis Area Streams

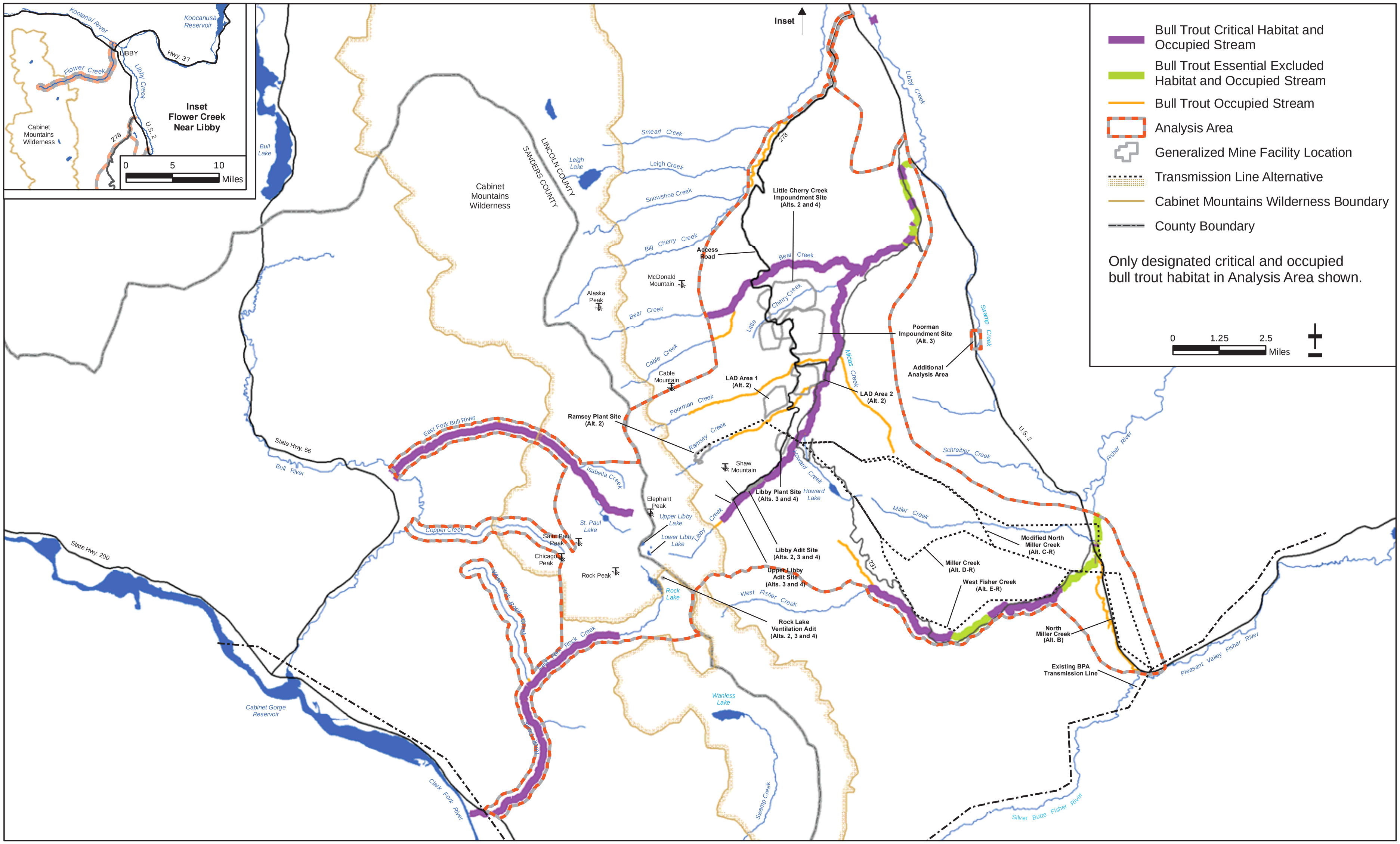


Figure 55. Designated Critical and Occupied Bull Trout Habitat in the Analysis Area Streams

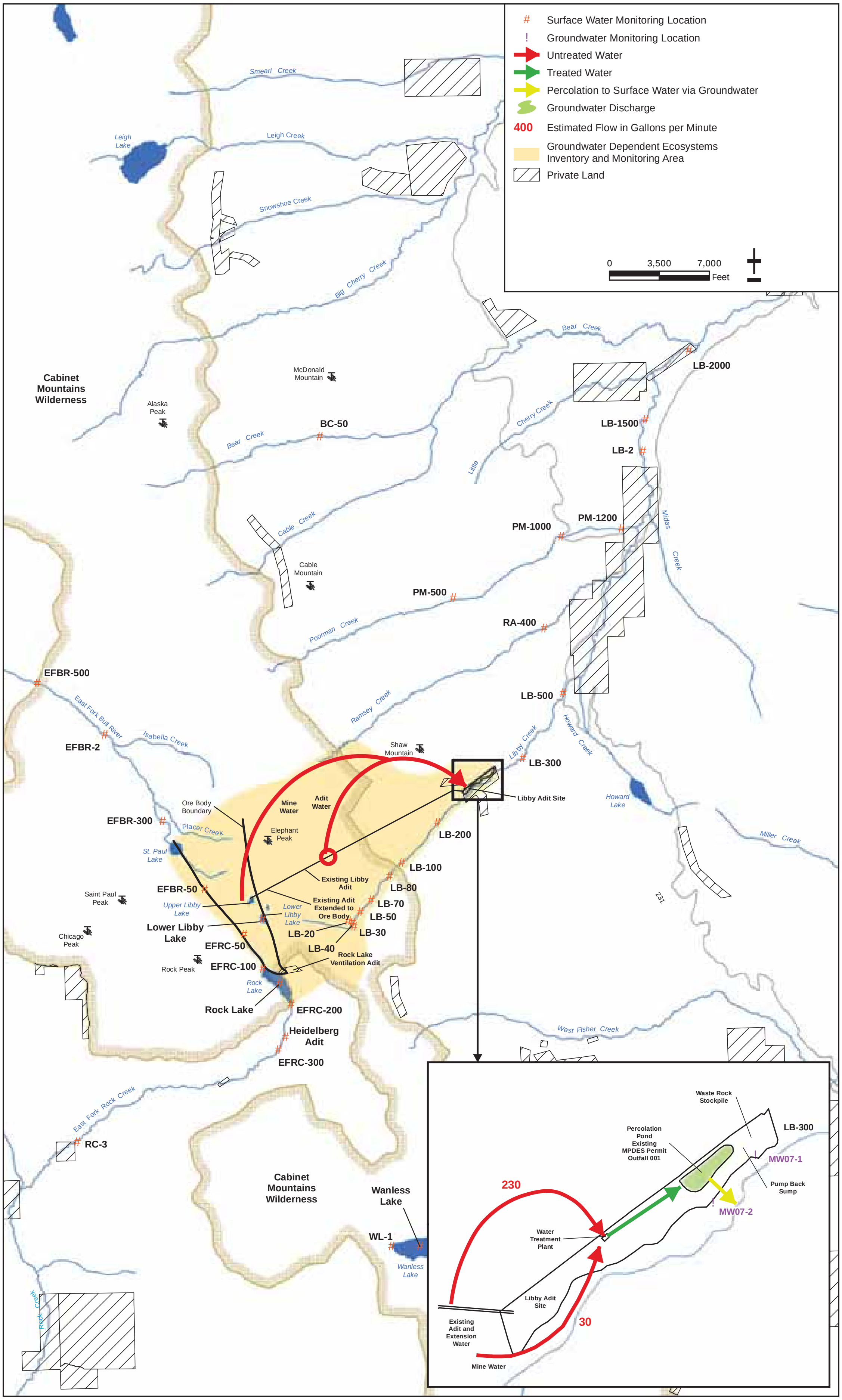


Figure 56. Project Water Balance, Evaluation Phase, Alternative 3

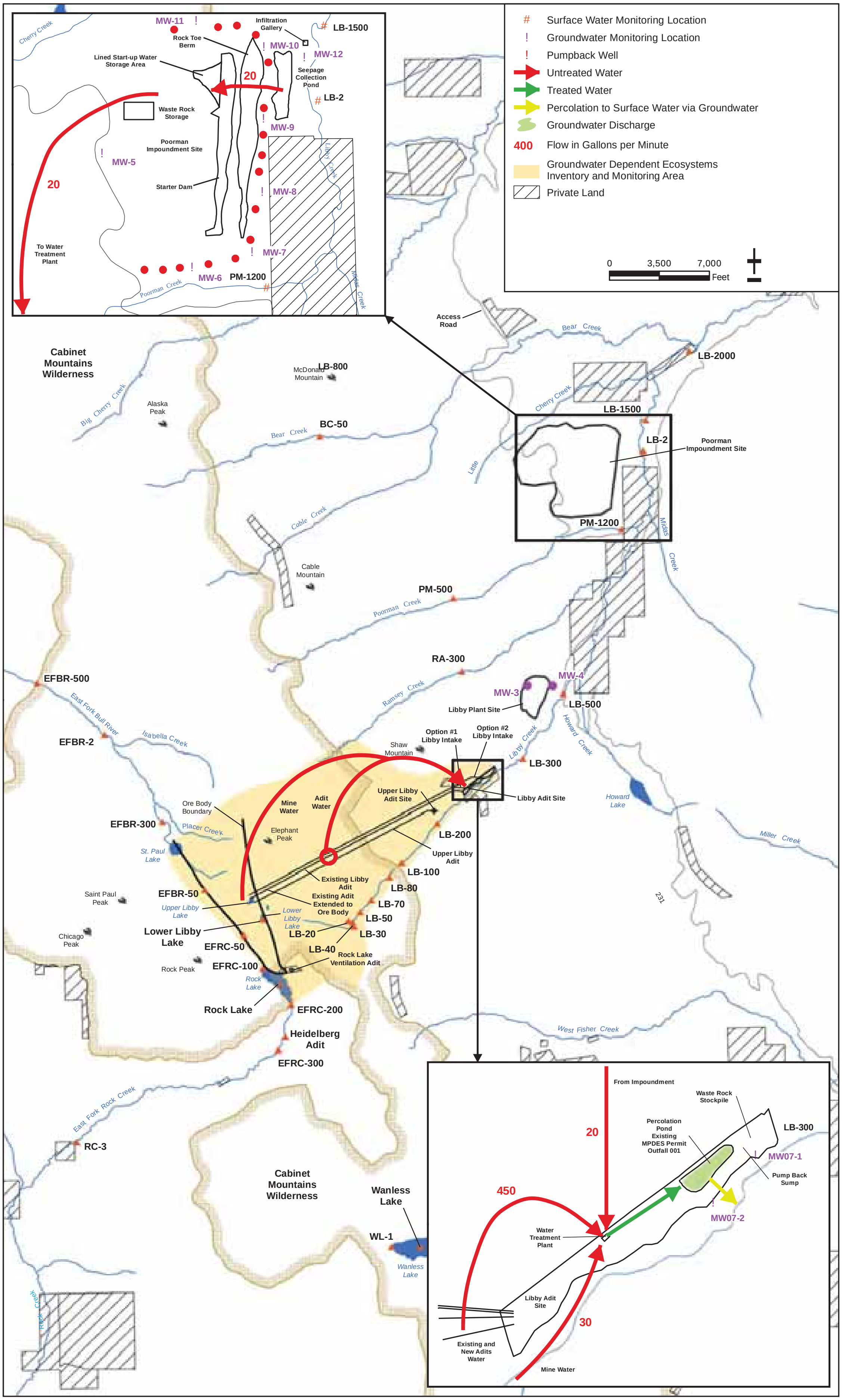


Figure 57. Project Water Balance, Construction Phase, Alternative 3

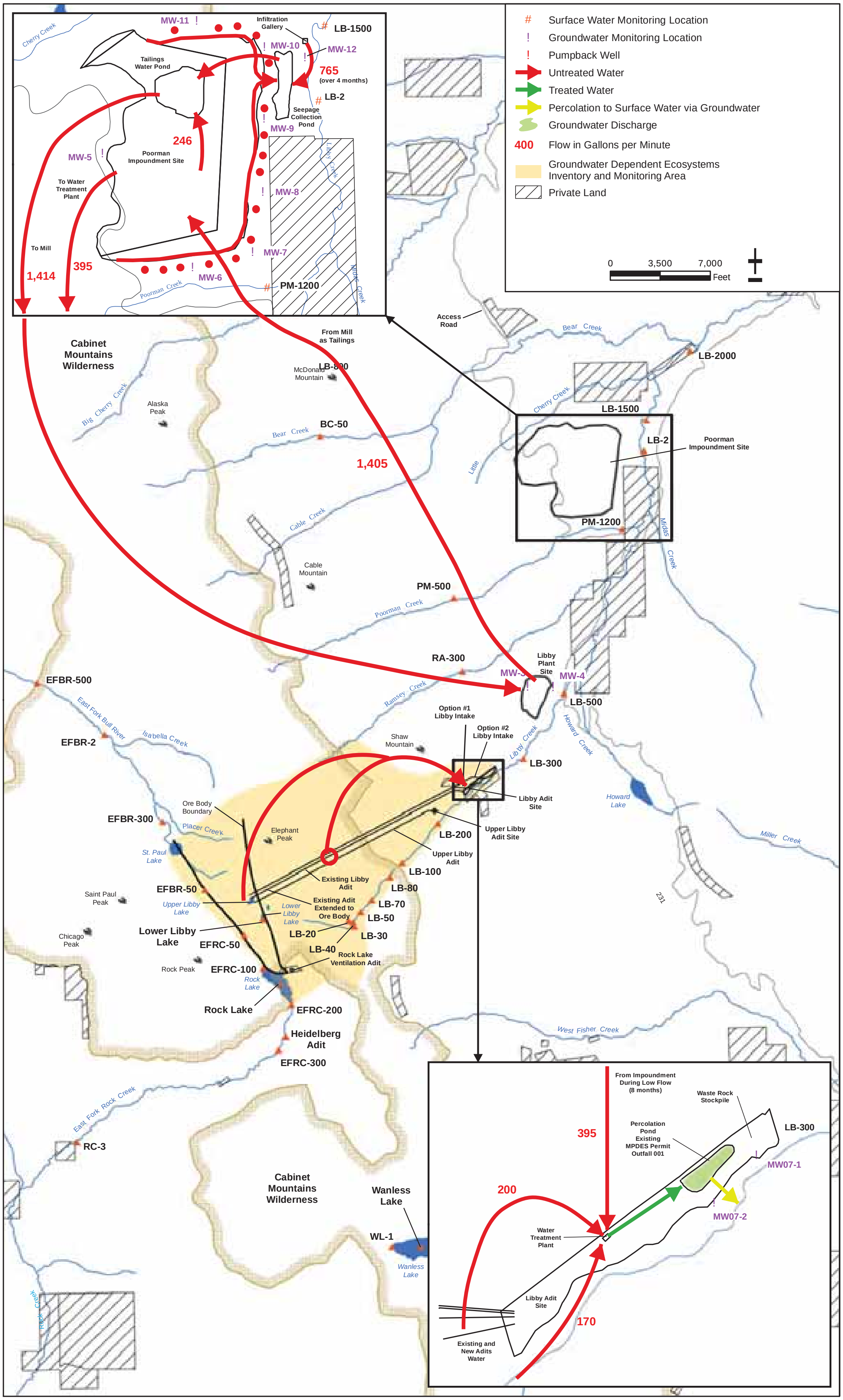


Figure 58. Project Water Balance, Operations Phase, Alternative 3

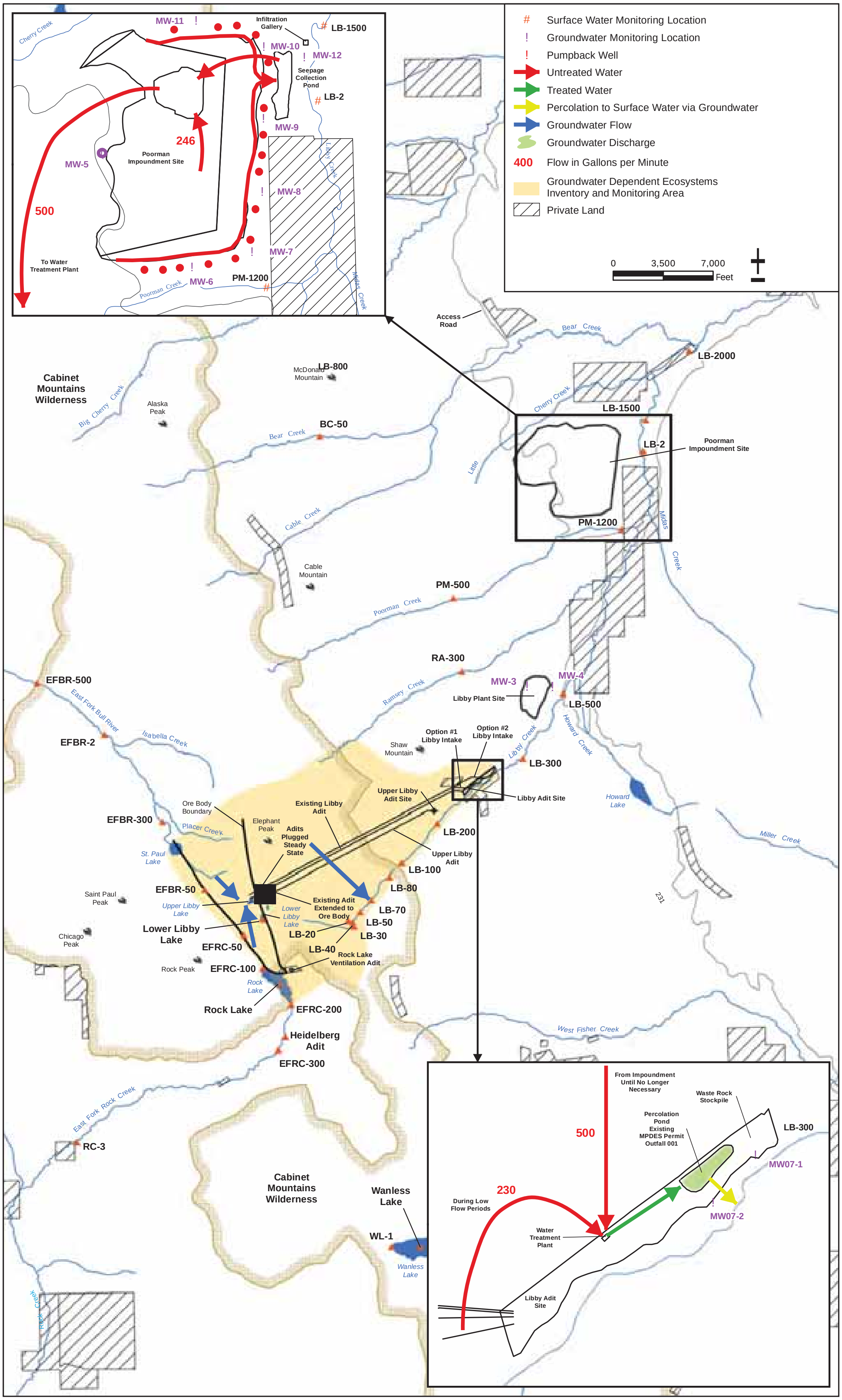


Figure 59. Project Water Balance, Closure Phase, Alternative 3

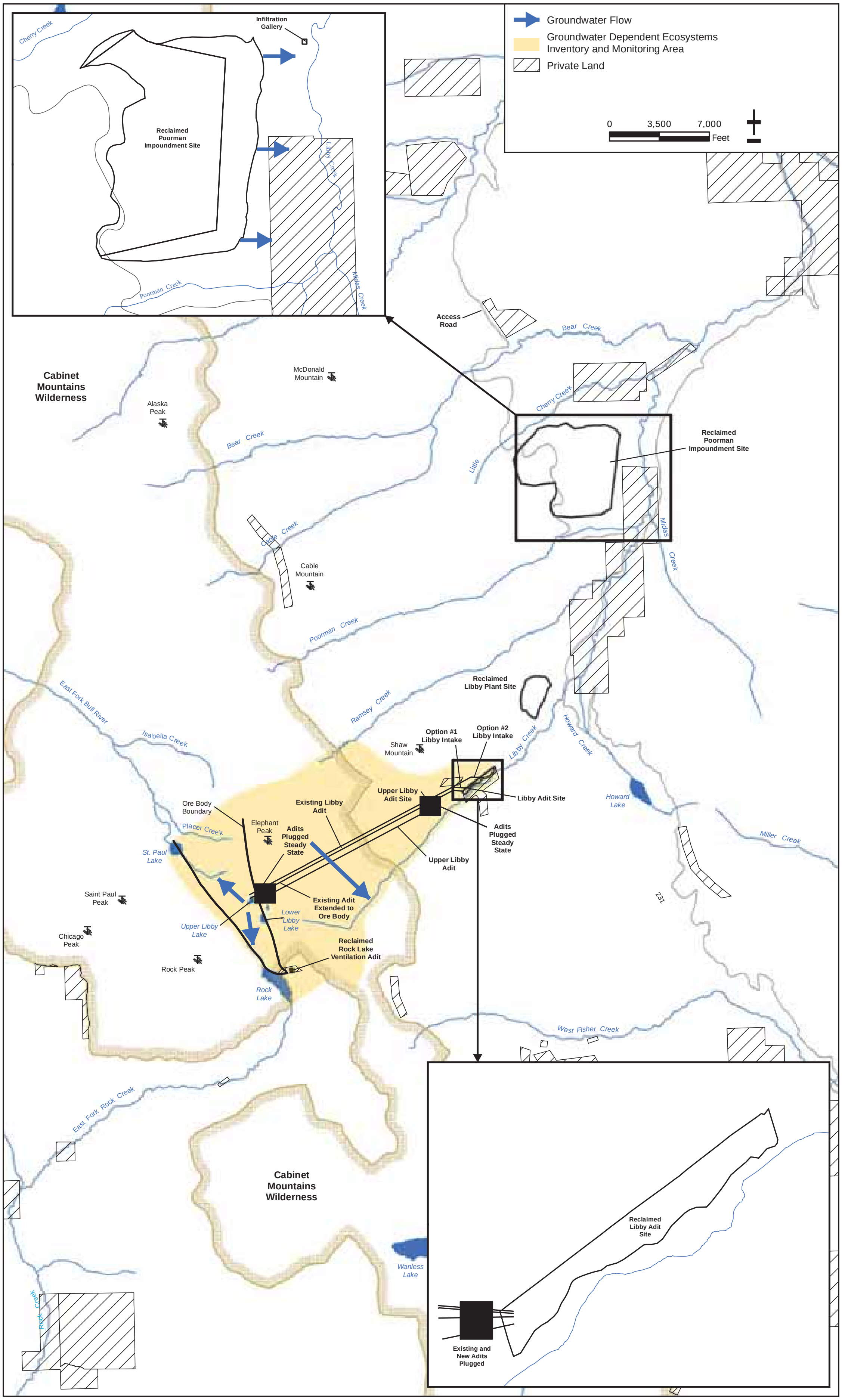
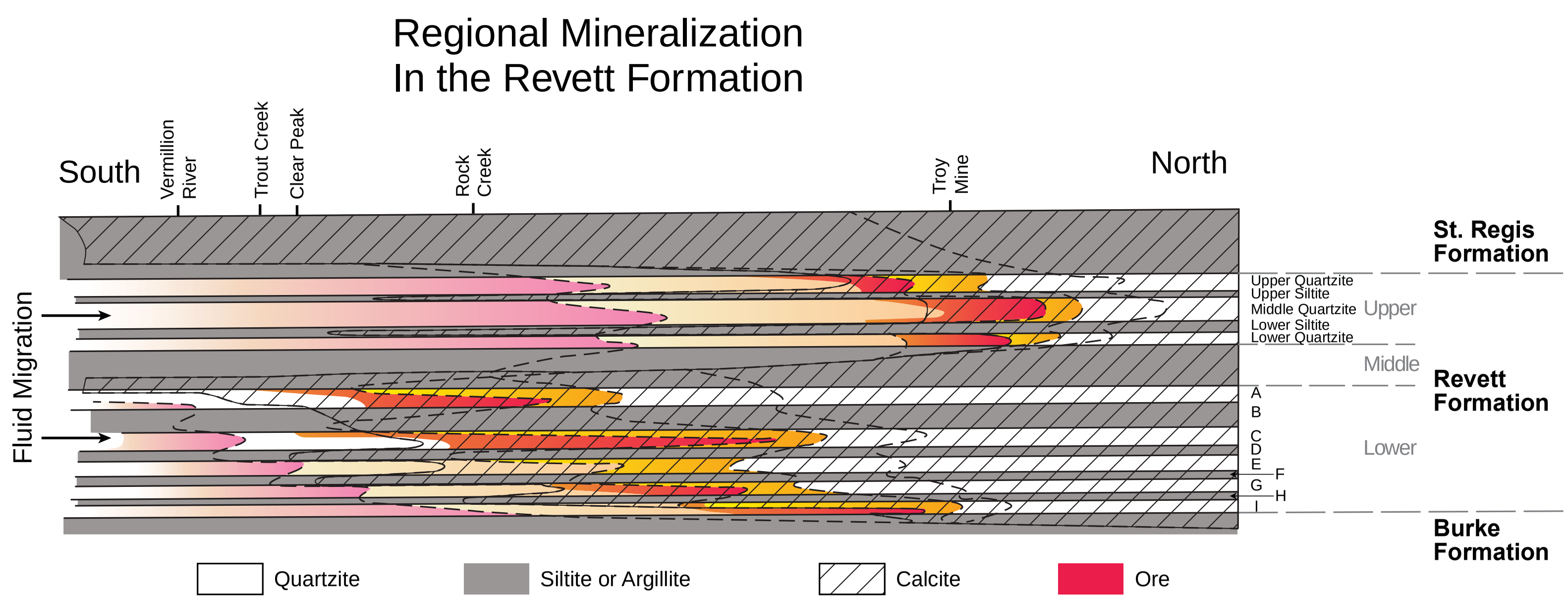
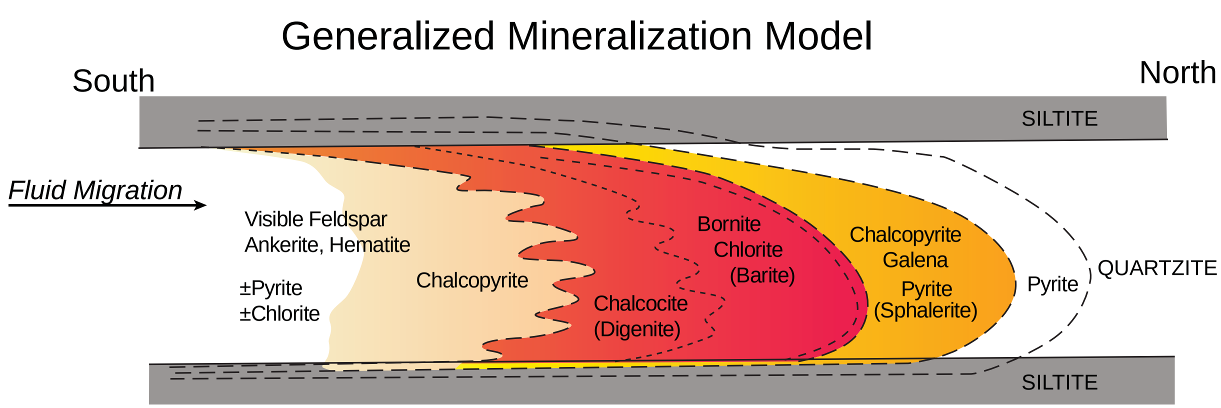


Figure 60. Project Water Balance, Late Post-Closure Phase, Alternative 3





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Preliminary Draft

Figure 61. Regional and Generalized Mineral Zones in the Revett Formation

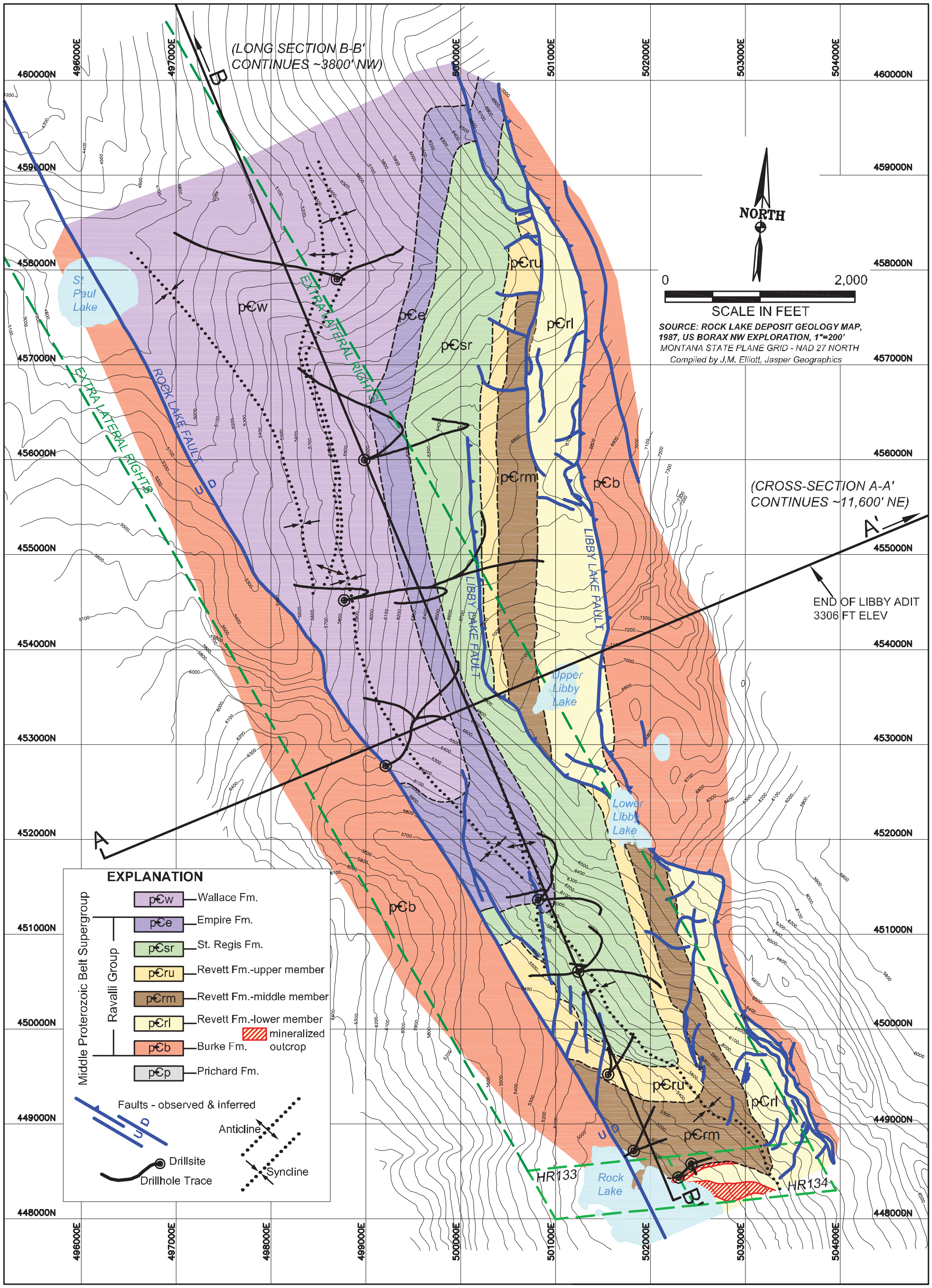
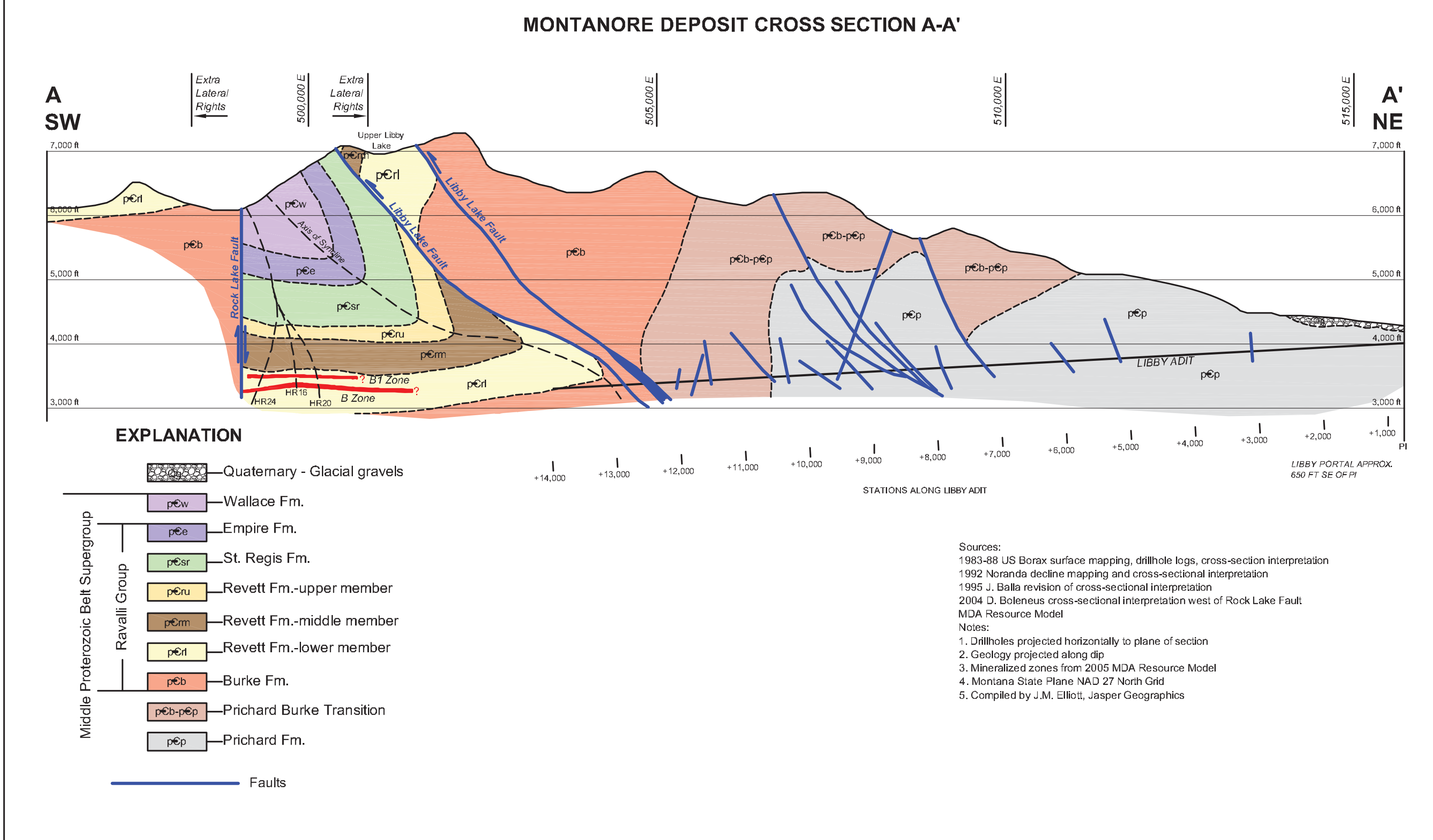


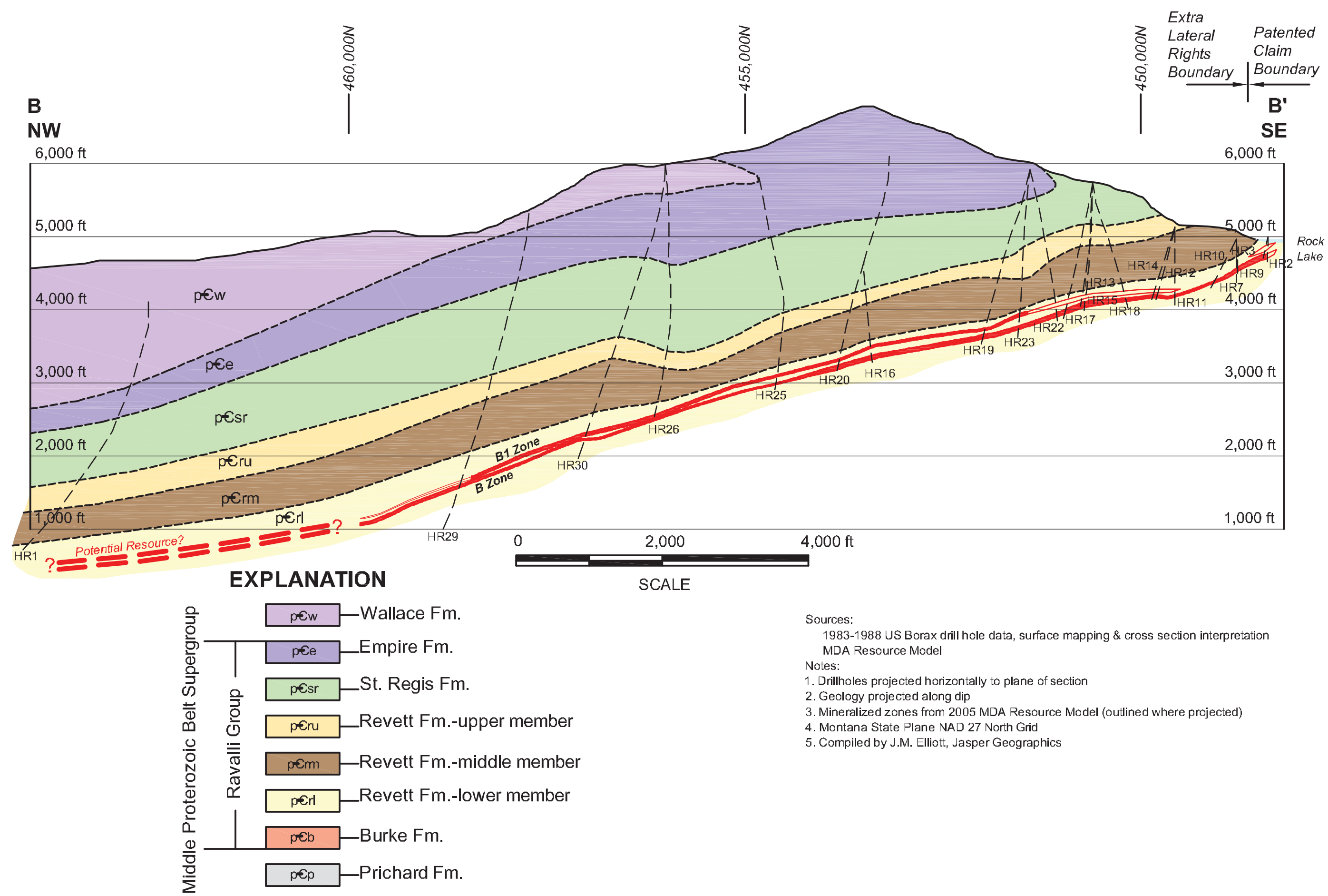
Figure 62. Bedrock Geology of the Rock Creek-Montanore Deposit



Note: Location of Cross-section shown on Figure 62.

Figure 63. Geologic Cross Section-Libby Adit

MONTANORE DEPOSIT LONG SECTION B-B'



Note: Location of Cross-section shown on Figure 62.

Figure 64. Geologic Cross Section-Montanore Sub-deposit

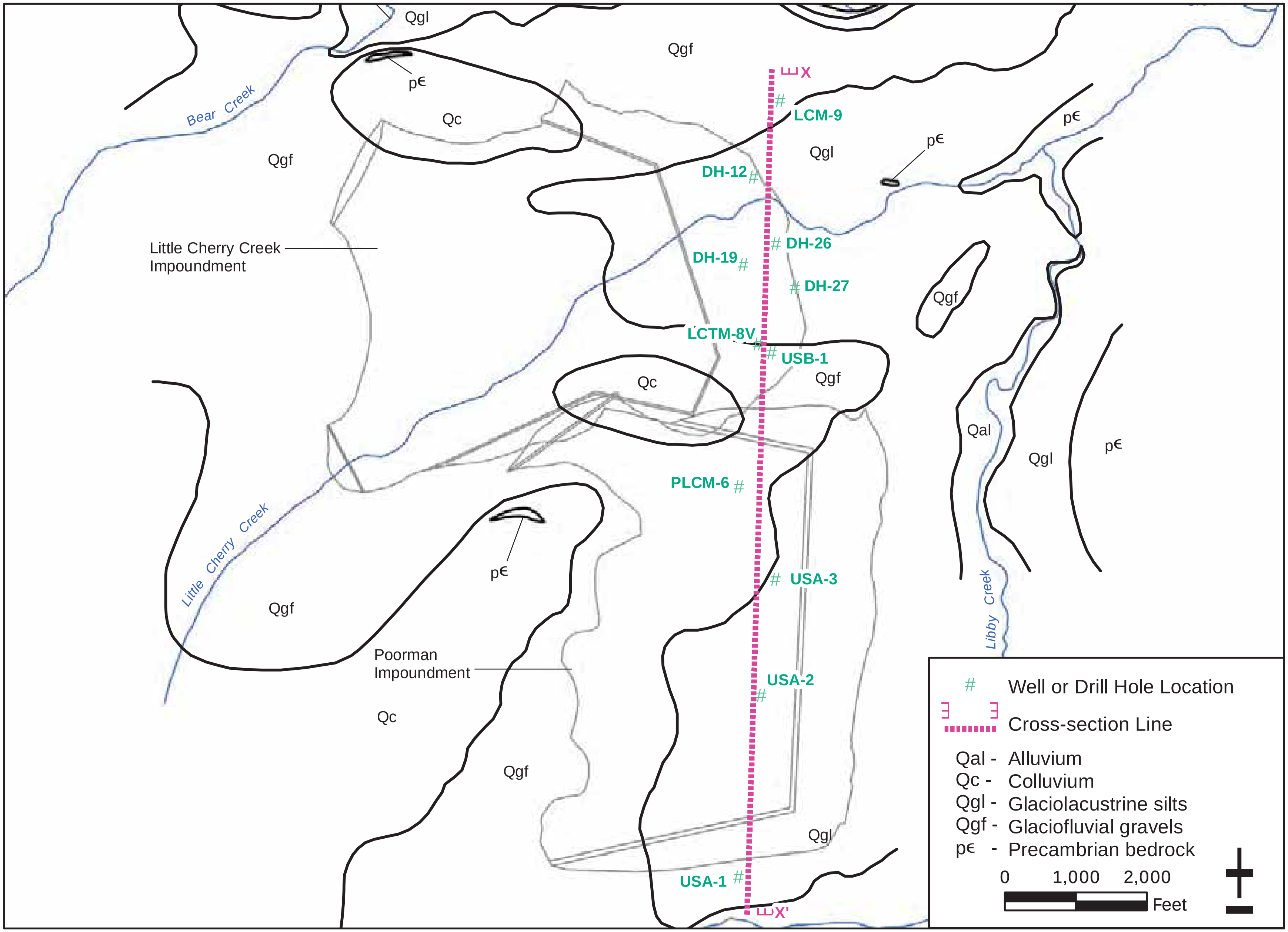


Figure 65. Geology of the Two Tailings Impoundment Sites

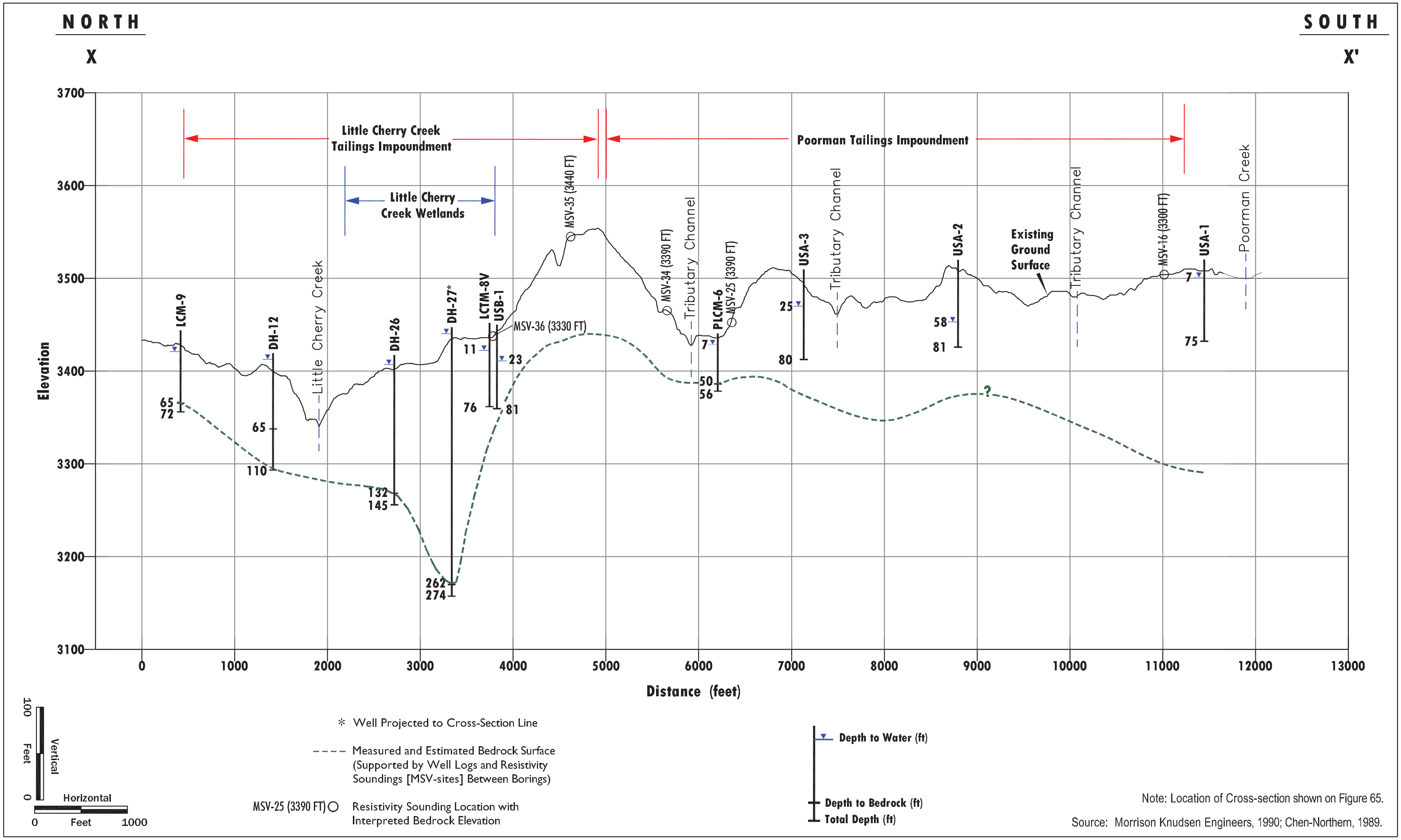


Figure 66. Geologic Cross Section of the Two Tailings Impoundment Sites

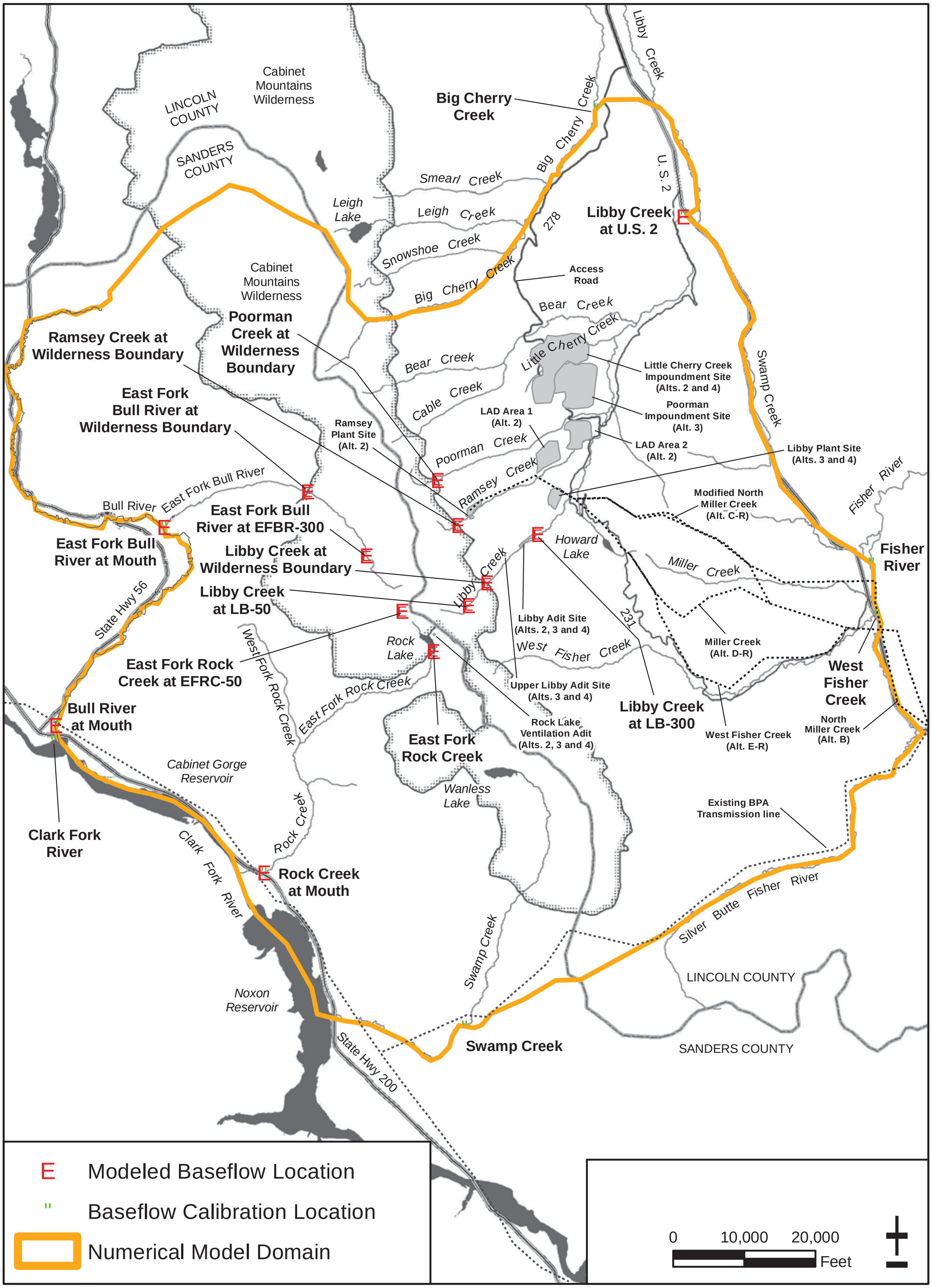


Figure 67. Numerical Model Domain and Groundwater Hydrology Analysis Area Location

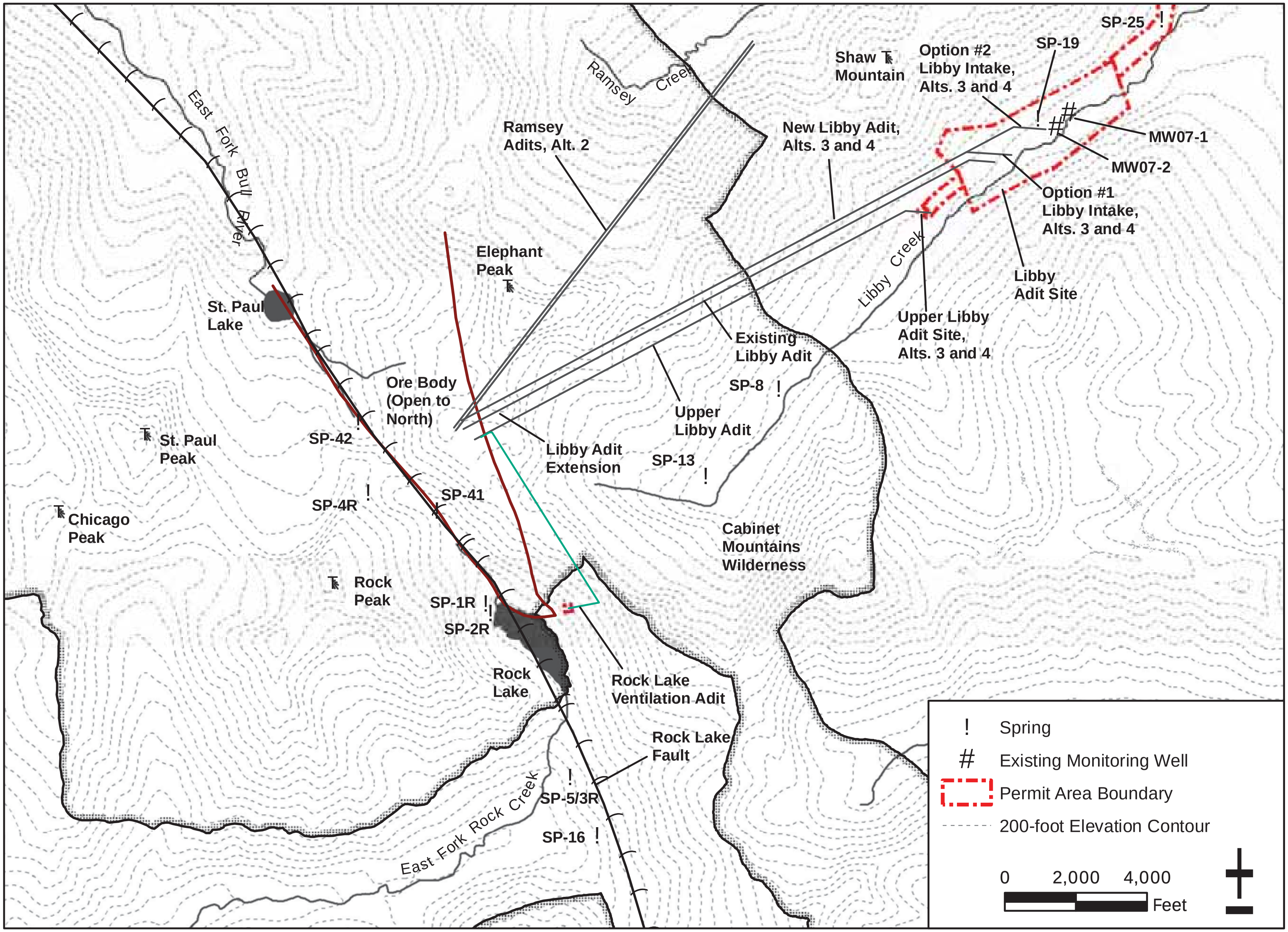


Figure 68. Existing Monitoring Wells and Identified Springs in the Mine Area

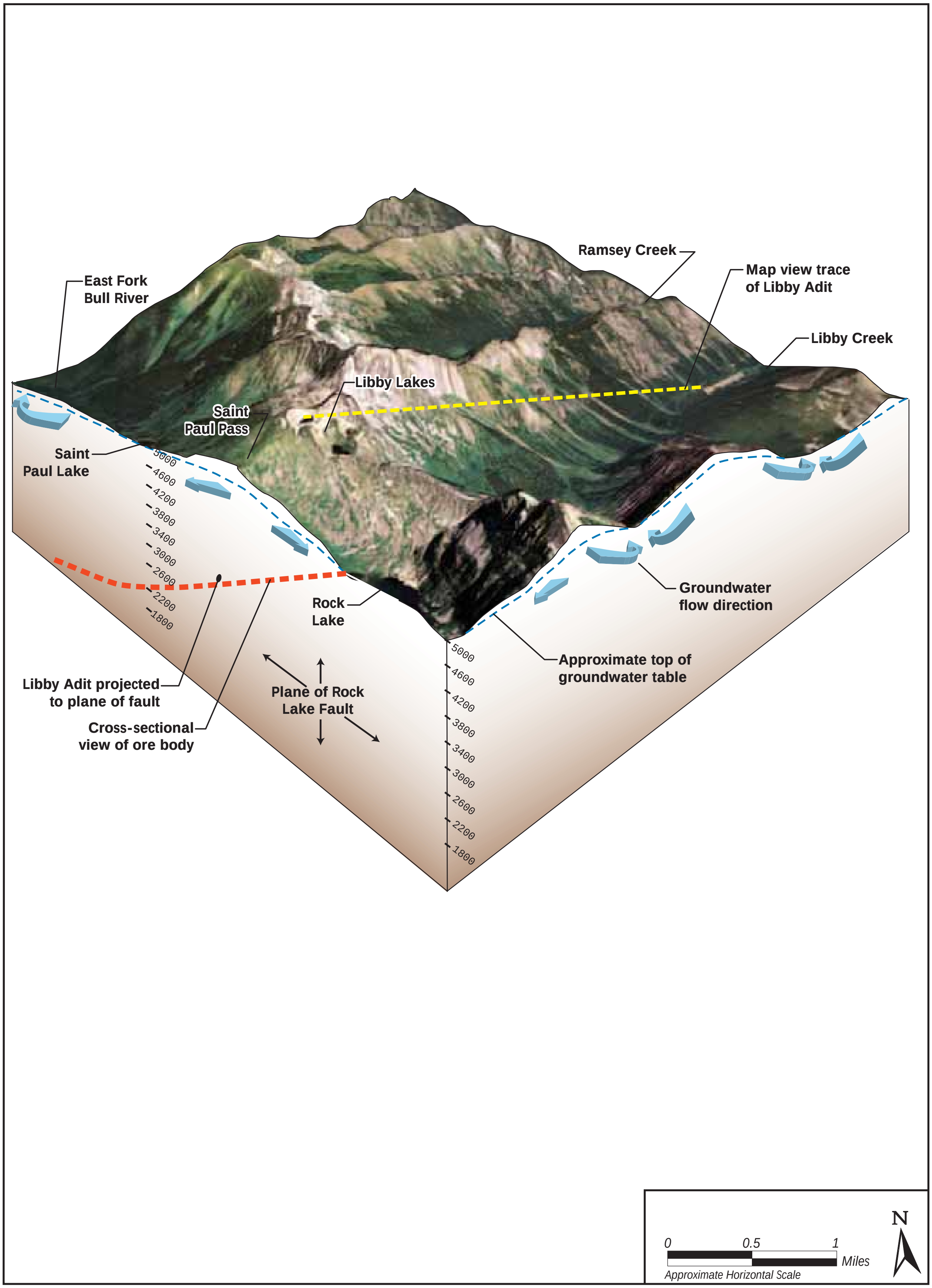


Figure 69. Three Dimensional Conceptual Model of the Montanore Mine Area Hydrogeology

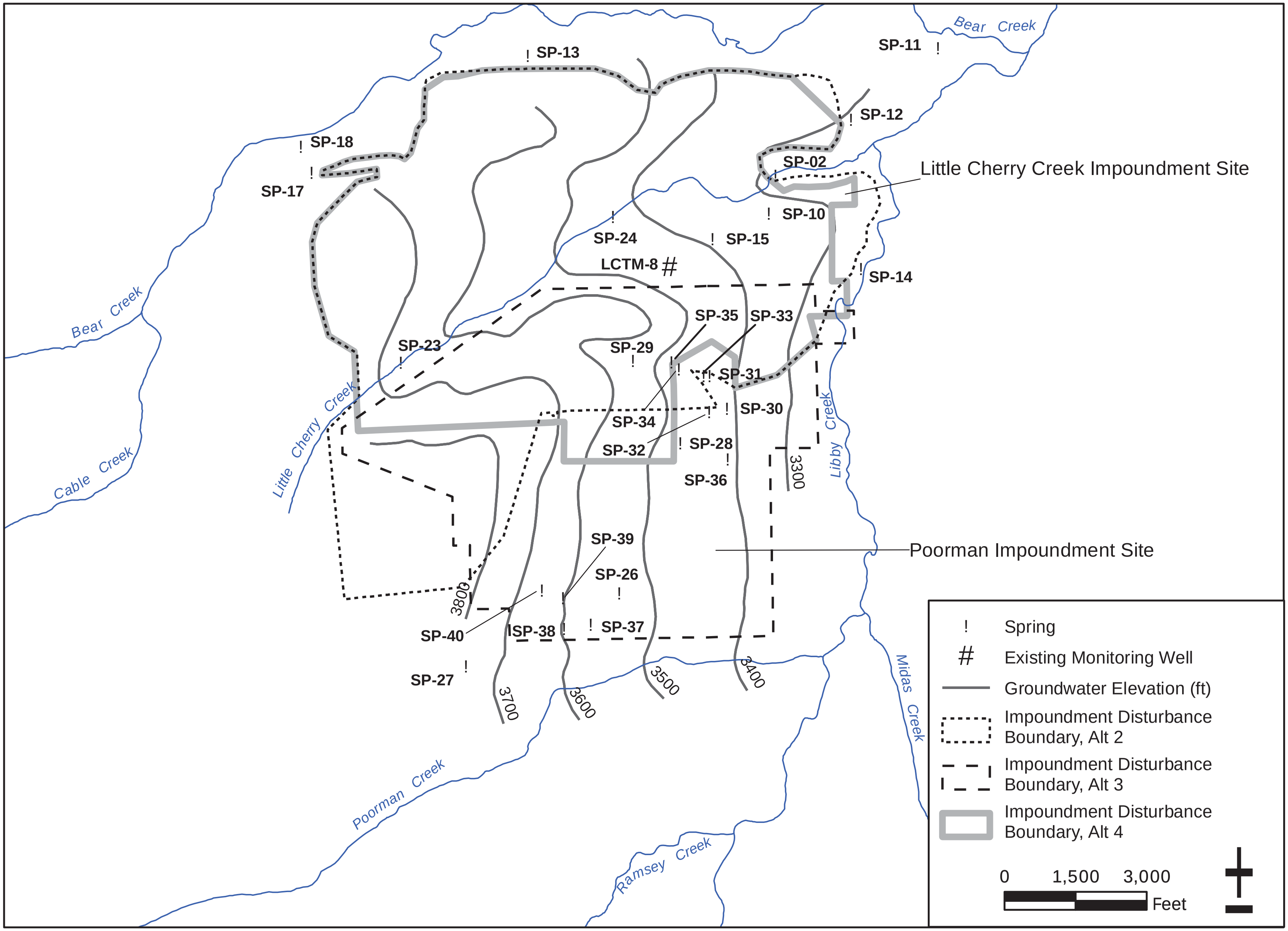


Figure 70. Existing Monitoring Wells, Identified Springs, and Groundwater Levels in the Tailings Impoundment Sites

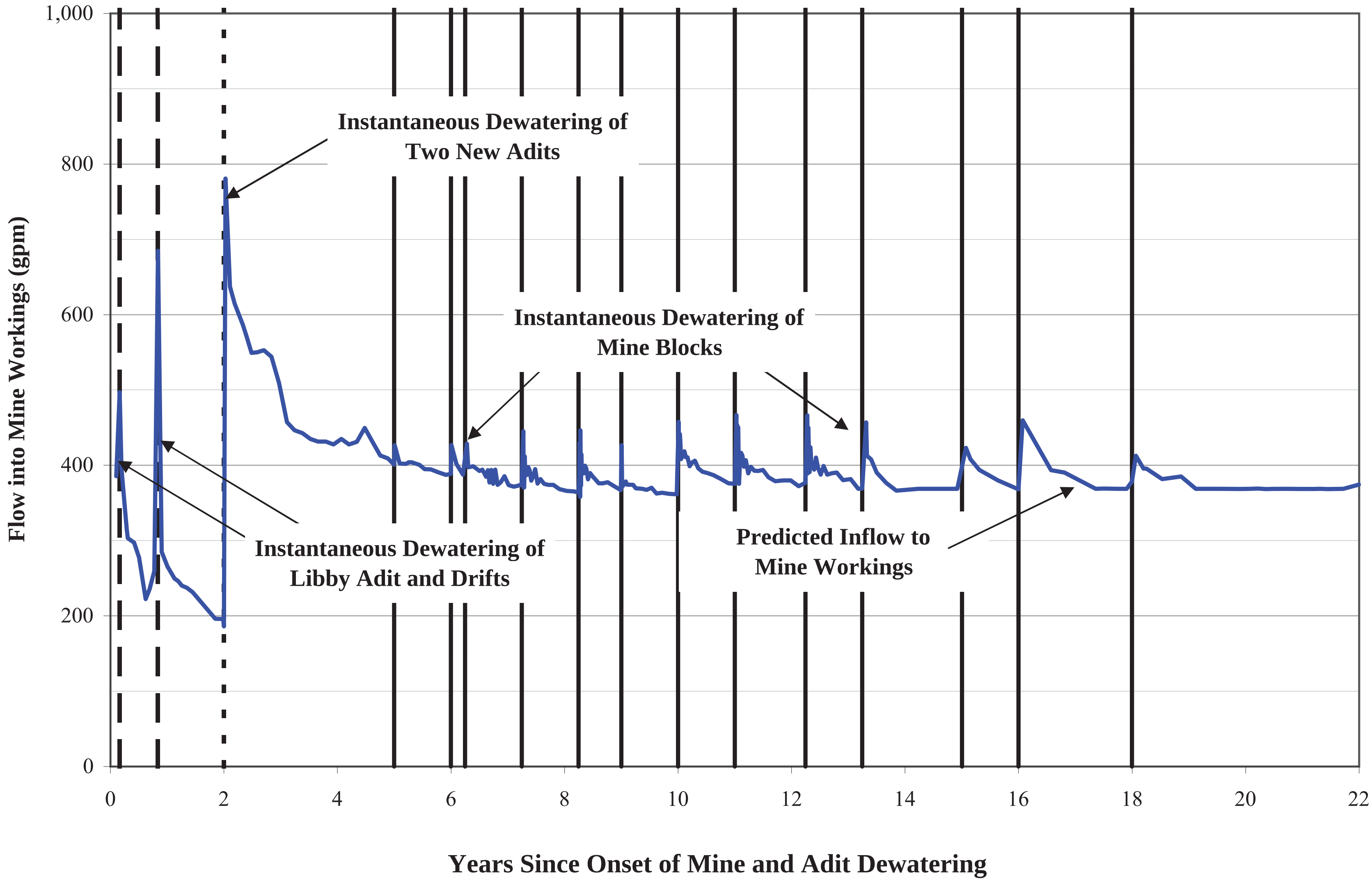


Figure 71. Predicted Dewatering Rates During Evaluation through Operations Phases

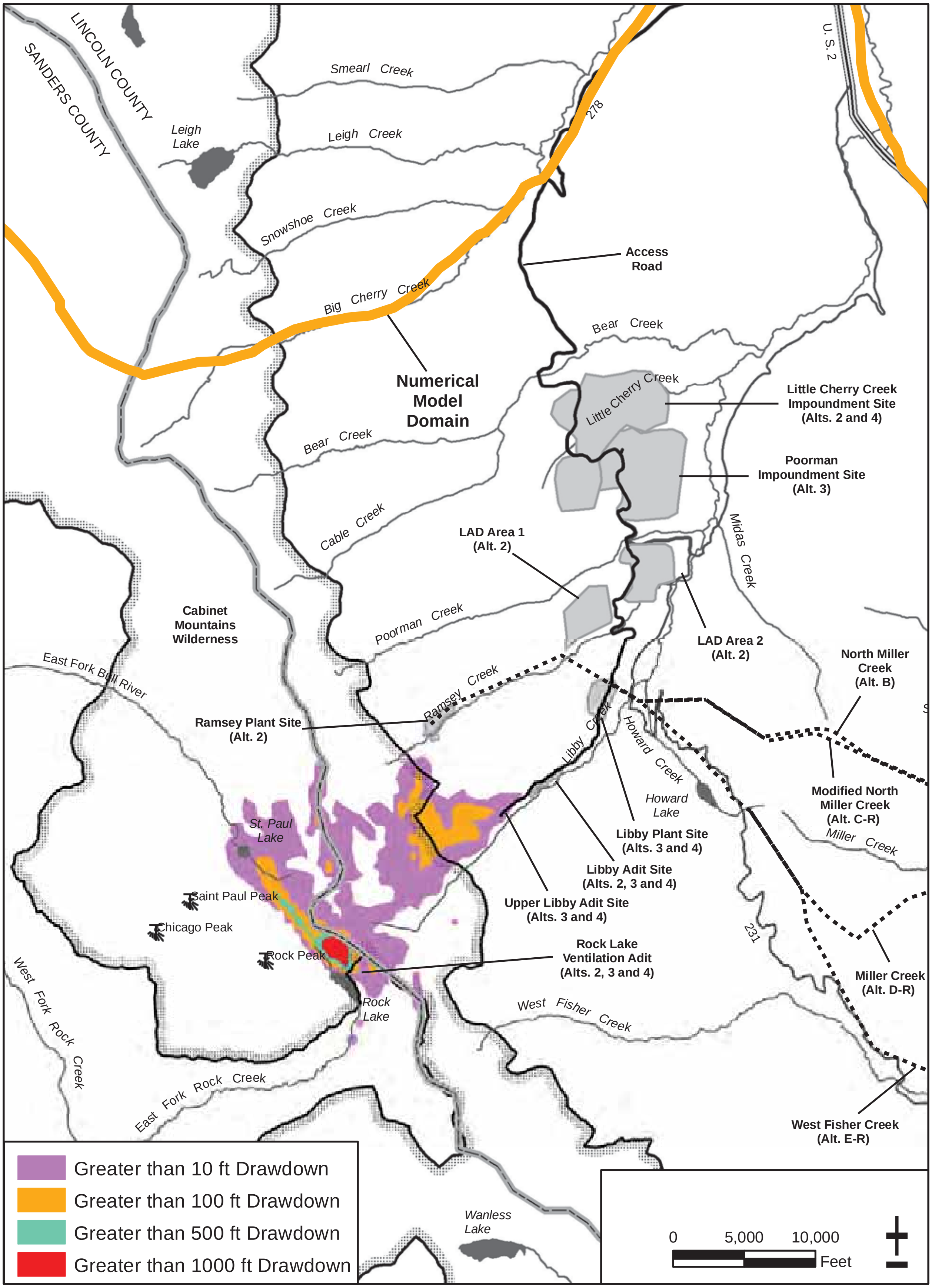


Figure 72. Predicted Area of Groundwater Drawdown Post-Closure Phase (Maximum Baseflow Change)

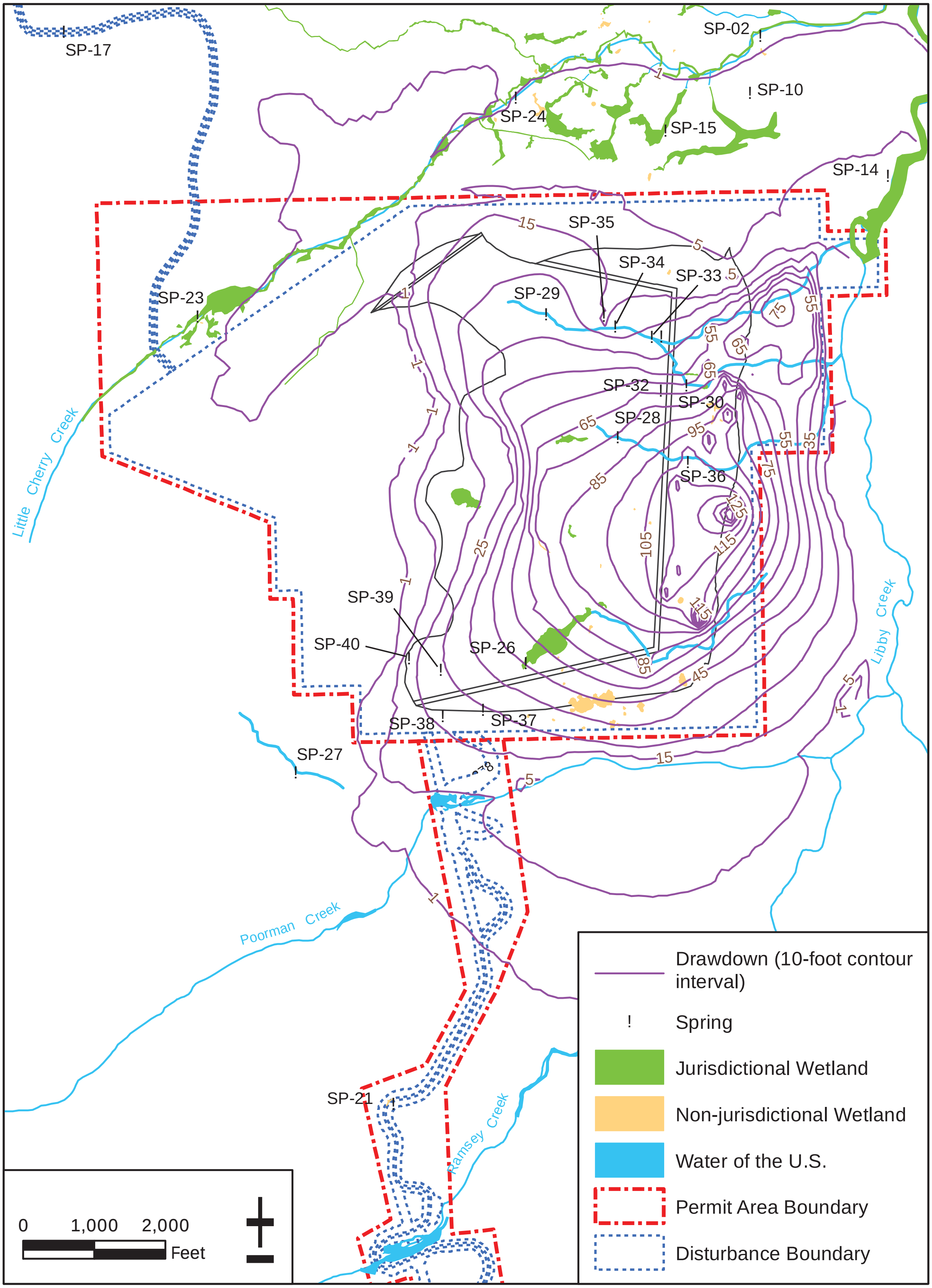


Figure 73. Predicted Area of Groundwater Drawdown in the Poorman Tailings Impoundment Area

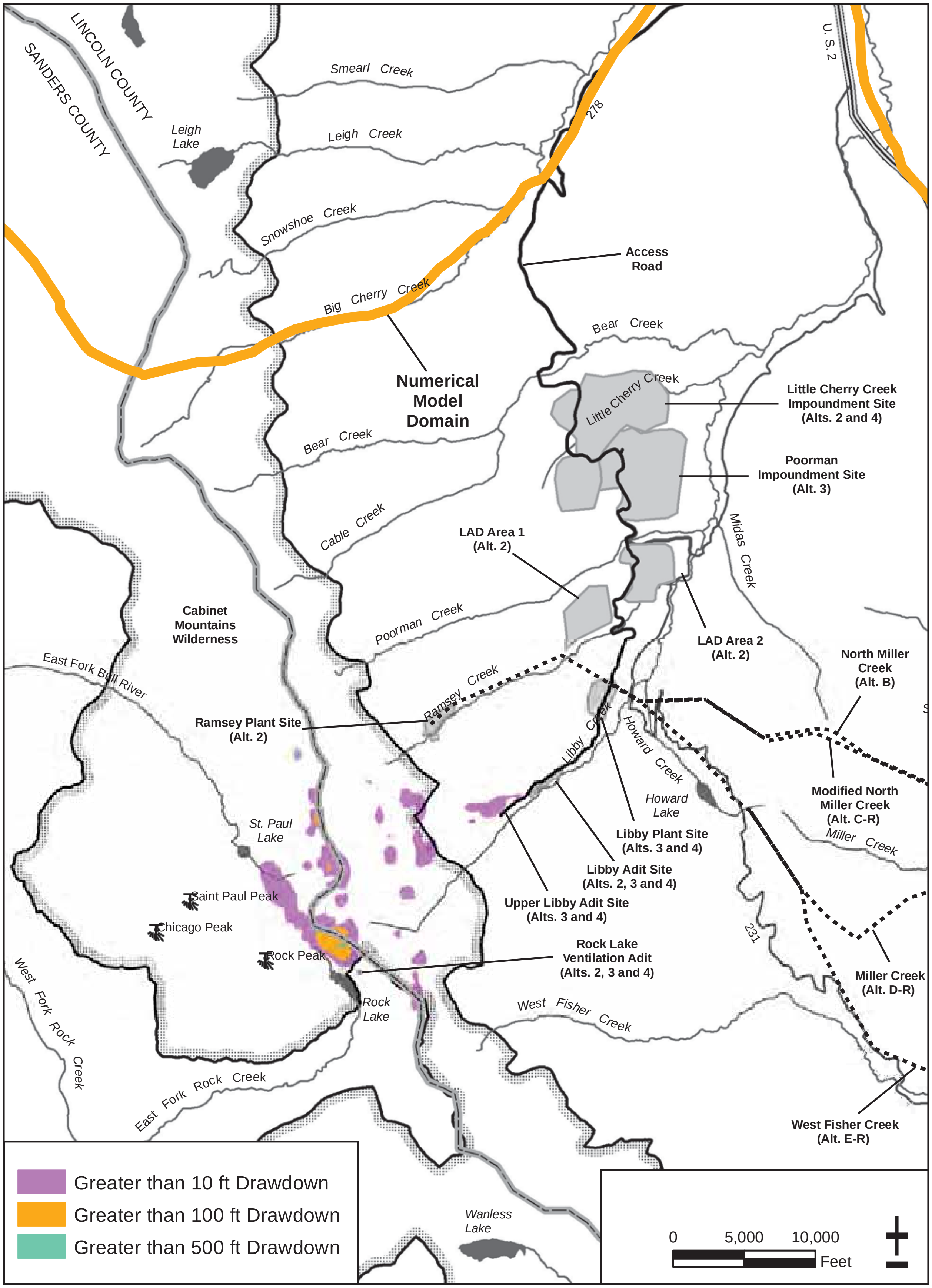


Figure 74. Residual Groundwater Drawdown Post-Closure Phase

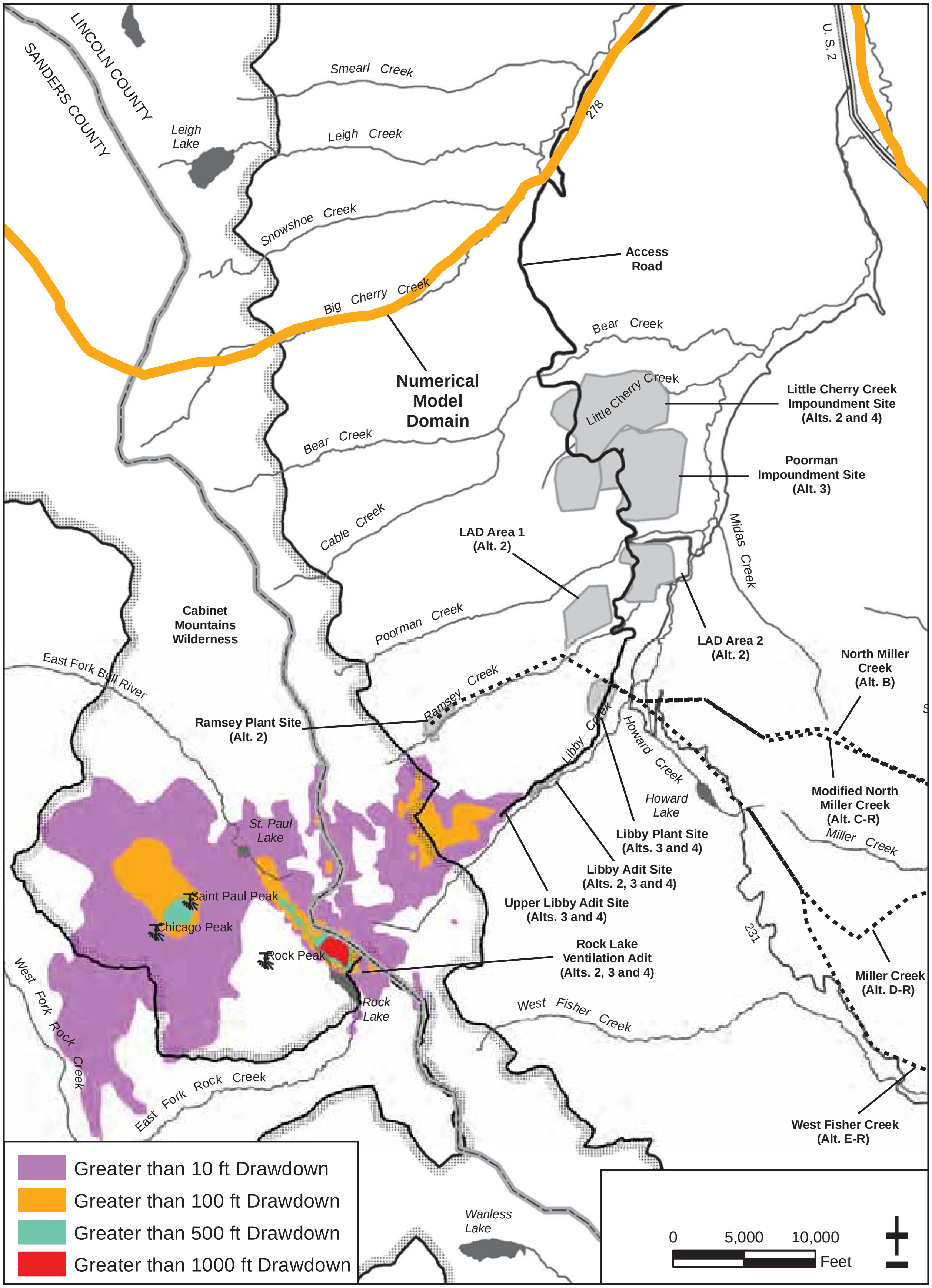


Figure 75. Cumulative Groundwater Drawdown Post-Closure Phase (Maximum Baseflow Change)

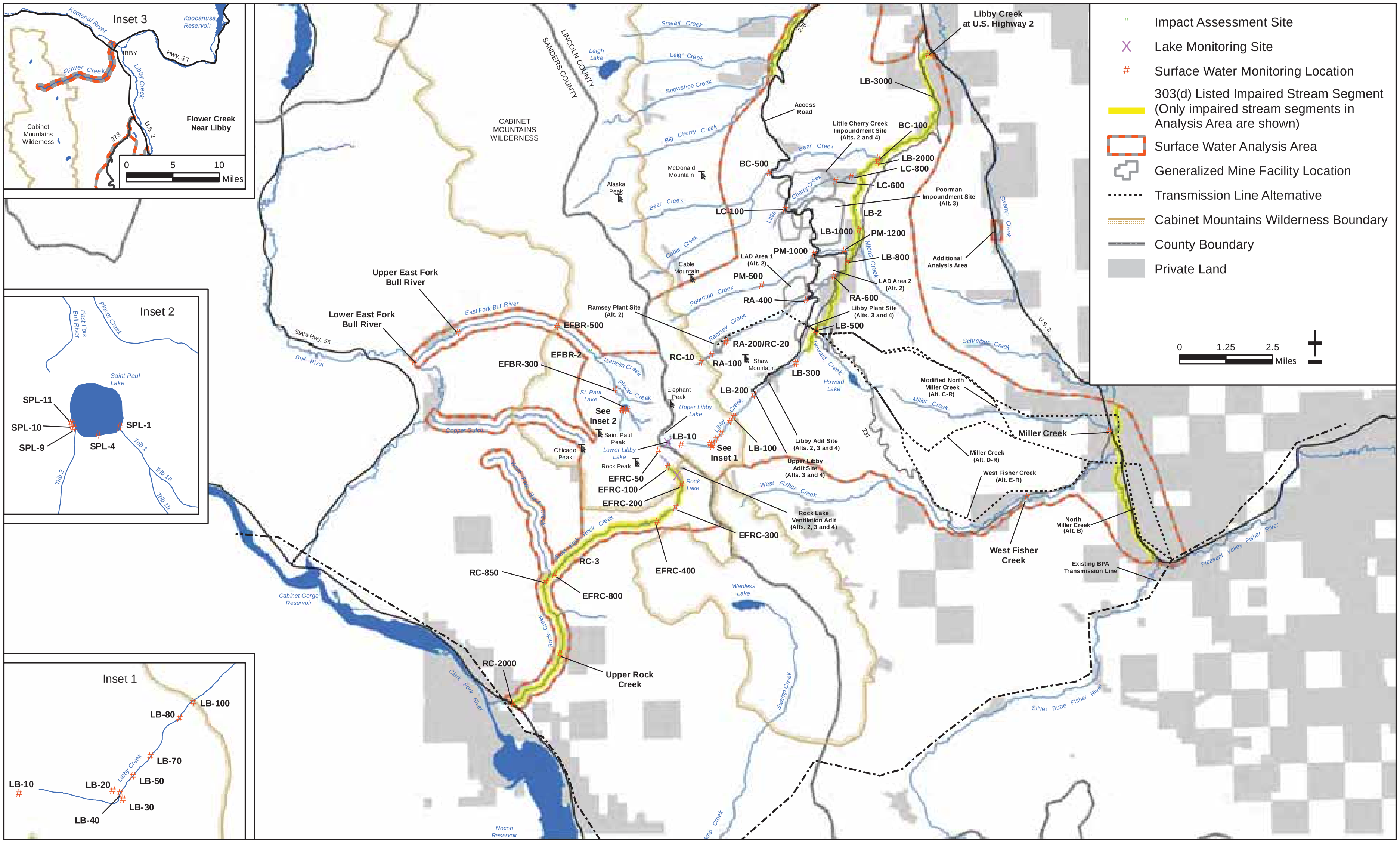


Figure 76. Surface Water Resources in the Analysis Area

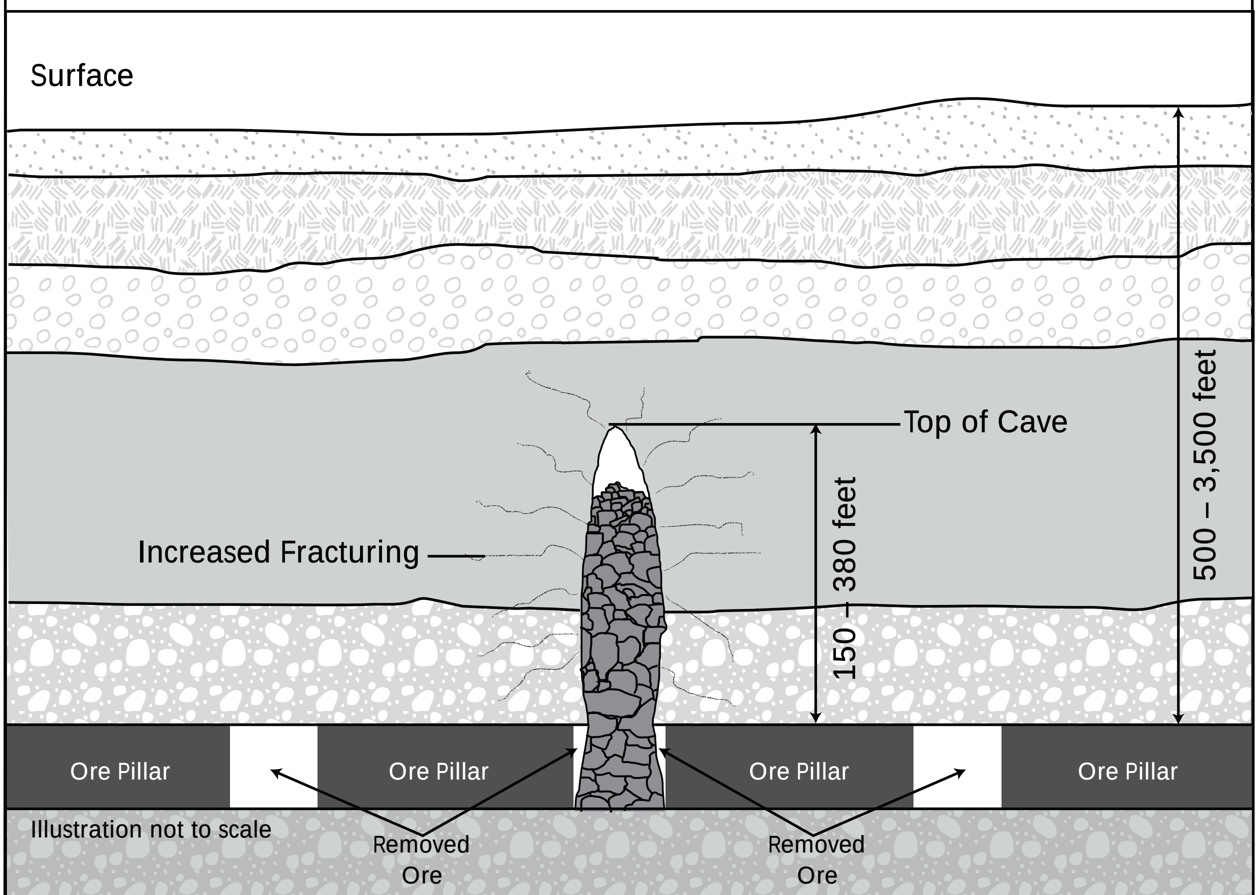


Figure 77. Typical Cross Sectional View of Chimney Subsidence

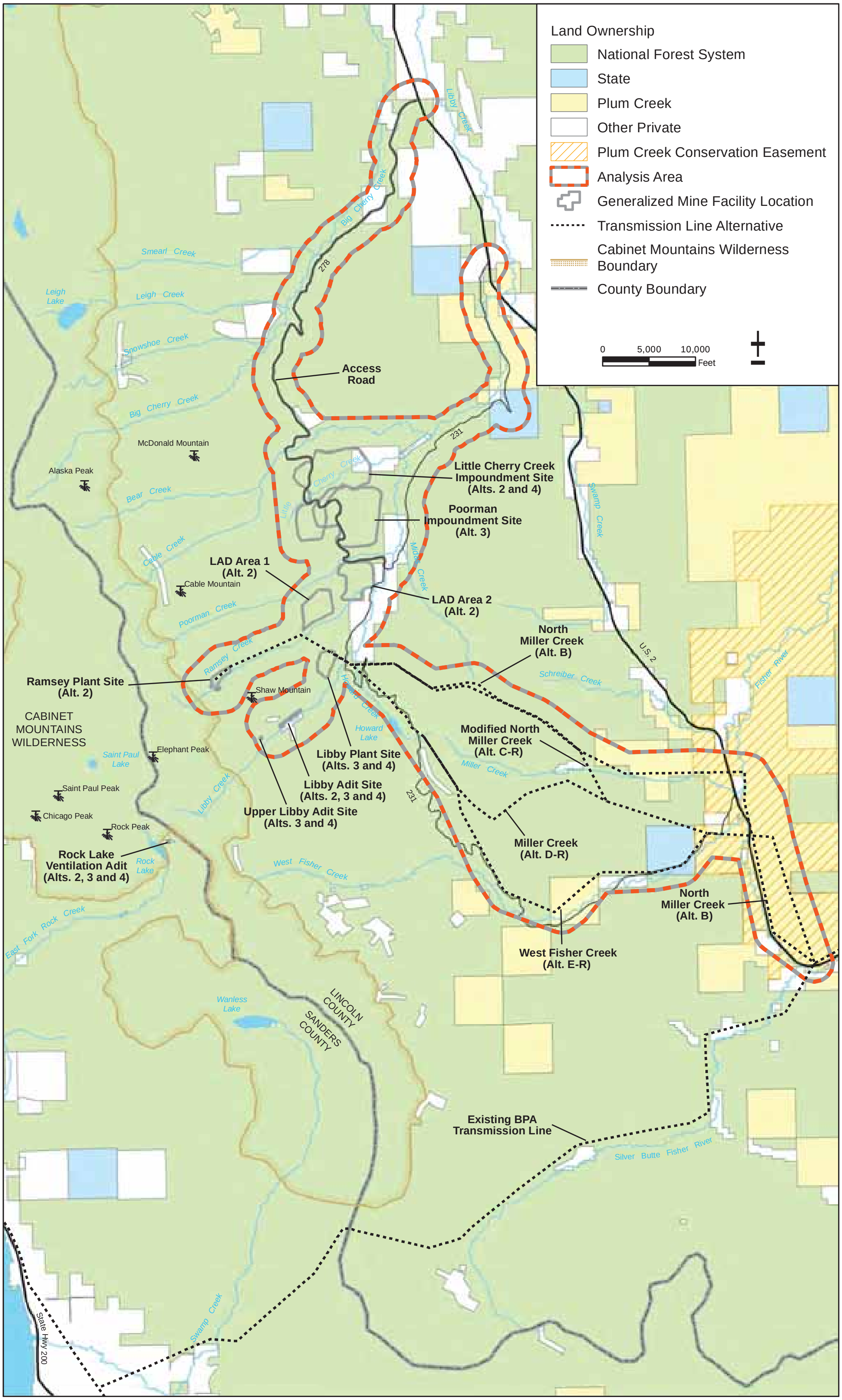


Figure 78. Land Ownership in the Analysis Area

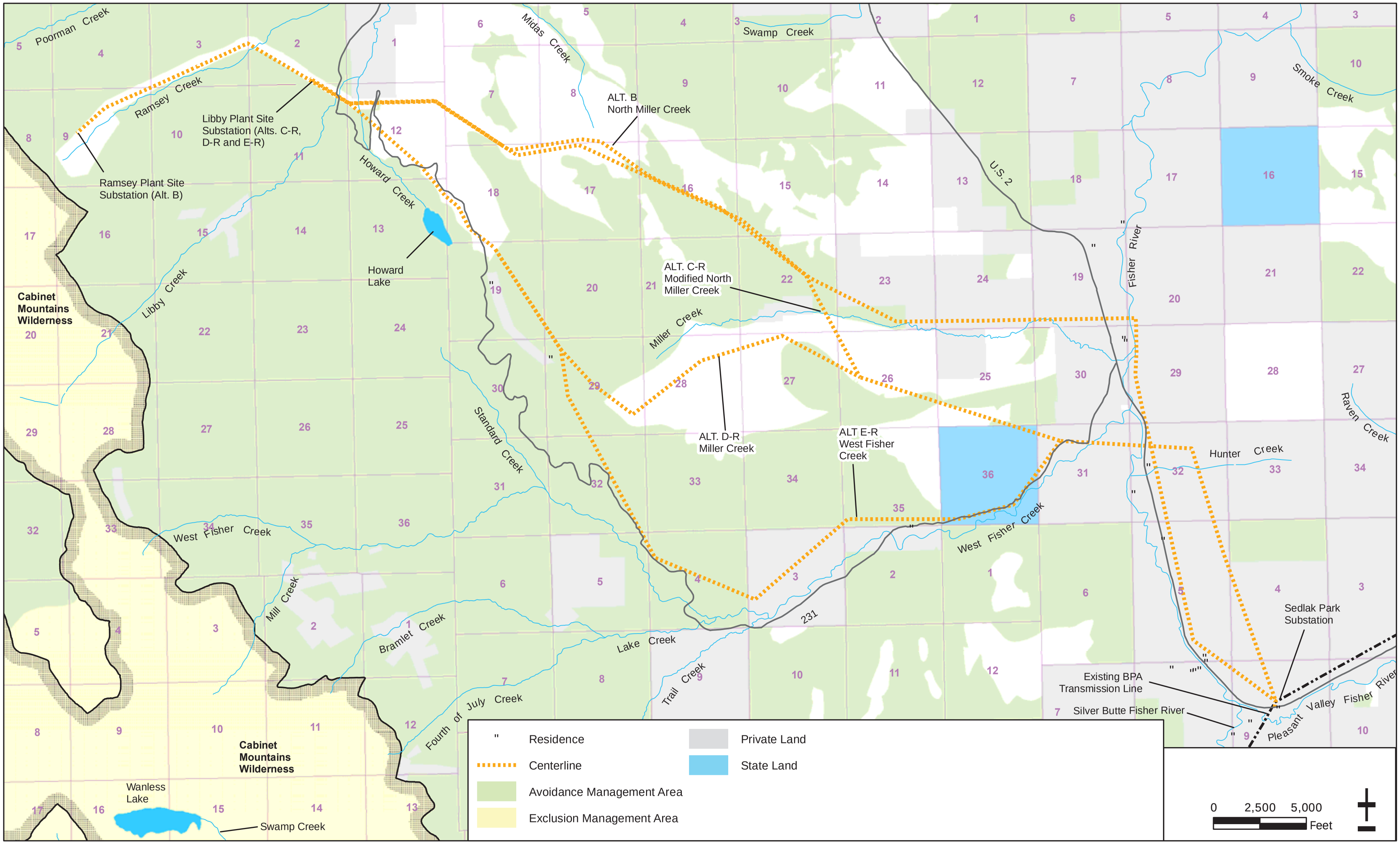


Figure 79. Residences, Corridor Exclusion Management Areas, and Corridor Avoidance Management Areas Along Transmission Line Alternatives

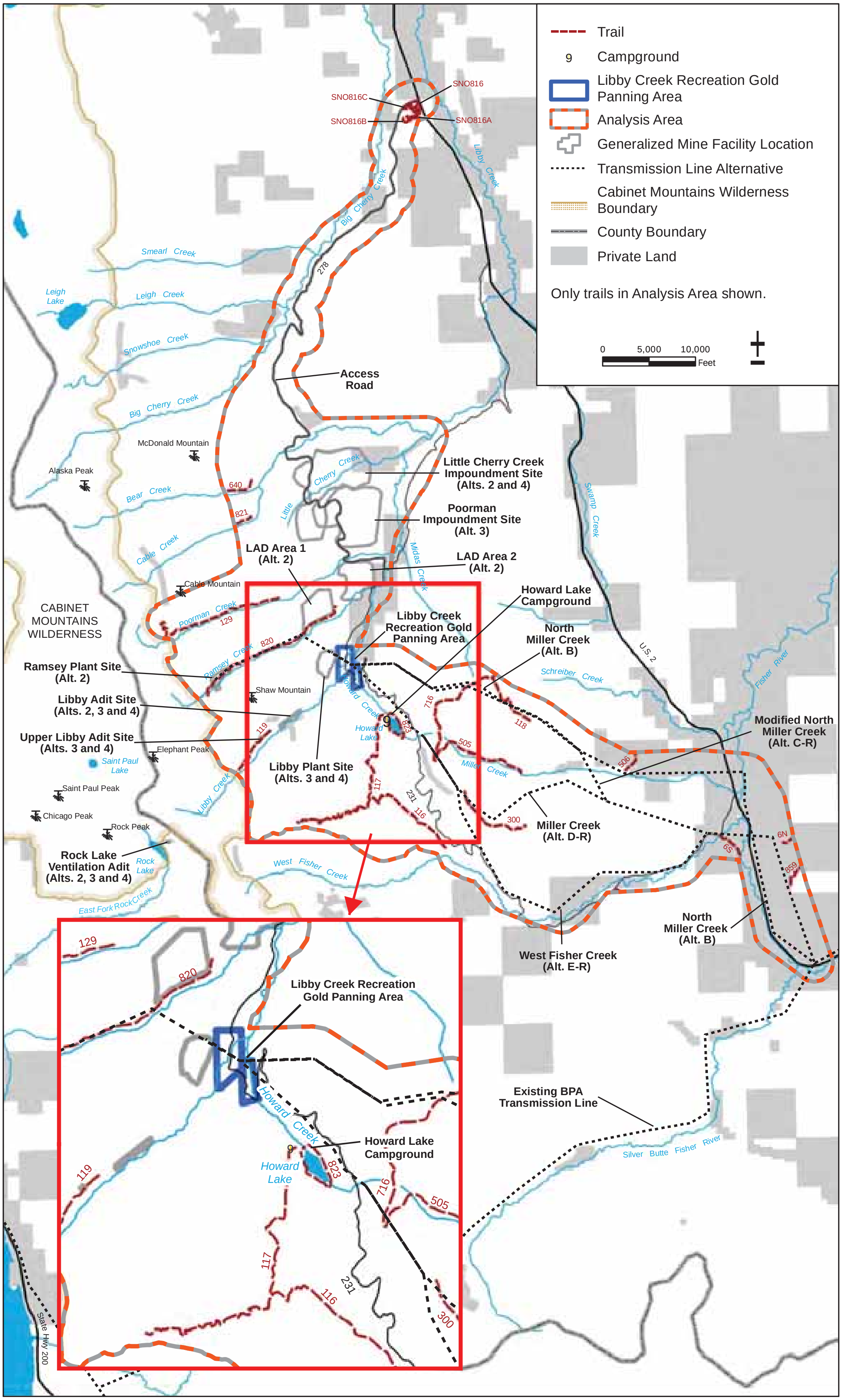


Figure 80. Key Recreation Resources in the Analysis Area

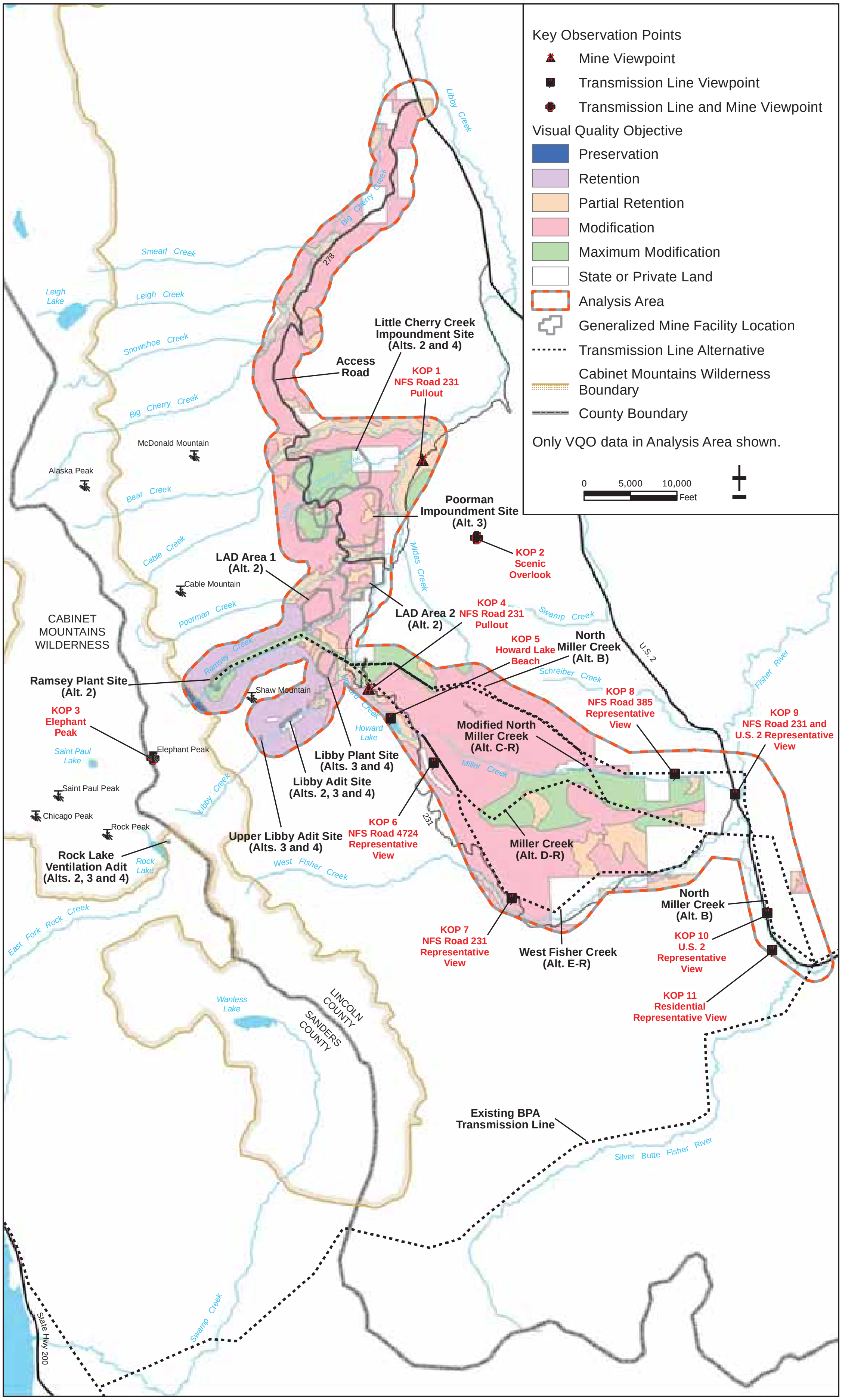


Figure 81. Visual Quality Objectives in the Analysis Area

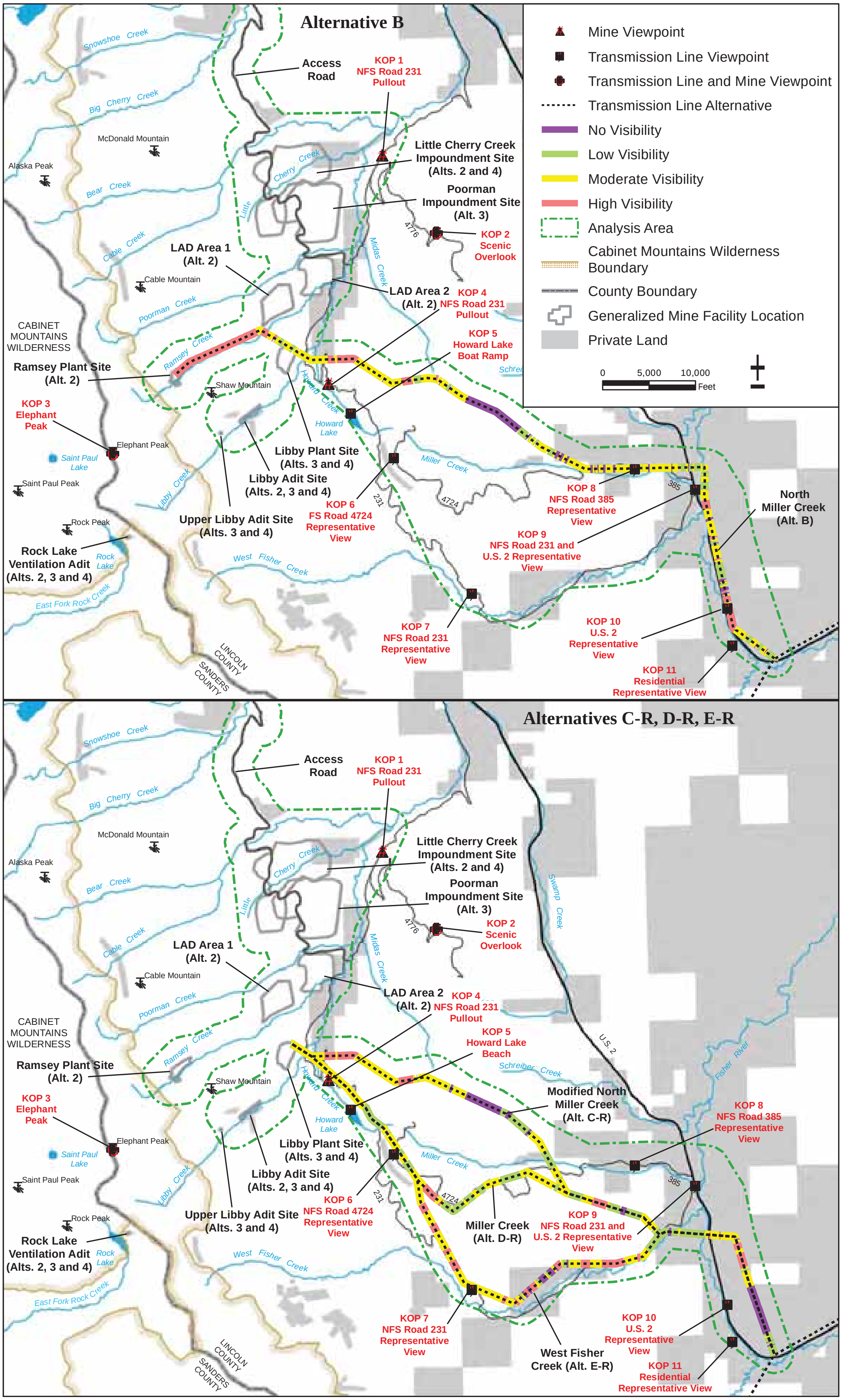


Figure 82. Transmission Line Segments Visible from KOPs, Roads and the CMW

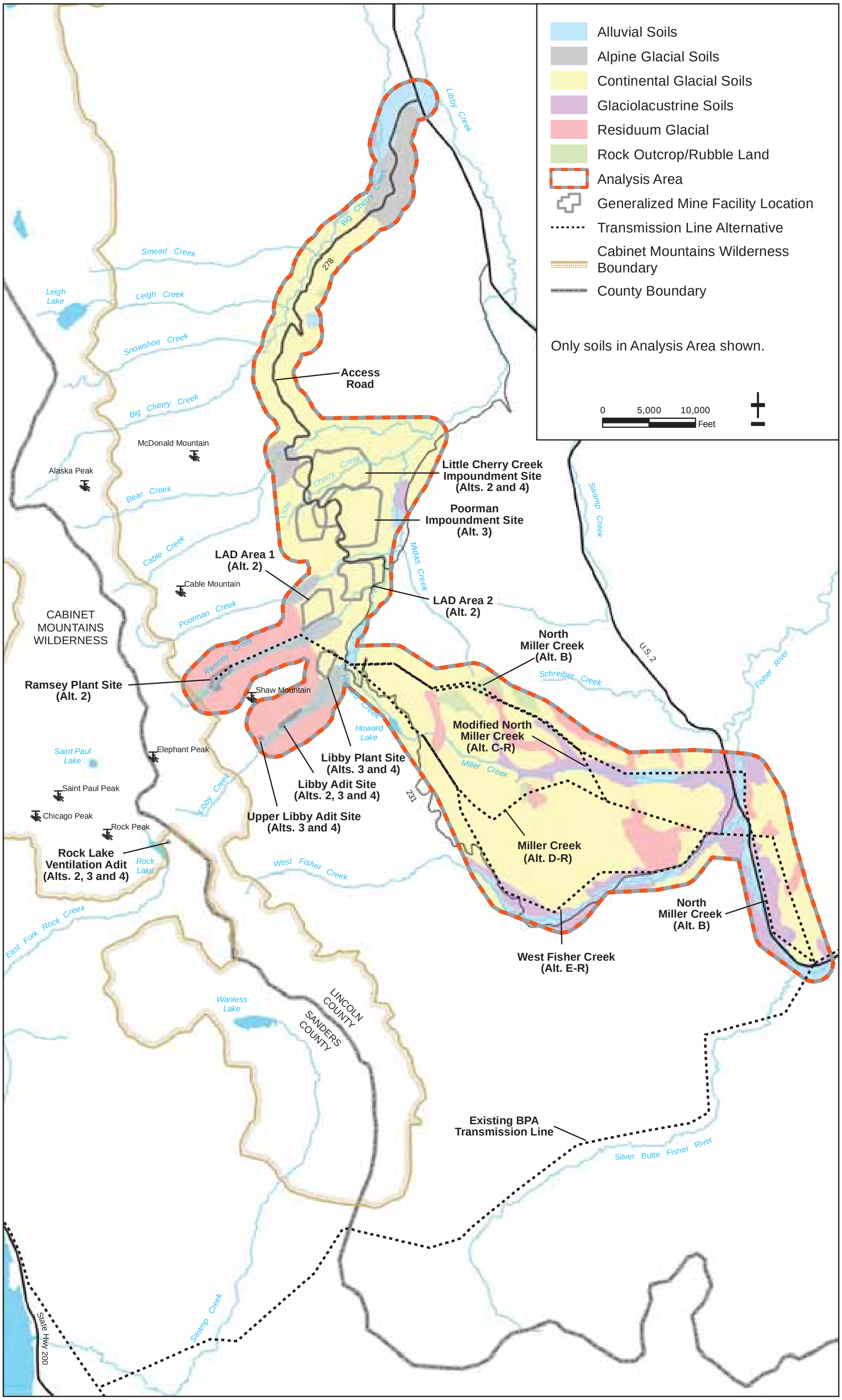


Figure 83. General Soil Types in the Analysis Area

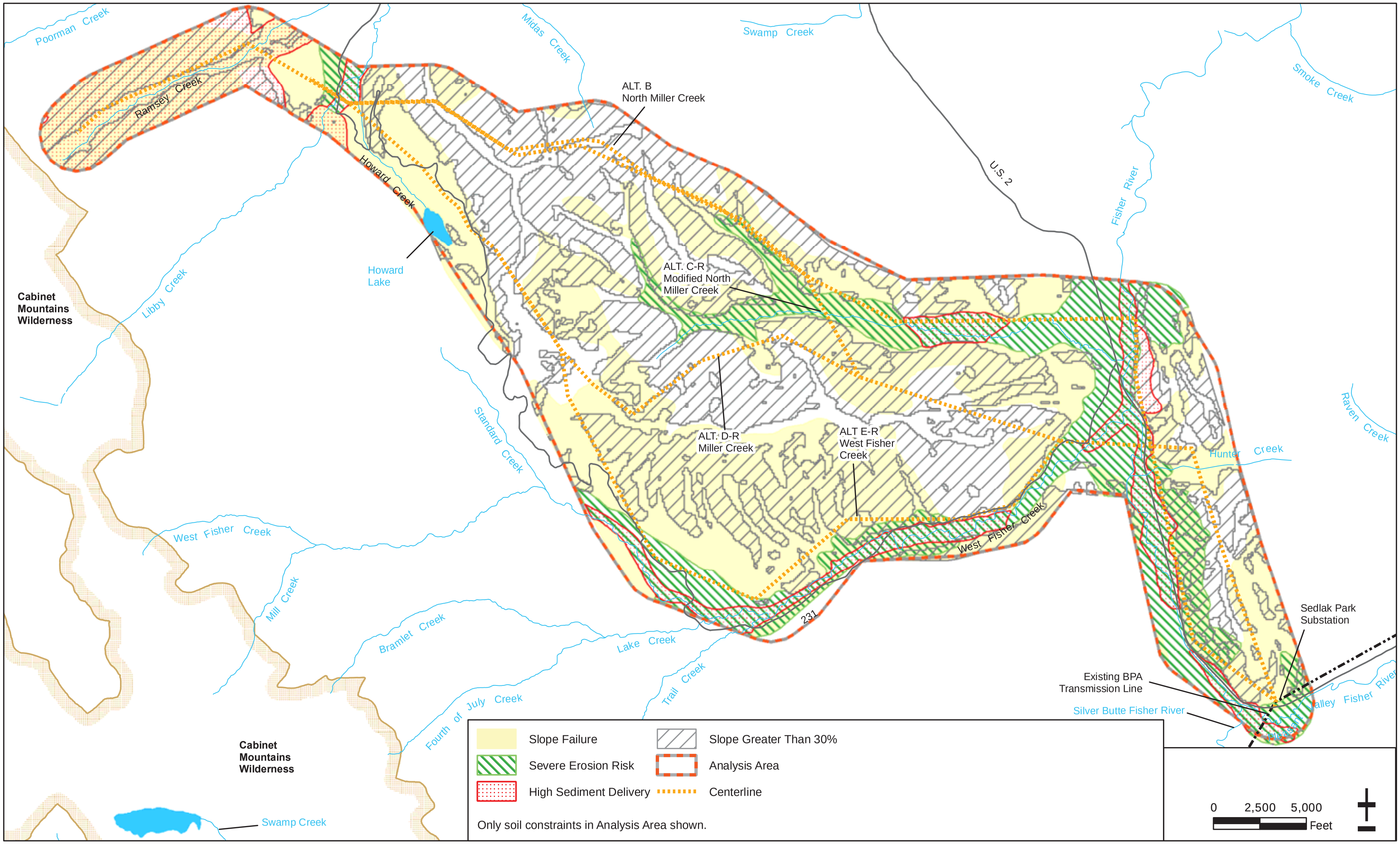


Figure 84. Soil Constraints Along Transmission Line Alternatives

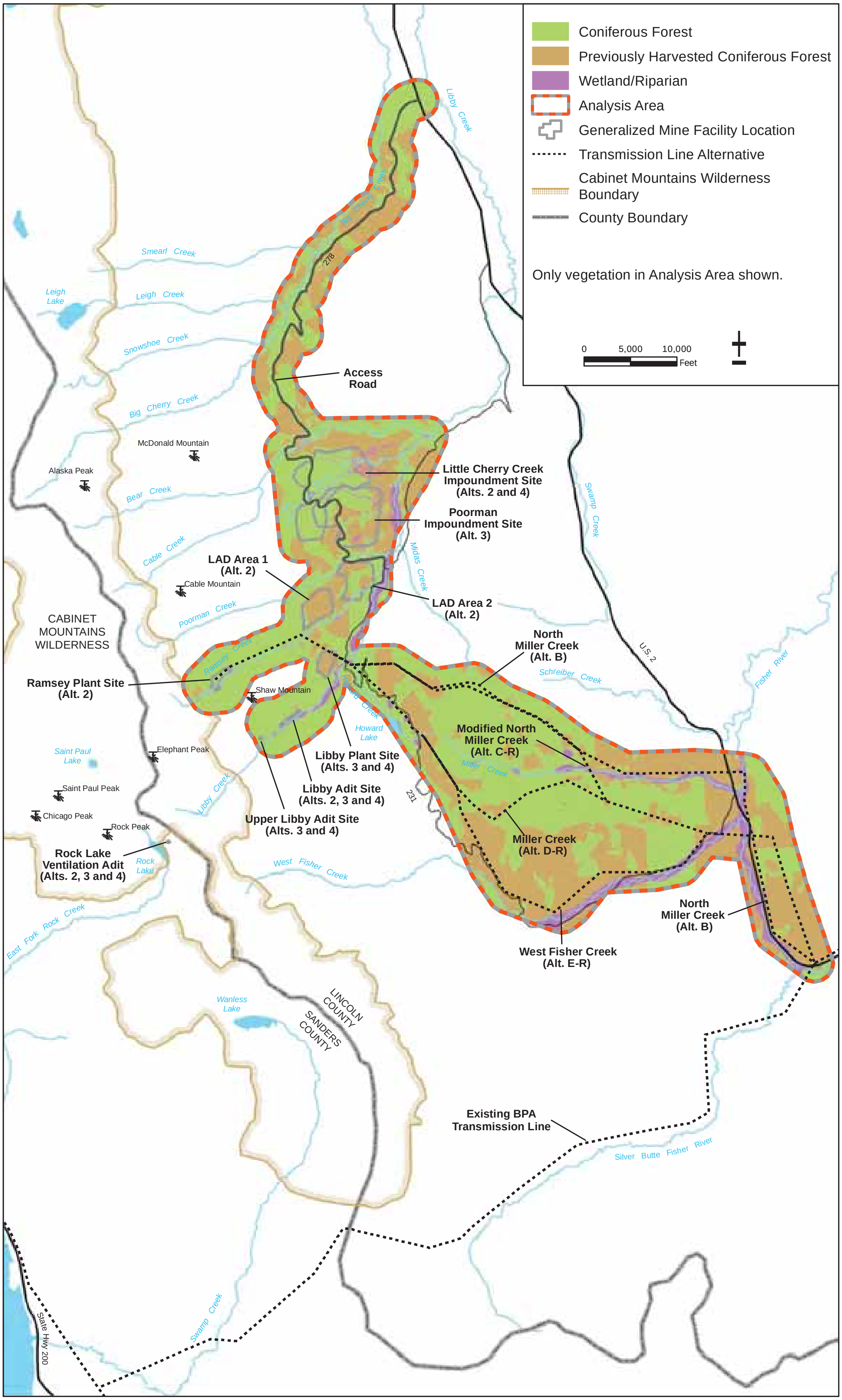


Figure 85. Vegetation Communities in the Analysis Area

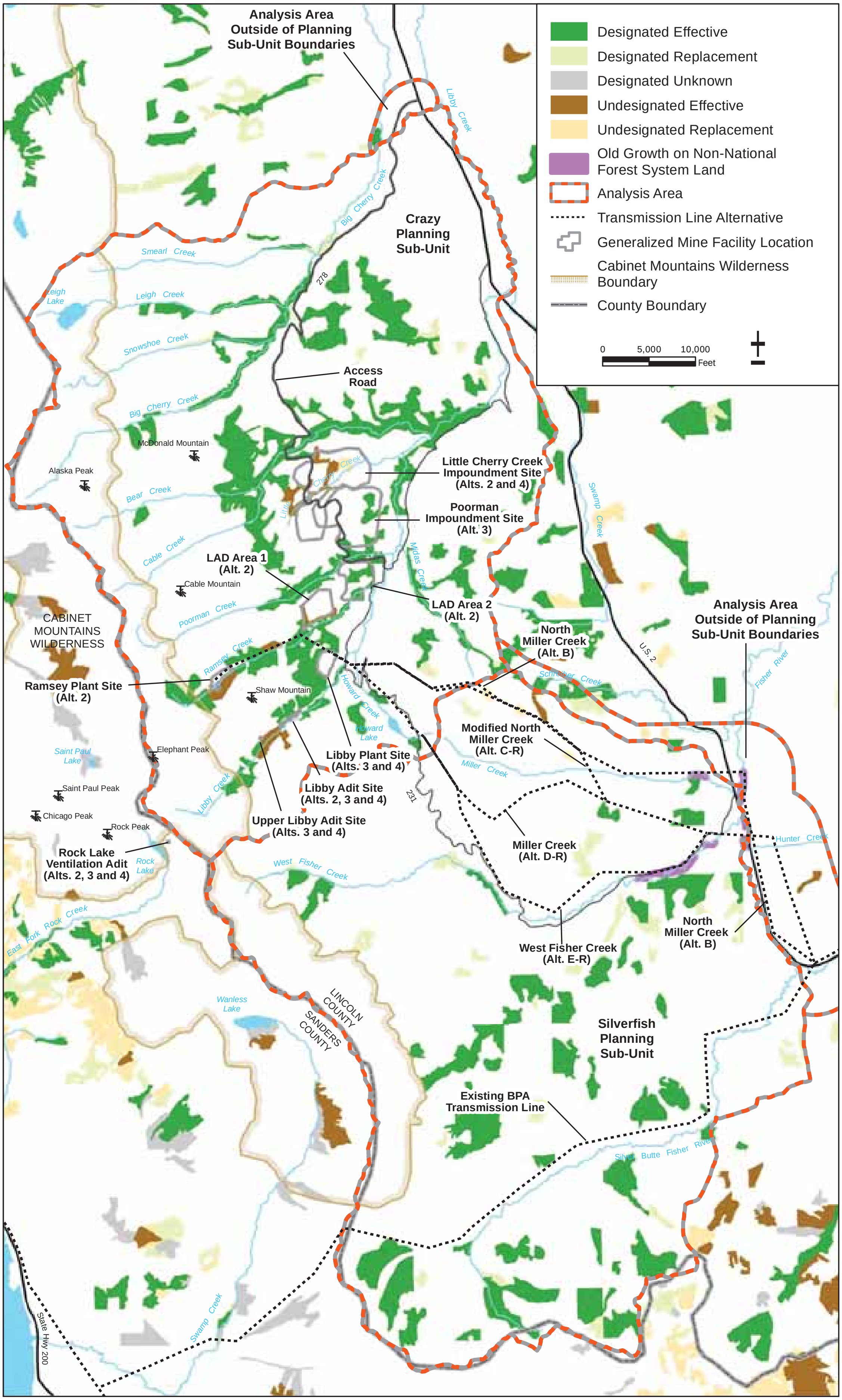


Figure 86. Old Growth Forest in the Analysis Area

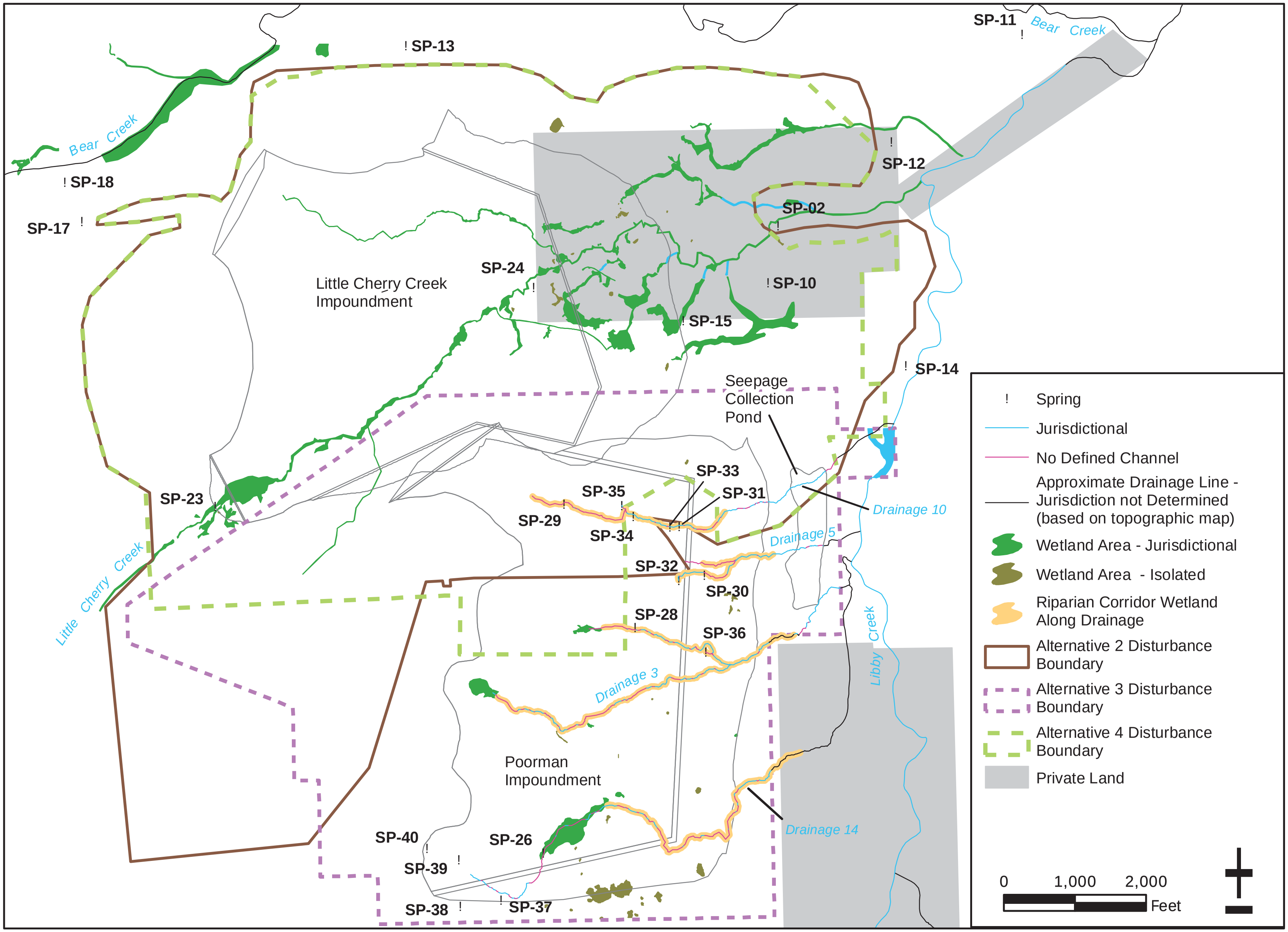


Figure 87. Wetlands in the Two Tailings Impoundment Sites

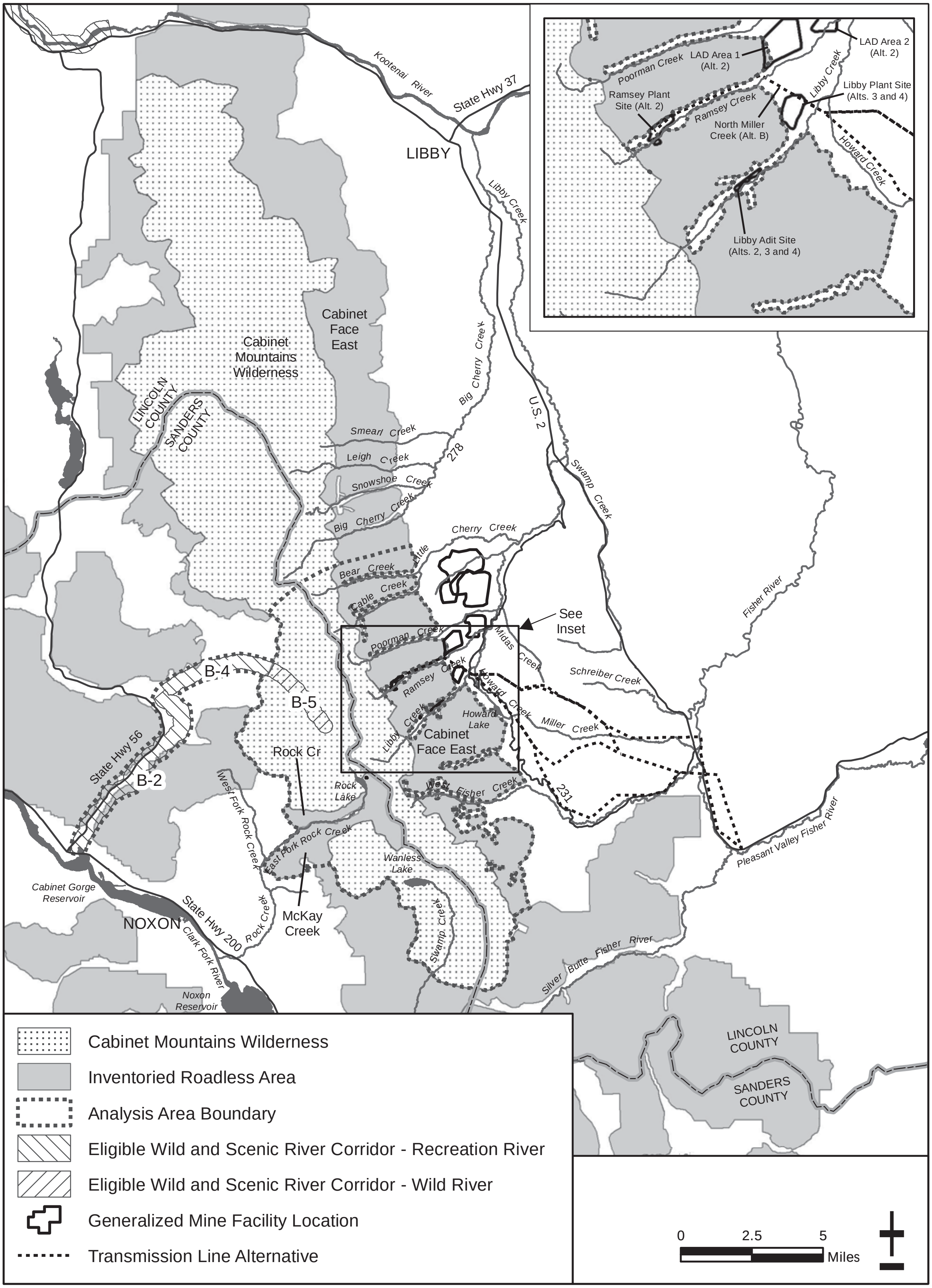


Figure 88. Cabinet Mountains Wilderness, IRAs and Wild and Scenic Rivers

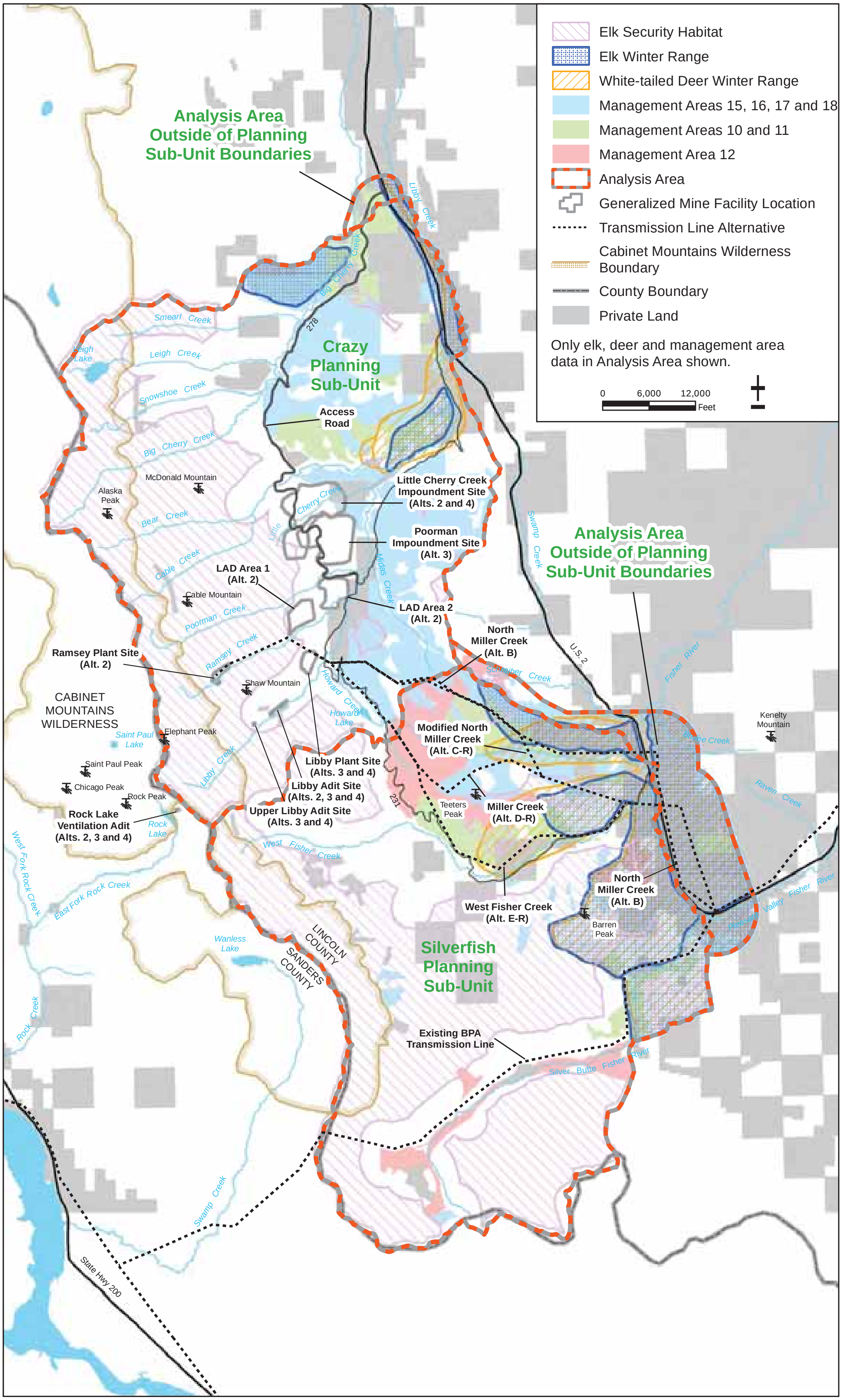


Figure 89. Elk and White-tailed Deer Habitat in the Analysis Area

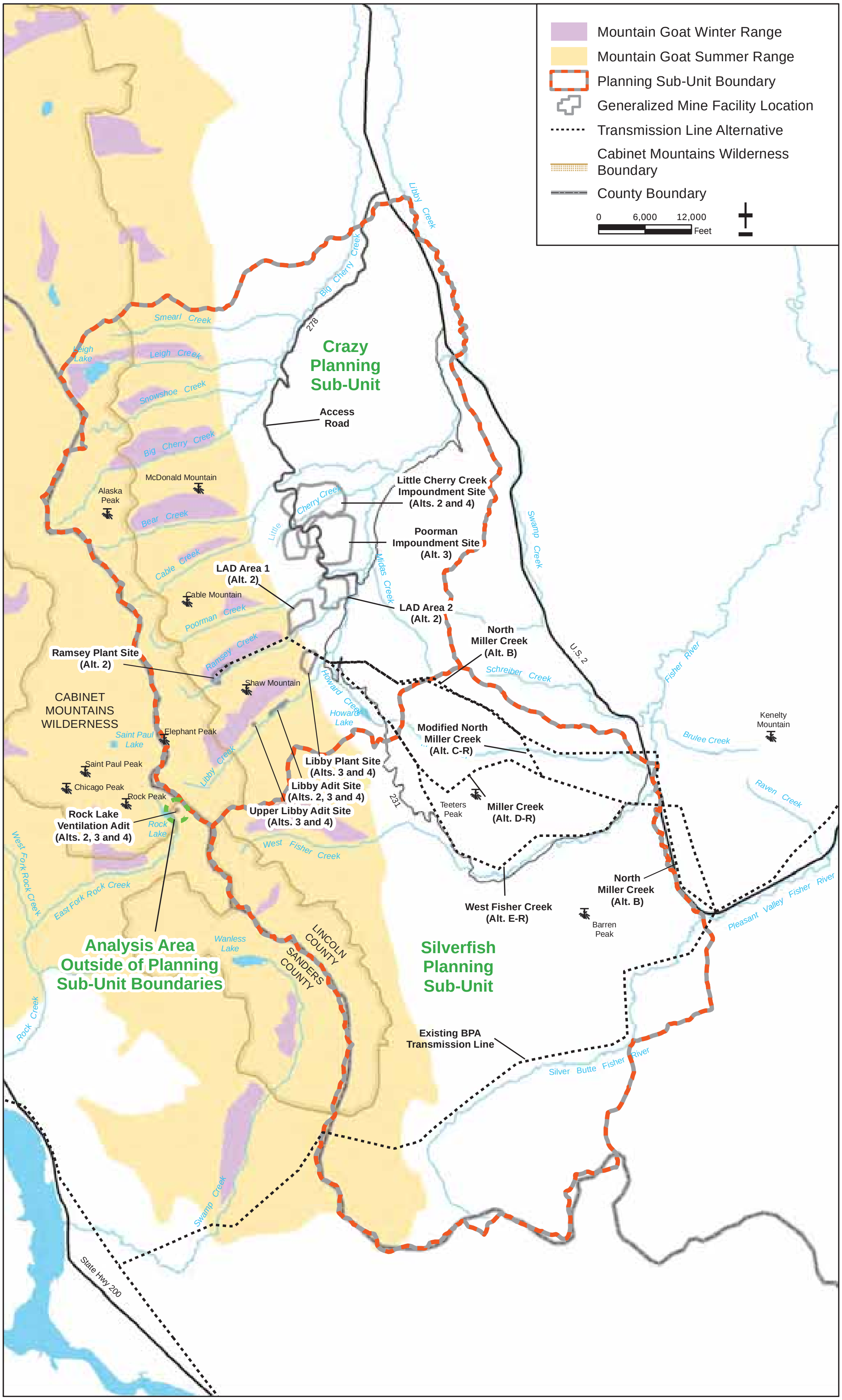


Figure 90. Mountain Goat Habitat in the Analysis Area

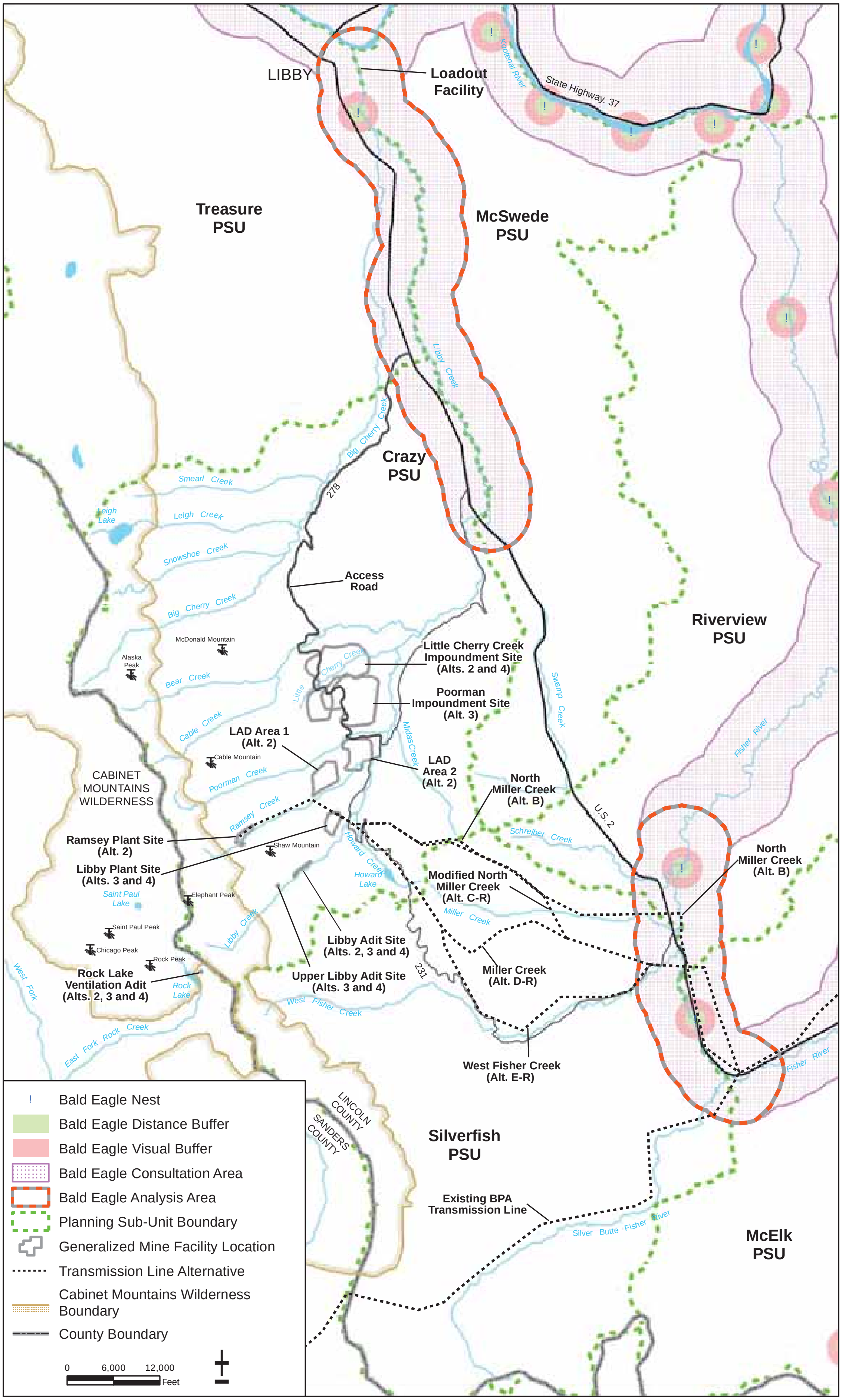


Figure 91. Bald Eagle Habitat Potentially Affected in the Analysis Area

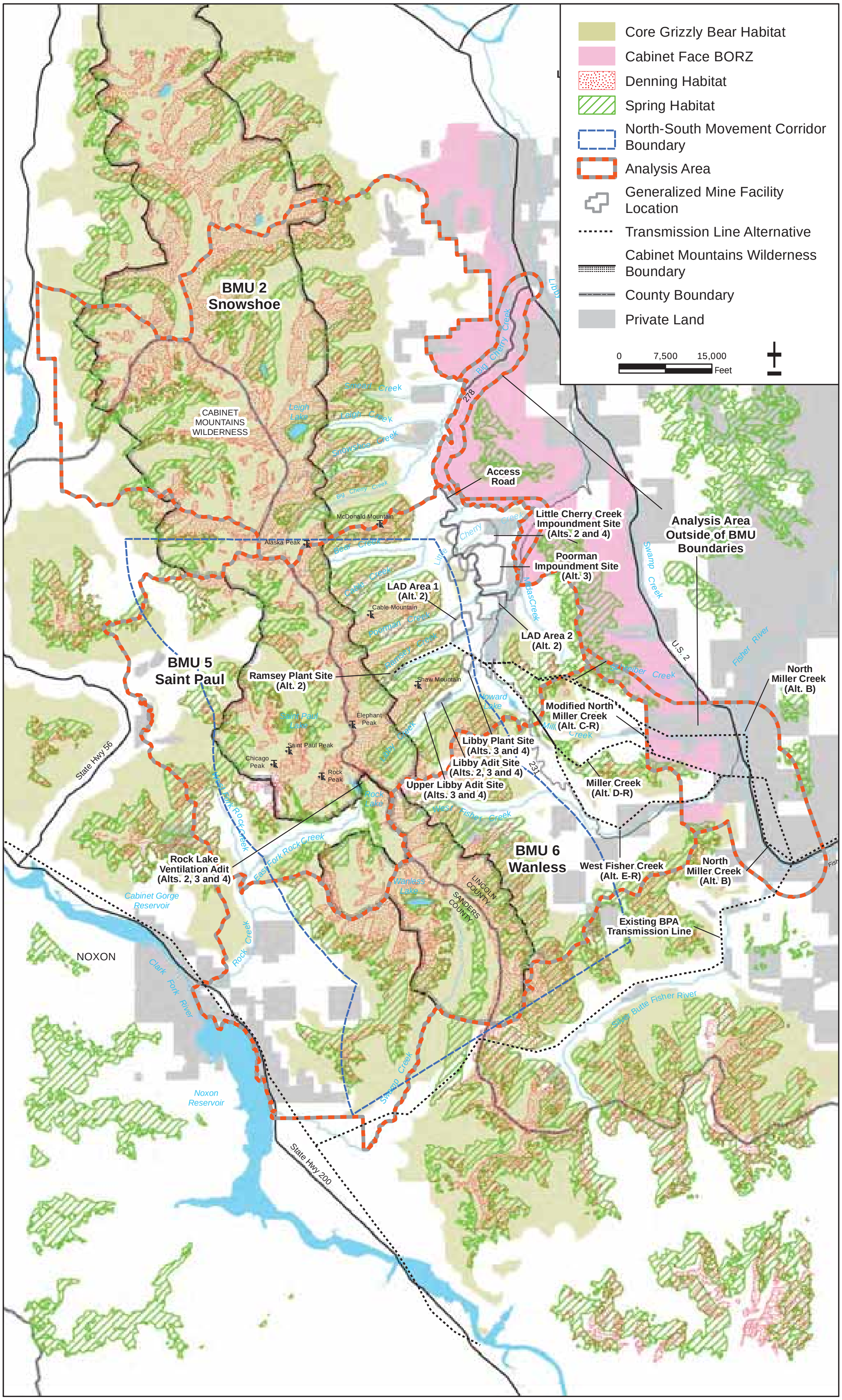


Figure 92. Grizzly Bear Habitat in the Snowshoe (2), Saint Paul (5), and Wanless (6) BMUs and the Cabinet Face BORZ

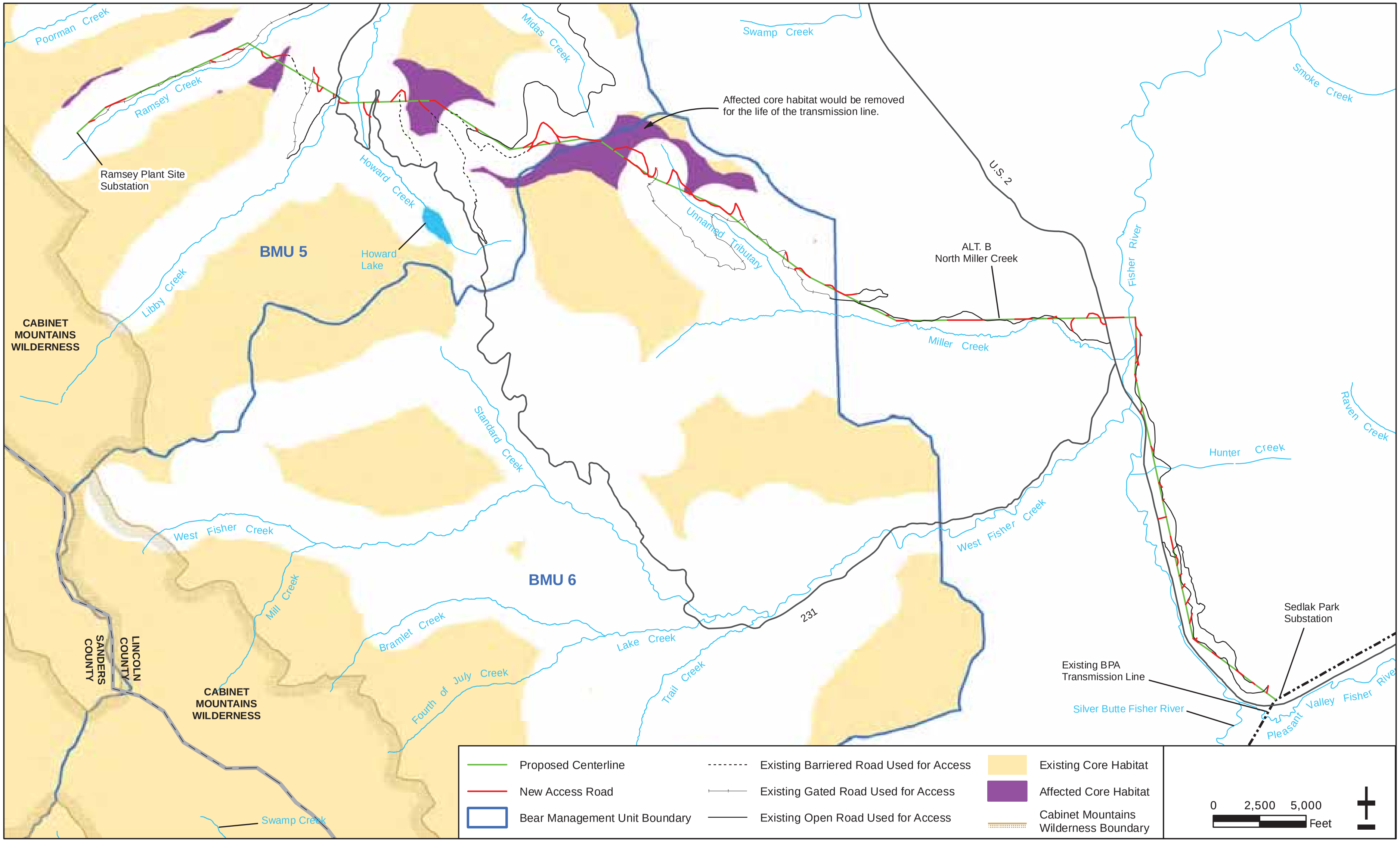


Figure 93. Effects on Grizzly Bear Core Habitat in Transmission Line Alternative B

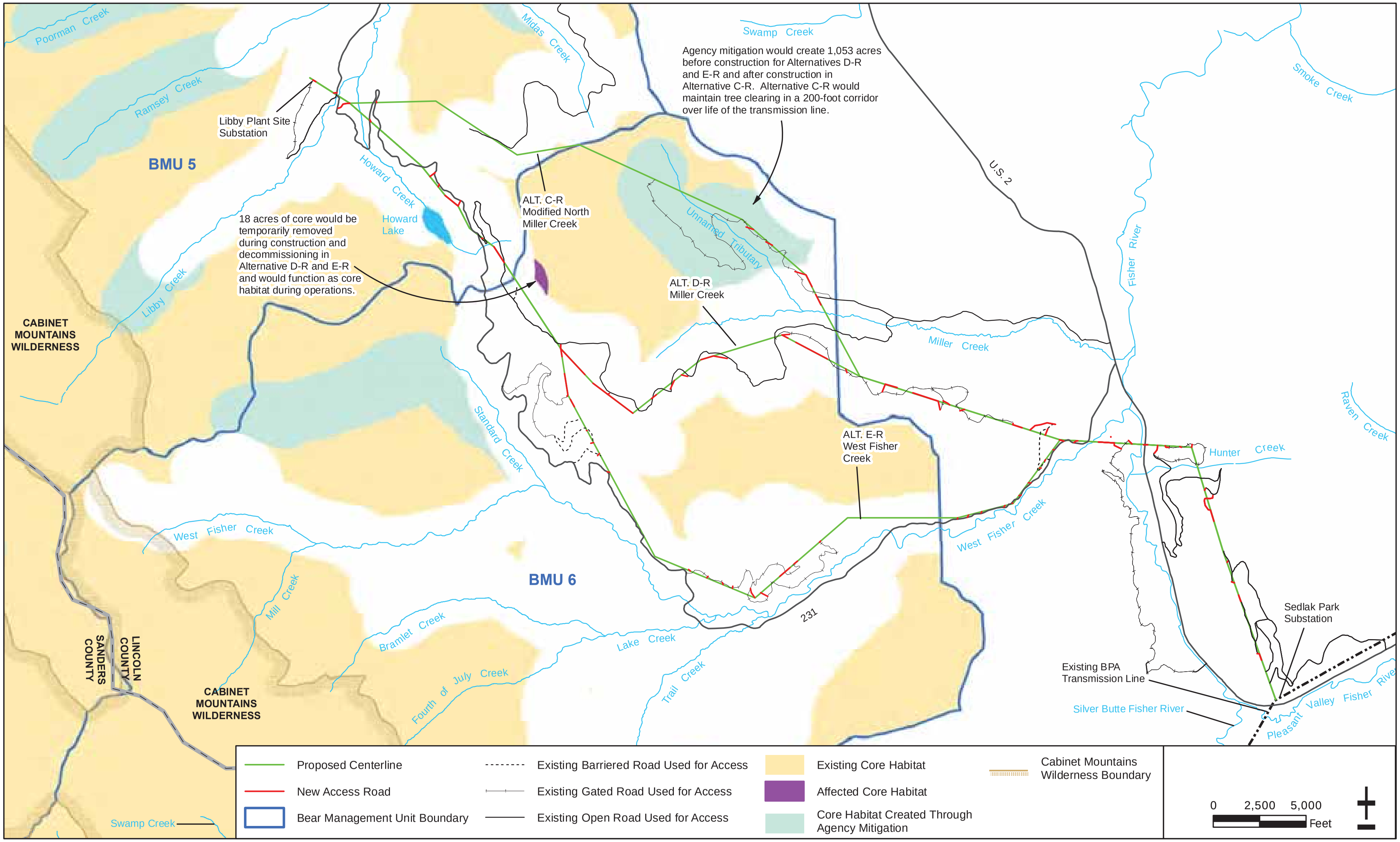


Figure 94. Effects on Grizzly Bear Core Habitat in Transmission Line Alternatives C-R, D-R and E-R.

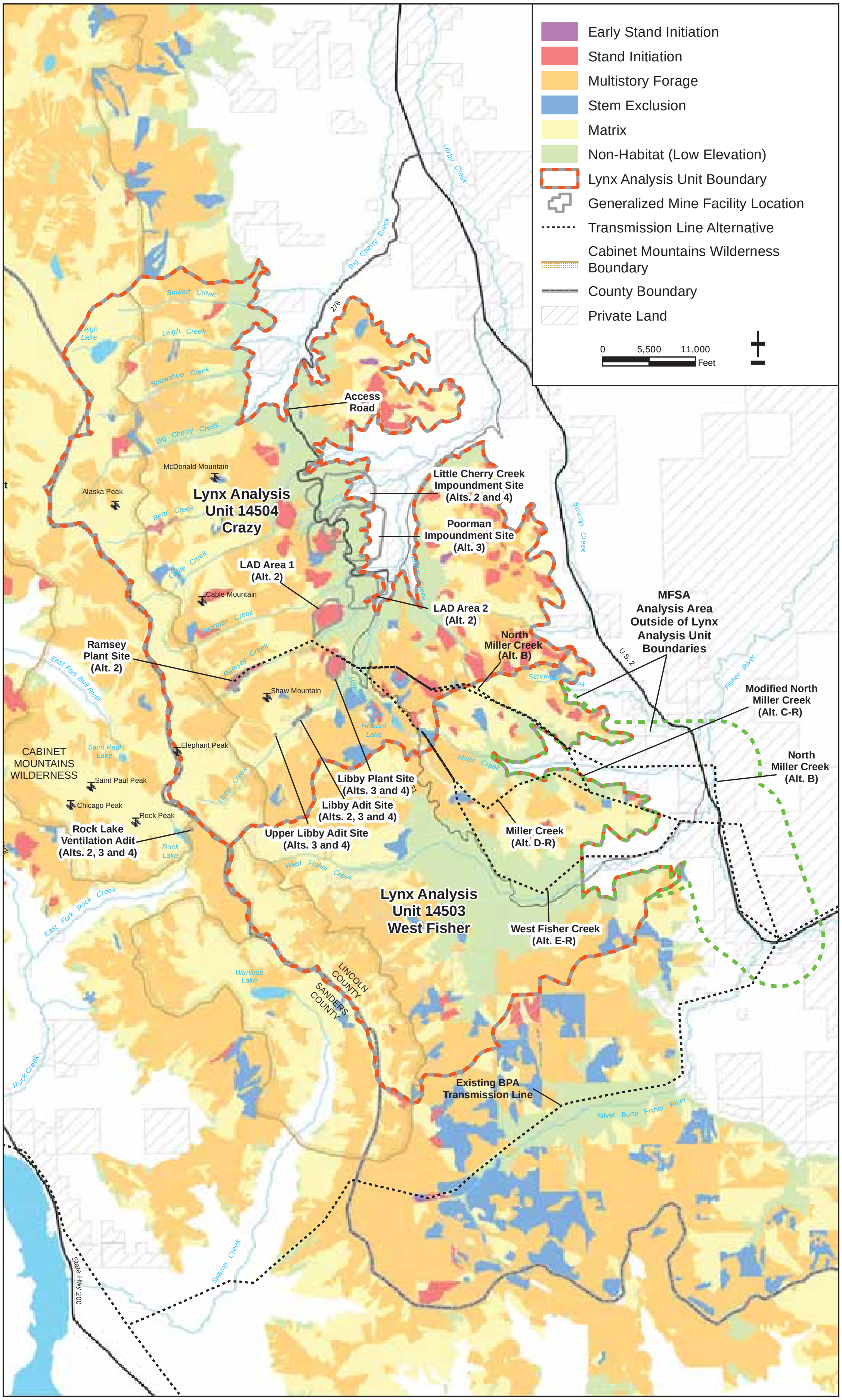


Figure 95. Lynx Habitat in the Analysis Area

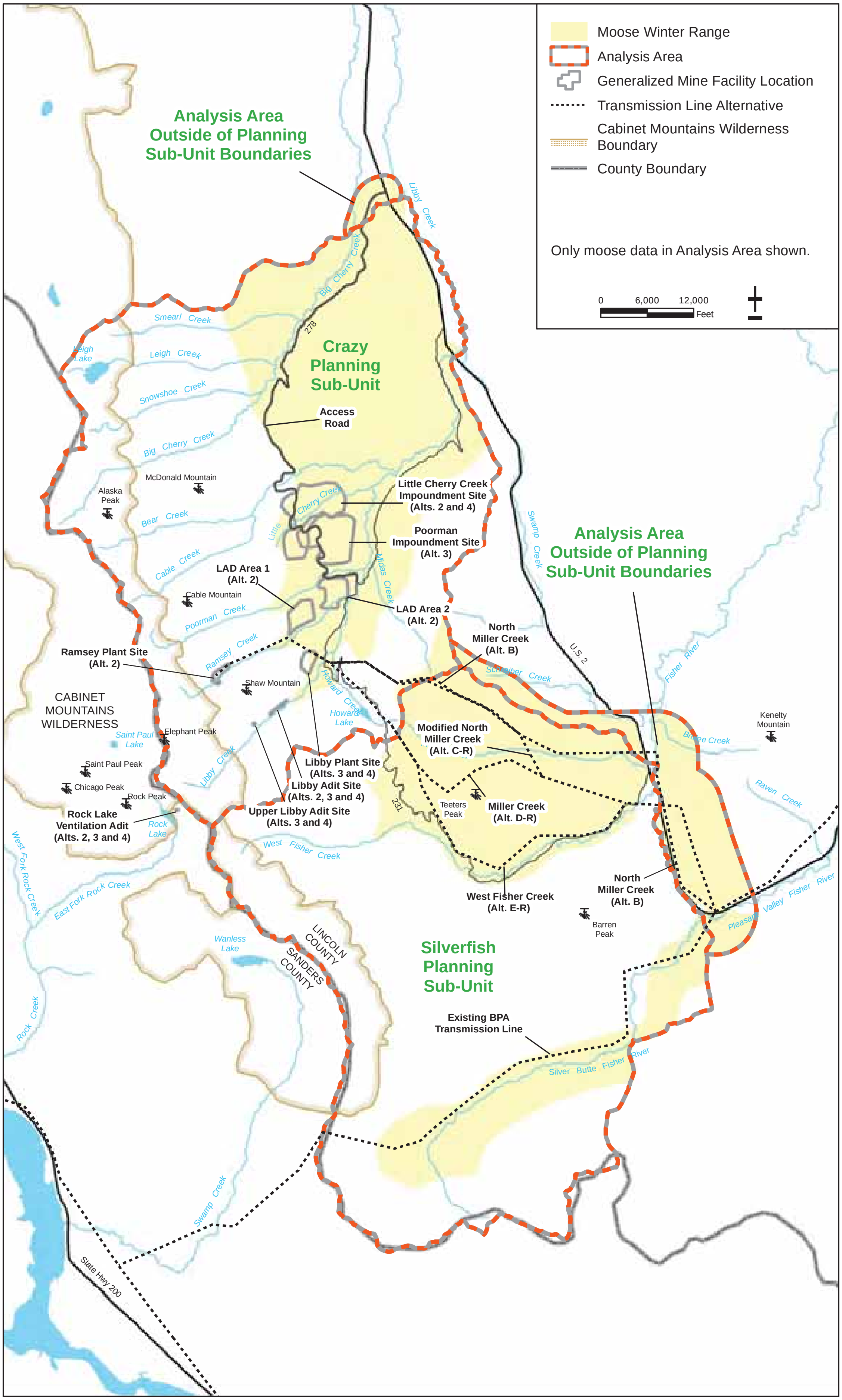


Figure 96. Moose Habitat in the Analysis Area