Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

March 17, 2003

Dear Stakeholder:

SUBJECT:

NOTICE OF AVAILABILITY OF FINAL ENVIRONMENTAL ASSESSMENT OF THE PROPOSED IN SEARCH OF TRUTH CANBY DISTRICT HEATING PROJECT, MODOC COUNTY, CALIFORNIA (DOE/EA 1460)

The U.S. Department of Energy's (DOE's) Golden Field Office (GO) has issued the final Environmental Assessment (EA) and a Finding of No Significant Impact (FONSI) for the subject geothermal project. These documents are available online in the GO electronic reading room at www.golden.doe.gov. Copies of the documents can be obtained by contacting Steve Blazek at the address and telephone number listed below. GO has prepared the final EA and FONSI in accordance with the National Environmental Policy Act (NEPA) and DOE's NEPA implementation guidance.

If you have any questions regarding these documents, please contact:

Steve Blazek, NEPA Compliance Officer DOE Golden Field Office 1617 Cole Boulevard Golden, CO 80401-3393, (303) 275-4723, (303) 275-4788 (fax), steve.blazek@go.doe.gov

Thank you for your interest and participation in DOE's NEPA process.

Sincerely,

/signed by/

John H. Kersten
Manager

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

March 7, 2003

DOE/EA-1460

FINDING OF NO SIGNIFICANT IMPACT
For the
IN SEARCH OF TRUTH CANBY DISTRICT HEATING PROJECT
CANBY, MODOC COUNTY, CALIFORNIA

AGENCY: U.S. Department of Energy, Golden Field Office

ACTION: Finding of No Significant Impact (FONSI)

SUMMARY: The U.S. Department of Energy (DOE) conducted an Environmental Assessment (EA) of the In Search of Truth (I'SOT) Canby District Heating Project, Modoc County, California, to evaluate potential environmental impacts of project construction and operations for three years.

DOE would provide partial funding, through its National Renewable Energy Laboratory (NREL), to I'SOT for the development and field verification of a small-scale, geothermal district heating system. Local district heating projects have the potential for widespread application, but achieving cost effectiveness in small development projects presents a number of challenges. To address these challenges, DOE is supporting the small-scale field verification of innovative geothermal direct-use system concepts to (1) determine and validate the economics, performance, and operational characteristics of local geothermal projects in different regions. and (2) evaluate the ability of such systems to provide distributed heating in order to facilitate their increased application in the western United States.

The proposed geothermal direct-use system would be located on property privately held by members of I'SOT in the town of Canby. The system would be capable of supplying space heating and potable hot water for homes and other buildings in the I'SOT community. NREL will take this opportunity to monitor and evaluate the technical and economic performance of the proposed district heating system. This information will be used to advance the design and use of small-scale geothermal technologies.

The EA addresses the construction and operation of the local, geothermal direct-use system for a three-year performance period, as well as the discharge of the geothermal effluent to the Pit River. Alternate pipeline routes were investigated. The originally proposed discharge pipeline route was modified to avoid wetlands and minimize impacts to biological resources. The Central Valley Regional Water Quality Control Board has approved discharge of the geothermal fluids to the Pit River. State and local approvals obtained following a California Environmental Quality Assurance review include California Division of Oil, Gas. and Geothermal Resources and the Modoc County Planning Department.

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DOE's Proposed Action is to provide a portion of the funds required to construct and operate the I'SOT District Heating Project. This funding would be provided through an NREL subcontract with I'SOT, Inc. and would be administered by NREL. The direct-use system would be managed by I'SOT, Inc.

All discussions and findings related to this site and the proposed action are contained in the attached Final EA and the attached Mitigation Action Plan (MAP). The Final EA and MAP are hereby incorporated by reference.

COPIES OF THE ENVIRONMENTAL ASSESSMENT ARE AVAILABLE FROM:

Steve Blazek, NEPA Compliance Officer
DOE Golden Field Office
16 17 Cole Boulevard
Golden, CO 80401-3393
(303) 275-4723, (303) 275-4788(fax), steve.blazek@go.doe.gov

FOR FURTHER INFORMATION ON THE DOE NEPA PROCESS CONTACT:

Office of NEPA Policy and Assistance
U.S. Department of Energy
1000 Independence Avenue, SW.
Washington: D.C. 20585
(202) 586-4600 or (800) 472-2756

DETERWNATION:

DOE determines that providing partial funding for the construction and first three years of operation of the I'SOT District Heating Project at Canby, California does not constitute a major Federal action significantly affecting the quality of the human environment, as defined by the National Environmental Policy Act. All mitigation measures identified in the EA and cited in the MAP as conditions required for Federal funding shall be incorporated into the NREL subcontract to I'SOT, Inc. The preparation of an Environmental Impact Statement is not required, and DOE is issuing this Finding of No Significant Impact.

Issued in Golden, Colorado, 7th day of March 2003.

John H. Kersten
Manager

I'SOT Canby District Heating Project

MODOC COUNTY, CALIFORNIA

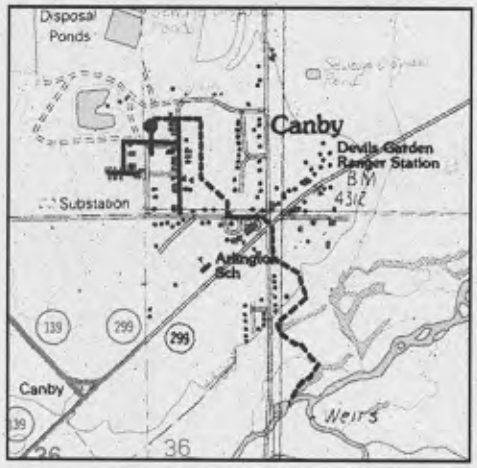
Final Environmental Assessment

DOE/EA 1460

March 2003

Prepared for:
U.S. Department of Energy
National Renewable Energy Laboratory
1617 Cole Boulevard
Golden, CO 80401-3393

Prepared by:
MHA Environmental Consulting, Inc.
4 West Fourth Avenue, Suite 303
San Mateo, California 94402



Glossary of Acronyms

ACRONYM	DEFINITION
AADT	Average Annual Daily Traffic
AAQS	Ambient Air Quality Standard
ADT	Average Daily Traffic
AE	Agriculture-Exclusive
APCD	Air Pollution Control District
As	Arsenic
asl	Above Sea Level
ASME	American Society of Mechanical Engineers
ATC	Authority to Construct
AWWA	American Water Works Association
B	Boron
BAAQMD	Bay Area Air Quality Management District
BACT	Best Available Control Technology
BEMA	Bald Eagle Management Area
bgs	Below Ground Surface
BLM	Bureau of Land Management
BMP	Best Management Practices
bw/d	Body Weight Per Day
Ca	Calcium
CA	California
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
Cal EPA	California Environmental Protection Agency
CARB	California Air Resources Board
CCR	California Code of Regulations
CFR	Code of Federal Regulations
CDF	California Division of Forestry
CDFG	California Department of Fish and Game

CDMG	California Department of Conservation, Division of Mines and Geology
CEC	California Energy Commission
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
cfs	Cubic Feet Per Second
Cl	Chlorine
CNDDB	California Department of Fish and Game Natural Diversity Database
CNPS	California Native Plant Society
CO	Carbon Monoxide
CUPA	Certified Unified Program Agencies
CVRWQCB	Central Valley Regional Water Quality Control Board
CWC	California Water Code
dB	Decibel
dBA	Decibels on the A-weighted Scale
DOC	Department of Conservation
DOE	Department of Energy
DOF	Department of Finance
DOGGR	California Division of Oil, Gas, and Geothermal Resources
DOT, Caltrans	Department of Transportation
DWR	Department of Water Resources
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	US Environmental Protection Agency
°F	Degrees Fahrenheit
F	Flourine
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FESA	Federal Endangered Species Act
FPPA	Farmlands Protection Policy Act

GAC	Granular Activated Carbon
gpd	Gallons Per Day
gpm	Gallons Per Minute
H_2S	Hydrogen Sulfide
HCO3	Bicarboante
HDD	Horizontal Directional Drilling
Hg	Mercury
HE-1	Primary Heat Exchanger
HE-2	Secondary Heat Exchanger
Hz	Hertz
IS	Initial Study
I'SOT	In Search of Truth
K	Potassium
KGRA	Known Geothermal Resource Area
KHS	Kelley Hot Springs
L_{dn}	Day-Night Average Noise Level
L_{eq}	Equivalent Steady-State Sound Level
LOS	Level of Service
MCAPCD	Modoc County Air Pollution Control District
MCL	Maximum Contaminant Level
MDB&M	Mount Diable Base &Meridian
Mg	Magnesium
MND	Mitigated Negative Declaration
MNF	Modoc National Forest
mgd	million gallons per day
mph	Miles Per Hour
µg	Microgram
Na	Sodium
NAAQS	National Ambient Air Quality Standards
NAHC	Native American Heritage Commission

NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
ng/L	Nanograms Per Liter
ng/g	Nanograms Per Gram
No.	Number
NO_2	Nitrogen Dioxide
NO_3	Nitrogen Trioxide
NO_X	Oxides of Nitrogen
NPAB	Northeast Plateau Air Basin
NPDES	National Pollutant Discharge Elimination System
NOAEL	No Observed Adverse Effect Level
NRCS	Natural Resources Conservation Service
NREL	National Renewable Energy Laboratory
NRHP	National Register of Historic Places
NSR	New Source Review
O_3	Ozone
OEHHA	Office of Environmental Health Hazard Assessment
ONC	Office of Noise Control
OSHA	Occupational Safety and Health Administration
Pb	Lead
PEX	Polybutylene
Pg/L	Picograms Per Liter
$PM_{2.5}$	Particulate Matter Less Than 2.5 Microns
PM_{IO}	Particulate Matter Less Than 10 Microns
ppm	Parts Per Million
ppt	Parts Per Trillion
PTO	Permit to Operate
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act

RfD	Reference Dose
ROG	Reactive Organic Gases
ROI	Region of Influence
ROWD	Report of Waste Discharge
RR	Residential-Rural
SHPO	State Historic Preservation Office
SiO_2	Silicon Dioxide
SO_2	Sulfur Dioxide
SO_4	Sulfate
SR	State Route
SVEC	Surprise Valley Electrification Company
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TCP	Traditional Cultural Property
TDS	Total Dissolved Solids
TSP	Total Suspended Particulates
UA	Urbanized Area
USDA	US Department of Agriculture
USFS	US Department of Agriculture, Forest Service
USFWS	US Fish and Wildlife Service
USGS	US Department of the Interior, Geological Survey
V/C	Volume/Capacity
WDR	Waste Discharge Requirement
WQO	Water Quality Objective

1: INTRODUCTION

1.1 Project Overview

The I'SOT (In Search of Truth) community proposes to construct and operate a geothermal district heating system in Modoc County, California (Figure 1.1-1). The district heating system involves

- Producing geothermal fluid (hot water) from an existing well
- Using the heat from the geothermal fluid to heat community water
- Piping the heated community water through a distribution piping system to provide space heating.

The cooled, filtered geothermal fluid will be discharged to the Pit River. The proposed action also includes construction and heating of a new food service and laundry building, as well as construction of a mechanical building to house system controls. The potential next project phase is the drilling of an injection well to eliminate discharge to the Pit River. The proposed project area is shown in Figure 1.1-2.

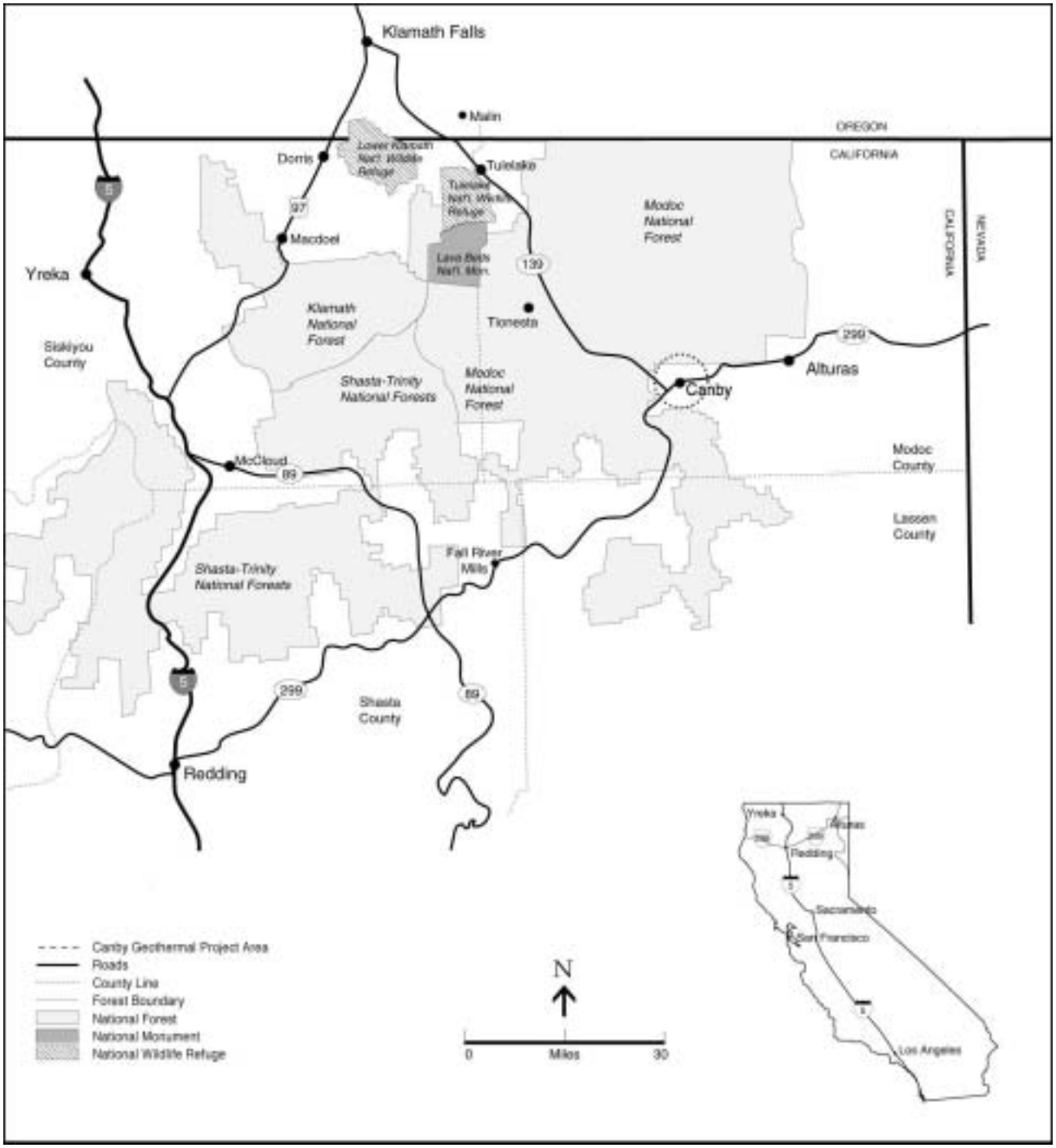
The U.S. Department of Energy (DOE) is considering providing partial funding for this district heating project for construction and operation for 3 years. The DOE is acting as the lead agency under the National Environmental Policy Act (NEPA). The DOE will consider the findings of this Environmental Assessment prior to making a decision to fund the project. The California Energy Commission (CEC) and the I'SOT community are providing additional funding for this project.

1.2 Purpose and Need

PURPOSE

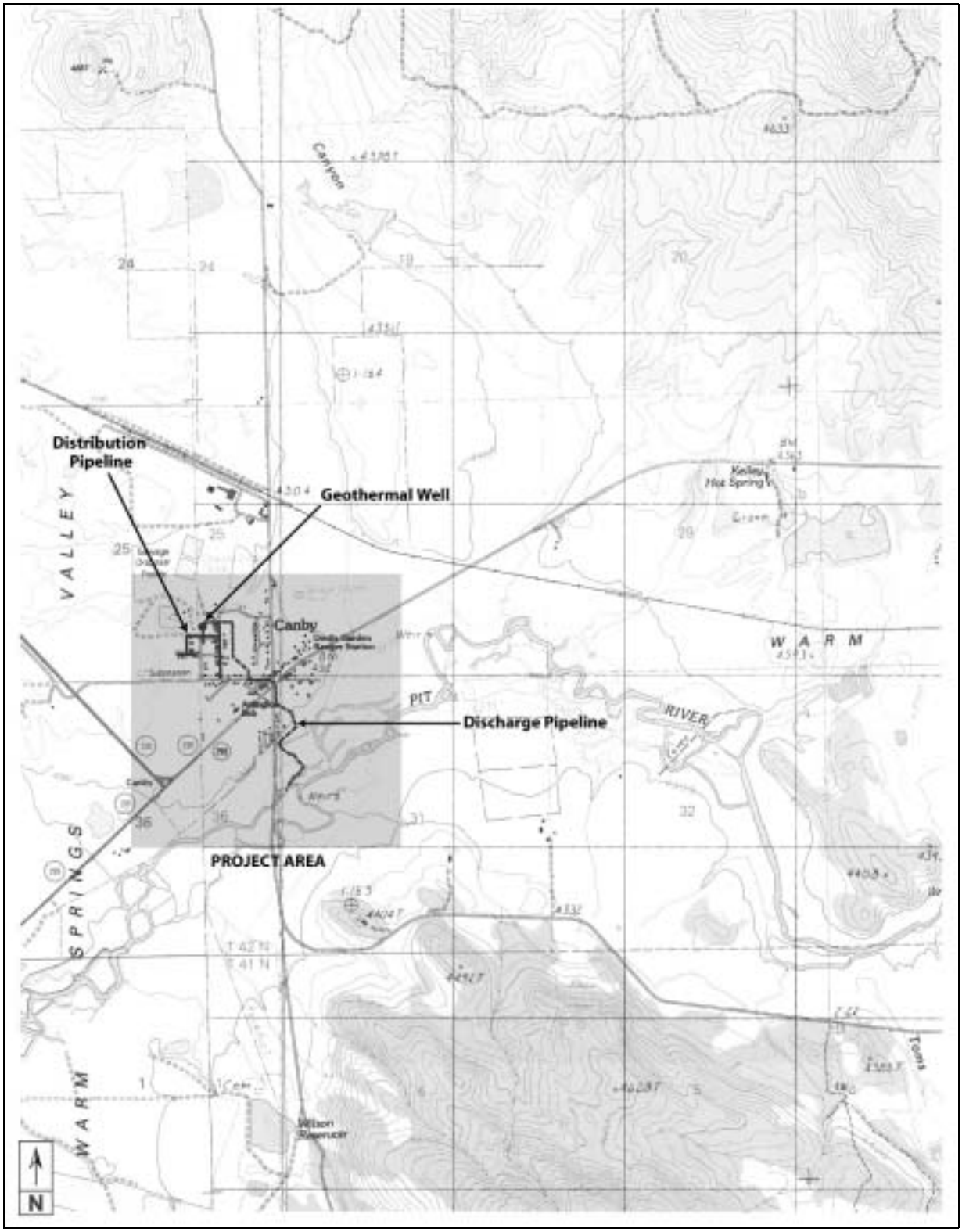
The purpose of the proposed action is to construct and operate a direct-use heating system for the I'SOT Community in Canby, California. As the cost of energy increases over time, there will be more small communities looking at developing the geothermal reserves in their area. I'SOT spends between $21,000-$42,000 annually in propane costs for residential space heating and domestic hot water (Merrick

Figure 1.1-1: Regional Location Map



SOURCE: BLM et al 1998

Figure 1.1-2: Proposed Project Area



SOURCE: USGS et al 2002

2002). This project would construct the piping and pipeline required for the direct-use system to reduce costs and dependence on propane for power.

One of the goals of the DOE/NREL Geothermal Program is to support the development and installation of low-to-medium temperature geothermal direct use technology as a technically feasible, practical and cost-competitive energy option in the United States (NREL 2002). In response to Request for Proposals (RFP) [RFP #RAA-1-31402, Development and Field Verification of Innovative Geothermal Direct-Use System Concepts], the I'SOT Community was competitively selected for negotiation of award. This funding award triggered the need for an environmental review by the DOE. Interest in the use of low-to-medium temperature (80 to 350°F) geothermal resources for direct use applications has been growing steadily. The vast majority of the nation's geothermal resource base consists of low-to-medium temperature resources; resources that are more likely to be technically feasible and economically viable for direct use applications.

No material costs are to be funded by DOE. DOE funding for the Canby District Heating Project would reimburse the following project components:

- Permitting Costs
- Engineering Costs
- System Installation labor
- Installation and implementation of the data gathering system for DOE Research and Development purposes

NEED

Recent events in electricity and gas demand indicate the need for alternative power sources. Although conservation is cited as a source of additional power to meet this need, conservation alone is not expected to meet all of the demand. Renewable energy sources, such a geothermal energy, already supply a significant amount of direct-use heating to western states such as Arizona, California, Nevada, Oregon, and Utah. Existing and improved technology for geothermal utilization will allow a broadening use of this resource. The National Energy Policy calls for increased domestic energy production, including the use of renewable energy (National Energy Policy Development Group 2001). The Federal government's position on geothermal power is that it will add sustainable economic development, create jobs, and support cleaner local and regional environments (GeoPowering the West 2000). Similar legislation has been introduced in the state of California in order to promote the use and development of renewable energy.

The need for the proposed action has been established by the U.S. Congress in the Geothermal Steam Act of 1970 and by the California legislature in the Warren-Alquist Act of 1974, both of which encouraged geothermal development as a means to diversify energy supplies. Other acts (including the Federal Land Policy and Management Act of 1976, the Public Utility Regulatory Policies Act of 1978, and the National Materials and Minerals Policy, Research, and Development Act of 1980) also identify the need to develop alternate energy resources.

1.3 Scoping and Agency Roles

SCOPING

DOE sent a scoping letter to public agencies and other interested parties on September 6, 2002 to solicit comments on the scope of the EA. Comments received during the scoping period are included in Appendix A. Responses to the scoping comments are incorporated into this document.

Letters were mailed and faxed to the Pit River Nation Tribal Representatives and nearby tribes to initiate nation-to-nation consultation (Appendix A). A meeting was held on September 10, 2002 with three representatives of the Pit River Nation. DOE agreed to hold additional meetings as requested by the tribe members. I'SOT agreed to contact officers of the Pit River Tribe regarding presence of an archaeological monitor during project construction.

On October 1, 2002 MHA Environmental Consulting, Inc. (MHA) sent a letter to the Native American Heritage Commission (NAHC) requesting a sacred sites record search. The NAHC responded that the record search failed to indicate the presence of Native American cultural resources in the immediate project area. The NAHC included a list of five tribal contacts in the project area to contact with the same request. DOE sent a letter to these five contacts on October 21, 2002 asking for comments and concerns. A follow-up phone call was made to each contact by MHA staff on November 12, 2002. Michelle Berditschevsky at the Pit River Tribe Environmental office in Burney stated that a water resources specialist from the tribe had expressed concern regarding the effluent discharge. Ms. Berditschevsky indicated that comments regarding the water quality and biology effects due to the discharge would be provided by the tribe when the Draft EA was available for review.

AGENCY ROLES AND PERMITTING PROCEDURES

National Environmental Policy Act

This EA was prepared in accordance with the requirements of the National Environmental Policy Act (NEPA), which requires environmental review of the proposed action to aid the decision maker in review of the proposed project. The DOE Golden Field Office Manager will make the decision concerning this proposed project.

The proposed action would require discretionary approval from a Federal agency. The proposed action is therefore subject to environmental review pursuant to NEPA. This document has been prepared as an Environmental Assessment (EA) in order to meet requirements of NEPA. This document has been prepared by a third-party consultant and distributed to tribes and agencies (Appendix B) under the direction of the lead agency, in accordance with NEPA guidelines.

Permitting Procedures

The NEPA review is required because the National Renewable Energy Laboratory (NREL), a private contractor for the Department of Energy, would provide funding for the proposed project. Related permits triggered by the proposed project are consideration of the potential project impacts to wetlands under Section 404 by the US Army Corps and potential effects of the project to endangered species under Section 7 by the US Fish and Wildlife Service. The effects to cultural resources will be considered in accordance with Section 106 of the National Historic Preservation Act (NHPA).

The proposed project is located in Modoc County, California. The DOE will make a decision whether NREL will fund the project installation. This funding made the DOE the lead Federal agency for NEPA review of the proposed action. Due to the identification of wetlands within the route of the discharge pipeline, the US Army Corps would need to issue a Section 404 permit. This makes the Army Corps a responsible agency under NEPA. Additional authorization is required from other federal, state, and local agencies.

The description of agency roles below provides information on the decisions that must be made by each agency.

U.S. Army Corps of Engineers

Construction of the 5,400 feet of discharge pipeline that includes construction along a levee road and in the wetlands would require that I'SOT obtain a Section 404 permit from the Army Corps. The proposed pipeline construction would cause some effect to wetlands in the area; therefore, the Corps would have the authority to issue a Nationwide or Individual wetland fill permit for the proposed action.

Regional Water Quality Control Board

The Central Valley Regional Water Quality Control Board (CVRWQCB) has jurisdiction over waste discharge to land and is responsible for issuing permits for discharging fluids to well pad sumps and injection of geothermal fluids under the National Pollutant Discharge Elimination System (NPDES). The CVRWQCB issued Wastewater Discharge Order No. R5-2002-0079/ NPDES No. CA0084859 for the project on April 26, 2002. This permit is included in Appendix C. This order covers the pipeline discharge of geothermal effluent to the Pit River. The RWQCB also has authority to issue a Section 401 Water Quality Certification for discharge to wetlands. As noted above, the proposed pipeline would include some effect to wetlands in the area; therefore the RWQCB would have the authority to issue a 401 Certification, should they desire to do so.

REQUIRED PERMITS AND APPROVALS

Table 1.3-1 lists the decisions or permits that must be issued by each agency.

Table 1.3-1: Required Permits and Approvals

Project Component	Project Action	Permits/Approvals Needed	Permit Status
ISO-1 well site and development of heating district	Construct well pad, distribution piping, and discharge pipeline	Modoc County Planning-Use Permit	Addendum to CEQA and modification of Use Permit for pipeline route change ~~to be submitted~~ pending approval
Discharge pipeline	Stream crossings	CDFG-Streambed Alteration	Permit issued
Discharge pipeline	Wetlands	US ARMY CORPS-SECTION 404, CVRWQCB-SECTION 401	Applications to be submitted for NWP 12 to Corps and Section 401 to RWQCB

Project Component	Project Action	Permits/Approvals Needed	Permit Status
Discharge pipeline	Directional Bore for conduit (3-inch) beneath State Route 299	California DOT-Encroachment Permit	Permit issued
Discharge pipeline	Geothermal effluent discharge to Pit River	CVRWQCB-Waste Discharge (NPDES)	Conditional permit issued

Notes:
CDFG=California Department of Fish and Game
CVRWQCB=Central Valley Regional Water Quality Control Board
DOT=Department of Transportation

SOURCE: MHA 2002

1.4 Project Background

GEOTHERMAL RESOURCE

The I'SOT (In Search of Truth)[1] Community proposes to construct a district heating system in order to harness geothermal energy to heat buildings in Canby, California. Geothermal energy is heat energy produced from the earth. Most direct-use applications employ shallow geothermal waters with low heat contents, and operate on smaller fluid volumes in contrast to electric power generation (DOE 1995). Both the hot water, and steam produced from the hot water, are discovered through geothermal exploration programs and brought to the surface by drilling wells. The hot water is then routed through a plate heat exchanger. Heat is transferred from the geothermal fluid to the domestic water, and then the hot water is distributed through buried pipelines to heat various buildings within the community. The geothermal fluid produced from the well would be discharged to the Pit River.

PREVIOUS ENVIRONMENTAL DOCUMENTATION

In August 1998, the DOE Idaho Operation Office granted a financial assistance award (75% DOE/25% I'SOT) to drill an exploratory well. This award was contingent on a matching award from the California Energy Commission (CEC) for material funding for a district heating system. In January 1999, I'SOT responded to a geothermal Research and Development solicitation from the CEC and was awarded a materials only award for $304,525. The California Division of Oil, Gas, and Geothermal Resources (DOGGR) as the lead agency, conducted an environmental review for the well drilling under the California Environmental Quality Act (CEQA), resulting in a Negative Declaration in September 1999. The Modoc County Planning Department as lead agency, conducted an environmental review for the use of the geothermal well and development of a district heating system under CEQA, resulting in an Initial Study/Mitigated Negative Declaration in September 2001.

[1] I'SOT is a society of people organized since 1969, as a community, exclusively for charitable, religious, and educational purposes within the meaning of section 501-c-3 of the Internal Revenue Code.

EXPLORATION ACTIVITIES

Drilling for the geothermal resource began on April 6, 2000. The original estimated depth to encounter the geothermal resource was 1,600 feet. I'SOT drilled a 2,100 foot well to use the geothermal water for district heating in April 2000. The resource was found on June 8, 2000 with a bottom hole temperature of 223° F and an estimated flow of 200-300 gallons per minute (gpm). A pump test resulted in the conclusion that the resource would have a long- term productivity rate of 37 gpm at about 180° - 190° F (Bohm 2000). Appendix D contains the complete Well Testing report.

In January 2001, NREL offered a 50/50 direct-use solicitation to fund the permitting, engineering, and installation of the I'SOT project.

1.5 Organization of this EA

This EA describes the existing environment, presents an analysis of the environmental consequences of the proposed project construction and operation, describes the effects of the alternatives to the proposed project, identifies mitigation measures to reduce impacts, and addresses the concerns of the interested parties who commented on the proposed project.

The information presented in this environmental analysis was obtained from personal communications with members of the US Army Corps, USFWS, US EPA, Central Valley Regional Water Control Board, and California Department of Fish and Game; site-specific surveys; and previous project documents. The documents referenced in this document include:

- Canby Geothermal Well Drilling Project IS/MND (DOGGR 1999)
- Geothermal Well History (DOGGR 2000)
- Adopted Waste Discharge Requirements for I'SOT Inc. Geothermal Project, Modoc County (CVRWQCB 2002)
- Well Testing at the ISO-1 Geothermal Well, Canby, Modoc County, CA (Bohm 2000)
- Mixing Zone Study for the I'SOT Geothermal Effluent Discharge Permit Application, Canby, Modoc County, California (Bohm 2001)
- Preliminary Investigation Regarding the Removal of Mercury from Geothermal Groundwater (I'SOT) (Bloom 2001)
- Archaeological Reconnaissance for the Proposed I'SOT Geothermal District Heating Demonstration Project, Canby, Modoc County, California (Vaughan 2001)
- Canby Geothermal Well Use and District Heating System Development Project IS/MND (Modoc County Planning Department 2001)
- Canby Geothermal Well Drilling Project IS/MND (DOGGR 1999

2: PROPOSED ACTION AND ALTERNATIVES

2.1 Approach to Alternatives

This chapter of the EA provides a detailed description of the alternatives, including the proposed action. NEPA requires that a reasonable range of alternatives be considered that could feasibly meet the objectives of the proposed action as defined in the purpose and need for the project described in Section 1.2 [CFR 1502.14(a)]. I'SOT evaluated a range of project alternatives during the scoping phase of the initial environmental review process. The proposed action would meet the purpose and need of the project to the greatest extent with the least environmental effects.

2.2 Alternative A–Proposed Action

2.2.1 LOCATION

The proposed project is located at the I'SOT facility in Canby, Modoc County, California. Figure 1.1-1 illustrates the regional area, and Figure 2.2-1 illustrates the location of the proposed project sites within the I'SOT facility. The existing geothermal well (ISO-1) is located on Section 25, Township 42 North, Range 9 East Mount Diable Base & Meridian (MDB&M). The distribution piping would extend from the new mechanical building adjacent to the well to the 34 existing separate I'SOT buildings totaling approximately 50,000 square feet. The retrofitted buildings include several older single-wide or double-wide modular homes, small wood-frame single-family homes, wood-frame group homes, and community buildings located within the I'SOT community north of County Road 83 and east of County Road 82.

Figure 2.2-1: Proposed Project Components

SOURCE: USGS Orthophoto, MHA, Inc. 2002

2.2.2 OVERVIEW OF THE PROPOSED ACTION

The proposed action is to implement a district heating system that would include production of geothermal fluids from an existing well, construction of a food service and laundry building, construction of a mechanical building with distribution piping, retrofitting water and space heating systems, and construction of an effluent discharge pipeline terminating at the Pit River. A potential future phase of this project could include drilling of an additional well to facilitate the injection of geothermal fluid and eliminate the discharge to the Pit River. This future phase is projected to occur in 5 to 10 years, contingent on funding sources.

I'SOT proposes several activities on their privately held property in the town of Canby. I'SOT proposes to:

- Produce up to 60 gallons per minute of geothermal fluid from an existing well (estimated peak demand flow rate is 37 gpm);
- Construct a mechanical and control building;
- Construct a food service and laundry building;
- Construct and operate a district heating system that would utilize the local geothermal resource (naturally occurring hot groundwater) as the heat source;
- Retrofit existing water heaters and space heaters to use community water heated by the geothermal fluid;
- Construct a geothermal effluent treatment system to remove heavy metals from the geothermal fluids; and,
- Construct approximately 5,400 feet of discharge pipeline to the Pit River for disposal of the geothermal fluids.

The proposed geothermal district heating project would be capable of supplying space heating and hot potable water for homes in the I'SOT community. The proposed district heating system includes production of geothermal fluid from an existing well to supply geothermal hot water to a heat exchanger facility. The heat exchanger is designed to extract the heat from the geothermal water and transfer that heat to water in the district heating pipeline. The district heating system would deliver the heated water to individual heating coils and domestic hot water supply tanks located in 36 separate buildings connected to the district heating system (Figure 2.2-2). The geothermal fluid remaining after heat exchange would be filtered to reduce levels of naturally occurring mercury. Before discharge to the Pit River, additional heat would be taken from the effluent by circulating it through a 4,000 ft. concrete slab of the food service/laundry building. Discharge into the Pit River would be through approximately 5,400 ft. of discharge pipeline and an existing multi-port diffuser pipe to enhance the mixing of the geothermal and Pit River water.

The Central Valley Regional Water Quality Control Board (CVRWQCB) has approved discharge of the geothermal fluids to the Pit River. The I'SOT project has obtained a National Pollution Discharge Elimination System (NPDES) Permit (No. CA 0084859) and CVRWQCB has issued Waste Discharge Requirements for conditional discharge of the geothermal fluid.

Geothermal Resource

The geothermal fluid would be drawn from I'SOT's 2,105-foot deep production well (ISO-1). Fluids from this well have temperatures from 180^0F to 200^0F and would be piped aboveground to a central mechanical equipment and control building on site.

Heat Exchangers

The district heating system is designed to use the heat from the geothermal groundwater to heat domestic water that is then used in water heaters and space heating. There would be two heat exchangers and a backup boiler located inside the mechanical building. The primary (HE-1) and secondary (HE-2) heat exchangers use a series of stainless steel plates, which are set in a series within a frame. Heat is transferred from the primary loop to the secondary loop through the plate-and-frame exchanger. The heat exchanger is designed to keep the geothermal fluids separate from the circulating potable water (fluid to be heated), to prevent the geothermal fluids from depositing scale or causing corrosion of the heating systems piping, and to prevent contamination of the heating fluid.

The district heating system's heating water would be transferred to each individual building by a distribution pipeline. Additional heat exchangers and radiant heaters in each building serve to heat air for space heating and water for domestic use. After heating the buildings on the system, the district heating water returns to the central heat exchanger for reheating and continued circulation back through the districting heating system. Adding cold water from the potable water system from a private community well into the direct heating system would make up any losses from consumptive use of hot water. The amount of make up water needed for domestic use is approximately 3,660 gallons per day (gpd).

Backup Boiler System

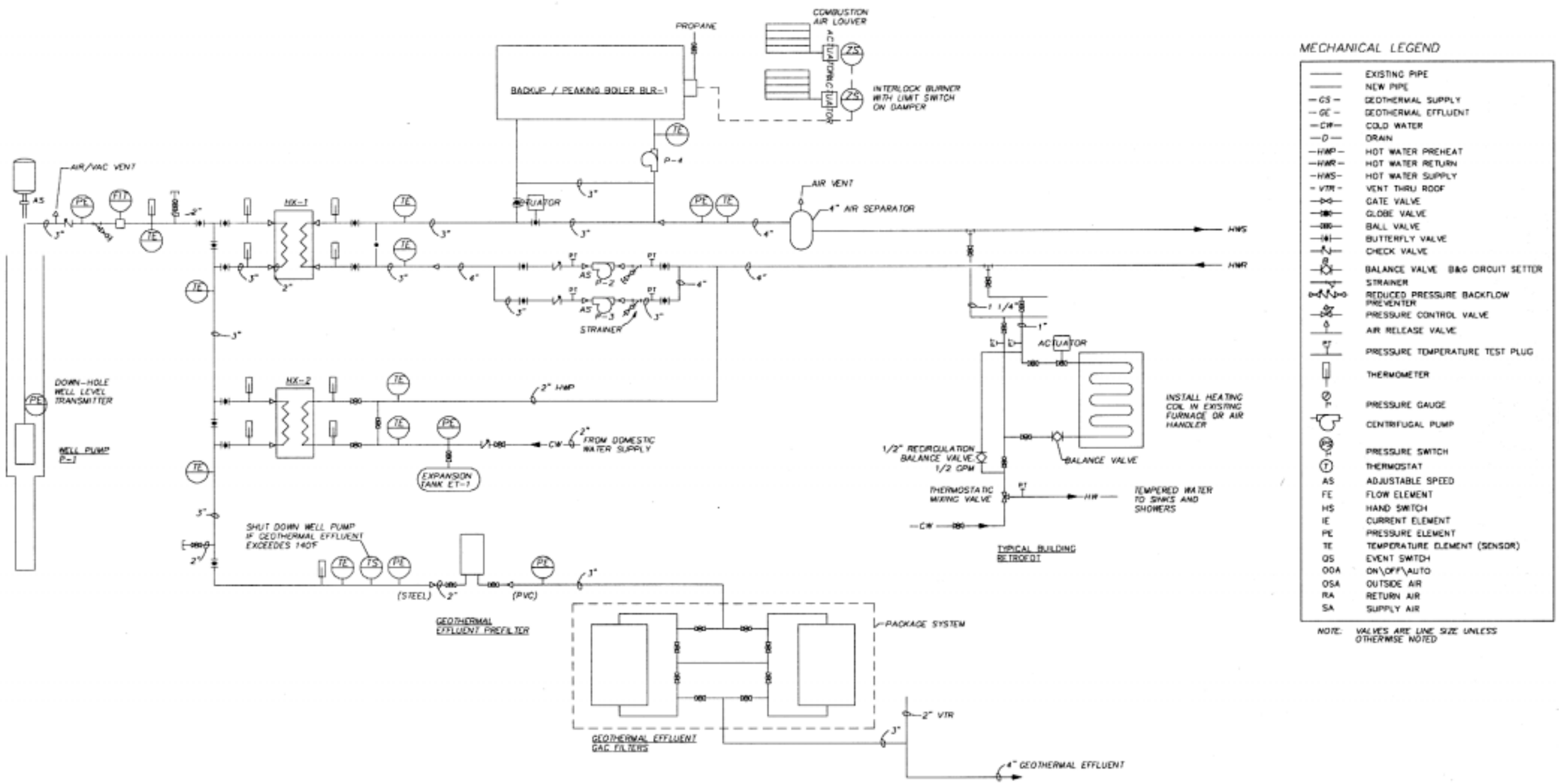
A centrally located backup/peaking boiler would be provided to act as a backup system should the geothermal heating system be taken offline for maintenance or repair during a high heating demand period and during river flows below 3 cfs, as according to the I'SOT NPDES requirements. The boiler would be copper-tubed and rated for potable water. The boiler would provide peaking or supplemental heating during periods of extreme cold weather or if the well capacity is less than the heat demand. Boosting the supply water temperature with the boiler would increase the heating capacity of all the heating coils in the district heating system and provide the extra heat needed in extreme weather. The boiler would be designed to provide full backup heating at maximum design conditions.

The backup boiler would be interconnected to the district heating circulating hot water system and would start operations whenever the district heating system water temperatures fall below the desired minimum temperature. The propane boiler would require a 1,500 to 2,000 gallon propane storage tank to provide one week's backup operation at peak rated rates. The boiler is anticipated for use approximately 1% to 2% of the year when temperatures fall below 7°F.

Computer Controls

The geothermal district heating system is operated by central computerized control systems, which consist of a series of computerized microprocessors that are used to monitor heating demand and to keep well flow rates and heat exchanger flow rates synchronized with the heating loads of the district heating system.

Figure 2.2-2: District Heating System Schematic



SOURCE: Merrick 2002

Geothermal Fluid Disposal

Geothermal water leaving the central heat exchanger is filtered and then disposed of through a pipeline to the Pit River. At the Pit River, an existing diffuser pipe at the discharge point mixes the filtered geothermal fluid with the Pit River water.

2.2.3 CONSTRUCTION

Geothermal Well and Geothermal Reservoir

No construction is required related to the geothermal well. I'SOT's existing, previously approved well would be used to provide geothermal fluids for the described district heating system (Figure 2.2-3). The Division of Oil, Gas and Geothermal Resources approved the 2,105 ft. deep well in September 1999 (DOGGR 1999).

The geothermal well was drilled in April 2000 into a formation of fractured lithified volcanic tuff of the Alturas Formation. The geothermal fluids are believed to be produced from fractured cemented fine-grained tuffs of the Alturas Formation in the interval below 1,900 ft, though most production is probably from a fracture zone around 2,050 ft. depth (Bohm 2000). The well is lined with a steel casing, which is cemented to the surrounding rock formations. The casing and cementing are designed to prevent intermingling of the geothermal water with shallower, potable groundwater. A deep well line-shaft turbine pump would be set at approximately 250 ft. into the well.

An 8 ft. by 6 ft. room attached to the main mechanical building would be constructed around the wellhead. This is a "separate" room and would have only three walls and share airspace with the main building. When the pump needs to be serviced, the 6' X 8' building would be removed as a unit and replaced after work is completed.

Figure 2.2-3: Existing Geothermal Well – ISO-1

SOURCE: MHA 2002

Food Service/Laundry Building

A new 4,000 sq. ft. community laundry and food service storage building would be constructed near the central mechanical building to take advantage of the geothermal district heating system hot water for laundry and other washing needs. The space heating needs would be served by circulating the spent geothermal fluid through the building's concrete slab on the way to discharge. The 21 ft. high building would be placed on the west side of County Road 161, 1,100 ft. north from County Road 83. A 100 ft. by 40 ft. concrete slab would be installed. Specific components to the slab system would include a zone valve to send discharge water to six separate areas of the slab that have different heat load requirements. The system would also include manifolds, 4,000 ft. of 1/2 in. Polybutylene (PEX) piping, conduits for the geothermal water to circulate through the concrete slab and other fittings designed for radiant flooring. PEX pipe can withstand freeze-thaw conditions making it suitable for radiant floor systems. Thermostats would be placed in six locations of the building to regulate demand. A circulation pump would move the geothermal water from the main discharge line through the concrete slab, then back into the discharge line.

Mechanical and Control Building

The building would be approximately 20 ft. by 20 ft. in size (400 sq. ft.) and would house the major equipment and control systems for the district heating system. The 16 ft. high building would house the geothermal well production pump, carbon filters, heat exchangers, backup/ peaking boiler, heating water loop circulation pumps, and central control system. A 408 sq. ft. concrete slab, electrical equipment, and the pre-engineered steel building would be constructed 1000 ft. north on County Road 203 from County Road 83.

District Heating System

Distribution pipelines would be constructed with a backhoe or excavator to trench the distribution pipelines. A 2 ft. wide by 4 ft. deep trench would be dug. The trench would be cut along the designated route and would be graded to allow for gravity draining. Excavated materials are removed and taken away a short distance and sifted to remove large rock. The trench bed is then filled with 6 to 10 inches of <1.5-inch gravel (gravel 1.5 inches or smaller). This gravel is used to form a level bed for the pipe. The pipe is laid in the trench on the gravel and then buried with the sifted earth material. Dump trucks would be used to haul out excess excavated material and bring in bedding for the pipeline. The construction corridor would be approximately 25 ft. wide. Lateral pipelines can be placed with trenching equipment and would require a 10 ft. construction corridor. A water truck would be used on site to control fugitive dust during construction.

Distribution pipes would vary in size and length as required to reach individual buildings. The districting heating system would include the following pipe lengths and size:

Table 2.2-1: Description of Piping for Distribution and Discharge Lines

Length	Size	Type
320 feet	4 inch	Preinsulated copper pipe, Type-L Equipment Pipe
3520 feet	3 inch	Preinsulated copper pipe, Type-L Distribution Pipelines
1560 feet	2 inch	Preinsulated copper pipe, Type-L Distribution Pipelines
1320 feet	1.5 inch	Preinsulated copper pipe, Type-L Lateral Pipelines

SOURCE: Merrick 2002

Thirty-four existing buildings would be retrofitted with air intake louvers and door sweeps. Hot water heating coils would be added to existing forced air heating systems to provide space heating. The required water supply and return temperature for these coils sets the design conditions system wide affecting heat exchanger size, pipe and pump sizing and overall system capacity. For the kitchen dishwashers, the hot water would flow through existing water heaters for temperature boosting if needed. At other locations, the existing water heaters would be bypassed or removed. A circulation pump distributes the heated service loop water throughout the district heating system. Only one circulation pump works at a time, as the second pump is utilized as a backup. The service loops of potable water uses the circulation pumps to circulate water into HE-1. The heated water temperature drops to 160°F, then is pumped to the residents at 110°F.

Figure 2.2-4 shows a plan view of the existing facilities with the proposed new buildings and distribution lines.

Granular Activated Carbon Filters

The activated carbon filters would be installed inside of the mechanical and control building. These filters would be designed to reduce levels of mercury from the geothermal water prior to discharging the geothermal fluid to the Pit River.

Discharge Pipeline

Geothermal fluid from the carbon filter unit would discharge into a 5,400 ft. long discharge pipeline. The proposed route for the pipeline crosses fields, runs along a levee road, and traverses a small portion of wetlands owned or controlled by the I'SOT community (Figure 2.2-5). The 4-inch pipeline would be buried approximately 3 ft. below the surface. A 25 ft. construction corridor would be needed to excavate the 3 ft. by 4 ft. deep trench. A backhoe or an excavator would be used to dig the trench. At the narrowest point, the width of the levee road is 12 ft. and the maximum width is 20 ft. The road is approximately 760 ft. long from the base of the hill to the bank of the Pit River. The levee road is always dry except during a rainstorm.

Excavated material would be used as overburden on the pipeline. Bedding material would be brought to the construction site by dump truck and excess excavated material removed or spread on site. The pipeline would be constructed utilizing bell and spigot type 4" PVC plastic pipe.

Figure 2.2-4: Plan View of District Heating System

SOURCE: Merrick and MHA 2002

Figure 2.2-5: Proposed Discharge Pipeline Route

SOURCE: Merrick 2002

Construction Schedule

The construction schedule for the proposed action (Table 2.2-2) assumes initiation of the project immediately following project approval. The schedule includes the following specific construction constraints imposed by environmental and land use issues in the project area:

- As mitigation to avoid increased impacts to wetland vegetation and soils, construction of the discharge pipeline should occur during the driest period-typically from March to May.

Table 2.2-2: Tentative Project Schedule

I'SOT Geothermal District Heating Demonstration Project
Accelerated Tentative Project Schedule

NREL Task	Description	Timeline
Phase I NREL Environmental Process	NREL to complete environmental work for construction.	September 2002 to February 2003
Task 4a Mechanical Building	Place concrete slab, erect steel building, install electrical.	March 2003
Task 4b Mechanical Equipment	Install production pump, carbon filters, heat exchangers, boiler, circulation pumps, controls, etc.	April 2003
Task 4f Remodel / Maintenance	This task would maintenance existing heaters and furnaces, ductwork, install air intake louvers, door sweeps, etc.	February to March 2003
Task 4c Distribution Piping	Excavate trenches, install all valves, valve boxes, pre-insulated piping, etc., bed, backfill, compact.	March to May 2003
Task 4d Retrofits	Install mixing valves on water heaters, coils in furnaces, some sheet metal work on furnaces.	March to April 2003
Task 4e Discharge Piping	Excavate 2' wide trench from Mechanical Building to Pit River, install a 4" bell and spigot PVC pipe, bed, backfill, compact.	March to May 2003

Table 2.2-2: Tentative Project Schedule (continued)

I'SOT Geothermal District Heating Demonstration Project
Accelerated Tentative Project Schedule

NREL Task	Description	Timeline
Task 5 Instrumentation	Install controls in mechanical building and on retrofits.	March to May 2003
Task 4h FS /Laundry Slab	Place concrete for a 100' x 40' slab and install manifolds, PEX piping, etc., for radiant flooring.	June to July 2003
Task 6 Startup and Checkout	A checklist of performance parameters would be prepared by the project engineer and verified at system startup. Project engineer would troubleshoot possible system problems.	June 2003
N/A	Test water quality per NPDES discharge requirements.	June 2003
Task 7 Performance Monitoring and Evaluation	Operation of the system would be monitored for 2 years after startup with all data being sent to NREL for evaluation.	July 2003 to July 2005
Task 8 Technology Transfer & Outreach	Technical presentation would be presented, results of project published.	For CEC June 2003 For NREL after 2003

SOURCE: Merrick 2002

2.2.4 OPERATION

Geothermal well

An open, drip-proof motor set at the surface would power the pump. Motor and pump speed would be adjustable, and controlled based on well flow level and demand requirements. Pump tests yielded a maximum flow rate of approximately 41 gallons per minute (gpm) indicating a high production rate. The system design is capable of pumping 60 gpm. Well water levels would be continuously monitored to allow pump operations up to the well capacity without drawing the well below a safe pumping level. The expected annual average flow rate for the district heating system is approximately 15 gpm and a peak flow rate of 37 gpm.

Food Service/Laundry Building

The 110°F discharge water from the mechanical building would be routed past the food service/laundry building in order to take advantage of the waste energy by circulating this water through the building's concrete slab. For laundry use, the district heating hot water would be used directly or mixed to an appropriate temperature.

Mechanical and Control Building

Two heat exchangers and a backup boiler would be located in the mechanical and control building. The geothermal wellhead would be adjacent to the main building as described above. The heat exchangers would be used to obtain the maximum heat extraction from the geothermal fluids. The two heat exchangers would be constructed of stainless steel to avoid corrosion by the geothermal fluid.

Primary Heat Exchanger. The primary heat exchanger (HE-1) would be used to heat returning water from the district heating system and to heat make-up domestic hot water. At design conditions, a flow of 37 gpm of geothermal fluid would be cooled from 190° to 110°F in HE-1. This would result in a heating of about 59 gpm of district heating system water from 100° to 150°F. HE-1 would be hydraulically sized for a flow of 80 gpm.

Secondary Heat Exchanger. From HE-1, the geothermal fluid would flow through a secondary heat exchanger, HE-2. HE-2 would be used to preheat the make-up water for domestic hot water supply. As potable hot water is consumed from the circulating hot water system, colder make-up water would be added to the system after being pre-heated by the geothermal fluid in the secondary heat exchanger HE-2. This heat exchanger provides substantial heating capacity to meet peak hot water demands. At a peak hot water flow of 30 gpm, assuming 80°F make-up water temperature, the heat exchanger would provide significant preheat energy, without increasing the geothermal pumping rate.

Backup Boiler System. The centrally located backup/peaking boiler would provide better control and more efficient supplemental heating than relying on the existing distributed furnaces and water heaters. The boiler at the mechanical building gives the opportunity to provide peaking to supplement geothermal heating during extreme cold weather or if the well capacity is less than the heat demand. With distributed backup heating, the choice to go to backup heat on an individual heater would require shutting off the geothermal supply to that heater. Supplementation is not feasible because the hot water coils would be located after the furnace. The boiler would be designed to provide full backup heating at maximum design conditions.

A standard package industrial propane boiler would be located in the mechanical and control building and discharge through a short stack to the atmosphere**.** The backup boiler would interconnect to the district heating circulating hot water system and would start operations whenever the district heating system water temperatures fall below the desired minimum temperature**.** The propane boiler would require a 1,500 to 2,000 gallon storage tank to provide one week's backup operation at peak rated rates.

District Heating System

Initially, 34 units would be connected to the district heating system. Later, the proposed 4,000 sq. ft. community laundry and foodservice storage building would be constructed near the central mechanical building and also receive heated water. The location of the building would take advantage of the geothermal district heating system for space heating and hot water for laundry and other domestic

needs**.** The heated water would circulate from the heat exchangers through an underground pipeline to each building in the heating district.

Heat loss calculations have been completed for each building and different size coils have been designed for the various ranges of heat loads (Brown 2002)**.** Several structures are older mobile homes heated with gas furnaces. In other structures the hot water heating coils would be added to existing forced air heating systems to provide space heating.

Water Circulation Pumps. The water circulation pumps would be made of brass or other material suitable for hot potable water. The pumps would be sized for up to 80 gpm each with 3 horsepower high efficiency inverter motors. This sizing allows a single pump to meet the peak flow providing installed backup pump ability.

Potable Water Heating. The potable hot water would be provided directly from the circulating district heating system water. Hot water used for showers and other direct contact uses, the hot water would be mixed down to 120^0F through an anti-scald valve. For kitchen dishwashers and laundry use the hot water would flow through the existing water heaters for temperature boosting if needed. Use of the heating water directly as potable hot water requires the entire heating water system be designed to potable water standards.

Pumps, piping, valves and heating coils would be rated for direct contact with potable water. Make-up water for potable hot water would be added at the heat exchanger building, where the make-up water is preheated with geothermal effluent from the main heat exchanger**.** The heating water distribution piping system contains about 2,400 gallons of hot potable water, which can help meet peak demands for hot water anywhere in the system.

Granular Activated Carbon Filters

The geothermal resource contains about 187 nanograms per liter (ng/L) of mercury. The geothermal fluid discharged from the secondary heat exchanger would be sent to a skid-mounted granular activated carbon (GAC) filter to reduce the mercury content prior to discharge of geothermal fluid to the Pit River. Prior to the geothermal fluids being transferred to the filter skid, it would be routed through approximately 360 feet of tubing embedded in a concrete slab at the new laundry facility to lower the temperature**.** The spent geothermal fluid would then sent to the GAC filter skid.

The geothermal fluids are passed through two pressure tanks containing granularized activated carbon providing sufficient residence time for the mercury to react with the activated carbon**.** Each tank would contain about 2,000 lbs of granular activated carbon. Average discharge to the filter skid would be 15 gal/min (gpm) over a one-year period. A bench-scale study (Basic Laboratory 2002) yielded mercury reductions of 92 to 99% using the same GAC filtration proposed for this project. Retention times used in the bench scale study were significantly shorter than those proposed for the full-scale filtration system, suggesting that full-scale removal efficiencies may be not be equivalent to those observed in the laboratory. Monitoring of the system would provide actual operating efficiency ratings.

The life expectancy of the filters is currently unknown, but water analysis would be conducted on a monthly basis to determine continued efficiency. When breakthrough occurs in the lead vessel, US Filter would swap out the vessels as needed, putting the lag vessel as the lead and putting the new vessel in the lag position.

The skid-mounted carbon filter consists of two pressure tanks and circulating pumps. The skid is approximately 8 feet by 3 feet by 10 feet and would be located in the central mechanical and control building at the wellhead. Effluent from the activated carbon filter would flow to the discharge pipeline.

A licensed vendor would clean the filters periodically and the contaminated carbon replaced with fresh activated carbon. The vendor would process the contaminated carbon for mercury recovery. Discarded filter material would be treated as a hazardous material by the vendor and disposed of in a Class 1 landfill.

Discharge Pipeline

Although the geothermal effluent is pumped into this pipeline, the pipe would drain by gravity and would run at atmospheric pressure. The proposed route for the pipeline crosses fields, runs along a levee road, and traverses a small portion of wetlands owned or controlled by the I'SOT community. See Figure 2.2-5 for a map of the proposed route. Figures 2.2-6 and 2.2-7 show the corridors for the pipeline.

Discharge to Pit River

Prior to discharge to the Pit River the geothermal effluent would be reduced in temperature from 100^0F to 80^0F and pass through a diffusion manifold at a point approximately 425 feet upstream from the County Road 54 Bridge at a temperature below 80^0F. The maximum flow rate would be 60 gpm based on NPDES permit restrictions, although the flow rate of the well is 37 gpm during peak demand. The NPDES permit discharge limits are set at 50 ng/L mercury, 600 µg/L boron, and 150 µg/L of arsenic daily maximum, at 80^0F for a flow rate of 60 gpm.

The mercury filter system is expected to capture between 92% and 99% of the mercury and discharge rates of mercury are expected to be closer to 4 to 7 ng/L based on 37 gal/min flow rates. At maximum capacity rate of 60 gal/min the mercury discharge rate is expected to be 10.5 ng/L. Temperature of discharged water is also expected to be less than 80^0F because the discharged water would travel through an energy disperser to heat a concrete slab and travel through the carbon filter tanks for approximately 35 minutes residence time prior to traveling approximately 5,400 feet to the discharge diffuser.

2.2.5 INSTRUMENTATION AND CONTROL

An automated distributed digital control system would be used to monitor and control operations of the geothermal production and heat exchanger system as well as to monitor and control operations of all of the heating systems in all of the buildings. Computerized control of the well production rate, district heating system and geothermal heat exchanger systems is necessary in order to meet the discharge temperature requirements and to meet the heating demand of the district heating system with a limited geothermal resource.

The control system would also provide extensive monitoring capability to confirm system performance and energy savings. The standard controller would have the capability to trend up to 156 data points, with a permanent record saved to a computer hard disk. Additional trends are possible with more control system memory. A modem would provide remote access for monitoring, alarms and system maintenance.

2.2.6 DECOMMISSIONING

Plans for Reclamation

The district heating system should have a 40 to 50 year life cycle and with repair and maintenance the system could be used for hundreds of years. The Boise, Idaho geothermal district heating system has been in continued used since the 1870's. Decommissioning would involve removal of the mechanical equipment from the central heating plant. This equipment could be salvaged to recover the metal in the plate heat exchangers. Upon decommissioning, the geothermal well would have to be plugged and abandoned in accordance with Department of Oil, Gas and Geothermal Resources (DOGGR) regulations. The mercury filter would be removed from the project site, and if not salvaged, then sent to a Class I hazardous materials land fill. The pipelines would be left buried with caps or put to other uses such as carrying irrigation water.

2.3 Project Evolution

DOE's alternatives are to fund or not fund the proposed project. In considering the environmental issues associated with the project, DOE worked with I'SOT to identify alternative pipeline routes that would reduce environmental effects. As a result of DOE's involvement there have been positive changes made to the project. The following project alternatives were investigated by I'SOT when designing the project and were eliminated due to feasibility issues. Reasons for the alternative elimination included currently prohibitive cost, effects to biological resources, and effects to Modoc County infrastructure.

2.3.1 INJECTION NOW/NO DISCHARGE TO PIT RIVER

The proposed project does not include an injection well for the disposal of the spent geothermal fluid after heat exchange. Drilling of an additional well in the general vicinity for injection of the spent geothermal fluid would cost an additional estimated $555,000 compared to the 5,400 ft. of underground pipeline which would cost approximately $34,000, a difference of $521,000. This estimate was derived from a memorandum to the Modoc Joint Unified School District Board of Trustees from Dr. Kevin J. Jolly, Superintendent regarding the history and current feasibility of Geothermal Well AL-2 (Jolly 2002). The second well for injection was considered by the I'SOT community to be cost prohibitive. At this time, neither I'SOT nor the DOE geothermal program has the finances for the cost of the injection well. An NPDES Permit has been obtained for the discharge of the geothermal water into the Pit River.

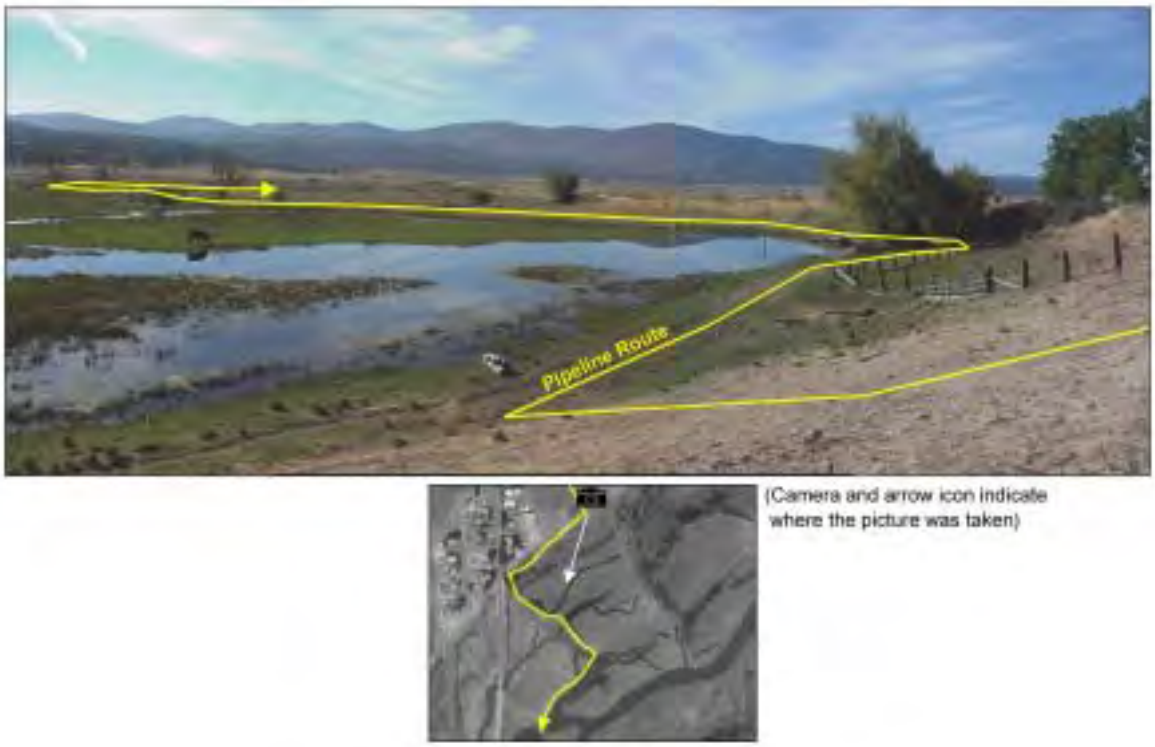
2.3.2 DISCHARGE OF EFFLUENT TO A CREATED WETLANDS

The pipeline was originally designed to discharge to a section of wetlands that would act as a biofilter for the geothermal effluent. This wastewater-type wetland filter was eliminated because it would alter and degrade the type of jurisdictional wetlands in the project area due to uptake of metals by vegetation. Wildlife foraging in the wetlands could potentially be affected by vegetation with metal accumulation. I'SOT consulted with Jim Rohrbach of the RWQCB regarding this alternative. The alternative was deemed unacceptable due to metal concentration build-up on the land surface that could potentially affect groundwater.

Figure 2.2-6: Corridors for the Pipeline (dry grazing land)

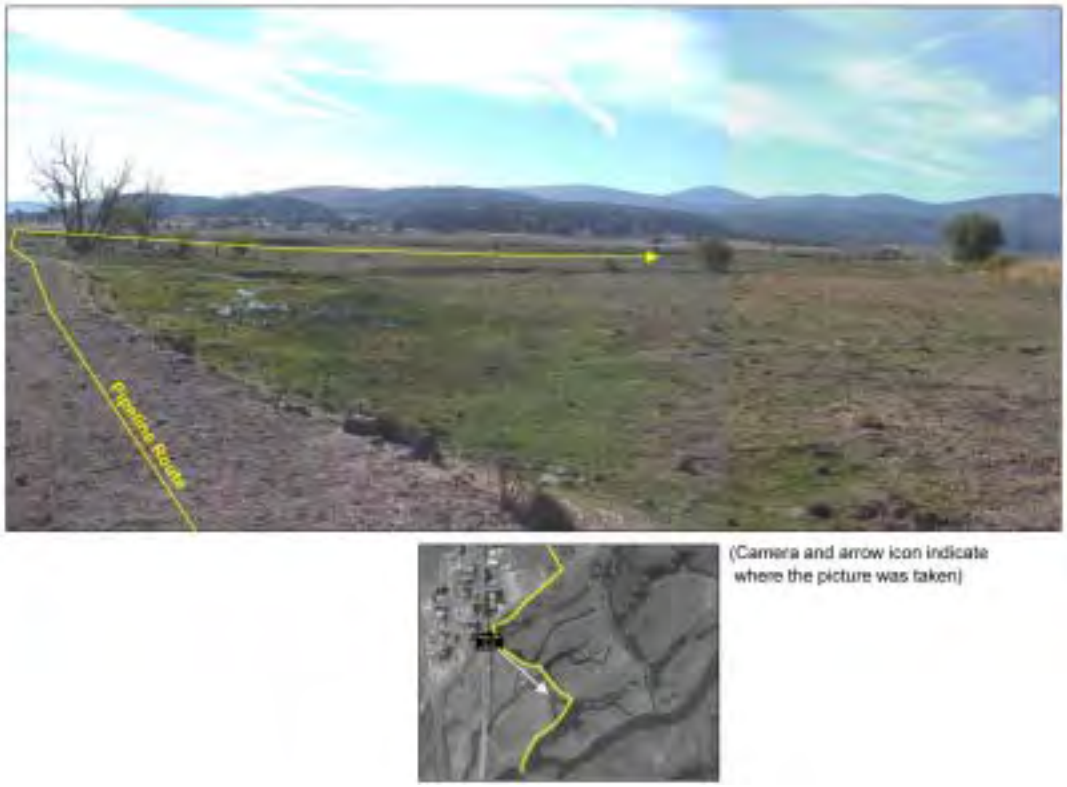
SOURCE: Merrick 2002

Figure 2.2-7a: Corridors for the pipeline (Levee Road). Looking southwest at the proposed pipeline route.



SOURCE: Merrick 2002

Figure 2.2-7b: Corridors for the pipeline (Levee Road). Composite picture of proposed pipeline re-route to discharge area (looking South).



SOURCE: Merrick 2002

2.3.3 DISCHARGE PIPELINE ROUTE THROUGH WETLANDS

The pipeline was originally designed to traverse a path on lands owned by I'SOT. An alternate path for the discharge pipeline would traverse a much greater portion of wetlands than the proposed path. An estimated 1,083 feet (0.62 acres) of wetlands would be affected by trenching this pipeline route. Complications with trenching through the wetlands, temporary effects to wetlands, and the increased likelihood of encountering special status species make this an undesirable alternative. The proposed project would affect 0.03 acres of wetlands.

2.3.4 DISCHARGE PIPELINE ROUTE ALONG COUNTY ROAD

An alternate path for the discharge pipeline would go along County Road 54, involve a bridge crossing, and traverse a small section of wetlands before reaching the discharge point at the Pit River. This alternate path could affect the public if the pipeline leaked or failed, would require additional CEQA analysis, and would require an encroachment permit from Modoc County. The project proponents prefer to keep the entire project on I'SOT property. This alternative was rejected because the environmental impacts to wetlands were greater than the proposed route. An estimated 198 feet (0.11 acres) of wetlands would be affected by trenching this pipeline route as opposed to the 45 feet (0.03 acres) for Alternative A.

2.4 No Action Alternative

Under the "No Action" alternative, the proposed district heating system would not be funded by NREL/DOE. The proposed project would proceed if alternative funding was secured by I'SOT, with effects from Alternative A potentially worse without DOE participation because no mitigation would be required (except NPDES required items). Without funding by DOE, I'SOT would not be reimbursed for costs resulting from permitting efforts, engineering consultation, and system installation costs. No data gathering system would be installed for DOE research and development (R&D) purposes. NREL would provide approximately 50% of the total project budget.

2.5 Impacts and Mitigation Measures

The proposed project could have the potential for adverse environmental effects. The following table summarizes measures that have been proposed as project conditions and would be incorporated as part of the proposed action prior to DOE approval.

Table 2.5-1: Summary of Monitoring and Mitigation Measures Considered as Project Conditions

Impact Type	Impact	Mitigation Measure	Level of Significance without Mitigation	Level of Significance with Mitigation
Air Quality	Dust emissions	**4.1-1**. I'SOT will limit all construction vehicles to 25 miles per hour or less on all unpaved roads to minimize dust generation.	Potentially Significant	Less than significant
Air Quality	Dust emissions	**4.1-2.** I'SOT will ensure that watering for dust suppression shall be applied throughout the construction area during the construction period. I'SOT will also ensure that watering is applied for dust suppression at the dumpsites for excavated material during dumping of excess excavated material.	Potentially Significant	Less than significant
Air Quality	Dust emissions	**4.1-3**. I'SOT will ensure that dump trucks used to transport bedding and trenching material shall be equipped with adequate cover material to prevent particulates from scattering along the transport route. I'SOT will also ensure that this cover material shall be used when transporting project-related bedding and trenching material. In addition, I'SOT shall ensure that watering for dust suppression shall be performed at dumpsites for excavated material during dumping of excess excavated material.	Potentially Significant	Less than significant
Hydrology	Potential for spills	**4.3-1**. I'SOT will design and construct the pipeline according to standard engineering practices and codes such as American Water Works Association (AWWA) or American	Potentially Significant	Less than significant

Table 2.5-1: Summary of Monitoring and Mitigation Measures Considered as Project Conditions

Impact Type	Impact	Mitigation Measure	Level of Significance without Mitigation	Level of Significance with Mitigation
		Society of Mechanical Engineers (ASME) Power Piping Code B31.1.		
Hydrology	Potential for groundwater contamination from pipeline breakage	**4.3-2**. I'SOT shall inspect the pipeline route on a monthly basis for possible pipeline damage generated from surface activities such as construction. Potential damage will be investigated and repaired, if necessary. I'SOT shall, upon pipeline installation and on an annual basis thereafter, perform a pressure test of the discharge pipeline. The pressure test shall involve blocking the pipeline at the discharge point such that no discharge escapes, filling the pipeline with water, and observing the water level at the head of the pipeline over time. A fall in water level indicates a leak in the pipeline and shall be followed by shutdown of the geothermal flow. Use of the discharge pipeline shall not recommence until the leak is identified, repaired, and a further pressure test indicates the pipeline is sealed. The leakage limit will be will be set as the manufacturer's estimate for leakage under the project's operating conditions. I'SOT shall provide the results of this testing to NREL during the first 3 years of operation.	Potentially Significant	Less than significant
Hydrology	Water quality and wildlife	**4.3-3.** The WDR sets 50 ng/L as the limit for mercury concentration in the effluent to be protective of water quality and wildlife. The GAC filter system removes 92-99% of incoming mercury yielding effluent mercury levels within a 2-19 ng/L range. Higher concentrations in the effluent may suggest declining filter efficacy. I'SOT will replace the GAC filters according to manufacturer's specifications. The mercury concentration in the effluent will be monitored monthly for the first six months and quarterly thereafter. If mercury concentrations in the effluent are found to be 45 ng/L, I'SOT will replace the GAC filters.	Potentially Significant	Less than significant
Biology	Vegetation and soil disturbance	**4.4-1.** To minimize the impacts to removed vegetation in the wetlands and other areas,	Significant	Less than significant

Table 2.5-1: Summary of Monitoring and Mitigation Measures Considered as Project Conditions

Impact Type	Impact	Mitigation Measure	Level of Significance without Mitigation	Level of Significance with Mitigation
	soil disturbance	during trenching, I'SOT will ensure that soil will be placed on either side of the trench. As much of the soil with its original vegetation as needed to return the ground to the original contour will be replaced immediately after the pipeline installation is completed. Due to the bedding material and pipe diameter, all of the removed soil will not refill into the trench; however, the fill soil will contain enough of the original vegetation to retain plant growth.		significant
Biology	Drainage to wetlands	**4.4-2.** To reduce likelihood of affecting drainage in the wetlands, I'SOT will carefully plan the timing of project implementation. I'SOT will perform construction activities adjacent to drainages and wetlands when the probability of heavy rain is minimal and inundation of the project wetlands is reduced due to manipulation of the weirs. This driest time, when construction would be carried out, falls between February and March. Replacement of weir boards occurs on April 1st, causing the drained wetlands to be re-saturated by the summer months.	Significant	Less than significant
Biology	Damage to eel-grass pondweed	**4.4-3.** I'SOT will place a sedimentation barrier fence adjacent to and on either side of the trench through the 0.03 acres of wetland. The fence shall remain in place until the construction is complete to prevent sediment from collecting on and damaging any eel-grass plants.	Significant	Less than significant
Biology	Pit River mercury concentration effects to fish and wildlife	~~**4.4-4.** The concentration of mercury in the effluent will be monitored monthly. The Pit River water concentration will also be monitored monthly at two stations, one 50 feet upstream from the point of discharge and the other 425 feet downstream from the point of discharge as stated in the NPDES permit.~~ ~~If the mercury concentration in the effluent exceeds the permit level of 50 ng/L, the proponent will coordinate with the RWQCB, CDFG, and USFWS to determine appropriate mitigation. Measures to reduce the effect~~	Significant	Less than significant

Table 2.5-1: Summary of Monitoring and Mitigation Measures Considered as Project Conditions

Impact Type	Impact	Mitigation Measure	Level of Significance without Mitigation	Level of Significance with Mitigation
		~~could include, but are not limited to, temporary cessation of discharge temporary collection and proper disposal of discharge until the concentrations decrease, alternative filter systems, or injection of the spent geothermal fluids back into the geothermal reservoir.~~ I'SOT shall monitor the concentration of mercury in the effluent monthly for six months and quarterly thereafter Refer to Mitigation Measure 4.3-3 (Hydrology and Water Quality) for requirements for replacement of the GAC filters. I'SOT shall also monitor the Pit River water concentration monthly at two stations, one 50 feet upstream from the point of discharge and the other 425 feet downstream from the point of discharge as stated in the NPDES permit. I'SOT shall provide test results to NREL for the first 3 years of operation. If the mercury concentration in the effluent exceeds the permit level of 50 ng/L, if concentration in the river exceeds 50 ng/L, or if assessment of the monitoring activities (including chronic toxicity testing, and fish residue analysis) suggests that discharge may result in significant increase in risk of mercury bioaccumulation in fish tissue I'SOT shall coordinate with the RWQCB, CDFG, and USFWS to determine appropriate mitigation. Measures to reduce the effect could include, but are not limited to, temporary cessation of discharge temporary collection and proper disposal of discharge until the concentrations decrease, alternative filter systems, or injection of the spent geothermal fluids back into the geothermal reservoir.		
Biology	Effects of mercury bioaccumulation in fish tissue and bald eagles	**4.4-5.** In accordance with the NPDES permit, I'SOT shall collect samples of Sacramento pike-minnow or other appropriate species will be collected and whole body concentrations of mercury will be determined at least every other year. I'SOT shall devise a sampling plan with the species	Significant	Less than significant

Table 2.5-1: Summary of Monitoring and Mitigation Measures Considered as Project Conditions

Impact Type	Impact	Mitigation Measure	Level of Significance without Mitigation	Level of Significance with Mitigation
		of fish, number to be collected, the age of the fish and the method of aging in consultation with USFWS and CDFG. The sampling plan and protocol shall be submitted to the Executive Officer of the CVRWQCB, USFWS, and CDFG for approval. ~~If fish tissue concentrations exceed 100 ng/g, then the proponent will coordinate with the RWQCB, CDFG, and USFWS to determine appropriate mitigation. Mitigation measures might include those measure outlined in Measure 4.4-4 to reduce mercury discharge to the river, as well as actions to improve or enhance local eagle foraging or nesting conditions in the area, as coordinated with USFWS and CDFG.~~ Current levels of mercury in fish tissue average 0.4 ng/g. The maximum projected increase in fish tissue concentration is to 0.895 ng/g. If the tissue mercury concentration averages above 5 ng/g, then the proponent will coordinate with the RWQCB, CDFG, and USFWS to determine appropriate mitigation. Mitigation measures might include those measure outlined in Measure 4.3-5 to reduce mercury discharge to the river, as well as actions to improve or enhance local eagle foraging or nesting conditions in the area, as coordinated with USFWS and CDFG.		
Cultural Resources	Potential to affect undiscovered resources	**4.5-1**. During pipeline installation I'SOT shall contract for a tribal monitor check for any Indian cultural resources or human remains. Mitigation to avoid effects to resources encountered might include avoidance or data collection.	Potentially Significant	Less than significant
Cultural Resources	Potential to affect undiscovered resources	**4.5-2**. Should any prehistoric or historic resources be encountered during site construction activities, I'SOT shall suspend construction activities within 50 feet of the discovery until a qualified consulting archaeologist has assessed the materials. If a decision is made to record the site, I'SOT shall ensure that recordation shall take place and it will be determined whether project well sites could be relocated to avoid any	Potentially Significant	Less than significant

Table 2.5-1: Summary of Monitoring and Mitigation Measures Considered as Project Conditions

Impact Type	Impact	Mitigation Measure	Level of Significance without Mitigation	Level of Significance with Mitigation
		additional effects. I'SOT shall not resume construction activities in the vicinity of the discovery until consultation has taken place and the resources have been appropriately evaluated or treated and specific authorization to resume construction activities is provided by the DOE. If avoidance is not feasible, I'SOT shall ensure that a qualified archaeologist will evaluate the site and a determination of eligibility for the NRHP shall be made. If the site is determined to be eligible, then I'SOT shall submit a mitigation proposal (which may include a data recovery program similar to those conducted for similar resources in the vicinity) with the site record to the SHPO for review and concurrence.		
Cultural Resources	Potential to affect undiscovered remains	**4.5-3**. If prehistoric archaeological deposits that include human remains or objects considered "cultural items" according to the Native American Graves Protection and Repatriation Act (NAGPRA) are discovered during site construction activities, I'SOT shall immediately notify the County Coroner and a qualified archaeologist and would follow NAGPRA regulations. If the remains are identified as American Indian, then I'SOT shall notify local American Indian groups or tribe(s) and the Native American Heritage Commission (NAHC) and initiate consultation. I'SOT shall ensure that the most likely descendants of these remains are notified and given the opportunity to make recommendations for the remains. If descendant recommendations are made which are not acceptable to I'SOT or DOE, then the NAHC would be requested to mediate the problem.	Potentially Significant	Less than significant
Noise	Noised impacts of construction	**4.7-1**. I'SOT will ensure that muffler systems shall be used on all heavy equipment during construction activities.	Significant	Less than significant
Noise	Noise impacts of construction	**4.7-2**. As required by the Modoc County General Plan, I'SOT will submit building permits for the project to the Modoc County Planning Department for review for	Significant	Less than significant

Table 2.5-1: Summary of Monitoring and Mitigation Measures Considered as Project Conditions

Impact Type	Impact	Mitigation Measure	Level of Significance without Mitigation	Level of Significance with Mitigation
		consistency with the noise element and other elements.		
Transportation and Traffic	Damage to roadway integrity	**4.11-1.** I'SOT will ensure that construction activities comply with all conditions of the Caltrans Encroachment Permit. These measures would minimize the chance of roadway damage during the jack and bore (HDD) process and would include the following: a. All equipment used on the paved surface of the State highway shall be rubber tired or rubber tracked, and meets the weight requirements for operation on a State highway. b. Any trench or excavation within 15 ft of the edge of the traveled way or 10 ft from the edge of pavement, whichever is greater, shall be closed. c. All work authorized herein shall be performed during daylight hours only. No work shall be performed during inclement weather. d. The minimum depth of cover over the bore casing within the State's right-of-way shall be 7.5 ft for high-risk uncased gas mains or 6 ft and 5 ft below any drainage facility. e. No open cutting of the roadway prism is permitted. f. Trenches and boring pits outside of the highway prism shall be backfilled with material approved by State's representative. g. HDD operators are required to have basic training on HDD rigs via the dealerships – Vermeer, Ditch Witch, American Auger, etc., and have proof of training in their possession. I'SOT will make a videotape before and after HDD operations to document roadway integrity has been unchanged or to determine if permittee is liable for damages to the State highway caused by his	Potentially Significant	Less than significant

Table 2.5-1: Summary of Monitoring and Mitigation Measures Considered as Project Conditions

Impact Type	Impact	Mitigation Measure	Level of Significance without Mitigation	Level of Significance with Mitigation
		operation. I'SOT will repair any damage caused by the construction, as required by Caltrans.		
Transportation and Traffic	Damage to roadway integrity	**4.11-2.** I'SOT will ensure that no vehicle used in construction or material delivery shall exceed the design load limit of the various roadways that may be used during construction.	Potentially Significant	Less than significant
Transportation and Traffic	Damage to roadway integrity	**4.11-3.** I'SOT will ensure that no construction equipment that utilizes tractor treads shall travel upon any public roadway.	Potentially Significant	Less than significant
Transportation and Traffic	Damage to roadway integrity	**4.11-4.** I'SOT will ensure that no construction equipment shall operate or park within 5-feet of either edge of a pavement edge.	Potentially Signficant	Less than significant
Human Health & Safety	Public safety during construction	**4.12-1.** Prior to project commencement, I'SOT will submit a site construction and safety plan to the Director of the Modoc County Planning Department for review and approval. The purpose of the plan shall be to ensure public safety during all phases of project construction through: a. The installation of safety signage, placed as appropriate within the construction corridor, that warns of risks associated with on-site construction activities and outlines measures to be taken to ensure safe use of facilities near construction areas and avoidance of active construction equipment b. The installation of temporary safety fencing to restrict or prevent public access to active on-site construction sites or equipment	Potentially Significant	Less than significant
Human Health & Safety	Impacts of potential spills on health and safety	**4.12-2.** Prior to project commencement I'SOT will submit to the Director of the Modoc County Planning Department for review and approval a safety plan. The purpose of the plan is to minimize the exposure of the public to potentially hazardous materials during all phases of the	Potentially Significant	Less than significant

Table 2.5-1: Summary of Monitoring and Mitigation Measures Considered as Project Conditions

Impact Type	Impact	Mitigation Measure	Level of Significance without Mitigation	Level of Significance with Mitigation
		project through: a. Appropriate methods (e.g., Best Management Practices) and approved containment and spill-control practices (e.g., spill control plan) for transport and storage of chemicals and materials on-site b. Safety signage, placed as appropriate along the construction corridor during construction or repairs, that warns of risks associated with on-site construction materials and outlines measures to be taken to ensure safe use of facilities near construction areas and avoidance of construction materials c. Temporary safety fencing during construction or repairs to restrict or prevent public access to active on-site construction materials or chemicals		
Human Health & Safety	Potential for fire risk	**4.12-3**. I'SOT will ensure that all construction equipment will be equipped with fire potential reduction equipment, such as but not limited to spark arresters, mufflers, etc.	Potentially Significant	Less than significant
Human Health & Safety	Potential for fire risk	**4.12-4**. I'SOT will ensure that fire preventative measures are taken during potentially hazardous operations, such as welding.	Potentially Significant	Less than significant
Human Health & Safety	Potential for fire risk	**4.12-5**. I'SOT will ensure that fire fighting equipment is supplied to the project site. Fire detectors, fire extinguishers, and hand-held fire fighting equipment would be available and maintained at the mechanical control building as well as the food service/laundry building for the duration of the project.	Potentially Significant	Less than significant

3: AFFECTED ENVIRONMENT

Introduction

This chapter of the EA provides a description of existing environmental conditions and applicable regulations within the area of the proposed district heating system project. This chapter is organized into sections by environmental parameter. Each of these sections identifies the:

- Environmental Setting
- Regulatory Setting

ENVIRONMENTAL SETTING

The environmental setting sections present a description of the physical environment for each of the twelve environmental parameters analyzed for the proposed project. The study area for each environmental setting varies among the parameters.

REGULATORY SETTING

The regulatory settings are presented for each of the fourteen environmental parameters. Federal, state, regional, district, and local regulations applicable to the project site are identified.

3.1 Meteorology/Air Quality

EXISTING CONDITIONS

Air Quality

The proposed project would be located in Modoc County within the Northeast Plateau Air Basin (NPAB). The NPAB extends from the Nevada border on the east to the Siskiyou Mountains on the west; from the Oregon border in the north to the southern border of Lassen County; and includes all of Lassen, Siskiyou, and Modoc Counties (Figure 3.1-1). The NPAB encompasses a total area of 14,920 square miles, and is the fourth largest air basin in California (BLM et al. 1998). The NPAB is designated as "attainment[1]" for the California Ambient Air Quality Standards (CAAQS) for Ozone (O_3), oxides of Nitrogen (NO_x), sulfates, and lead (Pb) but is "unclassified[2]" with regard to sulfur dioxide (SO_2), carbon monoxide (CO), visibility reducing particles, vinyl chloride (chloroethane), and hydrogen sulfide (H_2S). As is the case with most of California, the NPAB is classified as "nonattainment[3]" for particulate matter less than 10 microns (PM_{10}) (CARB 1997b). Table 3.1-1 presents estimated annual emissions for both the County and the NPAB.

Table 3.1-1: Modoc County 2001 Emissions Estimate by Pollutant Type in Tons/Day

Emissions (tons/day)	**TOG**	**ROG**	**CO**	**NOx**	**SOx**	**PM**	**PM_{10}**
Modoc County	5.02	3.90	33.79	4.78	0.31	35.69	21.99
Northeast Plateau Air Basin	51.60	38.86	406.79	24.56	1.68	130.10	85.92

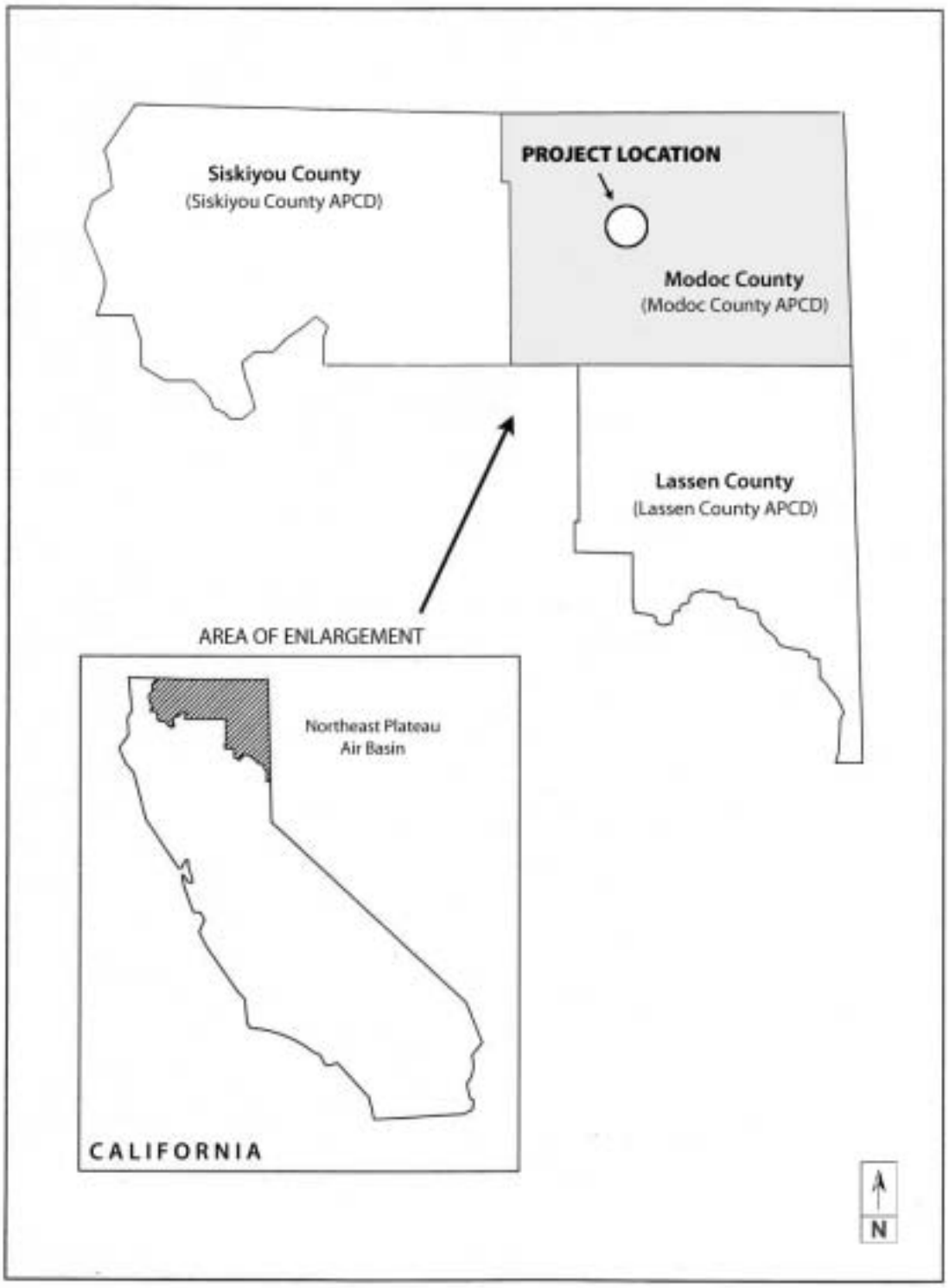
SOURCE: California Air Resources Board 2002

The NPAB is classified "nonattainment[4]" for particulate matter less than 10 microns (PM_{10}). The major contributors to PM_{10} emissions in the County include:

- Natural sources (i.e., wildfires) (2.70 tons/day)
- Unpaved roads dust (15.14 tons/day)
- Farming operations (4.5 tons/day)

[1] Attainment-Pollutant concentration does not exceed air quality standards.
[2] Unclassified-No federal standards exist for the pollutant.
[3] Nonattainment-Pollutant concentration exceeds air quality standards.
[4] Nonattainment-Pollutant concentration exceeds air quality standards.

Figure 3.1-1: Northeast Plateau Air Basin Location and APCD Jurisdictions



SOURCE: California Air Resources Board 1997 & MHA

Climate and Meteorology

Regional. Weather in northern California is dominated by the position of the Eastern Pacific high-pressure cell normally located off the coast of North America (BLM et. al 1998). Due to the positioning of this cell, an almost unbroken chain of winter storms occurs within the study area and a bulk of the precipitation within the study area occurs during this winter storm period. Weather systems in the region usually result in strong winds and unstable air masses, providing for good dispersion conditions. During fair weather periods, stable air conditions prevail throughout the region.

During the spring, the movement of the Pacific High pressure cell results in a decline of precipitation in vicinity of the proposed action. Spring conditions are rarely warm and dry, due to unstable conditions that result in rain and snow (BLM et al 1998).

Dry, warm conditions are characteristic of the summer months, although thunderstorms are not uncommon. The transitional period between the summer and winter/spring is generally characterized by cool, clear days and evening temperatures, which drop below freezing.

Local. Canby 3 SW was established as a weather station on July 1, 1948. It is located at Canby and is at an elevation of 4,310 feet. Table 3.1-2 presents meteorological data for Canby accumulated at this weather station from 1971 to 2000. The annual average high temperature for that period was 62°F and the annual average low temperature was 31.5°F. Average annual precipitation for that period was 16.45 inches.

Table 3.1-2: Canby Meteorological Data from 1971 to 2000

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	YEAR
Average High	40.7	45.9	51.1	57.8	67.1	76.4	85.6	85.1	77.2	66.2	49.4	41.5	62.0
Average Low	20.2	22.4	27.0	30.4	36.1	42.4	46.6	44.4	37.1	29.2	23.1	18.7	31.5
Monthly Precip.	1.85	1.95	2.19	1.46	1.48	.84	.26	.40	.77	1.08	2.11	2.06	16.45
Heating Degree Days	1071	864	805	628	417	193	63	76	245	537	861	1082	6842
Cooling Degree Days	0	0	0	0	1	24	96	68	10	0	0	0	199

SOURCE: Canby 3 SW, Weather Station of the U.S. Weather Service 2002

REGULATORY FRAMEWORK

Federal, state, and local requirements provide for the regulation of air quality in the project vicinity. A discussion of these requirements is provided below.

Federal

Ambient Air Quality Standards (AAQS). National AAQS (NAAQS) were established in 1971 for six pollution species with states retaining the option to add other pollutants, require more stringent compliance, or to include different exposure periods. The initial attainment deadline of 1977 was extended to 1987 for NAAQS, and has now been further extended in air quality problem areas like Southern California until the year 2010.

EPA developed standards for chronic ozone exposure (8+ hours per day) and for very small diameter particulate matter (called "$PM_{2.5}$"). New national AAQS were adopted on July 17, 1997. Those national standards currently in effect are shown in Table 3.1-3. There are no NAAQS for volatile organic compounds (VOCs).

An area that is found to be in violation of NAAQS is called a "nonattainment area." Pollution sources contributing to nonattainment areas are subject to tighter restrictions.

State and Local

Ambient Air Quality Standards (AAQS). The complete list of state standards currently in effect in California is shown in Table 3.1-3. California standards for PM_{10}, which includes $PM_{2.5}$, are more stringent than the federal $PM_{2.5}$ standard. There are no California AAQS for VOCs.

On June 20, 2002, the California Air Resources Board passed new, stricter standards for particulate matter (PM). The newly adopted standards include:

- A PM_{10} annual-average standard of 20 micrograms per cubic meter ($\mu g/m^3$), not to be exceeded;
- A new $PM_{2.5}$ annual-average standard of 12 $\mu g/m^3$, not to be exceeded;
- Retention of the 24-hour PM_{10} standard of 50 $\mu g/m^3$, not to be exceeded; and
- Retention of the sulfates 24-hour average standard of 25 $\mu g/m^3$.

Modoc County Air Pollution Control District. The Modoc County Air Pollution Control District (MCAPCD) is responsible for regulating stationary sources of air pollution. Businesses that may be impacted by air pollution regulations includes those involved with fuel burning, incineration, fueling systems, internal combustion engines, painting/coating processes, dry cleaning, degreasing, and many others.

The MCAPCD Rule Book contains all regulations on air emissions and can be viewed at http://www.arb.ca.gov/drdb/mod/cur.htm. The MCAPCD adheres to State Ambient Air Quality Standards. Applicants proposing new sources of air pollutants are required to obtain an Authority to Construct (ATC) and/or a Permit to Operate (PTO) from the MCAPCD. Rules for new sources are identified in Regulation VI of the District's Rules and Regulations.

In order to regulate new air emission sources that would emit or have the potential to emit criteria air pollutants, MCAPCD has adopted New Source Review (NSR) requirements. Two key provisions of NSR requirements are the use of best available control technology (BACT) and the identification of the need for emission offsets. BACT is required for sources emitting more than 250 pounds per day (lb/day) of any pollutant for which there is a national ambient air quality standard, or any precursor of such a pollutant. Emission offsets (or mitigation) may be required for net emission increases (i.e., increases after the application of BACT). The offset of net emission increases would not be required if it is demonstrated through modeling that emissions from a new source would not cause a new violation of any ambient air quality standard.

Table 3.1-3: Federal and California Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards [1]		Federal Standards [2]		
		Concentration [3]	Method [4]	Primary [3,5]	Secondary [3,6]	Method [7]
Ozone (O_3)	1 Hour	0.09 ppm (180 µg/m³)	Ultraviolet Photometry	0.12 ppm (235 µg/m³)[8]	Same as Primary Standard	Ethylene Chemiluminescence
	8 Hour	—		0.08 ppm (157 µg/m³)		
Respirable Particulate Matter (PM_{10})	Annual Geometric Mean	30 µg/m³	Size Selective Inlet Sampler ARB Method P (6/22/85)	—	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	24 Hour	50 µg/m³		150 µg/m³		
	Annual Arithmetic Mean	—		50 µg/m³		
Fine Particulate Matter ($PM_{2.5}$)	24 Hour	No Separate State Standard		65 µg/m³	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean			15 µg/m³		
Carbon Monoxide (CO)	8 Hour	9.0 ppm (10 mg/m³)	Non-dispersive Infrared Photometry (NDIR)	9 ppm (10 mg/m³)	None	Non-dispersive Infrared Photometry (NDIR)
	1 Hour	20 ppm (23 mg/m³)		35 ppm (40 mg/m³)		
	8 Hour (Lake Tahoe)	6 ppm (7 mg/m³)				
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	—	Gas Phase Chemiluminescence	0.053 ppm (100 µg/m³)	Same as Primary Standard	Gas Phase Chemiluminescence
	1 Hour	0.25 ppm (470 µg/m³)				
Lead	30 days average	1.5 µg/m³	AHI, Method 54 (12/74) Atomic Absorption	—	—	High Volume Sampler and Atomic Absorption
	Calendar Quarter	—		1.5 µg/m³	Same as Primary Standard	
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean	—	Fluorescence	0.030 ppm (80 µg/m³)	—	Pararosaniline
	24 Hour	0.04 ppm (105 µg/m³)		0.14 ppm (365 µg/m³)	—	
	3 Hour	—		—	0.5 ppm (1300 µg/m³)	
	1 Hour	0.25 ppm (655 µg/m³)		—	—	

Table 3.1-3: Federal and California Ambient Air Quality Standards (continued)

Pollutant	Averaging Time	California Standards [1]		Federal Standards [2]		
		Concentration [3]	Method [4]	Primary [5,8]	Secondary [6,8]	Method [7]
Visibility Reducing Particles	8 hour (10 am to 6 pm, PST)	In sufficient amount to produce an extinction coefficient of 0.23 per kilometer—visibility of ten miles or more (0.07—30 miles or more for Lake Tahoe) due to particles when the relative humidity is less than 70 percent. Method: ARB Method V (6/18/89)		No Federal Standards		
Sulfates	24 hour	25 µg/m³	Turbidimetric (Barium Sulfate-ARB Method 61 (2/76)			
Hydrogen Sulfide	1 hour	0.03 ppm (42 µg/m³)	Cadmium Hydroxide STRactan			

1. California standards for ozone, carbon monoxide (except Lake Tahoe), sulfur dioxide (1 and 24 hour), Nitrogen dioxide, suspended particulate matter—PM_{10}, and visibility reducing particles, are values that are not to be exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations. In addition, Section 70200.5 lists vinyl chloride (chloroethene) under "Ambient Air Quality Standards for Hazardous Substances." In 1978, the California Air Resources Board (ARB) adopted the vinyl chloride standard of 0.010 ppm (26 mg/m^3) averaged over a 24-hour period and measured by gas chromatography.

The standard notes that vinyl chloride is a "known human and animal carcinogen" and that "low-level effects are undefined, but are potentially serious. Level is not a threshold level and does not necessarily protect against harm. Level specified is lowest level at which violation can be reliably detected by the method specified. Ambient concentrations at or above the standard constitute an endangerment to the health of the public."

In 1990, the ARB identified vinyl chloride as a Toxic Air Contaminant and determined that there was not sufficient available scientific evidence to support the identification of a threshold exposure level. This action allows the implementation of health-protective control measures at levels below the 0.010-ppm ambient concentration specified in the 1978 standard.

2. National standards (other than ozone, particulate matter, and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest eight-hour concentration in a year, averaged over three years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when 99 percent of the daily concentrations, averaged over three years, are equal to or less than the standard. For $PM_{2.5}$, the 24-hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard.

Contact U.S. EPA for further clarification and current federal policies.

3. Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 mm of mercury. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 mm of mercury (1,013.2 millibar); ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

4. Any equivalent procedure, which can be shown to the satisfaction of the ARB to give equivalent results at or near the level of the air quality standard, may be used.

5. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.

6. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

7. Reference method as described by the EPA. An "equivalent method" of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by the EPA.

8. New federal 8-hour ozone and fine particulate matter standards were promulgated by the U.S. EPA on July 18, 1997. The federal 1-hour ozone standard continues to apply in areas that violated the standard. Contact U.S. EPA for further clarification and current federal policies.

SOURCE: California Air Resources Board 1999

3.2 Geology, Soils and Mineral Resources

REGIONAL SETTING

The I'SOT geothermal project is located in on the southwestern edge of the Modoc Plateau, a physiographic and geological province in northeast California and southeastern Oregon. It is bounded by the Basin and Range Province to the east and the Cascade Range to the west, northwest and southwest and the Columbia Plateau to the north.

The Modoc Plateau is a relatively flat and high (1,200 to 1,500 m (4,000 to 5,000 ft) above sea level (asl)) plain. It covers approximately 27,750 km^2 (10,000 mi^2) of the southwest corner of the Columbia Plateau.

Miocene pyroclastic basalts of the Cedarville Series formed the Modoc Plateau. In the Pliocene, these basalts were faulted along basin and range-type north-south trending extensional faults (Figure 3.2-1, Fault Zones of the Alturas Region). Deposition of the Pliocene Warren Basalt flows followed this faulting episode. These 30 m thick flows filled valleys and grabens created by the preceding faulting episode and formed the flat surface that dominates regional topography. Some sediments and tuffaceous layers interbed these flows.

This sequence is broken by discontinuous north to northwest trending normal faults associated with regional extension in the Basin and Range. Tectonically, the Modoc Plateau is similar to the Basin and Range except that: the faults are less active; faulting is more discontinuous; and there is no evidence of Holocene displacement on the northwest-trending faults that may comprise extensions of the Basin and Range Walker Lane belt (see Figure 3.2-1). While many faults within the Modoc Plateau display evidence of Quaternary displacement, Holocene displacement is limited to the western area, adjacent to the Cascade Range where Hat Creek, McArthur and related faults constitute a N10ºW zone 30 km wide by 90 km long which appears to have been active in the latest Pleistocene to Holocene.

Volcanism in the region is dominated by the Cascade Range to the west from Mt. Shasta to Medicine Lake Highlands to Mt. Lassen, which was historically active (1914-1917). Extensive and currently active hydrothermal systems are related to both Medicine Lake and Mt. Lassen.

In addition to the large high temperature systems related to Cascade volcanism, the I'SOT site lies within a region of moderate to low temperature hydrothermal activity. From the Surprise Valley system to the east, which appears to be related to deep circulation along the Basin & Range faulting in that valley, to warm water resources just a few miles away, in Alturas and Kelly Hot Springs. These hydrothermal resources appear to reflect regional high heat flow and faulting, and may be related to the regional tectonic location between the Basin and Range and the Cascade Range.

Local Site Geology

The project site is located in Warm Springs Valley, an east-west river valley (elevation) that cuts the elevated Modoc Plateau (4,000-6,000 ft asl) (CDMG 1991). The Pit River flows through the center of the valley.

Relatively flat-lying Modoc Plateau volcanics and volcanic sediments dominate the geology of the site. Structural displacement of the volcanics is minimal in the local vicinity of the project site. Although the trace of Likely Fault cuts through the Canby area (see Figure 3.2-1), no local displacement or recent seismic activity has been documented (CDMG 1991). The Likely fault extends over 50 miles, which may

Figure 3.2-1: Fault Zones of the Alturas Region

SOURCE: CDMG 1991

be an extension of the Walker Lane Basin and Range extensional fault system, and appears to have significant strike-slip horizontal offset. This fault which may correlate to a regional northwest/southeast structural trend with at least some component of lateral or strike slip motion (Duffield and Fournier, 1974). Additionally, there are no active Alquist-Priolo fault zones within the vicinity of the project site.

Soils at the ground surface of the site (see below) are underlain by alluvium to approximately 40 feet below ground surface (bgs). The alluvium is underlain by over 2,000 feet of fine-grained tuffs (volcanic ash) and lahars (volcanic mud flows) probably of the Alturas Formation. These clay-rich sediments are interrupted by: a thin (less than 10 ft) lava flow between 890 and 900 ft bgs, and a lacustrine sand (probably volcanic) layer between 630 and 1,680 ft bgs. Below 1,950 ft bgs the tuffs are lithified and fractured.

The geothermal fluid is encountered in the fractured permeability within the lithified tuffs below 1,950 to the total depth of 2,100 ft bgs. Minor alternation including chlorinization of clays and silica deposition throughout the section reflects the elevated temperature gradient (7 degrees F/100ft), which will be discussed below in the section describing the geothermal resource.

Soils

Soils in Modoc County are a valuable natural resource, supporting a vital agricultural economy. Some of these soils (SCS Number 106, 119 and 176[1]) meet the criteria for farmland of statewide importance as outlined in the U. S. Department of Agriculture's land inventory and monitoring (LIM) Project for the Alturas Area.

The prominent soil type in the project area is the Pit Series (SCS Number 176). The Pit series includes silty clay loams and clays on 0 to 2 % slopes and 2 to 5% slopes, respectively. It consists of slowly draining soils on flood plains and lake basins. The available water capacity is 9.5 to 11 inches (NRCS 1980). Runoff is typically slow and there is no hazard of erosion. This soil is suitable for cultivated crops, typically irrigated for pasture or alfalfa, requires additional procedures to overcome soil limitations, and is not suitable for intensive agriculture. Other soils include the Barnard (SCS Number 106), a gravelly loam and the Daphnedale (SCS Number 119), a loam on 2 to 9% slopes.

The geothermal well located in Canby is located on Barnard gravelly loam. It is common on older terraces and alluvial fans throughout Warm Springs Valley and the Alturas Basin. Runoff is considered medium and the hazard of erosion is moderate. Available water capacity is 4.0 to 5.5 inches. Range and Pastureland are primary uses of this soil.

The Daphnedale Series to the south consists of well-drained soils on old lake terraces and escarpments. The Daphnedale loam has slow permeability, runoff is medium and the hazard of erosion is moderate. This soil is used for pasture, dryland grain and less commonly irrigated hay.

[1] This Unit is of statewide importance if protected from flooding.

Table 3.2-1: Soil Types for the Project Area

Soil Unit Names (Soil Conservation Services, SCS Number)	Project Facility	Infiltration or Runoff Potential	Erosion Hazard Rating (EHP)	Erosion Factor (K)	Storie Index[1]	Land Capability Index[2]
Pit silty clay loam (176) (0-2% slopes)	Pit River Basin	Slow	Low	0.20	13	IIIw-5
Barnard gravelly loam (106) (0-9% slopes)	Town of Canby	Medium	Moderate		7	IIIe-3
Daphnedale loam (119) (2-9% slopes0	Western Canby	Medium	Moderate		24	IVe-1

[1] Storie Index- suitable for intensive agriculture without irrigation is 760
[2] Land Capability Index: III: suitable for cultivation but requires additional procedures to address soil limitation; IV: suitable for rangeland or pastureland

SOURCE: NRCS 1980

The discharge line traverses land characterized by the Pit Series Soils.

Unique Geologic Features

There are no unique geologic features in the project area.

Topography

The project site lies in the Warm Springs Valley, a topographic low within otherwise elevated and flat-lying Modoc Plateau. The elevation of the valley ranges from 4,400 ft to 4,300 ft and has been carved and widened by the alternating erosion and alluvial deposition of the Pit River bed, which wanders across the floor of the valley. Plateaus and hills surround the valley with elevations between 4,900 ft and 4,400 ft.

GEOLOGIC HAZARDS

Seismicity

The project area is not located in an area of historically high seismic activity; there are no recently (Holocene) active faults within close proximity to the project area. The closest fault that is believed to be capable of producing a seismic event of a magnitude 5.5 or greater on the Richter scale is the Mayfield Fault, located approximately 38 miles (61 kilometers) west of the project site, in Siskiyou County. The Likely Fault extends through the project area, but no Holocene activity has been recorded and therefore the project area is not identified as an Alquist-Priolo zone of seismic risk. To date, no earthquakes over 5.5 on the Richter scale have been recorded in Modoc County since 1769, and Modoc County lies in the lowest rated area in the State of California for earthquake activity (CDMG 2002). As a result, a significant seismic event that could result in liquefaction, ground shaking and/or surface rupture near the project area is not likely.

Liquefaction

Liquefaction occurs when water-saturated granular material is transformed from a solid state to a semi-liquid state because of an increase in the pore-water pressure caused by intense shaking. Liquefaction occurs as a result of the simultaneous occurrence of a combination of conditions. These include: 1) seismic activity to induce intense shaking, 2) loose, unconsolidated coarse-grained soils and 3) high water table. Liquefaction has not been observed in Modoc County.

Subsidence

Land subsidence is the lowering of the land-surface elevation from changes that take place underground. Common causes of land subsidence from human activity are pumping water, oil, and gas from underground reservoirs; dissolution of limestone aquifers (sinkholes); collapse of underground mines; drainage of organic soils; and initial wetting of dry soils (hydrocompaction). Generally, subsidence occurs in areas where there are sedimentary basins filled with unconsolidated sands, silts, clays, and gravels. Localized subsidence in the project area is unlikely due to the strength of the underlying volcanic bedrock (USFS and BLM 1994).

Volcanism

The Modoc Plateau area has experienced at least 4 volcanic eruptions in the past 1,500 years and the U.S. Geological Society has identified the area as one where another eruption is possible. However, the areas of active volcanism are significantly west of the site. Two recently active volcanoes are located west of the project site. Mount Shasta, located approximately 50 miles northwest of Canby, has erupted three times in the past 750 years, and the chances of an eruption in any given decade are 1 in 25 or 30 (USFS 1994a). Mount Lassen is situated approximately 130 miles (216 km) south to southwest of Canby. Three episodes of volcanism have occurred at the Lassen volcanic center in the past 1,100 years. These are the complex eruption at Chaos Crags, the eruptions at Cinder Cone, and the summit eruptions of Lassen Peak in 1914-1917 *(Clynne, 1990, IN: Wood and Kienle)*. Due to the distance to these potential eruptive centers, the most likely effect of volcanism at the project area would be in the form of wind-blown ash. Given the prevailing winds from the southwest, the project area could be affected by wind-blown transport of eruptive material from the Lassen area (see Figure 3.2-1).

Slope Stability/Landslides

Active landslides and slump and earthflow deposits are rare in the rock types found in the project area. Most of the soils in the project area are shallow to moderately shallow, with low potential for slope stability hazard. The USFS characterized slopes of greater than 30 percent as having a high risk of slope movement however; there are no slopes within the project area of this magnitude.

Mineral Resources

Modoc County contains a number of mineral resources including: cinders, pumice, pumicite, and crushed stone. Lakebed deposits include peat, diatomia and salt. Due to high extraction and transportation costs, the production of many of the resources in this region has been declining for many years. The principal mineral resources near Canby are two volcanic cinders just south of Duncan Reservoir. Cinder cones in western Modoc County have been great sources of volcanic cinders since the early 1930s. Today the cinders are primarily used for road pavement (Modoc County General Plan).

Mineral Rights

The geothermal well is located on the boundary between Assessor's Parcel No. 017-080-25 and Assessor's Parcel No. 017-080-56. The US General Land Office issued to the primary owner of Assessor's Parcel No. 017-080-25 a Land Patent (Certificate No. 2444), which granted mineral rights thereto (US General Land Office 1891). Assessor's Parcel No. 017-080-56 was first purchased by a private party in 1937. Land Patent No. 1092806, which granted to the owner all rights including mineral rights thereto, was issued in 1937 (US General Land Office 1937). Mineral rights on both sides of the well have been relinquished from public ownership to the private landowners. Ownership of the land and consequently all mineral rights thereto has since been transferred to subsequent owners. I'SOT, Inc. is the current title holder for the land on which the well is located. The Bureau of Land Management (BLM) Alturas Field Office has stated that there are no federal government claims to minerals in Township 42N, Range 9E, Section 25, MDB&M, on which the well is located (Singleton 2002, personal communication).

REGULATORY SETTING

State/Local

The Alquist-Priolo Special Studies Zones Act, which was enacted by the State of California in 1972 and renamed the Alquist-Priolo Earthquake Fault Zoning Act in 1993, was passed to prevent the construction of buildings used for human occupancy on the surface trace of active faults. The act requires the State Geologist to delineate earthquake fault zones by regulation along active faults within the state and to issue appropriate maps. For the purposes of this Act, an active fault is one that has moved in the last 11,000 years (Holocene time) (CDMG 1996).

The State of California has General Plan Guidelines, which can be used by counties and cities as a standard in developing their own General Plans. The General Plan Guidelines include a safety element section for the protection of the community from any unreasonable risks. Included in these risks are seismically induced surface rupture, ground shaking, ground failure, slope stability leading to mudslides and landslides, subsidence and other geologic hazards.

3.3 Hydrology and Geothermal Resources

REGIONAL HYDROLOGY

The project site is located in Modoc County, along the Pit River, one of the County's major hydrological features. The Pit River is the major river in Northeast California and one of the larger tributaries of the Sacramento River (CVRWQCB 1994). Water from the Pit River is currently used for agriculture, recreation and provides habitat for fresh-water fish. Pit River water is not used for municipal drinking water directly, although may be used indirectly from the Sacramento River. Groundwater is the primary source of water for towns along the Pit River.

Surface Water

Lakes and reservoirs are common within the region. Modoc County has the second highest area (248 mi^2) of surface water of all counties in California (Mintier Harnish 1988a). Goose Lake, the largest lake in the County, is located north of the project area in the headwater area of the Pit River. As a terminal lake, its area fluctuates around approximately 110 mi^2. When it is considerably larger, it can over flow into the North Fork of the Pit River. The high salinity and alkali content of Goose Lake make the water unsuitable for irrigation (Mintier Harnish 1988a). See Figure 3.3-1 and 3.3-2, Pit River Flow Data.

The project site is located within the Warm Springs Valley Drainage Basin (Figure 3.3-3), a sub-basin of the Pit River Basin. The Pit River is the largest river in northeastern California, drains the northeastern section of the state, and enters the Sacramento River at Shasta Lake. The north fork of the Pit River starts at Goose Lake, the south fork begins high in the Warner Mountains. The forks converge near Alturas, just east of the project area. The river flows through large, high mountain valleys and cuts its way through massive basalt flows to form canyons that exhibit unusual geological formations that promote a variety of wildlife species unique to these landscapes (CVRWQCB 1994). The project area is located in one of the major drainage basins of the Pit River (approximately 544 mi^2) as described in Table 3.3-1 below (DWR 1974).

Table: 3.3-1: Pit River Drainage Basin, Surface Water, Annual Surface Flows and Water Supply (Thousands of Acre-feet)

Basin/ Subarea	Estimated Drainage Area (Sq. Miles)	Mean Annual Natural Flow of Surface Water	Present (1974) Flow			Potential Flow		
			Surface	Ground	Total	Surface	Ground	Total
Goose Lake	363	50	19.3	4.0	23.3	24.8	7.0	31.8
North Fork Pit	237	49	26.4	3.0	29.4	30.6	4.2	34.8
South Fork Pit	485	70	68.3	4.0	72.3	79.4	5.9	85.3
Warm Springs Valley	544	31	48.0	2.0	50.0	50.2	4.1	54.3
Big Valley	706	135	18.3	3.4	21.7	20.8	3.9	24.7
McArthur	55	4	2.1	0.0	2.1	3.1	0.0	3.1
Total	2,390	339	182.4	16.4	198.8	208.9	25.1	234.0

SOURCE: DWR 1974

Groundwater

The site is located within the Alturas Groundwater Basin. The Alturas groundwater basin is approximately 100 mi^2. Groundwater resources typically occur in the shallow "Older Alluvium". The shallow alluvium is underlain by volcanic and volcanogenic sediments that typically have low permeability, although a few permeable zones may occur locally. Therefore, most of the groundwater resources in the area are typically shallow, although some wells are as deep as 800 feet. Wells typically yield 400 gallons per minute (gpm) up to a maximum of 1000 gpm (in 1974), and the entire basin has a storage capacity of 1,600,000 acre-feet. In the mid-seventies, approximately 9,000 acre-feet were being pumped from the basin annually; the basin has an estimated safe annual yield of approximately 17,000 acre-feet (DWR 1974).

With limited groundwater resources within much of the Plateau, rainfall or snow melt provides much of the recharge to both surface and ground waters. The Alturas Groundwater basin receives recharge from the higher elevation areas to the north and to a lesser extent, south of the Pit River. The climate in the project area is characterized by warm, dry summers and cool, moist winters. Average annual precipitation is 15-19 inches.

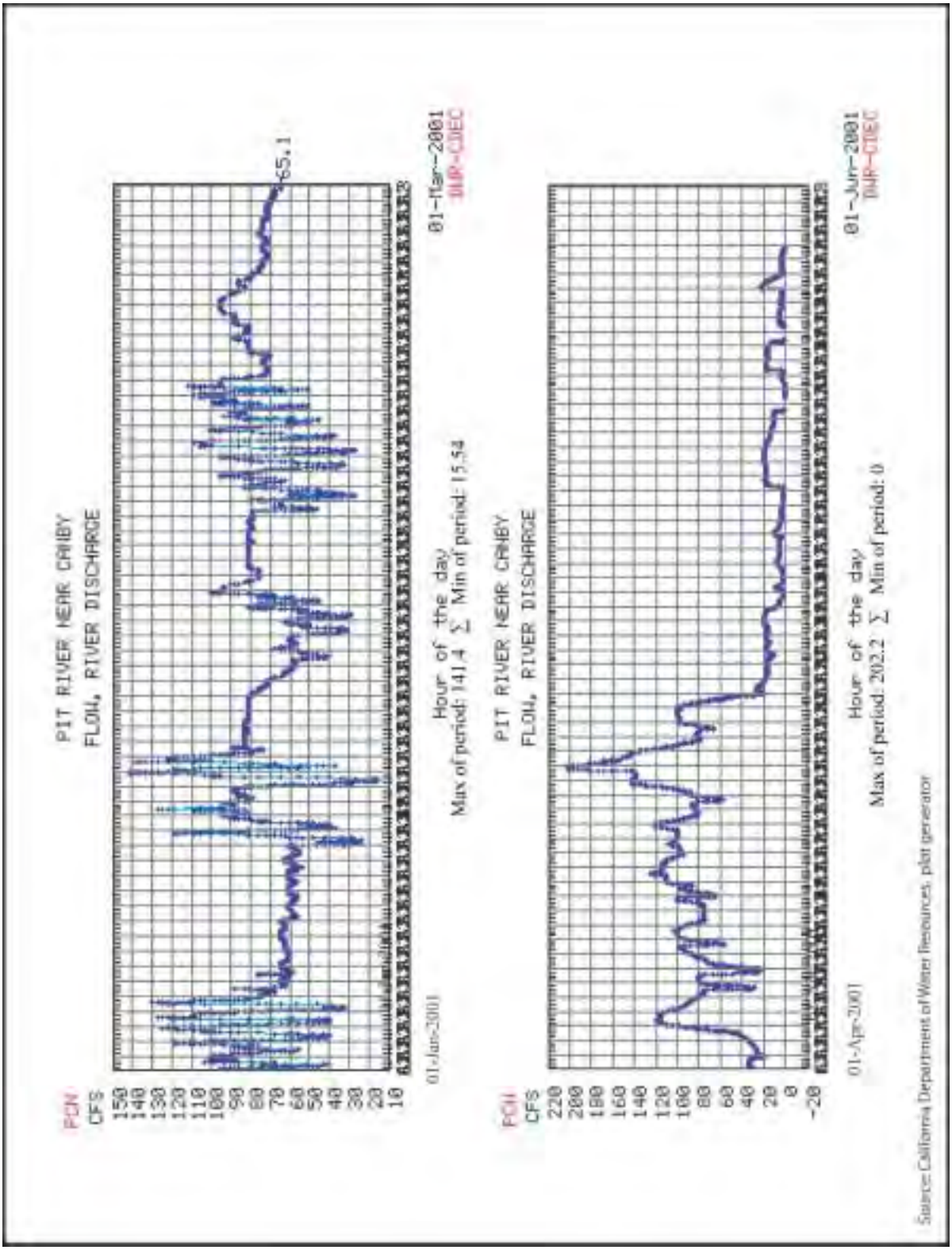
The Canby region is located in a complex geologic region between the *Cascade Range* and the *Basin and Range Region*. This tectonic setting produces a high temperature gradient (approximately 7°F/100 feet). The gradient provides the heat source for warm to moderate temperature groundwater aquifers at depths of over 1,000 feet. Where lithification and fractures provide permeability within the volcanic sequence, geothermal fluids can occur. Some of these warm waters flow to the surface as natural warm or hot springs.

Five thermal water areas, twenty-two thermal springs, and twenty-three thermal wells are reported in the Modoc County General Plan. Thermal waters, wells, and springs occur throughout the Pit River Valley from Alturas west to Canby. This section of the Pit River Valley includes four main springs including Kelley Hot Springs. The geothermal resources are discussed in detail below.

Water Quality

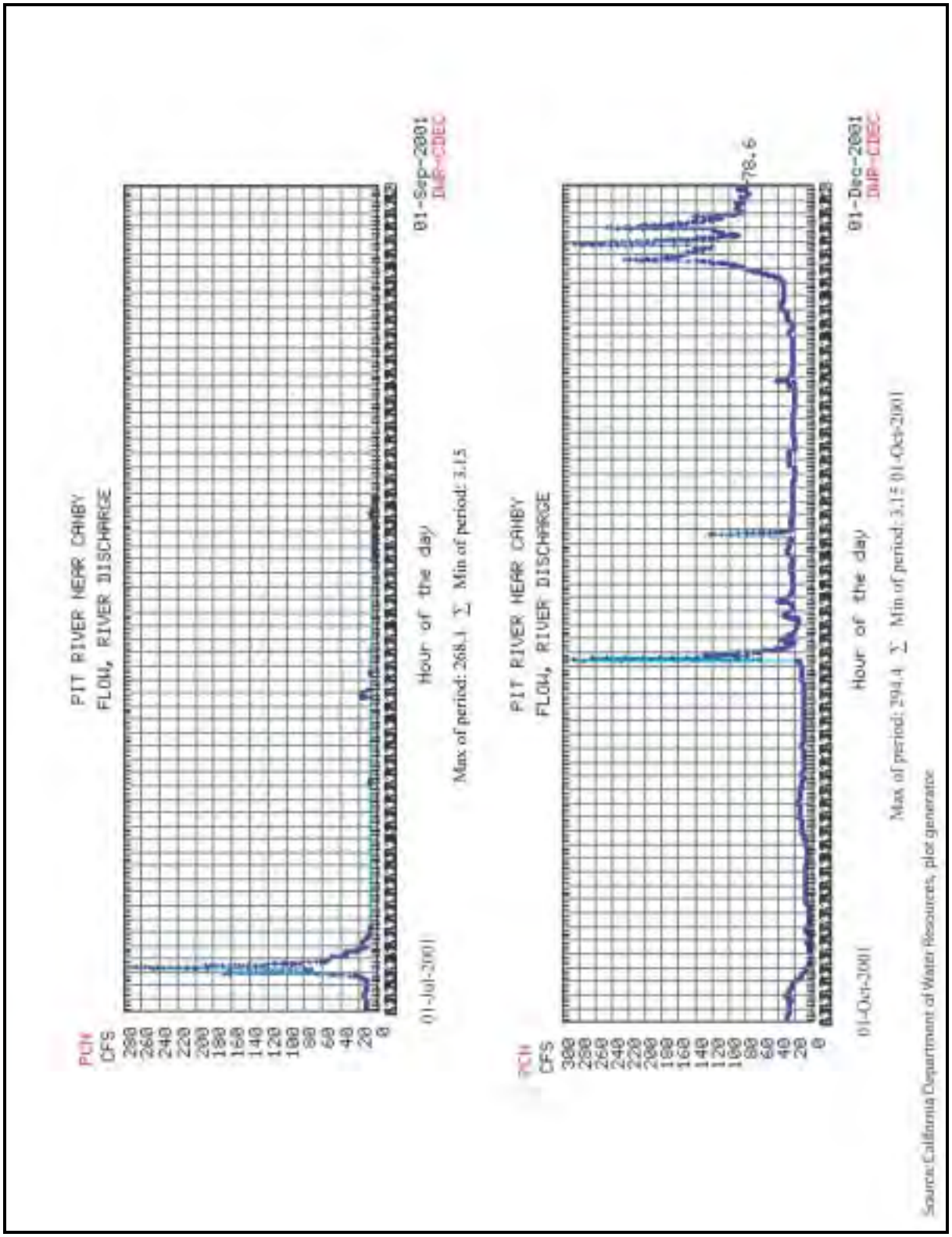
Water quality of surface and groundwater in the region is typically excellent. Some surface waters are terminal lakes, and as such, accumulate high concentrations of salts and minerals, including boron and arsenic. Although industrial impacts are rare, some agriculturally impacted surface and ground waters occur within the area; these impacted waters are typically identified by elevated nitrate concentrations. In addition, naturally occurring warm springs such as Kelley Hot Springs contribute elevated mineral and trace metal concentrations to the recharge of the Pit River.

Figure 3.3-1: Pit River Flow Data January–June 2001



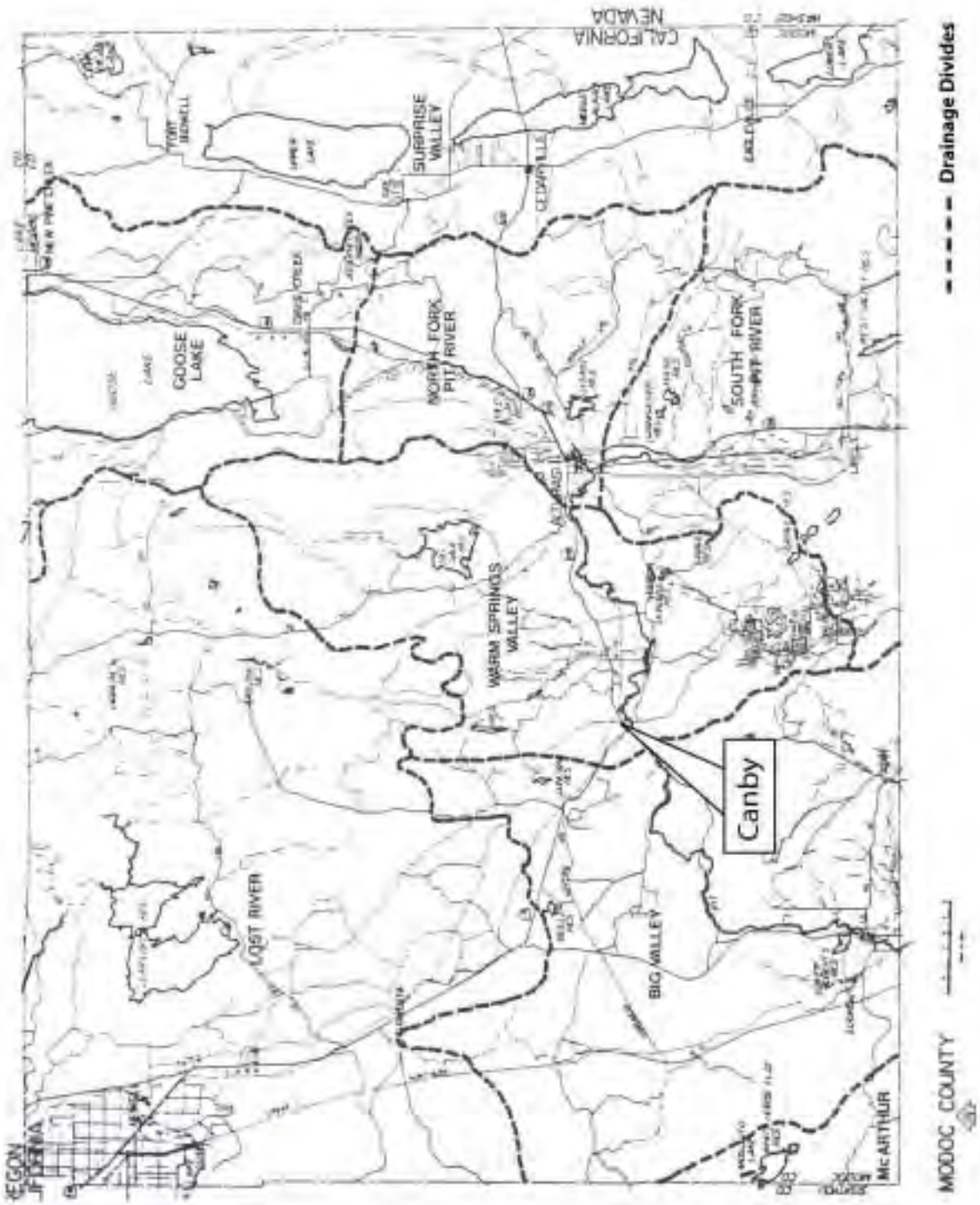
SOURCE: California Department of Water Resources 2001

Figure 3.3-2: Pit River Flow Data July–December 2001



SOURCE: DWR 2001

Figure 3.3-3: Modoc County Drainage Basins



SOURCE: Mintier Harnish & Associates 1988a

Figure 3.3-4: Hydrology Map

SOURCE: Wildflower Productions 2000

LOCAL HYDROLOGY

Local Surface Water

In the immediate vicinity of the project area, the westerly flowing Pit River dominates the surface waters (Figure 3.3-4). Tributaries flow into the river through the project area from the north and west including Westlake Creek and Blacks Canyon Creek. There are two reservoirs within the area. The smaller reservoir is immediately west of the well site and the other, the Duncan reservoir, contains over 1000 gallons and is located near Kelley Hot Springs on a tributary of the Pit River.

Table 3.3-2: Water Quality of the Canby Region

Element/ Substance	I'SOT Geothermal Well[1]	Kelley Hot Springs[1]	Pit River 4 miles south of Canby[2*]	Pit River North Fork near Alturas[2*]	Local GW[1]	Water Quality Objectives[3]
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Ca	14	20	18.77	25.15	15	-
Mg	<0.01	<0.01	7.55	10.614	8	-
Na	240	250	27.75	26.16	69	-
K	3.7	6.5	4.36	4.048	-	-
SO_4	280	300	13.50	11.83	51	250[4]
Cl	170	160	9.33	3.67	24	250
HCO_3	44	47	-	-	196	-
NO_3	<0.3	-	-	-	0.5	1
SiO_2	110	-	-	-	-	-
F	1.9	2.1	-	-	0.3	4, 2[4]
B	3.67*	3.8	0.26	<0.1	-	-
pH	8.65	-	8.1	7.9	-	6.5-8.5[4]
TDS	752	783	189	211.6	356	1,300,000(t) 500[4]
As	0.102*	0.117	0.0035	0.0036	-	0.010
Hg	0.188*	0.015	<0.001	<0.001	-	0.002

[1]I'SOT Well data, Kelly Hot Spring data, and local groundwater (GW) data from Burkhard Bohm, Plumas Geo-Hydrology, *Well Testing at the ISOT-1 Geothermal Well, Canby, Modoc County, CA,* October 18, 2000
[2]Pit River average values from California Department of Water Resources (1996-2002)
[3]Maximum Contaminant Limit, Safe Drinking Water Act, March 2002, Primary National Standards
[4]MCL from Safe Drinking Water Act, March 2002, Secondary National Standards
*Averaged values

SOURCE: DWR 2002a

The U.S. Geological Survey monitors water flow in the Pit River continuously at a location near Canby (Site PCN, elevation 4,266 ft. asl, 41.406° N, 120.927°) (see Figures 3.3-1 and 3.3-2). Flows are highly variable and correlate with the extreme variations in precipitation that Modoc County experiences from season to season; winter flows are much higher than summer flows. As can be seen in Figures 3.3-1 and 3.3-2, 2001 winter flows averaged approximately 70 cubic feet per second (cfs) and summer averages were around 3 cfs (DWR 2001). In that same year, flow rates varied from a high of 292 cfs to a low of 0 cfs. Extreme fluctuations during summer months are likely caused by rainstorms or regulated dam flow. The summer season of 2001 was unusually dry and Pit River levels were unusually low (Rohrbach 2002). There was no water in the Pit River upstream of Alturas until the point where the Alturas wastewater facility discharges into the river (Rohrbach2002). Water quality of the Pit River is excellent. Key constituents and concentrations for the Pit River and nearby waters are summarized in Table 3.3-2.

Local Groundwater

Based on groundwater wells in the area, groundwater resources occur within the alluvium underlying the project site. Groundwater levels appear to follow precipitation with both seasonal and year-to-year variation. Currently, water levels are at approximately 4,280 ft above sea level (asl) near the project well site, falling to 4,260 ft asl further south towards the river (DWR 2002a).

Groundwater quality in the project area is excellent. An average of seven local wells set <300 ft in total depth suggests Total Dissolved Solids (TDS) are less than 400 mg/L and all other values are less than Maximum Contaminant Levels (MCLs).

GEOTHERMAL RESOURCES

Geothermal resources occur in many parts of the Modoc Plateau ranging from the high-temperature resources at Medicine Lake Highlands and the Glass Mountain KGRA (>300 °F) to low to moderate temperature (100 to 300 °F) resources in Surprise Valley to the east of the project area. While the Glass Mountain geothermal system appears to be related to Cascade Range volcanism, the Surprise Valley Geothermal Resource appears to be a Basin and Range type of fault-controlled system (Weiss 1997). The geothermal resource at the project site is defined by the project well and similar wells located near Kelley Hot Springs, Alturas, and possibly Bieber. Although there is no evidence that this geothermal resource is continuous, it appears to occur at locations where regional high heat flow can transfer heat to water at appropriate depths and sufficient permeability exists to provide a production zone. All of these wells appear to produce warm water from a flat-lying zone of fractured lithified tuff, below 1,600 to 2,000 ft bgs, at approximately 180° to 240°F.

The project site area appears to be underlain by an extensive geothermal aquifer below 1,600 feet. The aquifer appears to extend from Kelley Hot Springs to Canby. Although the geothermal resource appears to occur within an almost flat-lying aquifer, it does not appear to be strictly stratigraphically controlled. Rather, the aquifer appears to occur when conditions allow the clay-rich volcanic rocks to become brittle and fracture.

The aquifer occurs within fractured lithified layers of the clay-rich, typically low- permeability volcanic rocks, typical of the Modoc Plateau. Since lithification is a prerequisite for sustaining fracture permeability. In these clay-rich rocks, and elevated temperatures accelerate lithification, higher heat flow may actually create the conditions that generate the aquifer. The correlation of variable depths of the thermal aquifer and variable temperature gradients also suggest that the depth of the aquifer is temperature- and permeability-controlled, rather than stratigraphically controlled.

At Kelley Hot Springs, the maximum temperature was 239°F at 1,600 feet bgs, indicating a temperature gradient from the surface to 1,600 feet of 11°/100 feet. That well became isothermal below 1600 feet and therefore the average temperature gradient over the total depth of the well of 3000 feet was 6.1 °F /100 feet. Temperature gradients in the Canby School Well No. 1 were 7 °F /100 feet to about 800 feet bgs. Temperature gradients measured in the project site well average 7.3 °F /100 feet over 2,000 feet.

The Kelley Hot Springs wells produced fluid from lithified and fractured volcanic rocks below 1600 feet. Both Alturas geothermal wells (AL-1 and AL-2) encountered geothermal fluids in lithified tuffs below 1800 feet bgs.

The similarities in temperature gradients and occurrence of the geothermal fluids in the Alturas, Bieber, Kelly Hot Springs, and I'SOT wells suggest the following common features of the geothermal reservoir (Drilling Geothermal Well I'SOT 2000):

- Production zones are associated with fractured lithified tuffs at > 1800 feet bgs.
- Temperature gradients above the lithified zones are approximately 7 °F /100 ft reflecting similar thermal properties,
- Reservoir temperatures at approximately 2000 ft bgs are at least 185°F and typically >200°F.

Like most geothermal resources, the productivity of wells completed in this aquifer depends on the nature of the well and the aquifer. Most wells completed in the aquifer appear to produce between 5 and 600 gpm. The project site well is capable of sustained production at approximately 40 gpm. The aquifer transmissivity was evaluated in Alturas and I'SOT at approximately 800 gpd/ft (Allen 1986).

The chemistry of geothermal fluids produced from the project site is similar to Kelley Hot Springs, as shown in Table 3-4.2.

FLOOD HAZARDS

100-Year Floodplain

The pipeline portion of the project extends to the edge of the Pit River and is within the flood plain of the river (Figure 3.2-4). The well and other facilities are within the town of Canby and are outside the area of concern for flooding.

The Pit Series soils have low permeability and high potential for flooding. Flooding can be frequent during the winter months in the immediate vicinity of the River. Flooding is not an issue in the summer because river flows are low. Flooding above the weir at the proposed point of discharge is manually controlled at the weir.

REGULATORY FRAMEWORK

Federal

National Pollutant Discharge Elimination System (NPDES). The Federal Pollution Control Act of 1972 as amended by the Clean Water Act in 1977 makes discharging pollutants from a point source to navigable waters illegal without a permit. In the project area, the Central Valley Regional Water Quality Control Board (CVRWQCB) administers and enforces the Clean Water Act. Waste Discharge Requirements for the proposed project were adopted on 13 May 2002.

In 1990, the Environmental Protection Agency (EPA) promulgated rules establishing Phase I of the National Pollutant Discharge Elimination System (NPDES) storm water program. The Storm Water Phase II Rule extends coverage of the NPDES storm water program to certain "small" MS4s (operations serving populations of 100,000 or greater) located in "urbanized areas" (UAs), and on a case-by-case basis those small MS4s (including those between 1 to 5 acres) located outside UAs that the NPDES permitting authority designates. The Canby population is about 160 and would not be considered an MS4. The project would not require a Storm Water Pollution Prevention Plan under the NPDES system as the project (1) would not involve significant amount of ground disturbance and potential for run-off, and (2) is not large enough to merit a SWPPP (Rohrbach 2002).

State/Local

California Division of Oil, Gas and Geothermal Resources (DOGGR). DOGGR oversees the drilling, operation, maintenance, plugging and abandonment of geothermal wells. The regulatory program emphasizes the wise development of geothermal resources in the state through sound engineering practices that protect the environment, prevent pollution, and ensure public safety.

In California, all geothermal wells on private and state lands are regulated by DOGGR, under provisions of the state Public Resources Code.

All drilling, reworking, and abandonment operations for geothermal wells on private and state lands require a permit from the DOGGR. If the well is being drilled as an exploratory project, an environmental study is required under the California Environmental Quality Act (CEQA), with the acting as the lead agency. DOGGR engineers monitor all wells to ensure that they are operated properly. Monitoring includes reviewing operational data and running tests to assure the soundness of the well casing. In addition, DOGGR engineers inspect most well sites annually.

The project proponent obtained a DOGGR permit for the production well (API No. 049-90039) and the well was inspected after the shallow casing was set. The blowout prevention equipment and its installation for use during drilling was approved on April 13, 2000.

Central Valley Regional Water Quality Control Board. The primary agency for regulating surface water and groundwater pollution in California is the Regional Water Quality Control Board (RWQCB). The State Water Resources Control Board (SWRCB) delegates authority for implementation of regulations to the RWQCB, but creates general policies and plans. Once approved, these water quality control plans are implemented and enforced by the nine RWQCBs. The SWRCB and RWQCB are agencies within the California Environmental Protection Agency (CalEPA). The RWQCB determines allowable concentration limits for effluents, issues permits, and enforces regulations. The project area is within the jurisdiction of the Central Valley RWQCB.

Porter-Cologne Water Quality Control Act of 1998. The Porter-Cologne Water Quality Control Act of 1970 established the jurisdiction of the nine California RWQCBs, granting them the authority to issue Waste Discharge Requirements (WDRs) that impose annual discharge fees and establish discharge limits, operation and maintenance requirements for treatment equipment, and monitoring, record keeping, and reporting requirements. Discharge of waste to land, such as septic leach fields, must comply with the WDRs. Two policies applicable to the RWQCBs oversight of this project are: State Water Board Resolution 68-16, which prohibits a discharger from reducing the quality of discharge or groundwater, even though such a reduction of water quality may not directly impact beneficial uses associated with the water body; and State Water Board Resolution 88-63, which specifies that except with specific exceptions, all surface

and groundwater of the State are to be protected as existing or potential sources of municipal and domestic supply.

As stated above, the regional board that regulates the proposed action is the Central Valley Regional Water Quality Control Board (CVRWQCB). The existing CVRWQCB Waste Discharge Order (R5-2002-0079) for the Canby Geothermal project is provided in Appendix D.

California Safe Drinking Water and Toxics Enforcement Act (Prop. 65). Through Cal EPA under the Office of Environmental Health Hazard Assessment (OEHHA) administration, actions are prohibited that contaminate drinking water with chemicals known to cause cancer or reproductive toxicity.

Modoc County General Plan. The Modoc County General Plan Goal, Policies, and Action Program states the following:

> "A significant opportunity relates to geothermal development. The economic potential of geothermal development is significant. The General Plan will enhance efforts to capitalize on geothermal energy development through the protection of known geothermal resources and the support, through land use policies, of locating geothermal using industries adjacent to the energy resource." (Mintier Harnish & Associates 1998b)

The Modoc County General Plan Goal, Policies, and Action Program includes the following policies pertinent to geothermal resources:

- Encourage the wise use of geothermal resources in the county.
- Continue efforts to use geothermal energy for public building space heating and warm water use.
- Designate industrial land uses adjacent to appropriately located geothermal resources.

3.4 Biological Resources

INTRODUCTION

This section outlines the biological resources setting of the proposed project area in Canby, California. The vegetation and wildlife of the regional and local project area are described. The regulatory setting, which includes state, federal, and local laws, regulations, and plans, is also discussed in the context of their applicability to the biological resources affected by the proposed project. The information presented in this section is derived from a environmental documents and records, literature, field surveys, and personal interviews with regional experts. The DOE has initiated consultation with the US Fish and Wildlife Service (USFWS). A Biological Assessment for the project has been prepared and submitted to the USFWS.

Approximately two thirds of the project runs through the town of Canby, through fallow agricultural fields in town, and along roadways. Local wildlife is limited to squirrels, birds, and other small animals commonly found in developed and disturbed areas. The other third of the project is located in the floodplain of the Pit River in flooded pastureland and wetland habitats. Due to man-made irrigation systems and weir manipulation on the Pit River the wetland area is atypical, with wet and dry seasons reversed (the wetland is wet in September despite limited rainfall and dry in February despite rainfall). Heavy cattle grazing in the wetland has further altered the natural state of the vegetation, limiting the size and diversity of plant growth. This area contains biological resources that are described and discussed in this section.

VEGETATION

Regional Vegetation and Wildlife Habitat

The proposed project is located within the Modoc Plateau geographic subdivision. The subdivision is part of the Great Basin province in northeastern California, east of the Cascade Mountain Range. This area can be typified as being a high desert and is subject to extreme climatic conditions. Most of the habitat in the Modoc Plateau is juniper savannah, sagebrush steppe or wetland, which is also consistent with the area in and around Canby, California. The elevation at the project site ranges from 4,310 feet to 4,290 feet in a northwest to southeast direction.

Vegetation at Site

Two thirds of the project area extends through fallow agricultural fields and city streets and exhibits characteristics of a high disturbance regime. The remaining third of the project area extends through the floodplain of the Pit River, which is essentially all riverine (river banks) and palustrine (inland marshes and swamps) wetland habitat. This wetland habitat has been heavily grazed by cattle, which has altered the natural height and minimized the diversity of the vegetation.

There are two major plant communities found within the project area. The first plant community is sagebrush steppe (also known as Great Basin scrub, or Big Sagebrush series), which has been converted to agricultural use. The second habitat is freshwater wetland habitat. A wetland delineation was performed by Stuart Consulting to determine the amount of jurisdictional wetlands in the project area (Appendix E). The wetland habitat has several associated microhabitats. The vegetation at this wetland site can be described as either emergent perennial wetland species or aquatic wetland species.

Special-Status Plant Species at Canby Project Site

The California Department of Fish and Game (CDFG) Natural Diversity Database (CNDDB) lists 41 vascular plant species that are of special concern for Modoc County. These species were considered to be special-status species if they were classified as one or more of the following:

- Listed, or proposed for listing, as Threatened, Endangered, or Species of Concern (formerly listed as Candidate List 1 or 2) under the Endangered Species Act by the U.S. Fish and Wildlife Service (CDFG 1996a and 1996b)
- Listed, or proposed for listing, as Rare, Threatened, or Endangered under the California Endangered Species Act (CDFG 1996b)
- Listed as "Sensitive" or "Special Interest" by the USFS (Sanger 1996, pers. com., Williams 1996, pers. com.)
- Listed as "Survey and Manage", Category 2, in the Northwest Forest Plan (USFS 1996)
- Listed as Category 1, 2, 3, or 4 of the CNPS Inventory of Rare and Endangered Vascular Plants of California (Skinner and Pavlik 1994)
- Identified in pertinent resource management plans, such as the Northwest Forest management Plan or National Forest resource plans.

Table 3.4-1 lists the sensitive species that may potentially exist on the site based on geographic subdivision, habitat present, edaphic (soil related) conditions, and site elevation (between 3,500 and 5,000 feet). These conditions collectively provide potential habitat for the listed species; the listed species may or may not exist on the site. The ecology of each of the observed or potential species listed in Table 3.4-1 is described in the Botanical Survey results (Appendix F).

The current agricultural regime has diminished potential for most of the species to occur within the project site to unlikely or very unlikely. Of the list of special status vascular plants known to occur in California one species, the eel-grass pondweed (*Potamogeton zosteriformis*), would have the potential to occur at the Canby project site. This species has been collected on the Pit River drainage within the project area. This species was not found during the fall botanical survey, although it may potentially be detected during the spring.

Special-Status Non-vascular Plants

Of the list of special status non-vascular plants known to occur in California, none have the potential to occur at the Canby project site. This evaluation was determined based on plant communities within the project area, habitat observed at the project site, and site elevation. This information was gathered using the California Native Plant Society's Inventory of Rare and Endangered Plants of California (Special Publication 1, Sixth Edition, published August 2001).

Table 3.4-1: Special-Status Plant Species Known to Occur or with the Potential to Occur in the Project Area

Species	Federal [1]	State [2]	CNPS [3]	Presence at Project Site
Hillside arnica (*Arnica fulgens*)	-	-	2	Very unlikely
Falcate saltbrush (*atriplex gardneri var. falcata*)	-	-	2	Very unlikely
Long-Haired star-tulip (*Calochortus langebarbatus var. longebarbatus*)	-	-	1B	Very unlikely
Boggs Lake Hedge-hyssop (*Gratiola heterosepala*)	-	E	1B	Very unlikely
Lilliput lupine (*Lupinus uncialis*)	-	-	2	Very unlikely
Janish's beardtongue (*Penstemon janishiae*)	-	-	2	Unlikely
Modoc County knotweed *(Polygonum polygaloides ssp. Esotericum*)	-	-	1B	Unlikely
Eel-Grass pondweed (*Potamogeton zosteriformis*)	-	-	2	Potentially present
Howell's thelypodium (*Thelypodium howellii ssp. howellii*)	-	-	1B	Very unlikely

[1] Federal:

[2] State: E-Listed as endangered under the California Endangered Species Act

[3] CNPS: 1B-plants rare, threatened or endangered in California and elsewhere; 2-rare, threatened or endangered in California but not elsewhere.

SOURCE: CNDDB Quad Search 2002, USFWS Modoc County List

Wildlife Habitat of Site

For the two thirds of the project that runs through the town of Canby there is little to no potential habitat for wildlife species other than birds, squirrels and other rodents commonly found in mostly disturbed areas with buildings and roadways. Birds and small mammals may use the fallow agricultural fields for foraging. The other third of the project is located in the floodplain of the Pit River in flooded pastureland and wetland habitats. The wetland area has been heavily grazed by cattle, which has altered the height and minimized the diversity of vegetation. A few willow trees, greatly impacted by beaver (*Castor canadensis*), were located along the margin of the wetland.

A habitat assessment for sensitive species was conducted in August 2002 (Galea 2002). Suitable breeding habitat was found within the assessment area for some ground nesting species, such as the greater sandhill crane and white faced ibis, although the high number of grazing cows and lack of high vegetation may make nesting more difficult. The lack of trees, brush or other tall vegetation reduces the potential for tree-nesting avian species in proximity to the project. Potential foraging habitat is available for many of the sensitive species on the list, especially avian predators. Potential habitat for many of the sensitive fish species is available in the Pit River.

WILDLIFE

Special-Status Wildlife Species at Site

There are a few special status wildlife species that either occur within or have the potential to occur within the Canby project site areas. The assessment area is defined as the route from the geothermal well to the Pit River, the immediate area of discharge, the immediate area downstream from the point of discharge, and any potential breeding habitat for sensitive species within several miles of the project. A ten-mile radius was considered to encompass the range of any northern spotted owl territory and known bald eagle nest sites that might support birds that forage along the Pit River near the project site. For purposes of this analysis, animal taxa are considered to be "special-status" if they fit one or more of the categories listed above in the vegetation section. These special status wildlife species are identified in Table 3.4-2.

A summary of special status animals' use of the Canby area is presented in Table 3.4-2. Environmental conditions in the study area and project proximity to known foraging or breeding sites create potential for listed species to occur. Listed species may or may not occur within the project area for the duration of the project. Three species of those listed under Table 3.4-2 are known to occur within the study area: the greater sandhill crane (*Gnus canadensis tabida*), the bald eagle (*Heliaeetus luecocephalus*), and the golden eagle (*Aquila chrysaetos*).

Greater Sandhill Crane. The greater sandhill crane (*Gnus canadensis tabida*) is listed in California as threatened. In California, greater sandhill cranes historically nested in the northeastern part of the state. Wintering grounds have been in the Central Valley wetlands, of which only about 5% remain in existence. Today far fewer greater sandhill cranes nest in Lassen, Modoc, Plumas, Shasta, Sierra, and Siskiyou Counties. Wintering areas are more restricted due to loss of habitat in the Central Valley wetlands. The population currently appears to be stable.

Greater sandhill cranes breed in large wetlands and feed in different habitat types such as meadows, irrigated pastures, grain fields, bogs, fens, marshes, and nearby fields. Cranes like to flock together at night (called roosting) for safety in an open expanse of shallow water. Cranes are omnivorous; they eat a variety of grains and seeds as well as aquatic invertebrates, insects, small reptiles, amphibians, eggs, and rodents.

The greater sandhill crane is known to nest and forage in the assessment area around the project. Although no nest sites are recorded within 0.5 miles of the project area, known nesting sites occur approximately 0.5 miles down river.

Bald Eagle. The bald eagle (*Haliaeetus leucocephalus*) prefers to nest close (within one mile) to large, fish-rich waters such as lakes and rivers. They typically utilize large conifers to build nests in, which can be stand alone or in the midst of a dense timber stand. During the winter, migrant bald eagles also utilize the Warm Springs Valley, increasing the overall population of bald eagles in the area. Summer populations for the western Warm Springs Valley is approximately ten bald eagles (five pairs) while winter populations vary from ten to fifteen eagles.

Table 3.4-2: Special Status Wildlife Species With the Potential to Occur Within the Region of the Project Area and Use of the Proposed Project Study Area

Species	Federal [1]	State [2]	Breeding Habitat in Project Area	Foraging Habitat in Project Area
Birds				
Greater Sandhill Crane (*Gnus canadensis tabida*)	-	CT	Yes	Yes
Northern spotted owl (*Strix occidentalis caurina*)	FT	CSC	No	No
Bald eagle (*Heliaeetus luecocephalus*)	FT	CE/CFP	No	Yes
Golden eagle (*Aquila chrysaetos*)	-	CSC/CFP	No	Yes
Swainson's hawk (*Buteo swainsoni*)	-	CT	No	Potential
White-faced ibis (*Plegadis chihi*)	-	CSC	Potential*	Potential*
Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)	FC	CE	No	No
Bank Swallow (*Riparia riparia*)	-	CT	No	Potential
Willow flycatcher (*Empidonax traillii*)	-	CE	Very limited or no potential	No
Reptiles				
Northwestern pond turtle (*Clemmys marmorata marmorata*)	FSC	CSC	Potential	Potential
Fish				
Modoc sucker (*Catostomus microps*)	E	E	No	Potential
Lost River sucker (*Deltistes luxatus*)	E	E	No	Potential
Shortnose sucker (*Chasmistes brevirostris*)	E	E	No	Potential
Cowhead Lake tui chub (*Gila bicolor vaccaceps*)	C	CSC	Potential	Potential
Pit Roach (*Lavina symmetricus mitrulus*)	-	CSC	Potential	Potential
Amphibians				
Oregon spotted frog (*Rana pretiosa*)	-	None	Very limited or no potential	Very limited

[1]Federal Status

FE	Federally endangered
FT	Federally threatened
FC	Federal candidate for listing
FSC	Federal species of concern
FPE	Federally proposed for endangered listing
FPT	Federally proposed for threatened listing

[2]State Status

CE	California endangered
CT	California threatened
CCE	California candidate for endangered listing
CSC	California species of concern (CDFG)
CFP	California fully protected

*White faced ibis have been observed in the vicinity of Clover Swale Creek, 5 miles from Canby, and thus have the potential to occur within or closer to the site.

SOURCE: National Diversity Database (NDDB) Quad Search, 2002, USFWS Modoc County list

The home range of a bald eagle pair can be as large as 13.7 miles; however, most eagles forage within 0.3-0.6 miles of the nest site (Garrett et al. 1993). Most bald eagle nest sites are located in suitable habitat in proximity to preferred foraging areas. During the breeding season, bald eagles forage mostly on fish. Based upon a Pacific Gas & Electric study (PG&E TES 1993), Sacramento suckers comprise a major component of the diet of nesting bald eagles on the Pit River; however, this study was conducted much farther downstream where the birds nested along the Pit River. Bald eagles are also known to forage on Pike minnow, large mouth bass, green ~~catfish~~ sunfish, and trout (Ratcliff, personal communication 2002a). These eagles also forage at numerous lakes and reservoirs located in the area, many of which are stocked with trout by the CDFG. For example, Ballard Reservoir is located 2.5 miles southwest of Canby, and the larger Duncan and "F" reservoirs are located approximately 5.5 miles northwest and 8 miles due north, respectively. Both are stocked with trout yearly for human fishing. These reservoirs may serve as some source of food for the bald eagles but are most likely not their primary food source.

The intermediate/warm waters of the Pit River are thought to be the primary food source for local bald eagles. During the winter and early spring (November–March), bald eagles can shift food sources (Ratcliff, personal communication 2002b). Great numbers of migratory waterfowl use the area in the fall and winter, and eagles prey on weak and crippled (due to sport hunting) waterfowl. Winter and spring flooding of pastures causes Belding's ground squirrels (*Citellus beldingi*) and voles to leave their burrows, where they are exposed to predation by raptors (D. Laye, personal communication 2002). During this time hunters shoot thousands of ground squirrels as a means of depredation control and the carcasses become eagle prey. For four weeks during the spring bald eagles' primary food source becomes these ground squirrels. Other minor food sources include wintering mule deer (*Odocoileus hemionus*) and pronghorn antelope (*Antilocapra americana*) that concentrate in the valley during winter, and become "road kill" that the eagles forage on.

There are four to five known bald eagle nest sites within approximately 5 miles of the project area (Romberger, personal communication 2002a). The closest two nest sites are about 1 mile and 2 miles southeast between the Pit River and Ballard Reservoir. The closest nest was discovered in 1991, although eagles were seen in the vicinity for several previous years. That nest has been active every year since and has been very successful with only three of twelve failed nesting years. In successful years it has hatched 2-3 young. Hatching of two to three young is rare with bald eagles in Modoc County, and this territory

has produced two young twice. The nest monitoring is not comprehensive enough to give an accurate fledged count. Underlying areas have not been checked for dead young, but some young have disappeared or been found below the nest, so total young hatched would not reflect eaglets fledged.

The next closest eagle nesting territory is near the Canby Bridge about 2 miles southeast of the project site. It was discovered in 2000 although eagles were seen in the vicinity for several previous years. It has been active since 2000 with two nests 1.5 miles apart. The first was built and not used in 2000. The second nest may have existed before its discovery in 2001. One young was fledged in this nest that year. In 2002 there were no fledglings (Romberger, personal communication 2002b).

These four eagles obtain a sizeable portion of their food from fish downstream of the project's discharge point. The other 2-3 nests are around 5 miles away and would utilize the Pit River for food, but would also take fish from some of the reservoirs in closer proximity to their nest sites than the river. Since these eagles could be influenced by other factors, nest success was not reviewed. Eagles have been spotted foraging up and down the Pit River along this stretch east of Canby and it is possible that the other nests up to 5 miles away might also utilize this section of the river for some portion of their food (Ratcliff, personal communication 2002b).

Golden Eagle. The golden eagle (*Aquila chrysaetos*) is a California species of special concern and a fully protected species within the state (refer to Table 3.3-2). Golden eagles are relatively common throughout the more open, hilly, or mountainous habitats of California, and remain within their territories year-round. Golden eagles require open country for foraging; therefore, they do not forage in dense, wooded stands. They prefer to nest in large conifers within dense stands or on cliffs. Golden eagles are relatively common in the Canby area, and likely forage occasionally in the project area due to the open terrain and potential availability of food, such as waterfowl and ground squirrels.

Modoc Sucker. The Modoc sucker is listed as endangered by the USFWS and by the State of California. The historic range of the Modoc sucker included small streams tributary to the Pit River in Modoc and Lassen Counties, California. Modoc sucker is one of a handful of species that are only found in the Pit River and Ash Creek watersheds (PRWA 2002). The species is endemic to the small tributary streams of the Upper Pit River, larger sections of Rush Creek, including drainage ditches, and Ash Creek (Moyle and Marchiochi 1975).

Spawning sites of Modoc suckers have been identified only in pools of tributaries to Johnson Creek and Washington Creek approximately 7 miles from the project area. Spawning season of the Modoc sucker is from mid-April to the last week of May or first week of June. Stream channelization through the meadow systems in the 1980s eroded natural barriers and had allowed for the movement of Sacramento suckers *(Catostomus occidentalis)* into areas formerly occupied by Modoc suckers. Hybridization between the two species had eliminated Modoc suckers from all streams except Washington and Hulbert Creeks in the Turner Creek drainage and Johnson Creek in the Rush Creek drainage (CDFG, MNF, USFWS 1983).

In general, sites where Modoc suckers have been found are characterized by low flows (intermittent in some); largely shallow pools; muddy bottoms; partial shade trees, shrubs, boulders, or undercut banks; abundant cover from riparian vegetation and undercut banks; and moderately clear water. The Modoc sucker prefers portions of small streams dominated by large, shallow, muddy-bottomed pools, partially shaded by overhanging trees. Spawning occurs over coarse fine gravel in the lower end of pools with abundant cover.

Modoc suckers are omnivorous with a diet consisting mostly of benthic invertebrates, algae, and detritus (Moyle and Marciochi 1975). These prey items are low on the food chain. Modoc suckers are probably bioaccumulating low levels of mercury from their prey but these levels are most likely well below standards and have no significant effect on the fish.

Recent surveys by USFWS staff found no morphological Modoc suckers in the main stem of the Pit River downstream of the project areas, even though the project area is in historical habitat and suitable habitat exists. There may be some individuals not detected by the surveys suggesting that Modoc Sucker do exist in low abundance in the project area (Reid pers. comm. 2002a). Currently the closest known Modoc sucker occupied area in the project vicinity is the Turner Creek drainage which begins about 7 miles downstream from the Pit River discharge point and up from its confluence with the Pit River, where the project effects would be unlikely to extend (Reid pers. Comm. 2002b).

Other Species. There are several species of birds, reptiles, and fish on the list that have potential breeding or foraging habitat in the area. Based on wildlife surveys of the project area, most of these species were not found to occur in the area of the project's effects, or the project would not impact their breeding or foraging habitat. Additional information about each species status and distribution, habitat requirements, and occurrence within the project area is listed in Appendix G. The one amphibian listed in Table 3.4-2 has very little or no potential to occur in the study area.

Swainson's Hawk. The Swainson's hawk (*Buteo swainsoni*) is state-listed as threatened. This hawk prefers grasslands, agricultural areas, and desert-like habitats. The hawk is commonly seen perched on a fence post in a prairie or open range. The Swainson's hawk preys primarily on insects and rodents. Limited potential habitat, in the form of foraging habitat, exists within the assessment area.

White Faced Ibis. The white faced ibis (*Plegadis chihi*) is listed as a California species of concern. The species is found mostly in freshwater areas, on marshes, swamps, ponds, and rivers. The species has been known to nest in the vicinity of Clover Swale Creek, 5 miles east of the project area. The white faced ibis has potential foraging habitat in the study area because of existing wetlands. Potential ibis breeding habitat in the form of heavily vegetated wetland areas is adjacent to, but not in, the direct impact area of the project (e.g. the pipeline route). Potential ibis foraging habitat exists in the wetlands area associated with the pastures although this is of lower quality because of the intensive grazing in that area.

Bank Swallow. The bank swallow (*Riparia riparia*) is listed as a California threatened species. No bank swallows were observed at the project area. Steep banks used for nesting by bank swallows are not present in the project area, which composed of very flat, wet pasture.

Northwestern Pond Turtle. The northwestern pond turtle (*Clemmys marmorata marmorata*) is listed as a federal species of concern and a California species of concern. Pond turtles prefer slow-moving water but can also utilize banks of large rivers and streams. Pond turtles are not known to occur in the assessment area.

~~*Modoc Sucker*. The Modoc sucker is listed as endangered by the USFWS and by the State of California. The species is endemic to the small tributary streams of the Upper Pit River. The species is currently restricted to several tributary streams of the Pit River, including Turner and Ash Creeks, tributaries located 20 miles downstream of the proposed discharge (See Figure 3.4-1). In general, sites where Modoc suckers have been found are characterized by low flows (intermittent in some); largely shallow pools; muddy bottoms; partial shade trees, shrubs, boulders, or undercut banks; abundant cover from riparian vegetation and undercut banks; and moderately clear water. The Modoc sucker prefers portions of small streams~~

~~dominated by large, shallow, muddy- bottomed pools, partially shaded by overhanging trees. Spawning occurs over coarse fine gravel in the lower end of pools with abundant cover. They feed on filamentous algae.~~

~~This species is not known to occur within the project area or immediately downstream in the Pit River, based upon surveys conducted by the USFWS specifically for this project (Reid, personal communication 2002). The closest known portion of the Pit River occupied by the Modoc sucker is 20 miles downstream.~~

Lost River Sucker. The Lost River sucker (*Deltistes luxatus*) is listed as endangered by the USFWS and by the State of California. The Lost River sucker is primarily a lake resident that spawns in rivers, streams, or springs associated with lake habitats. These suckers are omnivorous bottom feeders that have a that diet includes detritus, zooplankton, algae, and aquatic insects. The Lost River sucker is not known to occupy the study portion of the Pit River. This species was not found during sampling at the discharge site by the USFWS.

Shortnose Sucker. the shortnose sucker (*Chasmistes brevirostris*) is listed as endangered by the USFWS and by the State of California. Shortnose sucker is essentially found in the same lakes and rivers as the Lost River sucker. The shortnose sucker is not known to occupy the study portion of the Pit River. The species was not found during sampling at the discharge site by the USFWS.

Cowhead Lake Tui Chub. The Cowhead Lake tui chub (*Gila bicolor vaccaceps*) is a candidate species for federal listing, but has no specific status for the State of California. Tui chubs occur in a wide variety of habitats, most commonly in the weedy shallows of lakes and quiet waters in sluggish rivers. This species is not known to occupy the study portion of the Pit River and was not found during sampling at the discharge site by the USFWS.

Pit Roach. The pit roach (*Lavina symmetricus mitrulus*) is a species of concern in California. This species was once common and widely distributed in the upper Pit River drainage. Currently, its populations are few and scattered, occurring in either small, isolated streams or in some of the regulated sections of the Pit River. This species is not known to occupy the study portion of the Pit River. This species was not found during sampling at the discharge site by the USFWS. Pike minnow were located, which suggests that the roach would not occur in the study area due to the presence of this predator. The California roach, which is not a listed species, was found during sampling at the discharge site by the USFWS on September 6, 2002.

Mercury Levels and Bioaccumulation in Wildlife at Project Site

Bioaccumulation. Bioaccumulation is defined as the uptake and retention of a constituent by a living organism as a result of direct contact, inhalation, eating contaminated food, or drinking water contaminated with the constituents. Often, bioaccumulative constituents like mercury are retained in an organism's body tissues for extended periods of time. If a predator eats contaminated prey, then its tissues will become contaminated with the chemical constituents in the prey's tissues. Predator-prey relationships exist in hierarchies. Each predator-prey relationship is divided up into levels. For example, bacteria are primary producers and would uptake constituents from water. Protozoan (microscopic organisms) would consume the bacteria and are considered a higher level in the food chain. Small fish and insects might consume these protozoa and would comprise a higher level, and so on. As predators eat prey, these constituents move through the food web and become more concentrated in animals' tissue at higher levels in the food chain (Zillioux et al. 1993). Certain species, that are high on the food chain, are especially susceptible to metal accumulation and their adverse effects due to bioaccumulation.

The bald eagle is an example of a species that can be indirectly affected by mercury levels in water through bioaccumulation in their prey (fish).

Mercury can form many stable complexes with organic (carbon-containing) compounds. Microorganisms indigenous to soils, sediments, fresh water, and salt water, can convert inorganic mercury to form organic mercury in a process known as methylation. Methyl mercury is a toxic, organic compound that is fairly soluble in water. Almost all of the mercury found in animal tissues is in the form of methyl mercury. Methylation may occur in water, sediments or soil.

Current Mercury Levels in the Pit River. Current mercury levels in the Pit River were recently analyzed (Frontier 2002 Appendix I). The geothermal effluent from Kelley Hot Springs, located approximately 2 miles east of the proposed project discharge point, has a mercury concentration of 15 ng/L (Appendix I). Kelley Hot Springs also discharges geothermal fluid into the Pit River. The total mercury concentration in the Pit River above Kelley Hot Springs is ~~1.33~~ 1.96 ng/L. The total mercury concentration below the springs is ~~1.96~~ 1.33 ng/L. The river water at the proposed discharge point, located approximately 2 miles downstream from the Kelley Hot Springs discharge point, currently has a mercury concentration of 1.72 ng/L. There appears to be no statistically significant difference in mercury level through this section of the Pit River.

Current Fish Bioaccumulation. ~~In the summer of 2002, the USFWS sampled mercury levels in pike minnow tissue at the proposed discharge point on the Pit River (USFWS 2002a). The baseline fish tissue analysis averaged 0.409 ng/g methyl mercury (Frontier 2002). The sampled fish are at the third level in the food chain. According to the EPA Mercury Study Report to Congress (1997), approximately 80% of a bald eagle's fish diet is from this food chain level.~~

In the summer of 2002, the USFWS sampled mercury levels in pike minnow and Sacramento sucker tissue at the proposed discharge point on the Pit River (USFWS 2002a). The baseline fish tissue analysis averaged about 0.409 ng/g methyl mercury in pike minnow and 0.195 ng/g of methyl mercury in Sacramento sucker (Frontier 2002). Pike minnow are the largest and most piscivorous (fish-eating) fish in the Pit River. Pike minnow have the highest mercury concentrations and exhibit the greatest mercury bioaccumulation hazard because of their size, age and status as the top predator in the system (USFWS 2001). Bald eagle diet is comprised of roughly 60% Sacramento suckers, which have lower concentrations of methyl mercury in their tissue (Hunt et al. 1992). Using methyl mercury concentrations for pike minnow gives a worst-case scenario of methyl mercury consumption. Other fish species consumed by bald eagles (namely Sacramento sucker) have a lesser concentration of methyl mercury in their tissue.

Current Bald Eagle Mercury Consumption. Mercury bioaccumulation is particularly problematic for species high up on the food chain. In the Canby area, bald eagles could be adversely impacted by the bioaccumulation of mercury. A typical male bald eagle weighs approximately 4 kg while the larger females typically weigh between 4.5-6 kg. Bald eagles consume on approximately 12% of their body weight per day (Stalmaster and Gessaman 1984). With an existing 0.409 ng/g methyl mercury in the fish tissue, a 4 kg eagle eating 0.48 kg (approximately 1 pound) of contaminated fish a day would consume 196 ng of methyl mercury per day. This translates into an actual intake of 49 ng methyl mercury per kg body weight per day under current conditions.

$$480 \text{ g fish} \times \frac{0.409 \text{ ng methyl mercury}}{\text{g fish}} = 196 \text{ ng methyl mercury} \quad \text{THEN} \quad \frac{196 \text{ ng methyl mercury}}{4 \text{ kg eagle}} = \frac{49\text{ng (methyl mercury)}}{\text{kg (eagle)}}$$

REGULATORY FRAMEWORK

Federal

Federal law requires that all Federal departments and agencies shall use their authority to conserve endangered and threatened species as defined in the Federal Endangered Species Act (FESA). The Act defines as "endangered" any species that is in danger of extinction throughout all or a significant portion of its range, and as "threatened" any species likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

Two other special-status categories are recognized under FESA: (1) proposed for listing as threatened or endangered and (2) species of concern. "Proposed" endangered and threatened species are those species for which a proposed regulation has been published in the Federal Register, but not a final rule. "Species of Concern" is the current designation of species formerly identified as "candidate" for listing in the Federal Register.

Section 9 of FESA prohibits the "taking" of listed species. Under Section 7 of FESA, Federal agencies are directed to consult with the USFWS to ensure that no agency actions would jeopardize the continued existence of any listed species or result in the destruction of critical habitat. Although FESA requires formal consultation only for those species currently listed as threatened or endangered, the USFWS recommends that adverse impacts on species proposed for listing and species of concern also be considered because they may become listed during the design and construction phases of a project. The DOE is currently consulting with the USFWS under Section 7 of FESA to ensure regulations are appropriately addressed. A Biological Assessment for the project has been submitted to the USFWS.

The Bald Eagle Protection Act. The Act provides federal protection to the bald eagle, and through amendments, to the golden eagle. The act prohibits the direct or indirect take of an eagle, eagle part or product, and nest.

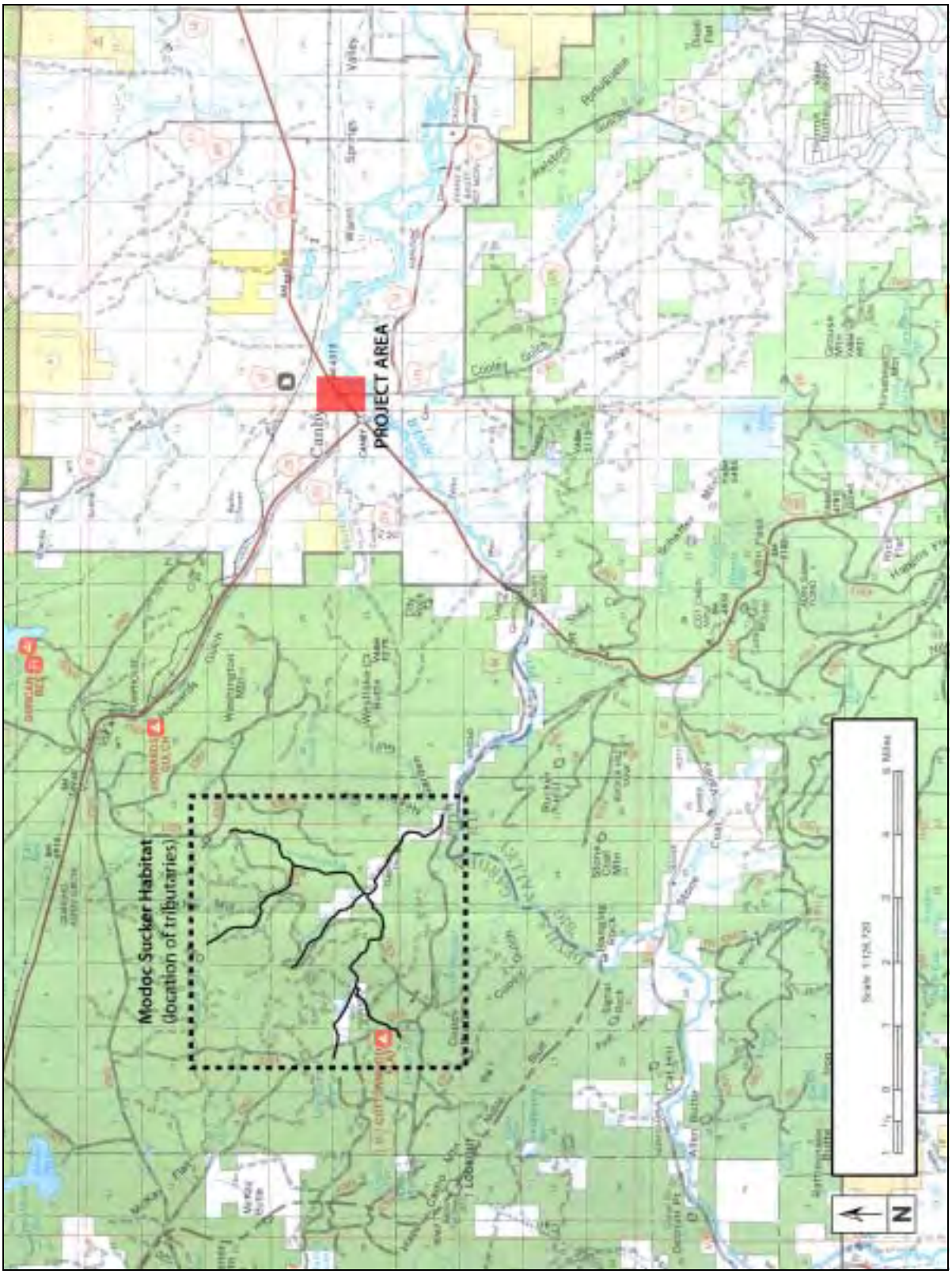
Migratory Bird Treaty Act. The Migratory Bird Treaty Act prohibits the killing of any migratory bird without a permit. With a few exceptions, most birds are considered migratory under the Act. The Act protects migratory birds and their nests.

State

The California Endangered Species Act (CESA) provides protection for endangered and threatened wildlife species as well. For proposed projects that may or would have an adverse effect on state-listed species, a formal consultation process must be initiated with the CDFG.

In addition to requiring consultation regarding potential adverse impacts to endangered and threatened wildlife, the CDFG currently maintains a list of "Species of Special Concern". These animal species are not listed as endangered or threatened by the State of California at present, but there is a concern that, if current trends continue, they may require official listing in the future. By identifying Species of Special Concern, the CDFG draws attention to the need for protective measures that would prevent the need to designate them as endangered or threatened in the future.

Figure 3.4-1: Modoc Sucker Habitat



SOURCE: 50 CFR Part 17 USFWS and MHA 1985, 2002

California Natural Diversity Data Base. In order to inventory special status species in California, the CDFG has established the California Natural Diversity Data Base (CNDDB), a program that lists the state's natural vegetation communities and "special plants." CNDDB special plants include state and Federally listed, proposed, and candidate species and taxa that the CDFG considers to be rare, very restricted in distribution, declining, or closely associated with a habitat that is declining at an alarming rate in California. Species that are identified as sensitive by other government agencies (e.g., the BLM and USFS) are also considered to be CNDDB special plants.

California Native Plant Society. The California Native Plant Society (CNPS) publishes and regularly updates the *Inventory of Rare and Endangered Vascular Plants of California*, (Skinner and Pavlik 1994) which has become a standard reference on California's rare and endangered plants. The CDFG recognizes that Lists 1A, 1B, and 2 of the *Inventory* contain plants that, in a majority of cases, would qualify for listing, and the CDFG will request their inclusion in environmental documents as necessary. Species classified as lists 3 or 4 are plants that are considered to be of lower sensitivity and do not fall under Federal or state regulatory authority.

Species Recovery Plans

Bald Eagle. A recovery plan for the bald eagle was published in 1986 (USFWS 1986). The primary goal of the recovery plan is to provide secure habitat for bald eagles within the seven-state Pacific recovery area, and to increase population levels in specific geographic areas to the extent that the species can be delisted. The seven states that comprise the Pacific recovery area include Idaho, Nevada, California, Oregon, Washington, Montana, and Wyoming.

Providing secure habitat for bald eagles involves identifying breeding and non-breeding habitat, arranging for long-term protection of bald eagle habitat, and managing habitat to ensure that its components are maintained and enhanced. Methods to secure bald eagle habitat that are outlined in the bald eagle recovery plan include: the need to assess the suitability of habitat not presently used by bald eagles, the incorporation of eagle habitat guidelines in agency land-use plans, the design and implementation of plans which secure individual nest sites, roosts, and foraging areas, and the need to maintain forested habitat that is presently used by eagles.

Modoc sucker. A revised action plan for the recover y of the Modoc sucker was published in 1983 (USFWS and CDFG, 1983). The purpose of the plan is to provide direction and assign responsibilities for the recovery of the Modoc sucker on the Modoc National Forest and adjacent private lands within its historic range.

The recovery efforts involve securing habitat and establishing viable Modoc sucker populations throughout the Turner-Hulbert-Washington creeks drainage, the Rush-Johnson Creeks drainage, and other streams during 1985-1990. The recovery plan includes actions necessary to secure viable populations and a timetable for completing these objectives. Methods include evaluating current populations in each drainage, preparing land adjustment plans, evaluating and constructing barriers in creek systems, and surveying for suitable habitat, and monitor population trends and habitat improvement effectiveness.

3.5 Cultural Resources

INTRODUCTION

The proposed action would take place in and around the Pit River in Canby, California (see Figure 1.1-2). The area was occupied by native people during historic and times.

PREHISTORIC RESOURCES OF THE REGION

Modoc County is rich in archaeological resources. The greatest diversity and density of archaeological sites occurs in the Devil's Garden area one mile north of the project area. The sites in that area represent seasonal activities of both the Modoc and Achumawi and their ancestors. Sites are most frequently found near water resources and on the edges of meadows and marshes. Winter villages and outlying specialized activity sites occur along and above the Pit River Valley and along the shores of Tule Lake.

Prehistoric archaeological sites and materials, such as petroglyphs, of the Native American Modoc, Achumawi, and Paiute of the area are essential to the interpretation of the Native American cultural heritage of the area. A number of archaeological studies have focused on parts of the Pit River and nearby areas. Twenty-four sites were located, of which five lie within the National Forest boundaries, along the Pit River Canyon and the lower stretches of tributary streams between Big Bend and Fender's Flat. Most of the sites appeared to be temporary campsites, although some sites with shell midden and house pits were noted, indicating longer periods of occupation. These sites are thought to be of the Achumawi (Mintier Harnish 1988a).

The project area lies within the ethnographic territory of the Astariwawi tribelet of the Achumawi or Pit River Indians. Several references discuss the culture and lifeways of the Achumawi (Dixon 1908, Kniffen 1928, Kroeber 1925, Merriam 1926, and Olmsted and Stewart 1978); the following information is excerpted from these sources (primarily the Stewart 1978). Achumawi translates to "river (literally "it flows") people." The Achumawi occupied lands extending from Mount Shasta on the northwest to Lassen Peak on the southwest, and from Goose Lake on the northeast to Eagle Lake on the southeast. Achumawi prehistory has been researched by Baumhoff and Olmsted (1964) who suggest that the Achumawi originally occupied the Pit River watershed 3,000 to 4,000 years ago.

The Astariwawi are one of nine Achumawi tribelets, each of which occupied a portion of the Pit River and its tributaries, as well as lands extending some distance away from the river. The nine tribelets functioned as self-governing units but were closely related through intermarriage. They shared a common language from the Palaihnihan branch of the Hokan family of languages, and although there were some dialectal differences, they were not different enough to prohibit communication.

Streams, lakes, meadows, and swamps were especially important to the Achumawi because they provided such a large proportion of their food and shelter. Prior to the construction of powerhouses on the Pit River, salmon and other anadromous fish traveled up the Pit River and its tributaries. In Achumawi territory, there were about 50 miles of salmon streams and 150 miles of streams from which bass, catfish, lamprey, pike, suckers, trout, and a number of species of minnows were taken. Crawfish and mussels were also eaten. Vegetal foods were an important part of the diet, and a wide variety of roots, seeds, berries, nuts, and herbs were gathered in season. Hunting appears to have been secondary to fishing and gathering, but numerous species were taken (Vaughn 2001).

HISTORIC

The earliest Euroamericans in northeastern California were fur traders and explorers for the Hudson's Bay Company from Fort Vancouver. John Charles Fremont visited the area in 1843 during an exploring expedition for the United States Government. In 1846 Lindsey and Jesse Applegate opened the South Emigrant Road between Tule Lake and Goose Lake. This became a popular road for immigrants traveling from Oregon to the gold fields in California, with the first wagon train entering California from the north via this route in 1848. The Emigrant Trail is now registered as State Historical Landmark No. 111, located about eight miles west of Canby near the Pit River, this historical landmark consists of visible remnants of the Lassen Trail, which was used extensively during the gold rush (www.rh2o.com).

The area was settled in 1869 by the Hess family followed by the Pope family in 1870. At that time it was called Warm Springs Valley, probably for the nearby hot springs. In 1874, the name was changed to Canby with the appointment of James Pope as the first postmaster. General E.R.S. Canby, for whom the town was named, was killed in 1873 during the Modoc Indian War at the Lava Beds.

Cattle and sheep ranching initially served as the primary economic base in Modoc County; agriculture gradually increased in importance. Cattle and sheep were competing for an increasingly limited amount of pasturage, as overgrazing and erosion left fewer and fewer acres for more and more animals. As the century progressed with constantly increasing demands on the relatively limited grassland, the federal government stepped in. In 1904, the Modoc Forest Reserve and the Warner Mountains Forest Reserve were made a part of the public lands scheme, and this ultimately became Modoc National Forest. It is the only National Forest in California created primarily for grazing rather than timber preservation needs.

In the middle 1930s the timber industry played an important factor in the growth of the town, and it became more than just "a wide spot in the road." At one time there were two mills operating, along with two logging camps, sixteen miles of rail logging, and a gandy dancer crew. The population grew to nearly 700 and there were over 100 students enrolled in the Arlington School. The lumber industry reached its peak in the 1940s, but the County continued to grow through the 1950s. The lumber industry has declined substantially, as has agriculture.

In 1966, the mill, then owned by Loveness Brothers, was destroyed by fire and Canby's heyday was over. Families moved away in search of employment. In 1969, I'SOT, Inc. (In Search of Truth) established a society of people organized exclusively for charitable, religious, and educational purposes within the meaning of section 501-c-3 of the Internal Revenue Code.

Project Surveys

Archaeological Reconnaissance. An archaeological reconnaissance was conducted along a linear corridor in the project area to assist in the environmental review and tribal consultation process. The research was used to prepare IS/MND for the Modoc County CEQA documentation for the project. In the initial linear survey of the proposed pipeline corridor, a prehistoric site was identified. In consultation with the I'SOT Project Coordinator, the line was moved west to avoid the site. This corridor was then surveyed, and no cultural resources were noted (Coyote & Fox 2001).

Michael Darcangelo of Far Western Anthropological Research Group, Inc. (FWARG) conducted a supplemental survey on October 14, 2002. The survey included areas not previously covered by Coyote & Fox in 2001. The areas surveyed were proposed locations for the food service/laundry building, mechanical building, and the pipeline route (1,300 ft.) along the levee road that had not been previously

surveyed. The levee road was surveyed because the discharge pipeline route was altered to avoid wetlands. No sites or isolated historic or prehistoric finds were discovered as a result of the current survey (Darcangelo 2002). The one site identified in the 2001 survey is located near a corridor segment that is no longer under consideration. Based on previous and current survey efforts, no further archaeological investigation is recommended for the project.

NATIVE AMERICAN CONCERNS AND TRADITIONAL CULTURAL VALUES

Native American Use of the Area

Modoc County was originally settled by three distinct groups of Native Americans: the Modocs in the Tulelake area, the Pit River Indians in the Warm Springs, South Fork, Alturas and Big Valley areas, and the Paiutes in Surprise Valley. Numerous permanent settlements existed throughout the area. There were also nomadic tribes throughout the region, principally the Paiutes. Figure 3.5-1 indicates the generalized location of tribal areas and settlements. The map indicates that in the general project vicinity three of the seven Pit River Indian village sites were located in the area west of Canby.

The Modocs and the Pits were basically sedentary tribes living in permanent villages. The name Modoc had its derivation from the original Indian name of the Modocs, which was Moatakni Maklaks. The Paiutes were semi-nomadic hunters and gatherers who traveled throughout Surprise Valley, northern Nevada and parts of California and Oregon.

The project area lies within the territory ethnographically ascribed to the Astariwa group of the Pit River Indians (Kniffen 1928). The name Astariwa means “hot spring” and refers specifically to the hot spring (Kelley Hot Spring) located about four miles east of Canby. The Astariwa occupied the area along the Pit River eight miles west of Alturas, to the crest of the mountains east of Big Valley.

Native American Consultation for the Proposed Project

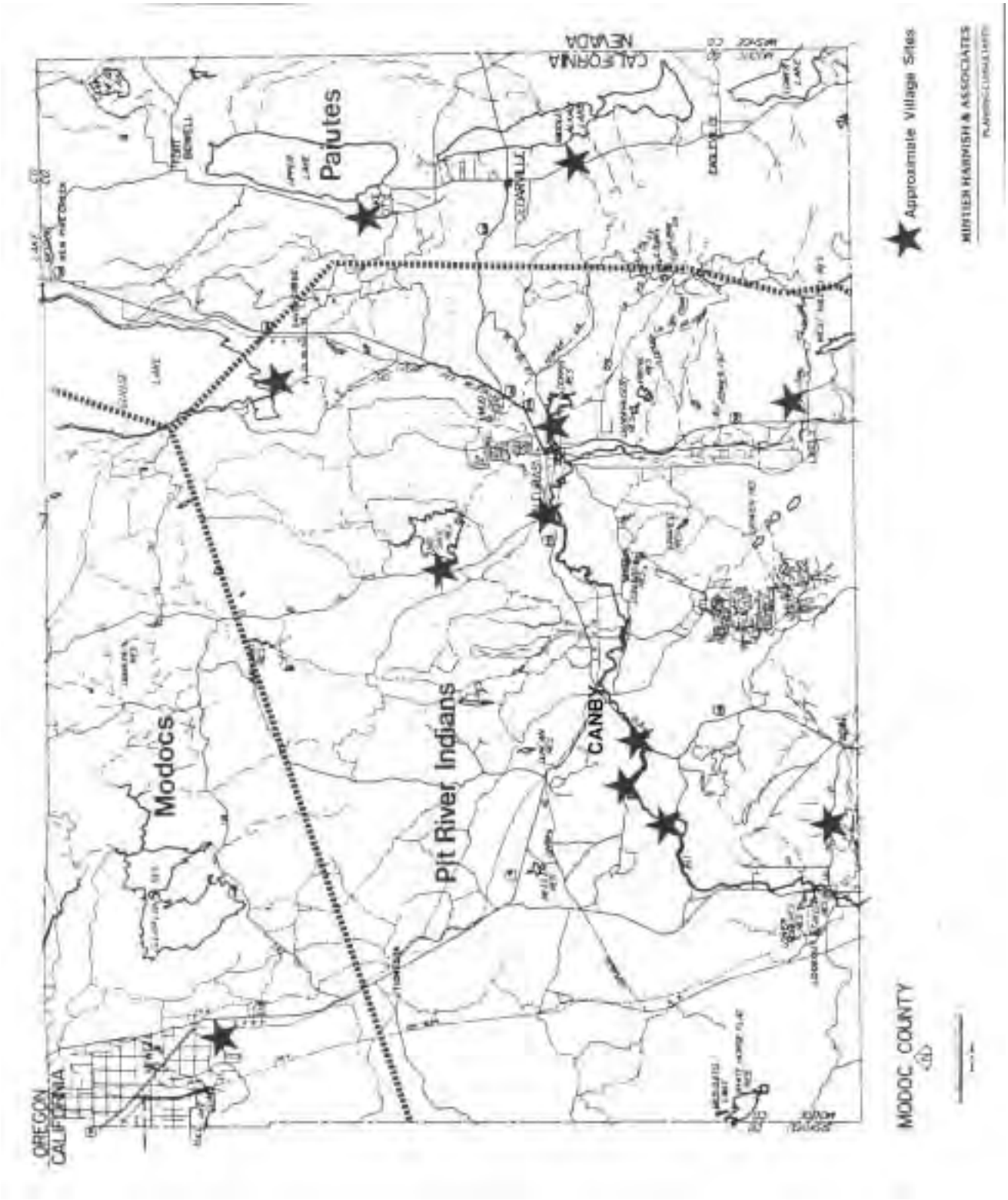
Consultations. The DOE is currently conducting its tribal consultations regarding the proposed project. Communications with tribal groups are presented in Table 3.5-1.

Table 3.5-1: DOE Tribal Consultations

Date	Contact
9/6/02	DOE sent scoping letter to Pit River Tribal Nation Chairman Gene Preston via mail and fax, as well as to other Pit River Tribal Band members.
9/10/02	DOE staff met with Pit River Tribal Band members at the I’SOT Canby Family Practice Center to give an overview of the project.
10/1/02	MHA sent letter to Native American Heritage Commission (NAHC) on behalf of the DOE to search for sacred sites in the project area.
10/21/02	DOE sent letter to tribal members listed by (NAHC) to request any known sacred sites or other information regarding the project area.
1/16/03	DOE and I’SOT staff met with Pit River Tribal Band members at the I’SOT Canby general purpose meeting facility to discuss construction monitoring and water quality issues.

SOURCE: MHA 2002

Figure 3.5-1: Tribal Areas & Settlements



SOURCE: Mintier Harnish 1988a

On October 1, 2002 a letter was sent by MHA on behalf of the DOE to the Native American Heritage Commission (NAHC) requesting a sacred sites record search in the vicinity of the proposed project. Debbie Pilas-Treadway responded noting that the search failed to indicate the presence of Native American cultural resources in the immediate project area. Ms. Treadway enclosed a list of tribal members to contact for further information. MHA followed up on the NAHC contact letter sent by DOE with phone calls on November 12, 2002 to the identified tribe members. Michelle Berditschevsky at the Pit River Tribe Environmental office noted that the water resources specialist had some concerns with the effluent discharge.

I'SOT Consultations. On September 10, 2002 I'SOT representatives met with the Pit River Tribes' tribal representative in their Family Practice Center in Canby, California to discuss the project components. Patricia Preston of the Astariwawi Band requested that a tribal monitor be present during pipeline construction. It was agreed that the tribal representative would monitor pipeline construction. Sharon Elmore, the Ajumawi Environmental Representative requested a second meeting to discuss the project further with additional tribal members.

The requested second meeting was held on January 16, 2003, at the I'SOT facility in Canby, CA. Tribal representatives presented four verbal comments at this meeting:

- A Tribal monitor was requested during construction (this comment was originally made at the first meeting in September 2002);
- Chlorine content of the discharge effluent could have potential impact on water quality;
- The project area could have cultural significance to the Tribe;
- The Tribe requested a Memorandum of Agreement concerning mitigation of potential impacts to cultural resources (see Section 8.3).

In response to DOE's request for comments, Patricia Preston, Cultural Resource Representative for the Astarawi Band of the Pit River Nation, provided DOE with a document "Astarawi Requirements for Contractors and Monitors in Dealing with Newly Discovered Cultural Resources." The document outlined the Pit River Nation's position with regard to protection of any indigenous cultural resources during I'SOT's construction of the geothermal heating plant.

REGULATORY FRAMEWORK

Federal

Several laws and Executive Orders address the issue of consultation with local Native American groups and cultural resources regarding the proposed project that may affect traditional religious practices or cultural resources, including:

- National Historic Preservation Act of 1996, as amended and 36 CFR 800
- Native American Graves Protection and Repatriation Act of 1990
- *Traditional Cultural Properties*, National Register (U.S. Department of the Interior) Bulletin 38
- American Indian Religious Freedom Act of 1978
- Archaeological and Historic Preservation Act of 1974

- Archaeological Resources Protection Act of 1979
- Executive Order 13175, November 6, 2000, Consultation and Coordination with Indian Tribal Governments and Statement by the President
- Executive Order 13007, May 24, 1996, Protection of Sacred Sites
- Executive Order 12898, February 11, 1994, Environmental Justice
- Executive Order 11593, May 13, 1971, Protection and Enhancement of the Cultural Environment
- Secretarial Order 3206, June 5, 1997, American Indian Tribal Rights, Federal-Tribal Trust Responsibilities
- National Environmental Policy Act of 1969
- 10 Code of Federal Regulations 1021.301, August 16, 1994, DOE Environmental Assessment Checklist Guidelines

State

Modoc County General Plan. The Modoc County General Plan Background Report states that various portions of the California State Code are relevant to the protection of archaeological resources. Due to the rich cultural and historic history of the project area, the General Plan notes that the enhancement and promotion of these valuable and extensive resources presents an important opportunity to develop policies and procedures for their protection. In addition, public agencies should seek to avoid damaging effects on archaeological resources wherever feasible.

The Modoc County General Plan Goal, Policies, and Action Program includes the following goals and policies pertinent to cultural resources:

> **GOAL:** To preserve, protect, and enhance the valuable natural, cultural, and historical resources of the county.
>
> **POLICY:** Historic Development 1. Develop a program to preserve and enhance historic and cultural building and places of significance.
>
> **POLICY:** Archaeological 1. Minimize the loss of archaeological resources through the development review and approval process.
>
> **ACTION PROGRAM 7:** Include consideration of archaeological history and cultural resources impacts in the review of any development proposal.

3.6 Land Use, Agriculture, and Recreation

EXISTING LAND USES

The proposed project area is located in the rural town of Canby, Modoc County, California. Modoc County could be called the "land unknown to most Californians" (Shasta Cascade 2002). Modoc County is located in the extreme northeast corner of California, is bounded on the north by the State of Oregon, on the east by the State of Nevada, on the south by Plumas County, and on the west by Siskiyou County. It is rectangular in shape, measures nearly 100 miles east and west, by nearly 60 miles north and south, and contains 2,750,000 acres. It was originally a portion of Siskiyou County, but was formed into a separate county by an Act of the Legislature of 1874. The county name originated from the celebrated Indian tribe whose resistance to the progress of the whites in their settlement resulted in the Modoc War in the northwestern part of the county and the adjoining part of Oregon.

Land Use

Modoc County is dominated by federal land ownership, with 61% of the land managed by the US Forest Service and Bureau of Land Management (BLM). Of the remaining 39%, 7% is in Timber Preserve Zones and cannot be used for other than timber production. Another 6% of the land in the County is used for intensive (irrigated) agricultural purposes (Mintier Harnish 1988a). The principal economic resources of the County are its forests, agricultural lands and recreation-tourism.

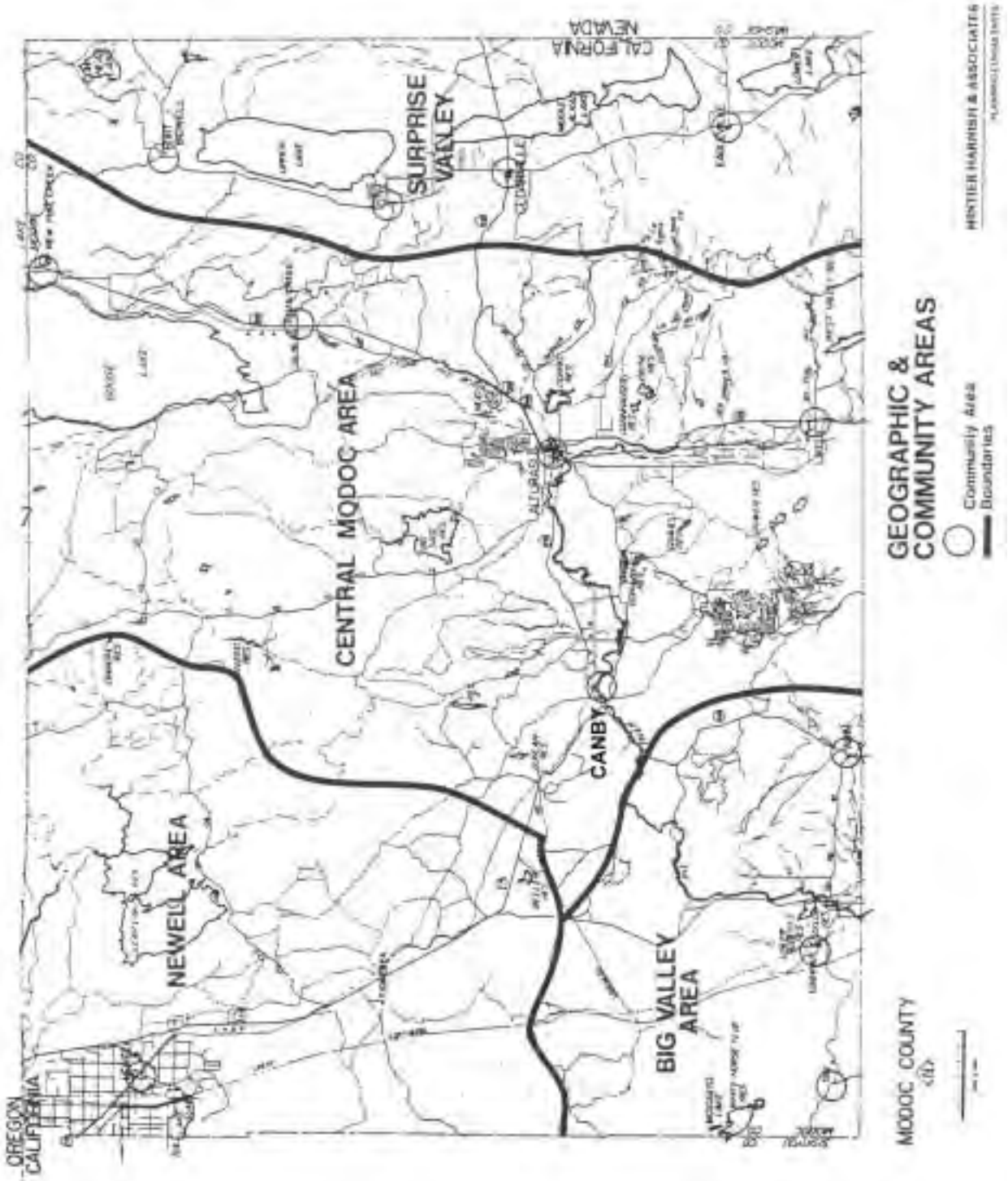
The Modoc County General Plan divides the county into four geographic areas: Newel, Big Valley, Central Modoc and Surprise Valley. Canby is located in the Central Modoc community area (Figure 3.6-1). The Central Modoc area is bounded by the County lines north and south, the crest of the Warner Mountains to the east and the geographic barrier posed by the Modoc National Forest to the west.

In 1988 the town of Canby consisted of 26 acres of residential land use and 160 acres of vacant land out of a total of 201.8 acres. A considerable number of acres of land in Canby are now owned by the I'SOT community. Currently, land designated as vacant land in the Modoc County General Plan within the project area is a mix of dry grazing land and wetlands (Figure 3.6-2a), while the remainder of the I'SOT community is designated residential. Figure 3.6-2b shows an updated land use map of the same general area. When there are lands that are "Unclassified", such as Vacant Lands, these lands revert back to the General Plan map. Those lands that are not officially designated as Agriculture Exclusive, Publicly Owned Lands, Timber Protection Area, Rural Residential or Urban Areas are considered to be Agriculture General (Alvord 2002).

Agriculture

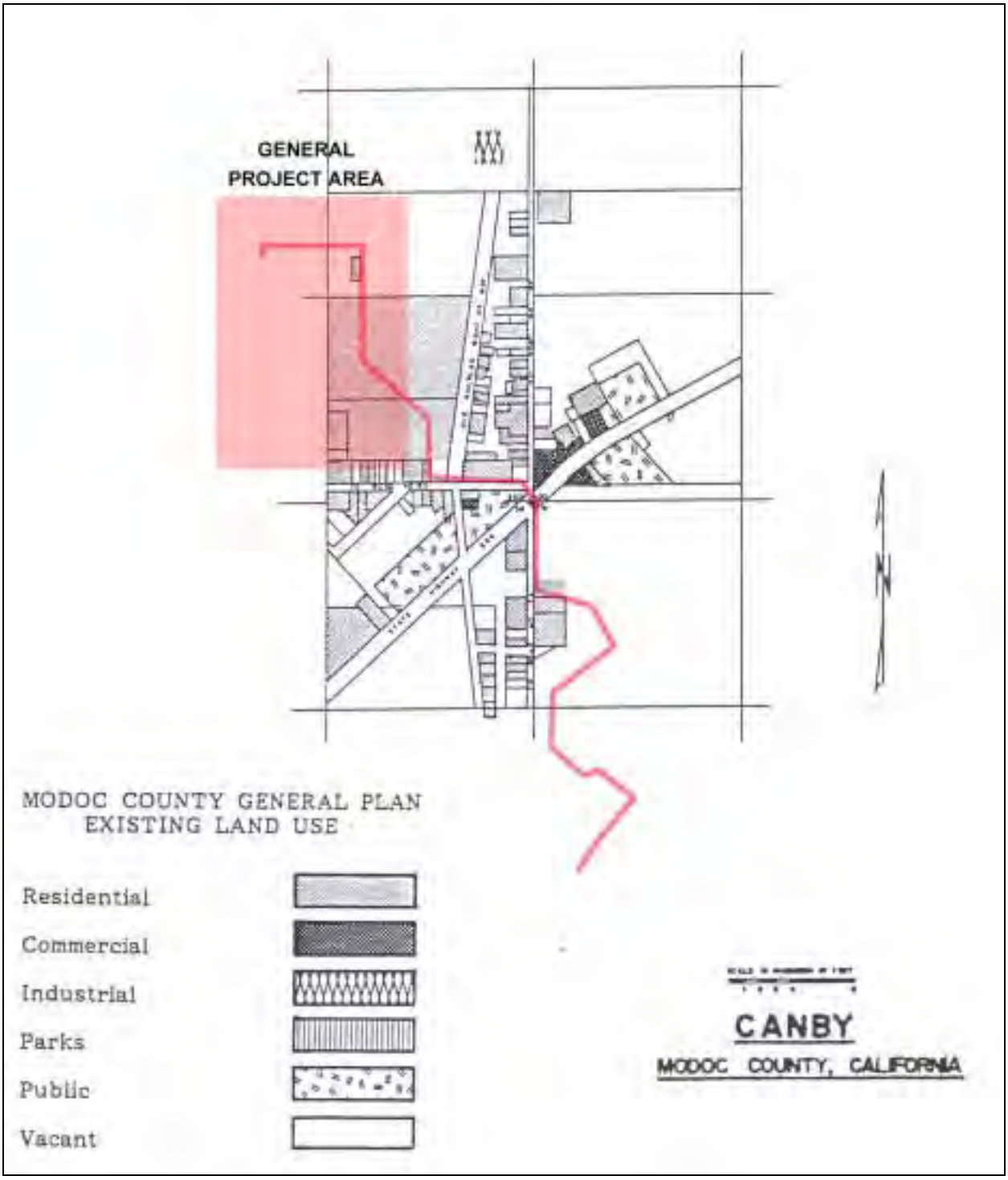
Alfalfa hay is Modoc County's major agricultural industry. In 2000, the county ranked 42nd in agricultural production in the state, with a total gross production value of $68.8 million. Crop sales accounted for 64 percent of the market value, while livestock sales accounted for 36 percent of the market value. The top five crops in Modoc County, by value, included: alfalfa hay, timber, cattle &calves, potatoes, and pasture & range (Modoc County Farm Bureau 2002). The most recent Census of Agriculture showed an increase of 2 percent in the average size of farms in Modoc County, with a decrease of 3 percent in the amount of land in farms (USDA 1997).

Figure 3.6-1: Geographic and Community Areas



SOURCE: Modoc County General Plan 1988

Figure 3.6-2a: Modoc County General Plan Land Use 1988



SOURCE: Modoc County General Plan 1988

Figure 3.6-2b: Modoc County General Plan Existing Land Use 2002

SOURCE: Modoc County Planning and MHA 2002

In central Modoc County the livestock industry is the most important facet of agricultural production. Nearly all farm operations use public lands to graze their cattle. The Alturas-Canby area had more acreage under production for each crop than either of the other areas in 1982. The main agricultural land uses in the Canby project area are a combination of irrigated cropland, dry cropland, and grazed land (irrigated and non-irrigated).

Important Farmlands. In 1984, The California Department of Conservation (DOC), Division of Land Resource Protection, prepared Advisory Guidelines and preliminary maps for the Farmland Mapping and Monitoring program. The Guidelines identified five categories of farmlands: prime farmlands, farmlands of statewide importance, unique farmlands, farmlands of local importance and grazing lands. The designations by the DOC correspond to the Important Farmlands map in the Modoc County General Plan. The Canby project area has a mix of farmlands of local importance and farmlands of statewide importance (Figure 3.6-3). There are no prime farmlands within the footprint of the project.

Soils. There are six high quality agricultural soils in the Alturas area. These soils were defined by Storie Index ratings of greater than 60[1]. Three types of soils are found in the Canby project area (USDA 1980).

- Pit River silty clay at the river discharge point
- Daphnedale loam in the distribution line and mechanical building area
- Barnard gravelly loam in the remaining project area

These three soil types do not fall into any of the six identified agricultural soil categories and all have a Storie Index of 24 or below. These soil mapping units meet the criteria for the category of Farmland of Statewide Importance as outlined in the U.S. Department of Agriculture's land inventory and monitoring (LIM) project for the Alturas area soil survey (USDA 1995). The Pit silty clay loam is a unit of statewide importance if protected from flooding. The project would be constructed on the levee road, not in the protected area.

Recreation

Recreation opportunities abound in Modoc County, with warm dry summers providing camping, hiking, fishing, water sports and many other outdoor activities. Winters allow cross-country and downhill skiing, ice-skating and typical winter outings. Nine hole golf courses are located in Alturas and Likely, Cedar Pass ski hill is between Alturas and Cedarville. The Warner Mountain wilderness is 18 miles long by 8 miles wide with 77 miles of trails suited for hikers and horseback riders. Trail elevations range from 7,000 to 9,000 feet. Visitors can still see turn-of-the-century towns, ranches, and farmlands.

The Modoc National Forest boundary lies approximately 5 miles south of the town of Canby. Forest Service recreational facilities provide camping for family vacationers, as well as hunters and outdoorsmen looking for facilities to use during the hunting season. The Modoc National Forest and Bureau of Land Management have many improved campgrounds with nearly 300 family camping sites available in the county. The proposed action does not lie within the forest boundary or within BLM lands.

[1] The Storie Index is a rating system, which expresses numerically the relative degree of suitability of a soil for general intensive agriculture.

Figure 3.6-3: Canby Area Important Farmland

SOURCE: Dept. of Conservation, Division of Land Resource Protection 2002

REGULATORY SETTING

Federal

Farmlands Protection Policy Act of 1981. The Farmlands Protection Policy Act (FPPA) states that Federal programs which contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses will be minimized (USGS website 2002). Pertinent regulations include 516 DM 2 Appendix 2(2.2), Department of Interior and Environmental Statement Memorandum No. ESM94-7, which states the following:

- Environmental assessments must be prepared for actions which may adversely affect such unique geographic characteristics as prime farmlands
- ESM94-7 adopts as a supplement to the department's NEPA procedures the Council on Environmental Quality (CEQ) memorandum of August 11, 1980, "Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing the National Environmental Policy Act."

State

Modoc County General Plan and Zoning Ordinance. The Modoc County General Plan Background Report states that protection of agricultural land is a major issue to be addressed during the revision of the General Plan. The General Plan should also develop programs and procedures, which include the appropriate agricultural agencies and officials within the County, and are designed to avoid the following:

1. Development projects which conflict with agricultural land uses,
2. Land divisions, which could lead to the creation of uneconomical land units.

The Modoc County General Plan Goals, Policies, and Action Programs report includes the following goals, policies, and actions that pertain to land use, agriculture, and recreation:

GOAL: To provide for a full range of residential land uses and housing opportunities while protecting the valuable environment and community assets of the county.

GOAL: Protect and support the agricultural economy of Modoc County.

POLICY 1: Preserve and protect valuable agricultural lands in the county.

POLICY 3: Support compatible, mixed, or alternative uses of agricultural land, including hunting and fishing clubs, and recreational ranches.

POLICY 4: Permit limited expansion of unincorporated communities in agricultural areas.

POLICY 7: Coordinate the review of any development proposals on production of agricultural land with all concerned public agencies.

POLICY 11: Consider initiating the Williamson Agricultural Land Conservation Act program in Modoc County.

ACTION PROGRAM 2: For all other agricultural lands, a minimum parcel size of 3 acres should be established under the designation general agriculture, except as otherwise permitted. When development is proposed on lands in the general agriculture category, the value of those lands for present and potential agricultural uses, such as irrigated pasture or cropland, dryland farming,

or other agricultural uses, will be considered. Soils, water availability, and the agricultural stability and future of the surrounding area are all factors that impact the value of these lands.

ACTION PROGRAM 6: The County will assist the agricultural community in identifying and promoting compatible economic ventures such as hunting clubs and dude ranches, which supplement farm income and do not take valuable agricultural land out of production. Local economic development groups should explore the feasibility of such activities as private hunting clubs, "dude" ranches, and geothermal-based recreational activities. The County should support such efforts through zoning and development permit approvals.

The land use designations set forth in the General Plan are implemented through the Zoning Ordinance, such that the various zones reflect the range of parcel sizes and uses for each general plan designation. The Modoc County Zoning Ordinance classifies all privately (and publicly) owned land into one of 15 basic zoning classifications. The project area that is south of Highway 299 is zoned as Agriculture-Exclusive (AE). The project area north of Highway 299 is zoned as Residential-Rural (RR-5). The purpose of the AE zone is to designate areas appropriate for general agriculture. The purpose of the RR-5 zone is to permit development while maintaining a rural character, and to reduce residential development impacts on the environment (Mintier Harnish 1988b).

3.7 Noise

TECHNICAL BACKGROUND

Sound is a pressure wave transmitted through the air and is described in terms of loudness or amplitude (measured in decibels [dBA]), frequency of pitch (measured in Hertz [Hz] or cycles per second), and duration (measured in minutes or seconds).

Typical human hearing can detect changes in sound levels of approximately 3 dBA under normal conditions. Changes as low as 1 dBA are discernible under quiet, controlled conditions. The human ear is not equally sensitive to all sound frequencies. Sound waves below 16 Hz are not heard at all but can be felt as vibrations. While people with extremely sensitive hearing can discern sounds with pitches as high as 20,000 Hz, most people cannot hear sound with a frequency above 5,000 Hz or below 200 Hz. A special frequency-dependent rating scale is used to relate noise to human sensitivity. The A-weighted decibel compensates by discriminating against frequencies in a manner approximating the sensitivity of the human ear.

Noise is defined as unwanted or objectionable sound, and usually reflects changes from typical background noise levels and spectra. Airborne sound is described as a rapid fluctuation of air pressure above and below the atmospheric pressure. Magnitude, frequency and duration are the variables used to characterize noise. In general, people can perceive a 3 dB difference in noise levels, and a difference of 6-10 dB is perceived as a doubling of loudness. Distance serves to attenuate noise levels and changes frequencies. With every doubling of distance, there is a corresponding reduction in noise levels of approximately 5 to 6 dB. Noise levels from familiar sources are shown in Table 3.7-1.

Table 3.7-1: Typical Residential/Commercial Noise Sources and Levels

Noise Source	Noise Level (dBA)
Rustle of leaves in breeze	25
Whisper (at 6 feet)	35
Inside average residence	40
Refrigerator (in same room)	40
Average office	55
Normal female speech (at 3 feet)	60
Vacuum cleaner (at 10 feet)	70
Garbage disposal (at 3 feet)	80
Food blender (at 3 feet)	90
Auto horn (at 10 feet)	100

SOURCE: J.J. Van Houten 1974

EXISTING CONDITIONS

Noise Sources

The project vicinity is predominately rural with most of the land being used for grazing livestock and growing different kinds of hay. Ambient noise levels in the vicinity of the proposed action are generally low and typical of rural and open space areas. Natural noise sources include animals, wind, and occasional summer thunderstorms. Typical noise levels in rural, uncongested environments include: 44 dBA on a tomato farm over a 24-hour period and 50 dBA over a 24-hour period along county roads (MHA 2002).

Canby is bordered by the Southern Pacific Railroad to the north and State Route 139 to the west. State Route 299 traverses through Canby, intersecting the proposed discharge pipeline route. The I'SOT Community is located along several County Roads including County Road 83, 203, 161, 82, and 54. An airplane landing strip is located roughly 0.8 miles from the I'SOT area. These roads and facilities contribute to ambient noise levels in the vicinity of the project.

Sensitive Receptors

Sensitive receptors would be mostly concentrated around the proposed building and distribution pipeline. Receptors include occupants of the surrounding mobile homes and group homes, rural medical-dental-behavioral health clinic, dining hall, school, and agriculture and custom haying workers along the discharge pipeline route.

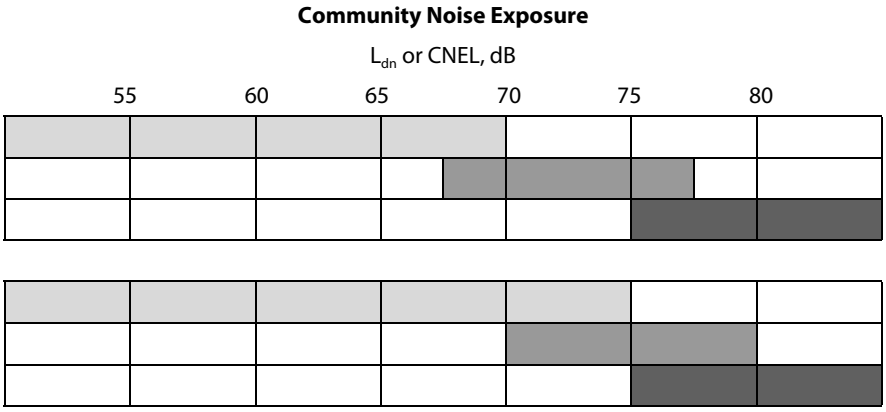
REGULATORY FRAMEWORK

Federal. The US EPA suggests a noise reduction goal of 55 dBA (L_{dn}) in residential areas for the protection of health and welfare. The US Department of Housing and Urban Development maintains a maximum standard for noise in residential areas of 65 dBA (L_{dn}). However, no federal regulations apply to potential impacts on noise in the project area.

State. No state regulations apply to potential noise issues of the proposed project. The California Office of Noise Control (ONC) adopted and published in 1976 Guidelines of the Preparation and Content of Noise Elements of the General Plan, which the Modoc County Noise Element discussed below has been based on. The 1976 ONC Guidelines have been updated and replaced by the Noise Element Guidelines issued in 1998 by the Governor's Office of Planning and Research. Table 3.7-2 shows suggested noise standards per land use designation from the Governor's Office of Planning and Research.

Table 3.7-2: Community Noise Exposure

Land Use Category	Community Noise Exposure L_{dn} or CNEL, dB						
	55	60	65	70	75	80	
Residential – Low Density Single Family, Duplex, Mobile Homes							
Residential – Multi Family							
Transient Lodging – Motels, Hotels							
Schools, Libraries, Churches, Hospitals, Nursing Homes							
Auditoriums, Concert Halls, Amphitheaters							
Sports Arena, Outdoor Spectator Sports							
Playgrounds, Neighborhood Parks							
Golf Courses, Riding Stables, Water Recreation, Cemeteries							



Interpretation

Normally Acceptable

Specified land use is satisfactory based on the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

Conditionally Acceptable

New Construction or development should be undertaken only after a detailed analysis is made of the noise reduction requirements and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning, will normally suffice.

Normally Unacceptable

New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

Clearly Unacceptable

New construction or development should generally not be undertaken.

SOURCE: Governor's Office of Planning and Research 1998

Local. The Noise Element of the Modoc County General Plan (Modoc County 1988) identifies a maximum noise level 60 dBA L_{dn}[1] for residential uses. The Noise compatibility standard on Modoc County is 54 dBA L_{eq}[2], based on an L_{dn} of 60 dBA. The following noise-related policies may pertain to the proposed action:

- Areas within Modoc County exposed to existing or projected future exterior noise levels exceeding 60 dB L_{dn} should be designated as noise-impacted areas.
- Noise level criteria applied to land uses other than residential or other noise-sensitive uses should be consistent with recommendations of the [Governor's Office of Planning and Research].

[1] L_{dn}, the day-night average noise level, is based on human reaction to cumulative noise exposure over a 24-hour period. L_{dn} accounts for community receptors' greater sensitivity to unwanted noise intrusion during the night. Noise between 10:00 p.m. and 7:00 a.m. is weighted by 10 dBA to take into account the greater annoyance of nighttime noise.
[2] L_{eq}, equivalent steady-state sound level, is a single value of sound level for any desired duration that includes all time-varying sound energy occurring during the measurement period.

- All building permits should be reviewed by the Planning Department for consistency with the noise element and other elements.

3.8 Infrastructure and Service Systems

ENVIRONMENTAL SETTING

Regional Setting

The Central Modoc region is a rural area that is served by local or private services and utilities. Existing utilities and service systems for Canby include electricity, communication systems, and solid waste disposal. Surprise Valley Electrification Corporation provides electricity and solid waste is transported to the Canby Transfer Station by the Modoc County Department of Public Works. Citizens Communications provides telephone service.

Local Setting

Gas and Electricity. Surprise Valley Electrification Corporation provides electricity for the town of Canby; however the individual landowners use private propane tanks for the provision of natural gas.

Water. The I'SOT Community in Canby and surrounding residents obtain potable water through private wells.

Wastewater. The I'SOT community has two 3.5-acre sewage lagoon treatment ponds that are both aerobic/anaerobic in nature. These ponds were installed by I'SOT Inc. in 1983. Sewage is sent to these ponds via pipelines. The ponds have both primary and secondary treatment. Primary treatment involves removing most inorganic matter through allowing solids to settle out of the raw sewage. In secondary treatment, bacteria digest the organic material (Merrick 2002a).

Stormwater. There is currently no storm water collection system at the I'SOT community.

Solid Waste. Solid waste from I'SOT goes to the Canby Transfer Station. There are 5 landfills and 7 transfer stations in Modoc County. These facilities are under a cooperative agreement to serve residents of Modoc County. In1988, the Department of Public Works estimated the capacity of these landfills to be adequate for the following 20 years. The County Department of Public Works operates Class II sanitary landfills at each of the following communities: Fort Bidwell, Lake City, Cedarville, Eagleville and Alturas. The landfills are open to the public, free of charge (Alvord 2002).

Communications. Telephone service is provided by Citizen Communications.

Schools. Canby is served by the Modoc Joint Unified School District. There are five elementary and junior high schools, and two high schools in the District. Three of the above seven schools are in outlying areas. I'SOT operates its own school on site. Students from outside the I'SOT community may also attend (Alvord 2002).

Health Services. Two major medical facilities serve the County. The Modoc Medical Center hospital in Alturas is a completely modern 28-bed facility, providing physicians for 24-hour emergency care. The Surprise Valley Hospital and Clinic in Cedarville has an 18-bed hospital.

Emergency Services

Fire Protection. Throughout the County, 12 fire districts provide fire protection within Modoc County. The Alturas Rural Fire Department covers the largest fire district in Modoc County. The Canby Fire Department serves the I'SOT community.

Police Protection. In Modoc County, the CHP, the Modoc County Sheriff's Department, and the City of Alturas Police Department provide police protection services. The Modoc County Sheriff's Department provides police services throughout the entire county. Police protection in the central Modoc area consists of five officers and a sheriff patrol.

REGULATORY SETTING

Other than general requirements for provision of utility services, there are few regulatory requirements applicable to this project. Project discharge water quality requirements are applied through the National Pollutant Discharge Elimination System (NPDES) permit process involving the Regional Water Quality Control Board. Specific building code requirements of Modoc County are applied to on-site provisions for new developments. I'SOT has applied for and received an NPDES permit for discharge of the geothermal effluent to the Pit River (see Sections 3.3 and 4.3, Hydrology and Geothermal Resources). I'SOT has also received a Use Permit for development of the district heating system. All new buildings would comply with the zoning ordinance requirements for the Modoc County zoning designation.

3.9 Aesthetics

LANDSCAPE CHARACTER/ SCENIC ATTRACTIVENESS

The region of the proposed action is land of varied terrain, which includes the Warner Mountains, a variety of lakes, streams and rivers, and high desert.

The primary influence of humans on the visual landscape in the vicinity of the proposed action has been through ranching, cattle grazing, and geothermal activities. Modoc National Wildlife Refuge lies mostly to the south of Alturas and covers thousands of acres of hunting, fishing, and observational grounds (Shasta Cascade 2002). Geothermal activities have resulted in the clearing of well pads in the nearby Kelly Hot Springs area.

Modoc Plateau

Canby is located on the Modoc Plateau, which is a flat, open area dominated by dry ranchland and wetlands. Vegetation is primarily shrub/grassland-dominated with sparse to dense ponderosa pine and juniper forests. The area is surrounded by mountains to the north, south, and west. The proposed action would occur within and on the border of the I'SOT community buildings and along County Road 54.

Scenic Highways

State Highway 139 is within the Master Plan of state highways eligible for official Scenic Highway designation by the State of California; however, it has not been officially designated as a Scenic Highway Route. The Modoc County General Plan recognizes highways 139 and 299 as scenic highway corridors between Adin and Tulelake. The intent of the County is to, in conjunction with historic place designations, increase tourist-related travel through the County and to protect existing scenic resources from incompatible use (e.g. billboards). The discharge pipeline would cross Highway 299.

REGULATORY FRAMEWORK

Federal Setting

US Department of Agriculture, Soil Conservation Service, Procedures to Establish Priorities in Landscape Architecture 1978. The USDA Natural Resource Conservation Service established guidelines to determine whether any change in the landscape would either impact or improve visual quality in agricultural areas. These guidelines are still in effect and would apply to this project, as there is considerable agriculture area as designated by the Modoc County General Plan (Snieckus 2002). A Visual Resource matrix rating system is used to assess the level of impact for a given project. The proposed project would not build any temporary or permanent structures that would conflict with the current scenic vista of the project area.

Figure 3.9-1: View from County Road 54 to the pipeline construction area

SOURCE: MHA 2002

Local Setting

Modoc County General Plan. The Modoc County General Plan contains limited guidelines for no scenic resources other than those for scenic highway corridors. Scenic integrity is a measure of how intact the landscape character is perceived. The General Plan notes that most highways within the County are located in highly scenic areas, however scenic highway designation may result in increased land use regulation where development may be limited (Mintier Harnish 1988a).

The proposed project sites are located near the intersection of highways 139 and 299. As the General Plan has not been updated since 1988, neither has the issue as to whether to designate additional sections of the highways as scenic highways.

3.10 Socioeconomics

EXISTING CONDITIONS

Population

Modoc County has an estimated population of 9,350 (January 2002) and is predominantly rural. The City of Alturas is the only incorporated area in the County, with a population of 2,840 (January 2002). Modoc County has a land area of 3,944 square miles and a population density of about 2.4 persons per square mile. The population within the County experienced a decline of 0.5% between 2001 and 2002 (DOF 2002a), and a decline of about 3.4% between 1990 and 2000. The County population has experienced a general decline in recent decades. Table 3.10-1 presents socioeconomic characteristics of Modoc County, including population, housing, and employment characteristics.

The I'SOT, Inc. community has a population of about 160 people occupying an area of about 201.8 acres. The average age in the community is 33 years (Merrick 2002).

Table 3.10-1: Socioeconomic Characteristics of Modoc County

1990 Population	9,678
2002 Population	9,350
2002 Housing Units	4,845
2002 Vacancy Rate	21.3%
1999 Per Capita Income	$21,427
2000 Civilian Employment	3,660
2000 Unemployment	330

SOURCE: DOF 2002a, 2002b, and 1990 and E5 2002

Housing

Department of Finance data (DOF 2002a and 2002b) indicate that housing stock in Modoc County increased from 4,672 units in 1990 to 4,845 units in 2002. The vacancy rate of the homes also increased from 20.6% in 1990 to 21.3% in 2002. Housing authorizations in the County have been valued at $2.7 million in 2000. Nonresidential permits have been valued at $3.0 million in 2000.

Labor Force and Employment

The 2000 civilian labor force on Modoc County was 3,990 with an 8.3% unemployment rate. Businesses with the greatest employment size in 1999 employed from 100-249 workers. The largest employers in the county were federal, state, and local government agencies. Agricultural employment included 330 in 2000. Non-agricultural wage and salary employment in 2000 is shown in Table 3.10-2.

Table 3.10-2: Modoc County Non-Agricultural Wage and Salary Employment in 2000

Industry	Number of Employees
Construction/mining	100
Manufacturing	40
Transportation/utility	130
Trade	530
Finance/insurance/real estate	70
Services	370
Federal government	260
State/local government	1,010
Total	**2,520**

SOURCE: DOF 2002a

The labor force within the I'SOT community is divided up into construction, group home service, rural medical-dental-behavioral health clinic service, and agriculture and custom haying.

Income and Sales

County. Estimated median household money income for the County in 1997 was $28,174. Average earnings per job in 1999 reached $22,865, average wages per job in 1999 was $19,848, and average earnings per non-farm proprietor in 1999 reached $20,301 (DOF 2002a).

Total taxable sales in the County were $61.9 million in 1999 and $75.9 million in 2000. The sales and use tax rate (including state, local, and district taxes) is 7.25%. The median adjusted gross income based on personal income tax returns was $23,075 for individual returns and $35,163 for joint returns.

I'SOT Community. I'SOT, Inc. is a non-profit corporation that depends on member contributions as well as State and Federal programs that it administers. Annual income of the individual I'SOT members ranges from zero to $80,000 (Merrick 2002, personal communication). Programs administered by I'SOT include:

- A United States Department of Agriculture (USDA) School Lunch Program (current)
- Federal work retraining programs, including Ecotech
- A USDA low income housing program: Modoc West Apartments
- A State of California housing program for very low income singles: El Rancho Apartments
- A rural health clinic that accepts MediCal

Agriculture. Agriculture has been a historically strong industry in the County since the 1950's. The 440 farms in the County cover 662,927 acres, about 26.3% of the county land area. The value of production in 2000 was $56.7 million, with hay and alfalfa as the leading commodities. Cattle and calves production was valued at $11.5 million in 2000. The project area includes agricultural areas within Canby.

Public Finance

County revenues from tax are primarily from property tax, which totaled $2.0 million for 1998-1999. County government tax collections totaled $2.7 million for 1998-1999. Expenditures for the 1998-1999 fiscal year included $19.0 million for the County, $19.6 for school districts, and $2.3 million for city expenses.

REGULATORY FRAMEWORK

Federal

On February 11, 1994, President William Clinton issued Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*. This Executive Order was designed to focus the attention of federal agencies on the human health and environmental conditions in minority communities and low-income communities. In an accompanying Presidential memorandum, the President emphasized that existing laws, including NEPA, provide opportunities for federal agencies to address environmental hazards in minority and low-income communities. In April of 1995, the EPA released the document titled *Environmental Justice Strategy: Executive Order 12898*. The document established EPA-wide goals and defined the approaches by which EPA would ensure disproportionately high and adverse human health or environmental effects on minority communities and low-income communities are identified and addressed.

State

No state goals, objectives, or policies are considered relevant to the potential socioeconomic effects that may result from implementation of the proposed project.

Local

The Economic Development Element of Modoc County emphasizes the need for job creation. The following policies pertain to the proposed action:

- Plan for and promote appropriately-located new industry which will broaden the employment base while being compatible with the community
- Support both public and private efforts towards compatible economic development and increased job opportunities

There are no local policies or regulations regarding environmental justice.

3.11 Transportation and Traffic

The study area for the transportation analysis of the proposed project includes the road system servicing the project area within approximately ten miles of project facilities. The analysis focuses on roads that would be used by project personnel during the life of the project, including roads in the general vicinity of the well site.

EXISTING SETTING

Regional Access Routes

Regional access to the area is provided by a highway system in the northeast corner of the state that includes Interstate 5 (I-5), US Highway 395, State Highway 299, State Highway 139, and State Highway 89. The I'SOT Community is accessed from Highway 299-E or 139 by County Road 83. The only highway to be used by project construction workers would be Highway 299. The peak hours, peak month, average daily traffic, and annual average daily traffic (AADT) volumes for the junction on this highway is summarized in Table 3.11-1. A summary description of each of these highways is provided below. Access in the project region is provided by these highways and illustrated in Figure 3.11-1.

Table 3.11-1: Potentially Relevant Existing Traffic Volume Levels on Highways in the Vicinity of the Project Area, Including State Routes 139 and 299

Mile Description	Peak Hour	Peak Month	Average Annual Daily Traffic
State Route 299			
21.75Jct. Rte. 139 Northwest	180	1900	1400
40.28Alturas, Juniper Street	390	3350	2900
State Route 139			
0.23North Jct. Rte. 299; Canby West	150	1300	970

Notes:

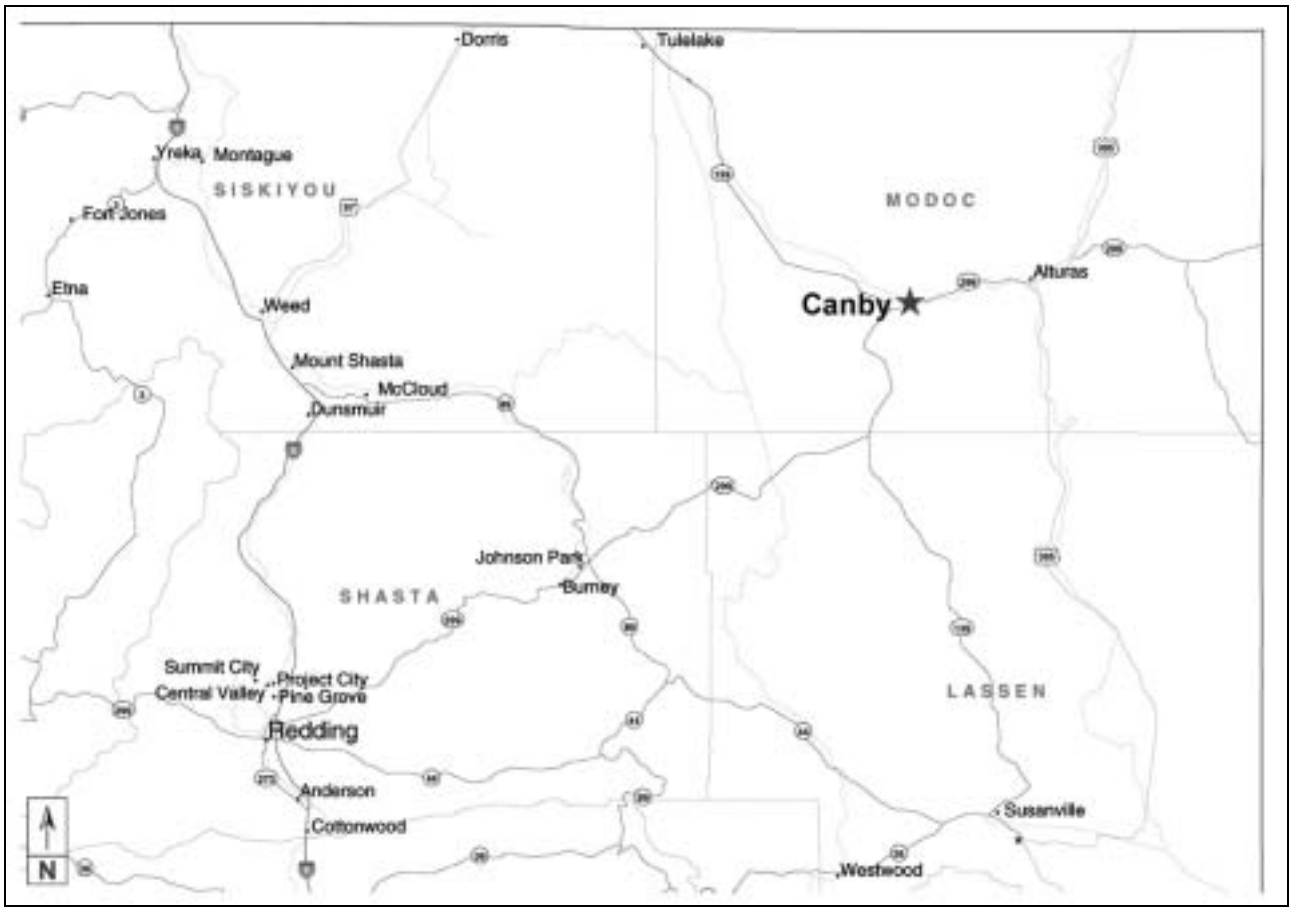
The above figures represent *Ahead* AADT, Peak Month, and Peak Hour. Ahead is defined as the number of vehicles after a count station.

SOURCE: Caltrans 2002

Highway 299. This road extends southwest from the California-Nevada border to Alturas and Canby and points further south. Highway 139 provides access to/from this highway from Oregon to the north. Interstate 5 connects to this road at Redding. The traffic volumes at the SR 139 intersection are estimated to be a relatively modest 100-200 vehicles during the peak hour.

Highway 139. This road extends southeast from the California-Oregon border to Canby and points further south. From the disparity in the variation during the peak hour and the AADT, it appears that notable traffic occurs during the off-peak hours.

Figure 3.11-1: Highway Access to the Project Region



SOURCE: Cartesia 1998 and MHA 2002

Project Vicinity Roads

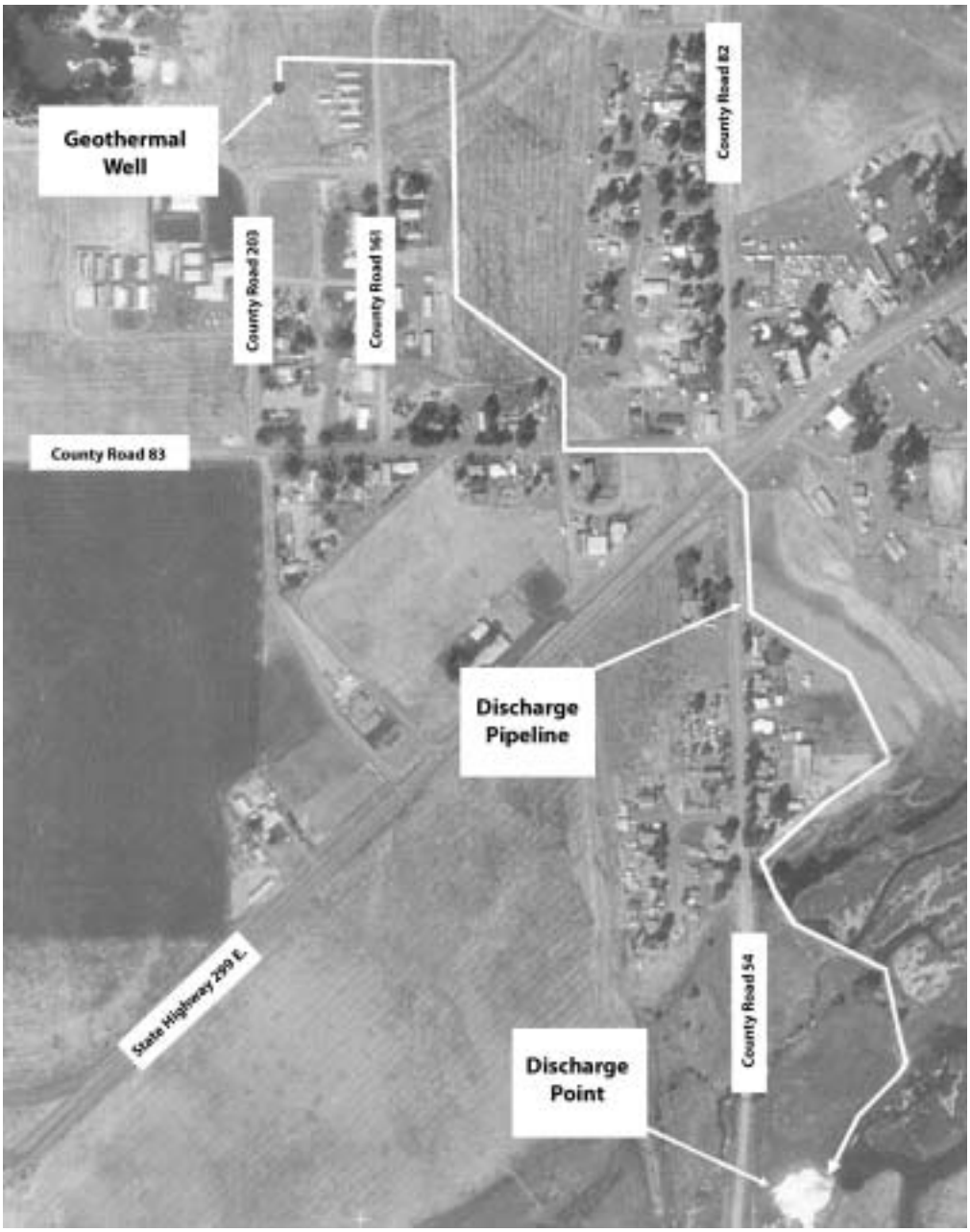
The project area is located entirely in the town of Canby, and roads in the immediate project vicinity are county roads. The vicinity of the proposed project is well accessed by several existing paved arterial roads, as well as many paved collector roads. Traffic volumes in the vicinity are very low and are typical of rural areas with sparse populations. Travel on vicinity roads occurs primarily during the summer/fall months, the period of recreational and hunting use. County Roads 203 and 161 provide the local access to the various building groups within the I'SOT Community. The primary access routes in the vicinity are illustrated in Figure 3.11-2 and summarized below.

County Road 203. County Road 203 is a paved two-lane collector that extends north from County Road 83 west of Highway 299 in Canby. No recent traffic volume data has been collected in the last 10 years for

this road. As County Road 161 and 203 both extend north from County Road 83, traffic volumes could be assumed to be similar.

County Road 161. County Road 161 is a paved two-lane rural road that also extends north from County Road 83 west of Highway 299 in Canby. This road is unpaved from the intersection of County Road 203 to County Road 82. Traffic volumes were lightest on this road probably due to the unpaved section.

Figure 3.11-2: Primary Access Routes in the Project Vicinity



SOURCE: USGS and MHA 2002

County Road 83. County Road 83, which fronts the I'SOT property on the south, is a paved two-lane rural road that extends east from Highway 299. This road has shown no great increase or decrease over the approximately 10 year period between counts.

County Road 82. County Road 82, which fronts the I'SOT property on the east, is a paved two-lane rural road that extends north from Highway 299. The increase in traffic from the 1978 and 1987 counts to the 1995 count is attributed to the residents retiring at the Cal Pine subdivision.

County Road 54. County Road 54, also known as Centerville Street, is a paved two-lane major collector that extends south from Highway 299. The increase in traffic from 1976 to 1995 and 2001 levels is attributed to the influx of residents to the Cal Pines subdivision during that period.

In addition to the roads described above, there are several gravel-surfaced roads that criss-cross the vicinity of the proposed action. These are private roads maintained by the I'SOT community. Table 3.11-2 summarizes the data collected most recently for the project vicinity county roads (Morris 2002a).

Table 3.11-2: Existing Traffic on County Roads 161, 83, 82, and 54

	Average Daily Traffic	
Location (Conditions)	**Average Annual Daily Traffic**	**Dates**
County Road 82 Post office at junction of County Road 83	640	8/30–9/5/95
	362	11/17–11/24/78
County Road 82 North by railroad tracks/ South of railroad tracks	300	8/30–9/5/95
	161	11/17–11/24/87
County Road 83 Post office by County Road 82	378	7/4–7/11/96
	434	11/17–11/24/87
County Road 83 Out from County Road 203	200	11/17–11/24/96
	229	10/6–10/13/86
County Road 161 North end of County Road 82	98 No other previous count	7/4–7/11/97 N/A
County Road 54 (Centerville Street) South of Canby at second bridge	240	8/23–8/30/2001
	266	6/8–6/15/95
	140	7/7–7/14/76

SOURCE: Morris 2002a

REGULATORY SETTING

The following state, regional, and local plans and policies seek to preserve the level of service quality for traffic in the project area.

California Department of Transportation

The State Department of Transportation (DOT, Caltrans) is the primary State agency responsible for improving and maintaining roads for the State of California. In areas with designated State Routes (SR), the State has responsibility to administer and maintain these roads while the local county is responsible for local roads. Local jurisdictions work with the DOT to designate transportation network requirements and critical areas in need of improvement.

The proposed project study area is within Caltrans District 2, which includes Modoc County. The district is composed of terrain ranging from river valley 200 feet above sea level to Mount Shasta rising to over 14,000 feet above sea level, from urban areas with populations above 125,000 to rural wilderness areas. These wide-ranging elements present District 2 with varied and diverse challenges. The proposed project would cross Highway 299. I'SOT has obtained an encroachment permit from Caltrans for this crossing.

Modoc County

In the *Modoc County General Plan* (Mintier Harnish & Associates 1988b), County Road 54 was shown to have a daily traffic volume of 180 at a location south of Canby. In comparison, State Route 299 was shown to as having a daily traffic volume of 1,600 from Junction 139N to Airport Road in Alturas. Although these traffic volumes cannot be relied upon for the current environment, as they were determined over ten years ago, it is useful to note the historically low levels of use of these facilities. The primary goal stated in the General Plan regarding circulation is the following:

> GOAL: To maintain an efficient, safe, and environmentally sound comprehensive circulation and transportation system.

According to the General Plan, the County's Action Program for Circulation, item 4, states, "Transportation facilities particular to industrial development should be analyzed for accessibility for truck traffic and emergency service." An additional relevant item in the Action Program states the following:

> 5. Communicate with utility companies in the development of commercial, industrial, or residential projects.

In the *Modoc County General Plan Background Report* (Mintier Harnish & Associates 1988a), State Route 139, from Canby to Oregon, is described as: "…a principal arterial of interstate importance with projected average daily traffic (ADT) of 1600-5250 and 14 percent truck use. There are 50.2 miles of this highway in the County. It is likely that most of Route 139 will remain an unimproved shoulderless, two-laned conventional highway for a long period. Safety and rehabilitation improvements will be planned on an "as needed" basis.

3.12 Human Health and Safety

This section presents a description of general hazards present in Modoc County and County facilities related to health and safety. These discussions are presented as a baseline perspective for determining the potential degree of impacts associated with human health and safety that may be triggered by the proposed project. Ares of concern (discussed in Section 4.12) are primarily associated with hazardous materials contamination and fires. Applicable regulations on associated hazards to human health and safety are also provided.

EXISTING CONDITIONS

Four basic hazard conditions are listed in the Modoc County Safety Element: geologic hazards, seismic hazards, wildland fire hazards, and flood hazards. Geologic and seismic hazards are discussed in Section 3.2 Geology.

Fire Hazards

Large areas of Modoc County are susceptible to wildland fire hazards. Very high fire hazards characterize about 40% of the County. Aside from state Responsibility Areas and the areas under the jurisdiction of the Forest Service (USFS), there are areas that fall within a local responsibility area. In these areas, response to calls for service would come from the local districts, although a system of mutual aid agreements exists that permits local districts to call upon other districts. The Alturas Rural Fire Department covers the largest fire district in the County. Fire activity for the Alturas Rural Fire Department in 1998 is presented in Table 3.12-1.

The Canby Fire District #62 as well as the California Division of Forestry (CDF) have jurisdiction over the Town of Canby. The Canby Department operates on volunteer service. The project area extends into a "light fuel" area, with flammable grasses, for wildland fires.

Table 3.12-1: 1998 Activity for Alturas Rural Fire Department

Activity Type	Number	Percentage
Emergency Medical Service	65	58.6%
Non-Structure Fires	36	32.4%
Mutual Aid	6	5.4%
Structure Fires	2	1.8%
Haz-Mat	1	0.9%
False Alarms or Systems Malfunctions	1	0.9%
Total Runs for 1998	**111**	**100.0%**

SOURCE: Fire Department EMS 2002

Flood Hazards

There are no significant flood hazards in Modoc County. Most areas subject to inundation are currently water bodies, uninhabited, or in publicly-owned lands. The County does not participate in the Federal Emergency Management Agency (FEMA) Program, and has zoned flood hazard areas designated on the Federal Insurance Rate Maps.

FEMA has designated the eastern, southeastern, and southern portions of Canby as flood hazard zones (FEMA 1984). These are agricultural areas and are potentially inundated by the Pit River. A portion of the discharge pipeline route south of State Route 299 until the discharge point would be located in the designated flood hazard area.

Hazardous Materials

No hazardous waste treatment facilities are located within Modoc County. Hazardous waste generated in the County must be shipped elsewhere for treatment or disposal.

Significant volumes of hazardous materials are commonly associated with intensive land uses such as industrial or mining uses. The proposed project is located where minimal industrial uses have occurred. A lumbermill existed in Canby during the 1940's and 1950's. Existing land uses are primarily agricultural.

REGULATORY SETTING

The current regulatory framework relevant to hazards and human health encompasses process risk related to the use of hazardous materials and management of risks from hazardous materials that have been or could be released into the environment. The use, storage, and disposal of hazardous materials and wastes are regulated through a network of sometimes overlapping federal, state, and local laws and regulations.

Businesses are required by law to handle hazardous materials appropriately and train employees to manage them safely. Hazardous waste laws impose "cradle to grave" liability, requiring generators of hazardous waste to handle it in a manner that protects human health the environment to the greatest extent possible. Both federal and state laws have established programs to identify hazardous waste sites, to require site remediation, and to recover the costs of site remediation from polluters. The following discussion briefly summarizes regulations that must be complied with regardless of ownership of the facility.

Federal

Occupational Safety and Health Administration (OSHA) regulations contained in Title 29 CFR contain employee safety provisions that are designed to minimize the hazards for employees in the workplace.

Through the Safe Drinking Water Act, the Environmental Protection Agency (EPA) sets standards for drinking water quality and oversees the states, localities, and water suppliers who implement those standards. The Safe Water Act Maximum Contaminant Levels (MCL) have been used as basis for permit conditions by the Central Valley Regional Water Quality Control Board.

In 1990, the Environmental Protection Agency (EPA) promulgated rules establishing Phase I of the National Pollutant Discharge Elimination System (NPDES) storm water program. The Storm Water Phase II Rule extends coverage of the NPDES storm water program to certain "small" MS4s located in "urbanized areas" (UAs), and on a case-by-case basis those small MS4s (including those disturbing between 1 to 5

acres) located outside UAs that the NPDES permitting authority designates. MS4s refer to operations serving 100,000 or greater; the Canby project would serve about 160 people and would not be considered an MS4. The project would also not require a Storm Water Pollution Prevention Plan (SWPPP) under the NPDES program as the project (1) would not involve significant amounts of ground disturbance and potential for run-off, and (2) would not be not large enough to warrant a SWPPP (Rohrbach 2002a).

State

Cal-OSHA regulations codified in Title 8 contain employee safety provisions that are designed to minimize the hazards for employees in the workplace.

Title 22 of the California Code of Regulations (CCR) defines and categorizes hazardous materials and wastes. The term "hazardous materials" refers to substances, which, if released in an unregulated manner, can be harmful to people, animals, property, and the environment. Title 22 defines a hazardous material as:

> "... a substance or combination of substances which, because of its quantity, concentration, or physical, chemical or infectious characteristics, may either (1) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness; or (2) pose a substantial present of potential hazard to human health or environment when improperly treated, stored, transported or disposed of or otherwise managed."

Hazardous wastes are categorized in Title 22 as either Resource Conservation and Recovery Act (RCRA) hazardous waste or non-RCRA hazardous waste, depending on whether the waste is regulated under RCRA. Geothermal wastes are not regulated by RCRA; however, they are regulated by Title 22 requirements. Title 22 lists chemical compounds that are presumed to make a material or waste hazardous; these compounds are considered hazardous unless specifically excluded by the U.S. Environmental Protection Agency (EPA).

The California Toxics Rule (CTR) contains water quality standards applicable to the project discharge. It sets the Human Health Limit for mercury at 50 ng/L (this limit has been recognized as not protective of aquatic life or species).

Local

The Modoc County Environmental Health Department is responsible for enforcing a variety of hazardous material, waste, safety, noise and other related requirements. Many communities have established Certified Unified Program Agencies (CUPA's). The intent of the CUPA program is to consolidate and make consistent the reporting requirements, permit format, inspection criteria, enforcement standards and fees for the following six hazardous materials programs:

- Hazardous Waste Generator & Onsite Hazardous Waste Treatment
- Aboveground Storage Tanks - Spill Prevention Control and Countermeasure Plan (SPCC)
- Underground Storage Tanks
- Hazardous Material Release Response Plans and Inventories
- California Accidental Release Prevention Program
- Uniform Fire Code Hazardous Material Plans and Inventories

Modoc County adopted an emergency preparedness plan in 1981. The purpose of the plan is threefold: (1) to provide a basis for the conduct and coordination of operations and the management of critical resources during emergencies; (2) to establish a mutual understanding of the authority, responsibilities, function, and operations of civil government during emergencies; and (3) to provide a basis for incorporating into the County emergency organization non-governmental agencies and organizations having resources necessary to meet foreseeable emergency requirements. The emergency plan sets forth procedures to be taken in emergencies, including, but not limited to, floods, fires, earthquakes, hazardous materials spills. The plan does not include a description of evacuation routes.

4: ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

Introduction

This chapter of the EA provides an analysis of expected environmental effects of the proposed action and alternatives. This chapter is organized into sections by environmental parameter. Each of the environmental analysis discussions present:

- Significance Criteria
- Methodology
- Impact Overview
- Effects of the Proposed Action
- Mitigation measures (as appropriate to mitigate significant effects)
- Effects of the Project Alternative

The Significance Criteria discussions identify the level of environmental effect that would be considered significant for each parameter. The methodology sections describe the approach used to obtain and analyze data and information for each parameter. Each of the environmental analysis sections presents discussions on the potential effects of the proposed project on the environment. Analyses are presented for each area of potential environmental concern. For each potential effect, a determination is made as to whether or not the proposed project would result in a significant environmental impact. Mitigation measures to be considered as project conditions are identified to reduce or eliminate adverse effects.

This chapter also includes a section describing the unavoidable adverse impacts that would occur as a result of the proposed project.

4.1 Meteorology/Air Quality

SIGNIFICANCE CRITERIA

The project would have a significant effect on the environment if it would:

- Violate or contribute substantially to an existing or projected violation of any ambient air quality standard
- Violate any regulatory requirement of the MCAPCD, CARB, or EPA
- Expose sensitive receptors to substantial pollutant concentrations
- Expose the public to objectionable odors
- Substantially alter air movement, moisture, temperature, or local or regional climate
- Create a potential public health hazard

METHODOLOGY

Air impact analysis for the project is divided into potential emissions from construction and from operations. Potential emissions from individual project components are considered. Impacts on the immediate vicinity and larger area to which emissions may travel, are considered and compared to baseline conditions provided in Section 3.1 Meteorology/Air Quality. Mitigation Measures are incorporated as necessary to minimize emissions of particulate matter less than 10 microns (PM_{10}) because the Northeast Plateau Air Basin (NPAB) is classified as "nonattainment" for PM_{10} (see Section 3.1 Meteorology/Air Quality).

IMPACT OVERVIEW

The primary air quality impact associated with the project would be localized, short-term impacts of construction, including dust and emissions from the operation of diesel-fueled engines. The primary criteria air pollutant of concern during construction of the proposed action would be particulate matter in the form of fugitive dust. During construction, fugitive dust emissions would occur from construction vehicles and equipment creating dust. Wind erosion may occur during the construction phase in areas where the soil is disturbed along the pipeline route. EPA's AP-42 ("Compilation of Air Pollutant Emission Factors") states that the dust deposition distance from 30-100 μm diameter fugitive dust is generally within a few hundred feet of the activity with a wind velocity of 10 mph. Smaller particles, including PM_{10}, are much more likely to have their settling rates retarded by atmospheric turbulence. A water truck would be used on site to control fugitive dust during construction. Use of the water truck would reduce dust emissions to less than significant amounts. Another area of concern is scattering of particles during transport and dumping of bedding material, which would be potentially significant without mitigation. Mitigation measures are incorporated to reduce all significant and potentially significant impacts to less than significant levels.

EFFECTS OF ALTERNATIVE A

Construction Emissions

Construction Traffic. Exhaust emissions of oxides of nitrogen (NO_x), ROG, carbon monoxide (CO), sulfur dioxide (SO_2), and PM_{10} would occur from internal combustion engines in dump trucks, excavators and other heavy construction equipment, and from construction workers' cars and supply trucks traveling to and from the work site. It is estimated that no more than a total of 53 tractor-trailer loads of materials would be needed for the project. The proposed action would not increase concentrations of criteria pollutants in excess of air quality standards because relatively few pieces of heavy equipment and small labor forces would be required for this project. Less than significant impacts would result from vehicle exhaust emissions. Dust generation from construction traffic on unpaved roads would create a potentially significant impact on the immediate area along the unpaved roads without mitigation. Some residents exist along Highway 54, which is an unpaved route. Mitigation Measure 4.1-1 would reduce potential dust generation along unpaved roads to a less than significant level.

Food Service/Laundry Building. A backhoe would be used to prepare the site of the food service/laundry building. A concrete truck would be used to construct the building. Dust generation may affect nearby residences and communal areas. This would be a significant impact without mitigation. Dust impacts from construction would be less than significant with the application of water for dust control as required under Mitigation Measure 4.1-2. Pollutant emissions from construction equipment would not be significant because only a few pieces of heavy equipment would be in operation during working days and daylight hours. The equipment would be used for about 3.5 months.

Mechanical and Control Building. A backhoe would be used to prepare the site of the mechanical building. A concrete truck would also be used to construct the building. Dust generation from the construction would be a significant impact without mitigation. A water truck would be used on site to control fugitive dust during construction, as required under Mitigation Measure 4.1-2. Dust impacts from construction and vehicle emissions would be less than significant after mitigation.

District Heating System. Distribution pipelines would be constructed with a backhoe or excavator to trench the distribution pipelines. A 2-foot wide by 4-foot deep trench would be excavated. Dump trucks would be used to haul away excess excavated material and bring in bedding for the pipeline. The excess material would be taken to an agricultural field nearby on I'SOT controlled property that needs fill material. Trenching the pipeline route would create fugitive dust along the residential and communal areas within a few hundred feet of the route. Watering would reduce this impact to less than significant. Transport of bedding material would result in potentially significant impacts without mitigation because particulate matter may scatter along the transport route. Implementation of Mitigation Measure 4.1-3 below would reduce scattered particulate matter to less than significant amounts. Mitigation Measure 4.1-2 would reduce impacts of dumping the excess excavated material to a less than significant level. Vehicle emissions would not be significant.

Discharge Pipeline. The proposed route for the discharge pipeline would be located mostly in agricultural fields away from residents. The route crosses fields, runs along a levee road, and traverses a small portion of wetlands owned or controlled by the I'SOT community (see Figure 2.2-5 for a map of the proposed route). Trenching the 5,400-foot pipeline route would create fugitive dust along the fields, levee road, and possibly the wetlands. Watering would reduce this impact to a less than significant level. Transport and dumping of bedding and trenching material may scatter particulate matter along the transport route and dumping area, which would be on I'SOT property. This impact would be potentially

significant without mitigation. Implementation of Mitigation Measures 4.1-2 and 4.1-3 below would reduce scattered particulate matter to less than significant levels.

Operation Emissions

Geothermal Well. An open, drip-proof motor set at the surface would power the pump at the well. This motor would run on electricity. No impacts on air quality would occur from operation of the motor at the geothermal well.

Backup Boiler System. A boiler is a combustion system that burns continuously fed fuel to heat a water stream to provide steam at any desired temperature and pressure. A standard package industrial propane boiler would be located in the mechanical and control building and would discharge through a short stack to the atmosphere. The boiler would be used during periods of extreme cold weather or if the well capacity is less than the heat demand. The ideal hydrocarbon products of combustion in which a fossil fuel is burned are water vapor and carbon dioxide. All other products are considered pollutants, consisting mainly of NO_x, CO, Precursor Organic Compounds in the form of unburned hydrocarbons, SO_x (Oxides of Sulfur), and PM. Use of the propane boiler would result in low pollutant emissions. The propane boiler would require a 1500- to 2000-gallon storage tank to provide one week's backup operation at peak rated rates.

Peak hot water usage may impose an additional heat demand of up to 600,000 Btu/hr, assuming a cold water temperature of 80°F and a peak flow of 30 gpm. The boiler would be a Raypak #RA1826 Indoor Propane potable water heater. It would have an output of about 1.8 million Btu (1,825.6 MBH) (Merrick 2002; Solberg 2002). This would be a peaking boiler; it would heat the incoming water from 150-160°F to a temperature that would satisfy the heating load at the residences. The MCAQMD does not have regulations specific to propane boiler emissions (Haas 2002). As a comparison, the Bay Area Air Quality Management District (BAAQMD) does not issue permits for propane boilers up to 10 million Btu as provided under Exemption 2-1-114 of the BAAQMD's Permit Handbook. The boiler would be used 1-2% of the year when temperature drops below 7°F. Use of the boiler would have less than significant impacts on air quality.

I'SOT uses about 28,710 gallons per year of propane for residential space heating and domestic hot water (Brown 2002). Implementation of the proposed project would result in decreasing consumption of propane for residential space heating and domestic hot water in Canby, thereby decreasing propane-related emissions in Canby.

Water Circulation Pumps. The pumps for water circulation would be sized for up to 80 gpm each with three-horsepower high efficiency inverter motors. These motors would run on electricity. No impacts on air quality are anticipated from operation of the motors for water circulation.

Conformity Analysis

All proposed federal actions must comply with the EPA rule on "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" (40 CFR 93, Subpart B). This regulation requires that an analysis of the conformity of the proposed federal action be prepared in federal nonattainment or maintenance areas for each pollutant for which the project area is designated as nonattainment or maintenance area, if the project emissions exceed thresholds listed in the regulation. The emissions of all pollutants are expected to be below the thresholds listed in the regulation for nonattainment or maintenance areas and would not be regionally significant. No further conformity analysis is required.

MITIGATION MEASURES

Mitigation Measure 4.1-1

I'SOT will limit all construction vehicles to 25 miles per hour or less on all unpaved roads to minimize dust generation.

Mitigation Measure 4.1-2

I'SOT will ensure that watering for dust suppression shall be applied throughout the construction area during the construction period. I'SOT will also ensure that watering is applied for dust suppression at the dumpsites for excavated material during dumping of excess excavated material.

Mitigation Measure 4.1-3

I'SOT will ensure that dump trucks used to transport bedding and trenching material shall be equipped with adequate cover material to prevent particulates from scattering along the transport route. I'SOT will also ensure that this cover material shall be used when transporting project-related bedding and trenching material. In addition, I'SOT shall ensure that watering for dust suppression shall be performed at dumpsites for excavated material during dumping of excess excavated material.

EFFECTS OF ALTERNATIVES B (NO ACTION)

If the project were not constructed due to lack of DOE funding, there would be no adverse effects on air quality from Alternative B, the "No Action" alternative; however, the project could proceed without DOE funding contingent upon alternative funding, with effects from Alternative A potentially worse without DOE participation because no mitigation would be required (except NPDES required items). The following measures would not be implemented without DOE involvement: 4.1-1, 4.1-2 and 4.1-3. Without funding by DOE, I'SOT would not be reimbursed for costs resulting from permitting efforts, engineering consultation, and system installation costs. No data gathering system would be installed for DOE research and development (R&D) purposes.

4.2 Geology, Soils and Mineral Resources

SIGNIFICANCE CRITERIA

Impacts related to geological resources are considered significant if:

- Risk to human health and safety from geologic hazards is increased
- The impact leads to other adverse impacts
- Unique geological or paleontological features or sites are impacted
- Subsidence, erosion or siltation are substantial
- The recovery of other geological resources is impeded.

METHODOLOGY

This analysis was performed by evaluating available data, information, and reports. These references are provided in the References Section. No additional data collection or field investigations were performed.

IMPACT OVERVIEW

The proposed project includes limited surface disturbance, occurs in a relatively flat valley, and has low seismic and volcanic activity; the potential effects related to geological conditions are less than significant.

EFFECTS OF PROPOSED ACTION

Potential geologic hazards include seismic and volcanic activity, ground subsidence, liquefaction, slope instability and landslides. The effects of these hazards are discussed below.

Seismicity

The project is located in an area of low seismic activity with no recent faulting and low topographic relief. There are no seismic epicenters located in Modoc County (USGS 1984). Any ground shaking, settlement, or seismically induced earth movement are not expected to pose a risk to human health and safety.

Although severe ground shaking could potentially rupture a pipeline, the low level of seismic activity is unlikely to produce enough ground movement to cause rupture of the 4-inch PVC pipeline. If a pipeline ruptured, the fluid spilled would probably either seep into the ground in the vicinity of the pipeline (pasture and border of the county road), or flow into the Pit River. The fluids that would spill would likely occur after the carbon treatment. No other project structures are vulnerable to rupture due to seismic shaking. Modoc County requires that facilities be constructed according to the most recent accepted building standards for earthquakes.. No additional mitigation measures are required.

Liquefaction

Although the Pit Series soil in the project area along the Pit River is frequently saturated, the soils in the project area are fine-grained and well consolidated and a seismic event is not likely. Therefore, the combination of the three conditions that can produce liquefactions (see Section 3.2 Geology, Soils and Seismicity) are highly unlikely and the potential for liquefaction in the project area is less than significant.

Volcanism

A natural volcanic event is unlikely to be close enough to present a significant risk to human health & safety, or to trigger landslides or slope instability. However, potentially active volcanic centers to the northwest and southwest (Mount Shasta and Mount Lassen) could produce airborne ash that could fall at the site, but it is unlikely to affect the project. Potential eruptions at Medicine Lake Highlands are unlikely and in any case are not expected to be sufficiently violent to generate airborne material. Therefore the risks of adverse impacts to the project or from the proposed action related to volcanism are not significant.

Subsidence

Ground subsidence is not expected to occur as a result of geothermal fluid withdrawal because of the competent nature of the rocks overlying the geothermal aquifer and the low volume of fluid withdrawal. No other action related to the project might cause subsidence; therefore, the project would not cause significant impacts related to subsidence.

Slope Instability/Landslides

The proposed action is located in an area with low topographic relief, relatively competent rocks, and little surface disturbance is proposed. It is unlikely that the project would produce or be affected by slope instability or landslides.

Unique Geologic Features

There are no unique geological or paleontological resources in the project area; consequently, construction and operation of the proposed project would have no impact on these types of features.

Erosion

The prominent soil type in the project area, the Pit Series, has low erosion potential. The project area is flat to gently sloping with little surface disturbance and relatively competent soils. The project is not expected to produce erosion or be adversely affected by erosion.

Topography

Topography would not be affected, as construction is limited to installation of piping, a pipeline, and two small buildings. No grading or other civil work is proposed. Therefore the project would have no significant effect on topography in the area.

Expansive Soils

Expansive soils can have an adverse effect on facility foundations when moisture causes the soil to swell and soften. The two proposed buildings would be constructed on Barnard gravelly loam, which has low expansivity. The discharge pipeline would be laid primarily in the Pit Series soil type, which has higher expansivity than Barnard gravelly loam. Linear structures such as the discharge pipeline are not significantly affected by the shrink-well potential of soils with high expansivity. Engineering controls accommodate these soil properties, for example, by lining the pipe with gravel. Gravel has low shrink-swell potential and adjusts to accommodate the soil around it, keeping the contained pipe intact. The project would not be affected by expansive soils.

Mineral Resources

No aspect of the proposed action would take place in the vicinity of the volcanic cinders identified in Section 3.2 (Geology, Soils and Seismicity). No other mineral resources were identified in the project vicinity. There would be no impact to mineral resources.

MITIGATION MEASURES

No further mitigation measures are required.

EFFECTS OF ALTERNATIVE B (NO ACTION)

If the project were not constructed due to lack of DOE funding, there would be no adverse effects to geology, soils, or mineral resources from Alternative B, the "No Action" alternative; however, the project could proceed without DOE funding contingent upon alternative funding, with effects from Alternative A potentially worse without DOE participation because no mitigation would be required (except NPDES required items). Without funding by DOE, I'SOT would not be reimbursed for costs resulting from permitting efforts, engineering consultation, and system installation costs. No data gathering system would be installed for DOE research and development (R&D) purposes.

4.3 Hydrology and Geothermal Resources

SIGNIFICANCE CRITERIA

The proposed action would be considered to have a significant impact on the environment if it would:

- Substantially deplete or degrade groundwater resources
- Change the amount of surface water in any water body
- Contaminate a public water supply
- Substantially degrade water quality
- Interfere substantially with groundwater recharge
- Cause substantial flooding, or expose people or property to water-related hazards such as flooding
- Substantially deplete or degrade the geothermal resource

METHODOLOGY

This analysis was performed by evaluating available data, information and reports. These materials are listed in Section 7.0, References. No additional data collection or field investigations were performed.

IMPACT OVERVIEW

Potential effects of the proposed project on hydrologic resources are limited to the effect of discharge of geothermal effluent on surface water quality, primarily the Pit River. These impacts have been thoroughly addressed in the NPDES Waste Discharge Requirements, Order No. R5-2002-0079 (the Order); compliance with that Order encompasses required mitigation measures for potential water resources impacts. If the requirements, limitations, and monitoring required by the Order are implemented no significant impact on water quality related to project operations would result (Finding 19 of the Order) and therefore no additional mitigation measures are indicated.

EFFECTS OF PROPOSED ACTION

Water Use

No increase in potable water use is projected for the proposed project. Potable make-up water would be pumped from the on-site potable water well to replace hot water drawn for domestic use from the circulating heating water. The amount of domestic potable make-up water would be approximately 3,660 gallons per day (gpd). Hot water consumption would not necessarily change as a result of the project because the existing water consumption will move to the new buildings. The impact to potable water would be less than significant.

Groundwater Water Quality

Local groundwater quality could be adversely affected if geothermal fluids were mixed with groundwater. The geothermal well presents a potential conduit for cross contamination between the aquifers. Surface infiltration of spills of geothermal fluid from the well and heat exchange facilities of the pipeline present a possible additional pathway for the mixing of geothermal fluids and shallow groundwater.

Groundwater quality is typically protected during drilling of geothermal wells by sealing shallow groundwater with appropriate casing and cement. The project well is cased and sealed with telescoping casing to 1,600 feet below ground surface (bgs). Caliper logs indicate that the casing is intact; therefore, it is highly unlikely that shallow aquifers would be affected. Proper well maintenance and future well abandonment required by DOGGR regulations will protect the integrity of the well and surrounding groundwater in the future.

Because the project does not include additional drilling, surface spills of geothermal fluids would be limited to geothermal fluid from the wellhead, heat exchanger, or pipeline. Given the low flow rates (a maximum or 60 gpm), the volume of spill is unlikely to be sufficient to cause an adverse impact to groundwater quality (see also the discussion of potential effects of spills in Section 4.12, Health and Safety).

Pipeline Breakage. Buried pipelines can break because of natural earth movement, corrosion, or accidental damage. Natural earth movement capable of breaking the pipeline includes seismic movement, shrinking and swelling of clays, and landslides. Although significant movement related to seismic activity or landslides is unlikely, (see Section 3.2, Geological Resources) soils in the area have a moderate to high shrink swell potential and are corrosive. Implementation of Mitigation Measure 4.3-1 will reduce the risk pipeline breakage due to the potential soil conditions (e.g. high shrink-swell potential and corrosivity) to a less than significant level. Additionally, the pipeline would be made of polyvinyl chloride (PVC) and would be less susceptible to corrosion than metal piping.

The proposed buried discharge pipeline presents a potential to affect shallow groundwater if the pipeline breaks and geothermal effluent is discharged directly to the ground. The gravel bed on which the pipe would be laid would conduct any water leaks downward. A leak of sufficient volume and duration could seep into groundwater. Groundwater depth below the pipeline varies from 20 ft to approximately 3 ft bgs as it approaches the Pit River. Mercury levels in the treated effluent would meet drinking water standards, but arsenic and boron levels would not. The implementation of Mitigation Measure 4.3-1 would reduce the likelihood of a pipeline break, and potential for contamination of groundwater, to a less than significant level. The implementation of Mitigation Measures 4.3-2 would reduce the likelihood of a leak of substantial volume remaining undetected for more than a month to less than significant level.

The risk of accidental damage will be reduced to a less than significant level by the laying of the pipeline 3 feet below the ground surface. This depth would ensure the pipeline's safety from accidents related to normal small town and farming activities such as cultivation and vehicular traffic. Major accidents such as drilling or digging with large construction equipment right on top of the pipeline would be required to cause a breakage.

Based on conversation with the RWQCB (Rohrbach 2002) it was determined that given the specifications of the discharge pipeline, the pipeline leak monitoring method initially outlined in the WDR (Appendix D) required more detail. Monthly inspection of the pipeline route would reveal only those leaks due to surface disturbance activities that may have damaged the pipeline (Rohrbach 2002). The 3-foot deep pipeline would be laid on a gravel bed, directing leaking fluids downward. Surface pooling of leakage would be unlikely and measurements of flow or pressure-testing would be more effective at detecting leaks due to underground causes (Rohrbach 2002). Mitigation Measure 4.3-2 was developed in consultation with the project engineer (Brian Brown, Brian Brown Engineering) and combines both inspection of the pipeline route for surface disturbance and pressure testing of the pipeline. This

measure would ensure that major leaks caused suddenly by construction or other ground-disturbing activities are detected within one month of occurrence, and minor leaks caused gradually by earth-shifting or pipeline degradation are detected within one year of occurrence. Implementation of Mitigation Measure 4.3-2 would reduce the risk of groundwater contamination to a less than significant level.

Surface Water Quality

Expression of Contaminant Levels. The magnitude of adverse effects that contaminants have on the health of humans and other organisms varies significantly from contaminant to contaminant. Drinking water standards for one contaminant may be orders of magnitude higher or lower than the standard for another contaminant. To avoid using excessive zeroes and decimal places, standards for individual contaminants are expressed in units most appropriate for the respective magnitude of the number. In this document, the units used are primarily nanograms per liter (ng/L) and micrograms per liter (μg/L). Arsenic and boron, for example, are expressed in micrograms per liter (μg/L), whereas mercury is expressed in nanograms per liter (ng/L). One thousand nanograms equals one microgram. Five micrograms is one thousand times more than 5 nanograms. The project proponent submitted a Report of Waste Discharge dated July 11, 2001 and applied for a NPDES permit to discharge waste. The NPDES Permit No. CA 0084859 was issued on May 13, 2002 by the CVRWQCB with the following specific restrictions, limitations and monitoring requirements.

1. Discharge will occur through a 4-inch diameter polyvinyl chloride (PVC) line and a diffusion manifold into the Pit River approximately 425 feet upstream from Modoc County Road 54 Bridge.
2. Discharge effluent temperature shall be ≤80 °F.
3. The discharge of effluent is prohibited when dilution by river water is less than 22.5:1.
4. The by-pass or overflow of effluent from the collection, transport, treatment, or disposal facilities to surface waters other than those designated for disposal purposes is prohibited.
5. The discharge of effluent to the Pit River with concentrations of arsenic >10 μg/L or mercury >50 ng/L is prohibited.
6. The maximum rate of effluent discharge shall not exceed 0.087 million gallons per day (or 60 gpm averaged over one day).
7. The effluent discharge pH shall be between 6.0 and 9.0.
8. Survival of aquatic organisms in 96-hour bioassays of undiluted effluent shall be no less than: Minimum for any one bioassay = 70%; Median for any 3 or more consecutive bioassays = 90%.
9. Receiving water (Pit River) must meet various limits as outlined in Table 4.3-1.

In order to achieve these objectives and limitations, the project proponent is required to install and operate a mercury treatment system, and comply with the orders Monitoring and Reporting program, which includes conducting fish tissue analysis, chronic toxicity testing, and periodic water quality monitoring.

Mercury. The Waste Discharge Requirement (WDR, Appendix D) sets 50 ng/L of mercury as the limit for both the receiving water and the effluent. Mercury levels in water from the geothermal well have been

shown to be as high as 231 ng/L (Basic Laboratory 2002); therefore, the WDR requires a mercury abatement system for the effluent as well as monitoring to determine the efficacy of that system. Testing of the granular activated carbon (GAC) filtration (bench scale testing conducted by Basic Laboratory Inc, April 18, 2002, see Appendix I) indicated that mercury removal efficiencies ranged from 92 to 99%, depending on the flow rate of the water through the filter. At 92 to 99% removal efficiency, the GAC filter system is expected to yield effluent mercury levels within the 2 to 19 ng/L range. This suggests that available technology is capable of achieving lower effluent mercury levels than those required by the WDR.

Table 4.3-1: NPDES Permit Receiving Water Limitations

Constituent	Limitation in Receiving Water
Arsenic	<10 μg/L
Boron	<600 μg/L
Mercury	<50ng/L
Dissolved Oxygen	<7 mg/L
Oil, grease, wax or any material	Visible film or nuisance or adverse effect on beneficial use
Chlorine	<detection
Discoloration	Aesthetic desirability
Fungi, slime or other objectionable growth	<Any
Turbidity	<1 NTU when background is 0-5 NTU
	<20% when background is 5-50 NTUs
	<10 NTUs when background is 50-100 NTUs
	<10% when background is>100 NTUs
pH	6.5 < pH < 8.5; change of >0.5 prohibited
Temperature	<5°F
Radionuclides	<MCLs CCR Title 22
Taste or Odor	Undesirable or adverse effect on beneficial use
Toxic pollutants	Prohibited
Applicable water quality standards	Violations prohibited

SOURCE: CVRWQCB WDR No. R5-2002-0079 2002

Due to its bioaccumulative properties and the potential effects on wildlife, mercury was not given a dilution credit by the water board. Withholding a dilution credit for mercury serves to limit the total amount of mercury entering the river, but does not mean that dilution does not occur. For the purposes of modeling mercury concentrations in the Pit River, river flow rates and effluent flow rates are used along with background river mercury concentrations and predicted effluent mercury concentrations.

The WDR recognizes that under worst-case conditions, dilution of the effluent occurs at a factor of 22.5 as it mixes with River water. Worst-case conditions would occur with a Pit River flow rate of 3 cubic feet per second, an effluent flow rate of 60 gallons per minute, and an effluent mercury concentration of 50 nanograms per liter.

The Pit River typically only reaches flow rates as low as 3 cfs in dry, summer conditions. The effluent flow rate of 60 gallons per minute is the highest level permitted; however, preliminary flow testing has shown a peak flow rate of 37 gallons per minute from the well. Peak flow of 37 gpm is expected only during winter months when maximal use of the geothermal heat is required.

Effluent mercury levels of 50 ng/L is the maximum permitted under the WDR; however, preliminary testing of the carbon treatment system suggests that treated effluent mercury levels will be in the range of 2 to 19 ng/L. The following analysis assumes these highly unlikely conditions (flow rate of 60 gpm and mercury concentration of 50 ng/L) to provide a worst-case scenario. Actual effects to water quality would be less.

A dilution factor of 22.5 applied to an effluent containing 50 ng/L of mercury would result in an increase in river mercury levels of 2.2 ng/L. Baseline Pit River mercury levels at the point of discharge averaged 1.72 ng/L (Frontier Geosciences 2002, Appendix I). For further details on baseline mercury levels in the Pit River, see the discussion below. An addition of a maximum of 2.2 ng/L to an average baseline concentration of 1.72 ng/L would result in a maximum post-effluent River concentration of 3.9 ng/L, well below the EPA limit for human drinking water of 50 ng/L. Compliance with human drinking water quality standards does not necessarily translate to compliance with standards or thresholds determined to be protective of wildlife. Effects on wildlife are discussed in Section 4.4, Biological Resources.

The Pit River mercury value of 1.72 ng/L resulting from the analysis by Frontier Geosciences in 2002 (Appendix I) differs considerably from the value for mercury concentrations in the Pit River quoted in the WDR (9.7 ng/L). The 9.7 ng/L value for mercury concentration is an average of results from samples collected by the RWQCB on July 31, 2001 for the WDR, and by Dale Merrick on June 25, 2001 for the California Toxics Rule (Rohrbach 2002). The summer season of 2001 was unusually dry, and a background mercury level in the range of 9.7 ng/L seems highly unusual (Rohrbach 2002). This value is a poor indicator of normal summer mercury levels in the Pit River because of the drought (Rohrbach 2002). In July of 2001, the flow rate of the river was less than 3 ft/s from July 7th through August 3rd.The Pit River upstream of Canby was completely dry until the point of discharge from the Alturas wastewater treatment facility in Alturas (Rohrbach 2002). It is likely that the only sources of water in the Pit River at Canby were the treated wastewater effluent from Alturas, the estimated 400 gallons per minute coming from Kelley Hot Springs, and any agricultural runoff occurring between Alturas and Canby. Water from Kelley Hot Springs is estimated to have mercury levels of 15 ng/L and enters the Pit River at approximately 2 miles upstream from Canby. Under the extremely dry conditions of 2001, it is conceivable that the bulk of water in the Pit River at Canby originated from Kelley Hot Springs, resulting in mercury levels in the range of 10 ng/L.5

On the day of sampling, the river exhibited its 25th consecutive day with a flow rate of less than 3 ft/s. According to USGS data, the average flow for July of 2001 was 8.60 ft/s, while normally, the average flow for July (taken from 1904-2001) is 65.9 ft/s (USGS archived data 2003). This drought would have attributed to the unusually high mercury concentration.

~~In the summer of 2001, the Pit River upstream of Canby was completely dry until the point of discharge from the Alturas wastewater treatment facility in Alturas (Rohrbach 2002). It is likely that the only sources~~

~~of water in the Pit River at Canby were the treated wastewater effluent from Alturas, the estimated 400 gallons per minute coming from Kelley Hot Springs, and any agricultural runoff occurring between Alturas and Canby. Water from Kelley Hot Springs is estimated to have mercury levels of 15 ng/L and enters the Pit River at approximately 2 miles upstream from Canby.~~

The unusually dry conditions of 2001 make 9.7 ng/L a poor indicator of normal summer mercury levels in the Pit River. Such conditions may occur from time to time; however, when flow rates are less than 3 ft/s permits do not allow discharge. September 2002 was also a dry year and had a flow rate average of 12.57 ft/s. Normally, the average flow rate in September (taken from 1904 to 2001) is 82.0 ft/s (USGS archived data 2003). Since flow rates were higher than 3 ft/s for 25 of 30 days in September, this data was more appropriate to use, although still representing a conservative case, given that the flow rate was well below the monthly average. Mercury levels are expected to be even lower than the 1.72 ng/L range under more normal conditions (Rohrbach 2002). To achieve a more representative estimate of impacts to the river, the 2002 data was used for the water quality impact analysis.

Arsenic. Geothermal effluent has been shown to contain arsenic in the range of 98 to 110 µg/L. This level exceeds the US EPA Maximum Contaminant Level (MCL) for arsenic of 50 µg/L and the Basin Plan Water Quality Objective of 10 µg/L. Unlike mercury, arsenic does not bioaccumulate; therefore, it is not of concern for wildlife such as the bald eagle which preys on fish in the Pit River. The WDR (Appendix D) sets a dilution credit of 22.5, which is the expected dilution ratio in the river during low flow season conditions at maximum geothermal flow of 60 gpm. At an effluent concentration of 110 µg/L and a dilution factor of 22.5, the discharged arsenic would be diluted to a concentration of 5 µg/L in the Pit River. The effluent arsenic concentration limit in the WDR is set at 150 µg/L.

The CVRWQCB indicated (Finding 19) that compliance with the requirements of the order would result in an insignificant impact on water quality; therefore, no additional mitigation measures are required.

Boron. Geothermal effluent has been shown to contain boron in the range of 3240 to 4090 µg/L, exceeding the applicable receiving water quality standard. Boron is not expected to increase in the discharge over time. The receiving water objective established in the WDR is 600 µg/L. Based on the mixing zone study (Appendix J) and a required minimum dilution of 22.5:1, the discharge would meet the receiving water limit at the diluted levels of 144 to 182 µg /L. An effluent limitation has not been established for boron (Appendix D).

Flooding

The proposed project does not alter the drainage and therefore will not affect flooding in the area. The buried pipeline would not be affected by flooding.

Geothermal Resource

The proposed project would include extraction of an annual average of 15 gallons per minute (gpm) of geothermal fluid from the geothermal aquifer. Pressure in the aquifer causes geothermal fluids to naturally surface at Kelley Hot Springs at an approximate flow rate of 400 gpm, approximately 2 miles from the I'SOT community. The relatively low flow extraction rate would have a less than significant impact on the geothermal resource.

Due to the moderate average withdrawal rate of approximately 15 gpm, distance from other uses (Kelley Hot Springs is approximately 2 miles east), and lack of cooler water injection, no adverse impacts to the

geothermal resource are anticipated. At Kelley Hot Springs there is a natural surfacing of geothermal fluids at a rate of approximately 400 gpm, indicating a surplus of geothermal fluid in the aquifer. The modest extraction rate of an average of 15 gpm would not have a significant impact on the geothermal resource, and injection of withdrawn fluids is not required to protect the geothermal resource.

MITIGATION MEASURES

Mitigation Measure 4.3-1. I'SOT will design and construct the pipeline according to standard engineering practices and codes such as the American Water Works Association (AWWA) or American Society of Mechanical Engineers (ASME) Power Piping Code B31.1.

Mitigation Measure 4.3-2. I'SOT shall inspect the pipeline route on a monthly basis for possible pipeline damage generated from surface activities such as construction. Potential damage will be investigated and repaired, if necessary. I'SOT shall, upon pipeline installation and on an annual basis thereafter, perform a pressure test of the discharge pipeline. The pressure test shall involve blocking the pipeline at the discharge point such that no discharge escapes, filling the pipeline with water, and observing the water level at the head of the pipeline over time. A fall in water level indicates a leak in the pipeline and shall be followed by shutdown of the geothermal flow. Use of the discharge pipeline shall not recommence until the leak is identified, repaired, and a further pressure test indicates the pipeline is sealed. The leakage limit will be set as the manufacturer's estimate for leakage under the project's operating conditions. I'SOT shall provide the results of this testing to NREL during the first 3 years of operation.

Mitigation Measure 4.3-3. The WDR sets 50 ng/L as the limit for mercury concentration in the effluent to be protective of water quality and wildlife. The GAC filter system removes 92-99% of incoming mercury yielding effluent mercury levels within a 2-19 ng/L range. Higher concentrations in the effluent may suggest declining filter efficacy. I'SOT will replace the GAC filters according to manufacturer's specifications. The mercury concentration in the effluent will be monitored monthly for the first six months and quarterly thereafter. If mercury concentrations in the effluent are found to be 45 ng/L, I'SOT will replace the GAC filters.

EFFECTS OF ALTERNATIVE B (NO ACTION)

If the project were not constructed due to lack of DOE funding, there would be no adverse effects to hydrologic or geothermal resources from Alternative B, the "No Action" alternative; however, the project could proceed without DOE funding contingent upon alternative funding, with effects from Alternative A potentially worse without DOE participation because no mitigation would be required (except NPDES required items). The following measures would not be implemented without DOE involvement: 4.3-1 and 4.3-2. Without funding by DOE, I'SOT would not be reimbursed for costs resulting from permitting efforts, engineering consultation, and system installation costs. No data gathering system would be installed for DOE research and development (R&D) purposes.

4.4 Biological Resources

SIGNIFICANCE CRITERIA

Federal and California endangered species laws require protection of listed endangered or threatened species. Other special-status species include

- Species proposed for listing or designated as species of concern by the USFWS
- Species of special concern identified by the California Department of Fish and Game (CDFG), the CDFG Natural Diversity Data Baste (CNDDB) list, and CNPS's Inventory of Rare and Endangered Vascular Plants of California
- Rare and endangered plant species regardless of whether they are formally listed.

Under NEPA, impacts to biological resources would be considered significant if they result in harm, harassment, or destruction of any endangered, threatened, or rare species (including proposed species), its habitat, migration corridors, or breeding areas.

METHODOLOGY

Vegetation

The Natural Diversity Database (NDDB) for Modoc County (rev. April 05, 1999) was used to create a list of species that are likely to occur at the project location. Occurrences for the Washington Mountain and Canby 7.5' Quadrangles (September 4, 2002) were also queried using the September 4, 2002 version of Rarefind2 (an electronic database). Soil survey maps and descriptions for the project area were obtained from the Natural Resources Conservation Service (NRCS) (Chico office) prior to fieldwork. The field surveys were conducted in September 2002. A list of all plant species encountered was prepared (see Appendix F), notes were taken concerning existing environmental conditions, and a written report was completed. All plants were identified based on the taxonomy of *The Jepson Manual of Higher Plants of California* (1993). Any plant species that were not identifiable at the project site were collected, later identified, and then added to the original species list. Plant communities were identified using *A Manual of California Vegetation* (1995) in the field and delineated on aerial photographs. The common names for many species were acquired from The CalFlora Database, an online electronic resource (September and October 2002).

Wildlife

A records search was conducted to determine if any special-status species were previously reported within the assessment area. A review of files maintained by the CDFG Natural Diversity Data Base (CNDDB 2001) was also conducted. The CNDDB is a computerized inventory of information maintained by CDFG on the general location and status of California's rare and threatened animals, plants, and natural biological communities. The CNDDB includes information on reported sightings only. Those state-listed and sensitive wildlife species occurring within the quadrangle that encompasses the project area are also presented in Appendix F.

The Klamath Falls office of the USFWS was contacted for a summary of all federally listed, proposed, and candidate species within Modoc County. The USFWS list of wildlife and fish species is presented in

Appendix H. USFS biologists for the Modoc National Forest were also consulted for information about known threatened and endangered species in the project area. A literature search was performed for information on foraging habitats on the Pit River.

Once a list of potential rare, threatened or endangered wildlife species from both the Federal and State sources was obtained, an assessment area for potential impacts or disturbances to these species was determined. The assessment area was defined as the route from the geothermal well to the Pit River, the immediate area of discharge, the immediate area downstream from the point of discharge, and any potential breeding habitat for sensitive species within several miles of the project. This distance was chosen to encompass the range of any potential or known raptor territory and nest sites.

The habitat analysis for sensitive species was conducted in two phases. First, the records of the CNDDB were searched as described above, and added to the correspondence provided by the USFWS and USFS. Any listed species with no potential for habitat within the assessment area, such as marine-dependant species, were dropped from the list for analysis. Next, a field investigation was conducted to observe habitat conditions and define habitat occurring on or near the project site and within the assessment area. The field investigation was conducted in August 2002 (Galea 2002). All potential habitats within the assessment area were assessed for their potential for listed species.

OVERVIEW OF EFFECTS OF PROJECT ALTERNATIVE A

A Biological Assessment (BA) has been prepared in coordination with the USFWS based on the analysis presented below. The BA is based on the information contained in the biological resources section of the EA

Construction Impacts

The primary construction-related effect on biological resources would result from the construction of the pipeline transporting effluent to the Pit River. The PVC line would be trenched into the ground (at 2 feet wide by four feet deep) beginning at the I'SOT facility in Canby on the north side of Route 54, continue through a pasture, under an existing roadway, and under Route 299 (see Canby/Geothermal Project Area and Habitat Designations in Appendix E). Once across the highway, the trenched line would be placed underground through another existing pasture. The line would then be ditched into an existing, raised berm running through a wet pasture area along the Pit River, which provides vehicular access to the concrete weir. The pasture area contains federally protected wetlands as defined by Section 404 of the Clean Water Act (see Appendix E); however, utilizing the raised berm for access minimizes impacts to the wetland areas. The trenching of the pipeline would involve temporary removal of small amounts of soil and vegetation, which would have a minimal effect on plant life in the project area. Vegetation would be replaced when the trenching is completed.

Operational Impacts

The primary impact of operation is the discharge of geothermal effluent (that contains mercury) to the Pit River. The discharge could have an impact on fish and foraging migratory and resident birds. Other operational effects to wildlife, vegetation, and livestock could result from a break or leak along the length of the pipeline. With mitigation, the impacts to wildlife would be less than significant.

GENERAL VEGETATION AND WETLANDS

Impact Overview

Small amounts of vegetation would be temporarily disturbed during the placement of the PVC pipeline along the mile-long route to the Pit River. For the portion of pipeline that traverses the sagebrush steppe habitat area, there would be minimal impact on existing vegetation and minimal impact on wildlife habitat because this land has been almost completely converted to agricultural and residential use. In the portion traversing wetland habitat, impacts to the area would be minimized because the majority of ground plant mass has been removed by heavy cattle grazing and the pipeline will follow an already established levee. Installation of the pipeline will result in temporary disturbance to 0.03 acres of jurisdictional wetland. If a leak or break occurs along the pipeline there could also be some impacts to adjacent vegetation from the accidental discharge of geothermal fluids. Mitigation is defined to ensure minimal disturbance or potential disturbance to wetland and drainage habitat. Specific potential impacts and mitigation measures are identified below.

Removal of Vegetation During Pipeline Construction

Vegetation. Excavation for the pipeline would include using a trenching implement on the back of a track-type tractor or similar device. The trench will be 2 feet wide by 4 feet deep. The upland two thirds of the project pipeline can be described as sagebrush steppe; however, most of the natural community has been converted into either residential dwellings or agricultural fields (see Canby/Geothermal Project Area and Habitat Designations in Appendix E). Imported fill material as well as surrounding soil was used in the construction of this levee system. Most of the area comprising the top of the levee is void of vegetation and shows no signs of wetland conditions. With the exception of 0.03 acres (Appendix E) the entire levee system has been delineated as upland, non-wetland habitat. Alternative Route A follows an existing levee system and is virtually denuded of vegetation.

The temporary loss of this vegetation during pipeline construction would not be significant. The impacts of the temporary project disturbance and removal of vegetation in this area would also be less than significant. Potential effects to sensitive species are described below.

Since the project does not involve a significant soil disturbance, opportunity for soil erosion is small. The project is not a large industrial project, and does not require a Storm Water Prevention Pollution Prevention Plan (Rohrbach, personal communication 2002).

Wetlands. In the wetland area that the pipeline traverses, a levee system bisects the area leaving the northward side drier than that of the unaltered wetland system that is adjacent to the Pit River drainage (see Canby/Geothermal Project Area and Habitat Designations in Appendix E). The severity of the cattle grazing in this wetland has left only sparse plants and a dominance of grass species. Vegetation in this area is most likely hydrophytic (water dwelling) because of the prominence of wetland soils and wetland hydrology.

The pipeline construction would affect 0.03 acres of wetland vegetation. There would be some disturbance to the vegetation that would be temporarily removed during trenching. This disturbance would be significant without mitigation; however, mitigation measure 4.4-1 would reduce the effects to vegetation to a less than significant level by requiring that excavated vegetation be retained and replaced after the pipeline is installed.

The pipeline construction could also affect the wetland water drainage due to the digging of a trench that could collect water in the wetland. A change in drainage could affect vegetation. Mitigation measure 4.4-2 would reduce the effects on wetland drainage effects to less than significant levels.

Mitigation Measure 4.4-1

To minimize the impacts to removed vegetation in the wetlands and other areas, during trenching, I'SOT will ensure that soil will be placed on either side of the trench. As much of the soil with its original vegetation as needed to return the ground to the original contour will be replaced immediately after the pipeline installation is completed. Due to the bedding material and pipe diameter, all of the removed soil will not refill into the trench; however, the fill soil will contain enough of the original vegetation to retain plant growth.

Mitigation Measure 4.4-2

To reduce likelihood of affecting drainage in the wetlands, I'SOT will carefully plan the timing of project implementation. I'SOT will perform construction activities adjacent to drainages and wetlands would be performed when the probability of heavy rain is minimal and inundation of the project wetlands is reduced due to manipulation of the weirs. This driest time, when construction would be carried out, falls between February and March. Replacement of weir boards occurs on April 1st, causing the drained wetlands to be re-saturated by the summer months.

PIPELINE LEAKS OR BREAKAGE

As discussed in Section 4.4, Hydrology and Geothermal Resources, pipeline breakage is unlikely and will be monitored and corrected by implementation of mitigation measure 4.3-2. The depth of the pipeline (3 feet below ground surface) eliminates the risk to vegetation. The pipeline is laid on a gravel bed, which promotes the downward drainage of any leakage. On-site plants have shallow root systems and would not be affected by such leakage. Additionally, in the event of a leak, the escaping water would be post-treatment. Mercury levels in the water are at concentrations deemed safe for drinking water. Boron does not bioaccumulate and arsenic bioaccumulates at an insignificant rate from soil into plants (Savannah River Site 1999). No special-status plants were found along the pipeline route. The risk to plants from pipeline leaks or breakage is less than significant.

SENSITIVE PLANT SPECIES

Most of the proposed project would occur on areas that support little vegetation; however, a minimal amount of wetland area would be disturbed during trenching resulting in a significant but temporary impact. The total discharge pipeline disturbs 6.2 acres including 25 feet on both sides of the piping. Only 0.03 acres of wetland would be directly affected. No special status species were identified in the fall 2002 Botanical Survey (Appendix F); however, the time of year when the botanical survey was completed is less than optimal for the identification of many annual species that have potential habitat on site. Table 4.4-1 summarizes impacts to special status plants present or plants potentially present at the project site. Specific potential impacts and mitigation measures are identified below.

Table 4.4-1: Summary Of Potential Impacts To Special Status Plants At The Project Sites

Species	Status	Potential Impacts
Boggs Lake hedge-hyssop (*Gratiola heterosepala*)	State E, CNPS 1B	Damage or loss of existing plants along pipeline in wetland area south of Canby
Howell's thelypodium (*Thelypodium howellii ssp. howellii*)	CNPS 1B	Damage or loss of existing plants along pipeline in wetland areas
Long-haired star-tulip (*Calochortus langebarbatus var. longebarbatus*)	CNPS 1B	Damage or loss of existing plants along pipeline in wetland area
Eel-grass pondweed (*Potamageton zosteriformis*)	CNPS 2	Damage or loss of existing plants along pipeline in Pit River drainage
Hillside arnica (*Arnica fulgens*)	CNPS 2	Damage or loss of existing plants along pipeline in wetland area in the south end of the project
Falcate saltbush (*Atriplex gardneri var. falcata*)	CNPS 2	Damage or loss of existing plants along pipeline in upland project area

State: E-Listed as endangered under the California Endangered Species Act
CNPS: 1B-plants rare, threatened or endangered in California and elsewhere; 2-rare, threatened or endangered in California but not elsewhere (California Native Plant Society).

SOURCE: Stuart Consulting 2002, NDDB Quad Search, 2002, USFWS Modoc County List

Boggs-Lake Hedge-Hyssop, Hillside Arnica, Long-Haired Star-Tulip, Howell's Thelypodium

Boggs-Lake Hedge-Hyssop, Hillside Arnica, Long-Haired Star-Tulip, and Howell's Thelypodium were not found in the surveys of the project area; however, each of these species was initially determined to be potentially present within the project area based on geographic range and suitable habitat conditions of the wetland areas. The levee road is bare of vegetation due to use as a vehicle access road. The 0.03 acres of wetland the pipeline crosses before terminating at the Pit River lacks suitable habitat to support any of these species. (Kristiaan Stuart, personal comm., 2002c). There would be no significant impact on any of these species.

Falicate Saltbrush

Falicate Saltbrush is known to occupy open alkaline soils in sagebrush scrub and is known to occur 0.3 miles northeast from the project area (Appendix F). Much of the upland habitat in the project area previously had suitable habitat for this species; however, under the current agricultural and grazing regime it is very unlikely that this perennial species would be found within the project area. There would therefore be no impact to the species.

Eel-grass Pondweed

Eel-grass pondweed is an aquatic, annual herb that occupies freshwater wetlands including ponds, lakes, and streams. The species has been collected on the Pit River drainage within the project area, even though its occurrence was not detected during the project botanical survey. It should be assumed that this species is present since the survey was conducted at the wrong time for detection and the project

habitat is ideal for its presence. Eel-grass pondweed could be significantly impacted by construction activities.

Mitigation Measure 4.4-3

I'SOT will place a sedimentation barrier fence should be placed adjacent to and on either side of the trench through the 0.03 acres of wetland. The fence shall remain in place until the construction is complete to prevent sediment from collecting on and damaging any eel-grass plants.

WILDLIFE

Impact Overview

No direct impacts to wildlife species are likely to result from the construction of the portion of the pipeline that traverses through the town of Canby, through fallow agricultural fields in town, and under roadways. The wetland habitat has been heavily grazed and is marginal habitat for wildlife. Temporary disturbance of wetlands for installation of the pipeline would not have a significant effect on wildlife.

Suitable breeding habitat was found within the assessment area for some ground nesting bird species, such as the greater sandhill cranes and ibis, although extensive grazing, high number of grazing cows, and lack of tall vegetation may make nesting more difficult. The lack of trees, brush, or other tall vegetation reduces the potential for tree-nesting avian species in proximity to the project. There would be no impact on breeding and nesting habitat due to the disturbed nature of the construction area.

Potential foraging habitat is found to be available for some of the sensitive species in the area, especially avian predators; however, the project construction requires little equipment, involves a small area of land, and is temporary. For these reasons there should be minimal or no impact on raptor foraging in the project area. Potential habitat for many of the sensitive fish species was found to be available in the Pit River.

The effluent discharge into the Pit River would contain arsenic, boron, and mercury. While the effluent constituents do not create a significant impact to water quality (refer to section 4.3, Hydrology and Geothermal Resources), the metal levels in the effluent could represent a potentially adverse affect to wildlife through bioaccumulation in the ecosystem. Table 4.4-2 provides a comparison of current and projected Pit River concentrations for arsenic, boron, and mercury to standard concentrations for these metals set by the EPA as being protective of aquatic life in freshwater. Discussion of mercury is addressed below. After dilution, the levels of arsenic in the river are projected to be less than the EPA standard levels. The EPA has not set a level for boron; however, the post-dilution boron concentration in the river is projected to be below the NPDES permit level. These two metals do not bioaccumulate at significant rates (The Savannah River Site 1999) and therefore would not impact wildlife preying on river species. The trace amounts of mercury in the operational fluid discharge into the Pit River could have potentially significant effects on fish and bird species through bioaccumulation. Mitigation measures will avoid or reduce these effects to less than significant levels.

Table 4.4-2: Comparison Of Current And Projected Concentrations Of Key Contaminants Of Concern In The Pit River Against USEPA National Recommended Ambient Water Quality Criteria For The Protection Of Aquatic Life In Freshwater

Inorganic Constituent	Current Level in Pit River	Projected Level in Pit River	Concentration Limit
Arsenic (µg/L or ppb)	3.74 [a]	5[b]	150[c]
Boron (µg/L or ppb)	108[a]	271[b]	none established
Mercury (inorganic) (ng/L or ppt)	1.72[d]	< 4[b]	770[c,e]

Notes and Sources:
a. DWR 2002.
b. Calculated; see text.
c. Expressed as dissolved. EPA 1999.
d. Appendix I.
e. Criterion derived from data for inorganic mercury (II), but is applied to total mercury. It will probably be under protective if a substantial portion of mercury in the water column is methyl mercury. Derivation of criterion did not consider exposure through the diet, which is probably important for aquatic life occupying upper trophic levels. EPA 1997.

Effects of Project Discharge on Aquatic Habitat and Species

Project-Associated Mercury Discharge. The proposed project would add small amounts of mercury to the Pit River, which could affect aquatic life and predators that utilize the river as a food source through the process of bioaccumulation (refer to Section 3.4 Biological Resources for a definition of bioaccumulation). The proposed granulated activated carbon system (GAC) is expected to reduce effluent mercury levels by 92 to 99% resulting in a maximum projected mercury concentration in the discharge to be 19 nanograms per liter[1] (ng/L) (Appendix I). Analytical data for the geothermal effluent from the proposed project indicated an average mercury concentration of 9.7 ng/L for project flow (Appendix D). The total mercury deposition would be less than the level defined in the permit because the proponent plans a maximum of 37 gpm in winter and around 10 gpm for summer heating, resulting in only a small increase in mercury concentration in the river due to the project. The project permit allows discharge of 60 gpm with 50 ng/L of mercury.

Mercury Concentration in the Pit River after Project Discharge. The proposed project would result in a low level of mercury being discharged into a river system. The final concentration of mercury in the Pit River depends on the flow rate of the river, the discharge rate, the concentration of mercury in the discharge, and the concentration of mercury in the river.

A mixing zone study determined the degree of dilution given certain variables of the project (Appendix J). Greater volumes of effluent would be discharged during the colder winter months, where there is a greater volume of water running through the Pit River system. The NPDES permit indicates that the ratio of thermal effluent to river water cannot be greater than 1:22.5. The mixing zone study suggests that complete mixing will occur within 20 feet downstream of the effluent discharge point, even though the NPDES permit established a mixing zone of 425 feet to the County Road 54 Bridge. Analysis shows that at the maximum project effluent discharge rate of mercury at 50 ng/L and 60 gpm, the concentration of

[1] A nanogram is 1 x 10^{-9} grams

mercury in the river would be less than 4 ng/L. (Figure 4.4-1). During most of the year when the flow of the Pit River is higher, the final concentration of mercury in the Pit River will only change by a few hundredths of a nanogram (Figure 4.4-2).

The EPA criterion for mercury concentrations in water for the protection of aquatic life (EPA 1998) is 770 ng/L. The maximum predicted mercury water concentration level of 4 ng/L does not violate any standards to protect humans or aquatic life. Mercury bioaccumulation from the project discharge would probably be at a variable rate due to the flowing body of water with an indeterminate volume. The proposed project could raise the concentration of mercury in the Pit River, which could potentially impact wildlife in and around the river (see the analysis below).

Mitigation Measure 4.4-4

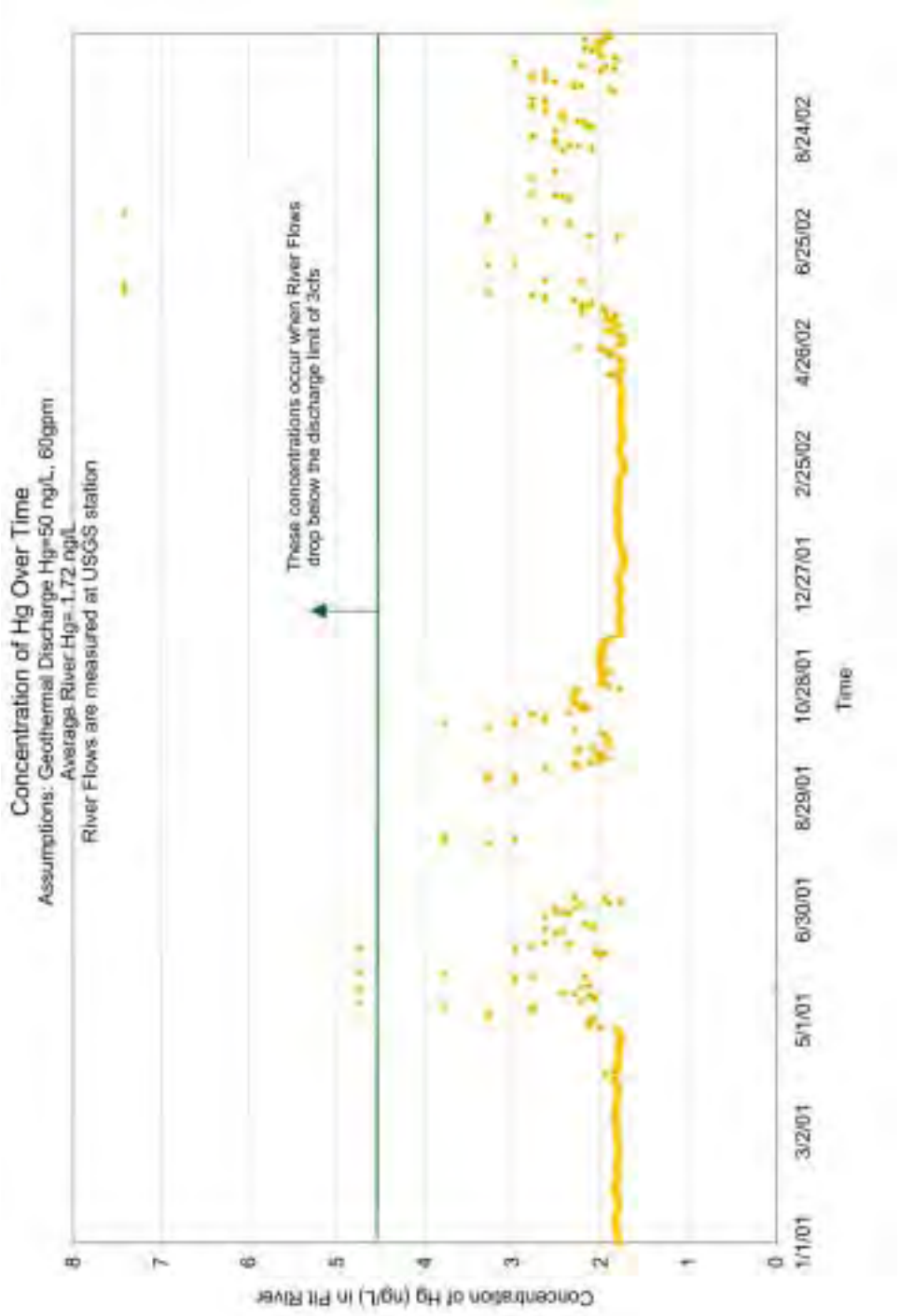
~~**4.4-4.** The concentration of mercury in the effluent will be monitored monthly. The Pit River water concentration will also be monitored monthly at two stations, one 50 feet upstream from the point of discharge and the other 425 feet downstream from the point of discharge as stated in the NPDES permit.~~

~~If the mercury concentration in the effluent exceeds the permit level of 50 ng/L, the proponent will coordinate with the RWQCB, CDFG, and USFWS to determine appropriate mitigation. Measures to reduce the effect could include, but are not limited to, temporary cessation of discharge temporary collection and proper disposal of discharge until the concentrations decrease, alternative filter systems, or injection of the spent geothermal fluids back into the geothermal reservoir.~~

I'SOT shall monitor the concentration of mercury in the effluent for six months and quarterly thereafter Refer to Mitigation Measure 4.3-3 (Hydrology and Water Quality) for requirements for replacement of the GAC filters. I'SOT shall also monitor the Pit River water concentration monthly at two stations, one 50 feet upstream from the point of discharge and the other 425 feet downstream from the point of discharge as stated in the NPDES permit. I'SOT shall provide test results to NREL for the first 3 years of operation

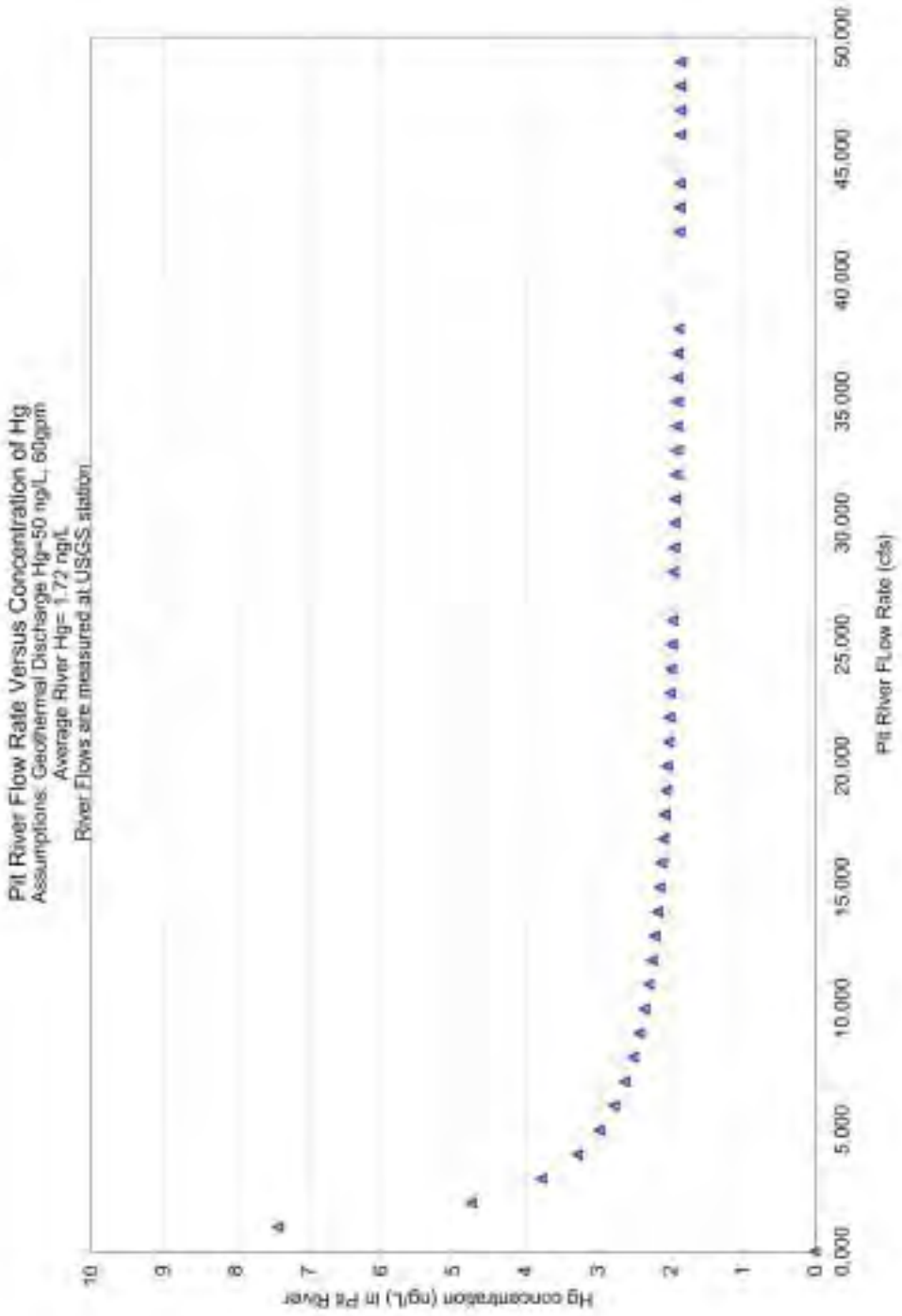
If the mercury concentration in the effluent exceeds the permit level of 50 ng/L, if concentration in the river exceeds 50 ng/L, or if assessment of the monitoring activities (including chronic toxicity testing, and fish residue analysis) suggests that discharge may result in significant increase in risk of mercury bioaccumulation in fish tissue I'SOT shall coordinate with the RWQCB, CDFG, and USFWS to determine appropriate mitigation. Measures to reduce the effect could include, but are not limited to, temporary cessation of discharge temporary collection and proper disposal of discharge until the concentrations decrease, alternative filter systems, or injection of the spent geothermal fluids back into the geothermal reservoir.

Figure 4.4-1: Concentration of Mercury over Time



SOURCE: Geologica 2002

Figure 4.4-2: Pit River Flow Rate Versus Concentration of Mercury



SOURCE: Geologica 2002

EFFECTS ON SENSITIVE WILDLIFE SPECIES

Several sensitive wildlife species listed in Table 4.4-3 may occur in the area of the project. The construction of the pipeline as well as the toxins in the effluent could directly or indirectly harm these species.

Table 4.4-3: Summary of Potential Impacts to Special Status Animals Occurring at the Project Sites

Species	Status	Potential Habitat Affected	Potential Impact
Birds			
Greater Sandhill Crane	California Threatened	Foraging, Reproductive	Prey contamination
Bald Eagle	Federally Endangered/ California Species of Concern/ California Fully Protected	Foraging	Prey contamination
While Faced Ibis	California Species of Concern	Foraging, Reproductive	None
Golden Eagle	California Species of Concern/ California Fully Protected	Foraging	None
Fish			
Modoc Sucker[1]	Federally Endangered/ California Endangered	~~None~~ Foraging	~~None~~ Habitat contamination

SOURCE: Galea 2002, NDDB Quad Search 2002, USFWS Modoc County list

1. Modoc Sucker is not known to occur in the project area according to surveys. Potential impacts are discussed because a few individuals undetected by the surveys could potentially be in the main stem of the Pit River. ~~it is a federal and California listed endangered species.~~

Bald Eagle

The U.S. EPA and the USFWS have established methyl mercury standards for the protection of the bald eagle. The three mercury standards include a daily methyl mercury intake limit, a tissue concentration limit for aquatic prey (fish), and a water concentration for prey habitat. These standards along with current and projected methyl mercury concentrations are outlined in Table 4.4-4. Further discussion and analysis of these standards is addressed below.

The U.S. EPA calculated a reference dose (RfD) for methyl mercury for avian species based on the "chronic, no observed adverse effect level" (NOAEL) from studies on mallard ducks. The RfD is defined as the daily intake (in nanograms mercury per kg body weight per day) that may occur without appreciable risk of any adverse effect on the organism; the value calculated for this bird was 21,000 ng /kg body weight per day (21 µg/kg body weight per day). Species-specific water concentration values for methyl mercury were estimated as the ratio of an RfD, to the estimated methyl mercury consumption rate for the species. The limit for bald eagles has been set at 0.082 nanograms per liter (ng/L) (EPA 1997) (see Table 4.4-4).

Table 4.4-4: Comparison Of Current And Projected Methyl Mercury Concentrations And Dosing Levels Against Limits And Levels Deemed Protective For Birds

	Current Conditions	Projected Worst Case Conditions[a]	Standard/Threshold	
			EPA	FWS
Methyl Mercury Concentration in Water (ng/L)	0.255[b]	0.558[c]	0.082[d]	n/a
Methyl Mercury Concentration in Fish Tissue (ng/g)	0.409[b]	0.895[c]	n/a	95[e,f]
Eagle's Intake of Methyl Mercury (ng/kg of body weight/day)	49[b]	107	21,000[d]	n/a

Notes and Sources:

a. Projected values based on NPDES permit limits (worst case conditions) of effluent at 50 ng/L mercury, a maximum discharge rate of 60 gpm, and a minimum river flow rate of 3 cfs).

b. Frontier Geosciences, Inc. Total Mercury in Tissue Analysis for I'SOT Project October 2002 (Appendix I).

c. Calculated; see text.

d. U.S. EPA limit protective of birds, also known as a "reference dose" or "RfD". EPA 1997.

e. Calculated from total mercury concentration limit in fish tissue for consumption by birds of 100 ng/g and a total mercury to methyl mercury conversion factor of 0.95.

f. Eisler, Ronald. 1987. Mercury hazards to fish, wildlife, and invertebrates: a synoptic review. U.S. Fish and Wildlife Service. Biological Report 85 (1.10).

The project effects on water quality and biological resources are described below.

Predicted Mercury Concentration in Pit River from Project. Project effects on water quality are described in Section 4.3 Hydrology and Geothermal Resources. The effects are summarized here. The proposed project would not significantly increase the concentration of mercury in the Pit River water (Figure 4.4-1 and Figure 4.4-2). At times when the river flow rate is lowest (but still higher than 3 cfs, the minimum discharge limit set by the NPDES permit to discharge effluent into the river), the final concentration in the river taken 425 feet downstream would be less than 4 ng/L (refer to Figure 4.4-1 for the maximum final concentration of mercury in the Pit River). A concentration of 4 ng/L falls below regulatory thresholds for protection of humans and aquatic species. The final concentration of mercury in the river would only reach 4 ng/L under the worst-case conditions where 50 ng/L mercury is discharged in effluent at a rate of 60 gpm would be discharged into the river and the river flow is 3 cfs. Such discharge conditions are not anticipated to occur since low river flows are experienced during the summer when use of the district heating system would be minimal. Under normal operating conditions the increase in mercury concentration above current levels will usually only be a few hundredths of a nanogram, for a total mercury concentration of less than 2 ng/L.

Predicted Methyl Mercury Concentration in Pit River From Project. The final concentration of methyl mercury in the Pit River after discharge from the proposed project can be estimated by taking a ratio of current mercury (1.72 ng/L) to current methyl mercury (0.255 ng/L) concentrations in the river (see Table 4.4-4). After discharge, the predicted maximum total mercury concentration in the Pit River of 4 ng/L would translate into an expected methyl mercury concentration of 0.558 ng/L.

CURRENT		PREDICTED
$\frac{1.72 \text{ ng/L mercury}}{0.255 \text{ ng/L methyl mercury}}$	=	$\frac{4 \text{ ng/L mercury}}{X \text{ ng/L methyl mercury}}$

X = 0.558 ng/g methyl mercury

This level would not exceed water quality standards. This level is above the standard of 0.082 ng/L methyl mercury set by EPA as being protective of bald eagles. The baseline level of methyl mercury in the Pit River of 0.255 ng/L is above the standard. The existing methyl mercury levels in the Pit River are above the EPA-defined levels for protection of birds; however, analysis indicates that bioaccumulation of methyl mercury in fish tissue is not happening at as high a rate as theoretical models predict. The project would be adding more methyl mercury to an already exceeded level. It is unlikely that bald eagles would be jeopardized because fish tissue concentrations would be well below the allowable limit (refer to the fish tissue limit calculation below and the analysis thereafter for further discussion of this conclusion). The mercury discharge would not result in a significant effect.

Predicted Bioaccumulation in Fish Tissue From Project. For the predicted methyl mercury concentration of 0.558 ng/L, we can predict the estimated bioaccumulation in the fish tissue based on current methyl mercury concentrations and current bioaccumulation in the fish tissue. At the discharge point, the methyl mercury in the water is 0.255 ng/L and the methyl mercury in the fish tissue is 0.409 ng/g (see Section 3.3 Hydrology and Geothermal Resources and Section 3.4 Biological Resources). If the concentration in the water became 0.558 ng/L methyl mercury, bioaccumulation would result in fish tissue having a concentration of 0.895 ng/g methyl mercury, which is well below the limit of 95 ng/g established by the FWS as being protective of bald eagles. Despite the methyl mercury level in the water exceeding the EPA limit, the methyl mercury concentration in the fish tissue is well below the limit.

CURRENT		PREDICTED
$\frac{0.255 \text{ ng/L methyl mercury (water)}}{0.409 \text{ ng/g methyl mercury (fish tissue)}}$	=	$\frac{0.588 \text{ ng/L methyl mercury (water)}}{X \text{ ng/g methyl mercury (fish tissue)}}$

X = 0.895 ng/g

The bioaccumulation of mercury in fish would not result in a significant impact on fish or bald eagles.

Predicted Mercury Consumption in Bald Eagles. Performing the calculation for total methyl mercury intake by bald eagles, a 4 kg bird eating 0.48 kg (480 g) of contaminated fish would consume 430 ng of methyl mercury per day. This translates into 107 ng/kg body weight per day, which is well below the intake limit of 21,000 ng/kg body weight per day.

$$480 \text{ g} \times \frac{0.895 \text{ ng}}{\text{g}} = 430 \text{ ng} \quad \text{THEN} \quad \frac{430 \text{ ng}}{4 \text{ kg body weight}} = 107 \text{ ng/kg of body weight}$$

The project discharge would not result in a significant effect to fish or bald eagles that might consume the fish.

Analysis of Effect on Bald Eagles. The EPA has set a concentration limit of 0.082 ng/L (82 pg/L[2]) for methyl mercury in water as being protective of bald eagles (EPA 1997). Currently, the existing methyl mercury concentration in the Pit River at the discharge point is above the EPA level at 0.255 ng/L (255 pg/L). The proposed project would increase the methyl mercury level to as high as 0.558 ng/L; however, analysis based on current conditions seems to indicate that fish tissue methyl mercury calculations do not exceed standards despite the high level in the water. In a report by the US Fish and Wildlife Service addressing mercury hazards to fish, wildlife and invertebrates, it is recommended that fish tissue consumed by birds have a mercury level of less than 100 ng/g (Eisler 1987). Using a total mercury to methyl mercury conversion factor of 0.95, this translates into 95 ng/g methyl mercury limit in fish tissue (Eisler 1987)(see Table 4.3-4). The current fish tissue concentration is only 0.409 ng/g methyl mercury and the predicted concentrations with the proposed project would be 0.895 ng/g in a worst case scenario (see Section 3.4 Biological Resources and refer to Table 4.3-4).

It is difficult to determine why the fish tissue concentrations are lower than expected given the relatively high free mercury concentrations in the river. Most bioaccumulation models are designed for closed systems such as lakes. In a river system, various factors may account for reduced bioaccumulation. ~~The constant movement of fish upstream and downstream may expose them to mercury concentrations that vary from those concentrations in the project area. Another~~ One possibility is that there may be fewer levels in the food chain in the Pit River than expected, resulting in less bioaccumulation in the fish tissue. Another possibility may be that the relatively high methyl mercury concentrations observed during the summer months are ephemeral. Based on fish tissue concentration data, bioaccumulation in Pit River fish is less than predicted by theoretical models.

There are indications that local eagles have not been adversely affected by existing conditions at the river. A typical effect of bioaccumulation of mercury in bald eagles is reduced reproductive success due to eggshell thinning and behavioral problems. The closest bald eagle territory is only one mile away from the project area; however, that nest has been unusually successful hatching 2-3 young twice and only failing three times in twelve years (USFS data, Romberger 2002b). Bioaccumulation of mercury in bald eagles would be even lower than these estimates because fish do not constitute 100% of bald eagle diet. A study on Pit River bald eagle ecology indicated that fish comprised approximately 88% of the diet of bald eagles found foraging in the Pit River (Hunt 1992). Bald eagles are also known to have other food sources such as waterfowl, ground squirrels and fish from local reservoirs, all of which may or may not contribute additional mercury to the eagles through diet.

The proposed project will increase the level of methyl mercury in the Pit River from 0.255 ng/L to a maximum of 0.558 ng/L when the level is already above the limit set by the EPA (0.082 ng/L) for the protection of bald eagles (see Table 4.4-4). The free mercury in the Pit River is higher than the EPA limit; however, current and predicted fish tissue concentrations are much lower than the USFWS published limit for the protection of bald eagles. Water standards are intended to limit the amount of mercury available for bioaccumulation based on theoretical models. As discussed earlier, there are several reasons why bioaccumulation is not occurring at theoretical rates in the Pit River, including movement of fish, fluctuating levels of mercury in the Pit River and reduced levels in the food chain. The mercury levels in

[2] pg/L=picograms per liter. A picogram is 1 x 10^{-12} grams.

the Pit River seem to fluctuate greatly from year to year (refer to Section 4.3 Hydrology and Geothermal Resources). Bald eagles accumulate mercury directly from fish and not from water; therefore, fish tissue concentrations provide a clear indicator of mercury consumption by the eagles. Mercury accumulates in tissue over the lifespan of the fish. This makes fish tissue levels a good indicator of long-term bioaccumulation rates, and compensates for seasonal and annual fluctuations in river conditions and thus mercury levels in the Pit River over time.

The additional mercury added to the Pit River should not increase fish tissue concentrations by an appreciable amount. These concentrations would remain far below the fish tissue limits to protect bald eagles, even in a worst case discharge scenario of 50 ng/L, at 60 gpm, with a river flow of 3 cfs. While it is highly unlikely, if conditions changed in the Pit River, or other unforeseen factors contribute to bioaccumulation causing fish tissue levels to exceed 100 ng/g, there could be a potentially significant adverse effect to bald eagles. Mitigation measure 4.4-5 would reduce these potentially significant effects to a less than significant level.

Mitigation Measure 4.4-5

In accordance with the NPDES permit, I'SOT shall collect samples of Sacramento pike-minnow or other appropriate species and whole body concentrations of mercury will be determined at least every other year. I'SOT shall devise a sampling plan with the species of fish, number to be collected, the age of the fish and the method of aging in consultation with USFWS and CDFG. The sampling plan and protocol shall be submitted to the Executive Officer of the CVRWQCB, USFWS, and CDFG for approval. ~~If fish tissue concentrations exceed 100 ng/g, then the proponent will coordinate with the RWQCB, CDFG, and USFWS to determine appropriate mitigation. Mitigation measures might include those measure outlined in Measure 4.4-4 to reduce mercury discharge to the river, as well as actions to improve or enhance local eagle foraging or nesting conditions in the area, as coordinated with USFWS and CDFG.~~ Current levels of mercury in fish tissue average 0.4 ng/g. The maximum projected increase in fish tissue concentration is to 0.895 ng/g. If the tissue mercury concentration averages above 5 ng/g, then the proponent will coordinate with the RWQCB, CDFG, and USFWS to determine appropriate mitigation. Mitigation measures might include those measure outlined in Measure 4.3-5 to reduce mercury discharge to the river, as well as actions to improve or enhance local eagle foraging or nesting conditions in the area, as coordinated with USFWS and CDFG.

Greater Sandhill Crane

Greater sandhill cranes breed in large wetlands and feed in different habitat types such as meadows, irrigated pastures, grain fields, bogs, fens, marshes, and nearby fields. Cranes like to flock together at night (called roosting) for safety in an open expanse of shallow water. Cranes are omnivorous, and eat a variety of grains and seeds, but also eat aquatic invertebrates, insects, small reptiles, amphibians, eggs, and rodents as well as some fish. Fish do not constitute a significant portion of their diet.

The greater sandhill crane is known to nest and forage in the study area around the project. Although no nest sites are recorded within 0.5 miles of the project area, known nesting sites occur approximately 0.5 miles down river.

No direct habitat alteration will occur from this project. Prey species for sandhill cranes could potentially be impacted by contaminants released in the discharge; however, cranes typically eat frogs and aquatic insects of a lower food chain levels than pike minnow. These prey items are lower on the food chain and

methyl mercury tissue concentrations increase with increasing predator-prey relationship levels. Greater sandhill crane prey would have significantly lower concentrations of mercury than pike minnow. Consumption of prey would therefore have less than significant impacts to cranes.

Golden Eagle

Golden eagles require open country for foraging. They prefer to nest in large conifers at the periphery of dense stands or on cliffs. Golden eagles are relatively common in the Canby area, and likely forage occasionally in the project area due to the open terrain and potential availability of food such as waterfowl and ground squirrels.

No habitat alteration would result for this species due to this project. The majority of golden eagle prey is not affected by mercury bioaccumulation. These birds prey upon a variety of creatures from prairie dogs, cottontail rabbits, jackrabbits and ground squirrels to grouse, ducks, chukars, reptiles and smaller birds (www.enature.com, www.desertusa.com, 2002). Most waterfowl listed above feed on vegetation in the wetland areas and therefore would not be affected by bioaccumulation of mercury in fish. There is no suitable nesting habitat in the project area; the project would not affect golden eagle nesting. Therefore, there should be no significant impacts to this species by this project and no mitigation is necessary.

White Faced Ibis

The white faced ibis has potential foraging habitat in the study area in the existing wetlands. Potential ibis breeding habitat in the heavily vegetated wetland areas is adjacent to, but not in, the direct impact area of the project (e.g. the pipeline route). Potential ibis foraging habitat exists in the wetlands area associated with the pastures, although this habitat is of lower quality because of the intensive grazing in that area. Impacts from construction to breeding and foraging habitat would therefore be less than significant because construction activities would not directly affect nearby breeding habitat and would involve minimal disturbance to potential but low quality foraging habitat in the project area. The white face ibis also feeds on a variety of different animals that live in and around a marsh. They primarily feed in marshland areas and would not be significantly impacted by mercury bioaccumulation from consumed prey.

Modoc Sucker

The Modoc sucker is listed as endangered by the USFWS and by the State of California. The species is endemic to the small tributary streams of the Upper Pit River, and is currently restricted to several tributary streams of the Pit River, including Turner and Ash Creeks, which are tributaries located ~~20~~ 7 miles downstream of the proposed discharge. In general, sites where Modoc suckers have been found are characterized by the following: low flows (intermittent in some); largely shallow pools; muddy bottoms; partial shade trees, shrubs, boulders, or undercut banks; abundant cover from riparian vegetation and undercut banks; and moderately clear water. The Modoc sucker prefers portions of small streams dominated by large, shallow, muddy- bottomed pools, partially shaded by overhanging trees. Spawning occurs over coarse fine gravel in the lower end of pools with abundant cover. This type of habitat is not found in the project area. They feed on filamentous algae.

Recent surveys by USFWS staff found no morphological Modoc suckers in the main stem of the Pit River downstream of the project areas, even though the project area is in historical habitat and suitable habitat exists. There may be some individuals not detected by the surveys suggesting that Modoc sucker do exist in low abundance in the project area (Reid pers. comm. 2002a). Currently, the closest known Modoc

sucker occupied area in the project vicinity is the Turner Creek drainage which begins about 7 miles downstream from the Pit River discharge point and is up from its confluence with the Pit River, where the project effects would be unlikely to extend (Reid pers. Comm. 2002b). ~~Modoc sucker is not known to occur within the project area or immediately downstream in the Pit River, based upon recent surveys conducted by the USFWS specifically for this project (Reid, personal communication 2002). The closest known occupied portion of the Pit River is 20-7 miles downstream~~ (refer to Figure 3.3-1 for map of territories). ~~Modoc sucker is known to hybridize with the Sacramento sucker and genetic tests were conducted to determine if any hybrid individuals were found in the Pit River (USFWS 2002b). The initial morphological analysis from the genetic survey did not show any hybrid Modoc sucker in the Pit River (Reid 2002). In order for a hybrid to exist, there would have to be pure Modoc suckers in the River, which were not found.~~

The project should cause less than significant impacts to any Modoc suckers potentially living in the river near the project area. Current fish tissue samples show that pike minnow have about 0.4 ng/g of methyl mercury in their tissue, and project operations would increase that amount to a maximum of around 0.9 ng/g. Sacramento suckers, which are closer in size, age and morphology to Modoc suckers only have 0.195 ng/g of methyl mercury in their tissue. Modoc suckers are smaller fish, lower on the food chain, and would experience less bioaccumulation than pike minnow. Tissue concentrations due to the project in the potentially limited number of Modoc sucker individuals in the main stem of the Pit River would most likely be even less than 0.9 ng/g. Most Modoc suckers are found far enough downstream of the project that mercury concentrations should be minimal by that point due to dilution effects.

Other Species

The proposed project would not have effects on any other listed or sensitive species because of the lack of suitable habitat or lack of presence (see the Affected Environment, Section 3.3 Biological Resources).

EFFECTS OF ALTERNATIVE B (NO ACTION)

If the project were not constructed due to lack of DOE funding, there would be no adverse effects to biological resources from Alternative B, the “No Action” alternative; however, the project could proceed without DOE funding contingent upon alternative funding, with effects from Alternative A potentially worse without DOE participation because no mitigation would be required (except NPDES required items). The following measures would not be implemented without DOE involvement: 4.4-1, 4.4-2 and 4.4-3. Without funding by DOE, I’SOT would not be reimbursed for costs resulting from permitting efforts, engineering consultation, and system installation costs. No data gathering system would be installed for DOE research and development (R&D) purposes.

4.5 Cultural Resources

SIGNIFICANCE CRITERIA

The significance criteria discussed below are pursuant to the regulations identified in Section 3.5 of this document. The regulations include:

- National Historic Preservation Act of 1996, as amended
- American Indian Religious Freedom Act of 1978
- Executive Order 13007
- Executive Order 12898
- National Environmental Policy Act

Federal law requires the consideration of effects to historical and cultural resources prior to authorizing any activity. 36CFR296 (Protection of Archaeological Resources) and 36CFR800 (Protection of Historic and Cultural Properties) provide guidelines for the protection of cultural resources, while state law requires the protection of historical and cultural resources. A proposed action would be considered to have a significant effect on cultural resources if it adversely affects a resource listed or determined to be eligible for listing on the National Register of Historic Places (NRHP). The proposed project would have a significant effect if it damaged the integrity of an identified sacred site or interfered substantially with Native American religious or ceremonial practices.

METHODOLOGY

The impacts assessment for cultural resources and traditional cultural values is based the results of literature searches, consultations, and cultural resource surveys performed for the proposed project. The results of the studies are presented in two archaeological reports (Vaughan 2001 and Darcangelo 2002).

IMPACT OVERVIEW

A survey conducted in 2001 by Coyote & Fox identified obsidian flakes along the originally proposed pipeline route. That route was approximately 5,200 ft. and ran through dry farmland and wetlands. The route was initially altered to avoid the identified site then altered again to avoid wetlands. A second survey conducted by Far Western Anthropological Research Group, Inc. (FWARG) in October 2002 found no other cultural resources. Additional areas surveyed include the portion of the levee where the discharge pipeline will be laid, the food service/laundry building, and the mechanical building. No traditional cultural uses were identified that would be affected by the proposed project. The proposed project would not have adverse effects on cultural resources or traditional cultural values.

EFFECTS OF THE PROPOSED ACTION – ALTERNATIVE A

Potential impacts to cultural resources in the project area are described for each project component.

Mechanical and Food Service/Laundry Buildings

The proposed project would include construction of two new buildings within the residential area of the I'SOT community. The footprint for these buildings was surveyed by FWARG and no cultural resources

were noted. Buried resources are not expected in this area. There would be no impact to cultural resources from construction of these buildings.

Distribution Piping

Spot checks were made by FWARG for the distribution piping locations, as these locations consisted predominantly of graveled driveways leading to existing structures, leaving no original ground surface to inspect. The likelihood of finding buried resources in this area of previous disturbance is low. No cultural resources would be impacted from installation of the distribution piping; therefore this construction of this project component is less than significant.

Discharge Pipeline

The proposed project would include installation of an effluent discharge pipeline along dry farmland, 1,300 ft. of levee road, and some wetland area. The pipeline route was surveyed for the presence of cultural resources. No resources were found along the pipeline route. Excavation for installation of the pipeline has the potential to affect previously unknown cultural resources. Mitigation measures 4.5-1, 4.5-2, and 4.5-3 would be implemented to avoid the potentials for adverse effects to undiscovered resources and undiscovered human remains. The potential for discovery of buried resources is considered low since much of the pipeline route has been subject to previous surface disturbance for agriculture and road construction.

Hand laying the discharge pipeline along proposed route would have no effect on cultural resources.

NATIVE AMERICAN CONCERNS AND EFFECTS TO TRADITIONAL CULTURAL VALUES

Native American Concerns

During scoping for the project, members of the Pit River tribe expressed concerns about geothermal-related impacts and potential effects of construction on cultural resources. The projected environmental impacts of the proposed district heating project are discussed throughout Chapter 4 of this document. The environmental effects of geothermal resource development and utilization of the well for space and water heating are less than significant. Initial consultation between the Pit River tribal members and DOE resulted in a request for a tribal monitor during construction activities. This action was agreed to and is incorporated as Mitigation Measure 4.5-1. Additional mitigation measures would be implemented if cultural resources are found during construction activities.

Project Effects on Traditional Cultural Properties

There are no Traditional Cultural Properties (TCPs) within the project study area; therefore, the project would have no impact on TCPs.

Native Americans have been known to use Kelley Hot Springs. The project would have no effect on Kelley Hot Springs and no effect on traditional uses at Kelley Hot Springs.

MITIGATION MEASURES

Mitigation Measure 4.5-1

During pipeline installation I'SOT shall contract for a tribal monitor to check for any Indian cultural resources or human remains. Mitigation to avoid effects to resources encountered might include avoidance or data collection.

Mitigation Measure 4.5-2

Should any prehistoric or historic resources be encountered during site construction activities, I'SOT shall suspend construction activities within 50 feet of the discovery until a qualified consulting archaeologist has assessed the materials. If a decision is made to record the site, I'SOT shall ensure that recordation shall take place and it will be determined whether project well sites could be relocated to avoid any additional effects. I'SOT shall not resume construction activities in the vicinity of the discovery until consultation has taken place and the resources have been appropriately evaluated or treated and specific authorization to resume construction activities is provided by the DOE. If avoidance is not feasible, I'SOT shall ensure that a qualified archaeologist will evaluate the site and a determination of eligibility for the NRHP shall be made. If the site is determined to be eligible, then I'SOT shall submit a mitigation proposal (which may include a data recovery program similar to those conducted for similar resources in the vicinity) with the site record to the SHPO for review and concurrence.

Mitigation Measure 4.5-3

If prehistoric archaeological deposits that include human remains or objects considered "cultural items" according to the Native American Graves Protection and Repatriation Act (NAGPRA) are discovered during site construction activities, I'SOT shall immediately notify the County Coroner and a qualified archaeologist and would follow NAGPRA regulations. If the remains are identified as American Indian, then I'SOT shall notify local American Indian groups or tribe(s) and the Native American Heritage Commission (NAHC) within 24 hours and initiate consultation. I'SOT shall ensure that the most likely descendants of these remains are notified and given the opportunity to make recommendations for the remains. If descendant recommendations are made which are not acceptable to I'SOT or DOE, then the NAHC would be requested to mediate the problem.

EFFECTS OF THE NO ACTION ALTERNATIVE

If the project were not constructed due to lack of DOE funding, there would be no adverse effects to cultural resources from Alternative B, the "No Action" alternative; however, the project could proceed without DOE funding contingent upon alternative funding. Without DOE involvement, implementation of mitigation measures 4.5-1, 4.5-2, and 4.5-3 would be contingent upon communications between I'SOT and the Tribe, which would not be obligatory. Without funding by DOE, I'SOT would not be reimbursed for costs resulting from permitting efforts, engineering consultation, and system installation costs. No data gathering system would be installed for DOE research and development (R&D) purposes.

4.6 Land Use, Agriculture, and Recreation

SIGNIFICANCE CRITERIA

A land use impact resulting from a proposed action or alternative may be significant if it conflicts with established land uses in the area, disrupts or divides established land use configurations, represents a substantial change in existing land uses, or is inconsistent with adopted land use plans. Direct impacts are those that directly conflict with the land use around a proposed project, for example, the construction of a multi-family residential development in an area designated for agriculture.

Impacts to recreational resources could be considered significant if they result in a decline in the quality or quantity of existing recreational facilities or services, or if they exceed adopted state or local (or other generally accepted) recreation planning standards.

METHODOLOGY

The impacts assessment for land use, agriculture, and recreation are based on information provided by the Modoc County General Plan and US Department of Agriculture. The project impacts were reviewed for consistency with plans and regulations set by these agencies.

IMPACT OVERVIEW

The proposed project would not result in any permanent change to an existing land use. Construction of the mechanical building and the food service/laundry building would occur on private property owned by I'SOT. Building design would be compatible with the existing buildings on the property. Installation of the distribution piping and discharge pipeline would result in minor, temporary disturbance to the I'SOT community property, dry farmland, the levee road, and a small portion of wetlands. Trenching for the pipeline installation would occur over 20-30 days and vegetation would be replaced to its former condition (see Section 4.3, Biology).

The operation phase would not change any existing land use from pre-construction conditions. I'SOT has applied for and received a Use Permit from Modoc County for the use of the geothermal well and development of the district heating system.

EFFECTS OF PROPOSED ACTION – ALTERNATIVE A

Existing Land Uses

The proposed action would not be expected to conflict with existing land uses or with American Indian uses in the vicinity (see Section 4.5, Cultural Resources).

The proposed action would occur on relatively small sites on privately owned property and would therefore not be considered to represent a substantial alteration of the present land uses in the areas.

Noise generated by implementation of the proposed action would not be expected to adversely affect other land uses in the vicinity (see Section 4.7, Noise). In addition, the proposed action would not be expected to emit odors that would adversely affect other land uses (see Section 4.1, Air Quality), and would not be expected to result in adverse visual effects (see Section 4.9, Aesthetics). There are no established recreation uses in the project vicinity; therefore the proposed action would not adversely affect recreation uses.

Effects on Agriculture

The predominant use of the land associated with the discharge pipeline route is dry land cattle grazing. Due to the short duration of construction for the pipeline installation, effects on rancher's use of the land would be minimal and temporary in nature.

Effects on Recreation

There are no formal recreation areas within the project area. The project would have no impact to recreation uses.

Consistency with Plans

Modoc County General Plan. The proposed action would be consistent with the goals and policies of the Modoc County General Plan for land use, agriculture, and recreation. The district heating system operation would be compatible with the residential land use designation of the I'SOT community and Canby. Construction and operation of the pipeline would not affect the use of the land for agricultural purposes. The project encompasses several parcels located around the township of Canby. Tables 4.6-1 and 4.6-2 indicate the project parcel numbers, zoning designation, and general plan designation.

Table 4.6-1: Zoning Designations

Zoning	Assessor's Parcel Number
Industrial	017-060-56
Low Density Residential	017-080-02 & 25, 017-090-10 & 63
High Density Residential	017-090-57, 61, 62, & 64
Commercial	017-100-22
Unclassified	017-160-75

SOURCE: Modoc County 2001

Table 4.6-2: General Plan Designations

General Plan	Assessor's Parcel Number
General Agriculture	017-060-56
Exclusive Agriculture	017-160-75
Urban Area	017-080-02 & 25, 017-090-10, 57, 61, 62, 63, 64, 017-100-22

SOURCE: Modoc County 2001

The construction and operation of the district heating system at the I'SOT Community would not conflict with the Modoc County zoning ordinance or general plan designations as shown in the above tables.

MITIGATION MEASURES

The effects of the proposed action would be less than significant. No mitigation is required.

EFFECTS OF NO ACTION ALTERNATIVE

If the project were not constructed due to lack of DOE funding, there would be no adverse effects to land use, agriculture, and recreation from Alternative B, the "No Action" alternative; however, the project could proceed without DOE funding contingent upon alternative funding, with effects from Alternative A potentially worse without DOE participation because no mitigation would be required (except NPDES required items). Without funding by DOE, I'SOT would not be reimbursed for costs resulting from permitting efforts, engineering consultation, and system installation costs. No data gathering system would be installed for DOE research and development (R&D) purposes.

4.7 Noise

SIGNIFICANCE CRITERIA

The Noise Element of the Modoc County General Plan (Modoc County 1988) identifies a maximum noise level 60 dBA L_{dn}[1] for residential uses. The Noise compatibility standard on Modoc County is 54 dBA L_{eq}[2], based on an L_{dn} of 60 dBA. A noise effect would be considered significant if the level of noise from operation equals or exceeds 54 dBA L_{eq} at the receptors.

METHODOLOGY

Noise analysis for the proposed action is based on projected emissions from construction and operation compared against existing conditions. Noise emissions are assumed to attenuate at a rate of 6 dB per doubling of distance. Surrounding receptors are considered and impacts to these receptors are based on projected source emissions and the assumed rate of attenuation. Measures to minimize noise emissions are recommended as applicable.

IMPACT OVERVIEW

Construction would have temporary significant impacts on receptors within the ISOT community. Measures are recommended to reduce emission levels during construction. Operational noise emissions would not be significant.

EFFECTS OF ALTERNATIVE A

Construction Noise

Operation of heavy equipment would be the primary source of noise during the construction of the food service/laundry and mechanical and control buildings. Surrounding receptors would be affected during construction hours (daytime hours) for about 3.5 months. Implementation of Mitigation Measure 4.7-1 below would reduce noise emissions from construction equipment.

Conservative estimates of noise emissions from constructing the distribution and discharge pipelines are presented in Table 4.7-1. Pipeline construction would significantly affect receptors within the I'SOT community as well as agricultural workers within just over 200 feet of the construction activities.

Operation Noise

The district heating system is anticipated to have a 40- to 50-year life cycle. Any noise emissions resulting from project operation would last as long as operations take place. All noise emissions would affect only the occupants of the I'SOT community on a regular basis for the duration of the project.

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[1] L_{dn}, the day-night average noise level, is based on human reaction to cumulative noise exposure over a 24-hour period. L_{dn} accounts for community receptors' greater sensitivity to unwanted noise intrusion during the night. Noise between 10:00 p.m. and 7:00 a.m. is weighted by 10 dBA to take into account the greater annoyance of nighttime noise.

[2] L_{eq}, equivalent steady-state sound level, is a single value of sound level for any desired duration that includes all time-varying sound energy occurring during the measurement period.

Table 4.7-1: Estimated Peak Pipeline Construction Noise Emissions

		Distance from Equipment & Noise Level (dBA) at Receiver		
Construction Phase	**Loudest Equipment**	**50 ft**	**100 ft**	**200 ft**
Clearing/grubbing	Bulldozer	85	79	73
Trenching/earthwork	Bulldozer/backhoe	80	74	68
Positioning Pipe	Sideboom/tractor	85	79	73
Backfilling	Bulldozer/backhoe	85	79	73

NOTE: Assumes a basic sound level drop-off rate of 6.0 dB per doubling of distance.

SOURCE: Federal Transit Administration 1995

Geothermal Well. A 7.5-hp electric lineshaft turbine well pump would push geothermal fluid through mechanical equipment designed to extract energy in order to heat 53,000 ft^2 of residential housing. An open, drip-proof motor set at the surface would power the pump. This motor would be located inside a removable 8 x 6-foot building attached to the main mechanical building. The motor would be housed and noise would thus be muffled. Noise emissions from the motor would not be significant.

Backup Boiler System. The backup boiler system would be located in the mechanical and control building. Noise emissions from the boiler would not be significant.

Water Circulation Pumps. The two water circulation pumps would be located in the mechanical control building. One pump would be used at a time and the other would be used for backup. The pumps for water circulation would be sized for up to 80 gpm each with three-horsepower high efficiency inverter motors. The pumps and motors would be housed and noise would thus be muffled. Noise emissions from the pumps and inverter motors would not be significant.

Traffic Noise

Traffic noise would be induced during the construction phase of the project. Vehicles associated with construction would generate intermittent noise throughout the vicinity of the proposed action. Vehicle noise would occur sporadically during weekdays and daytime hours for 3.5 months. The project noise would not represent a significant increase in noise.

Noise Effects on Animal Species

During construction activities, some animals may avoid habitats in the vicinity of the proposed project due to the increased noise levels, particularly if a species is sensitive to a frequency range that the construction activities would generate. Any avoidance of habitats in the vicinity of the proposed project by wildlife species during construction would be temporary and not significant. Section 3.3 Biological Resources provides a listing of the species in the project vicinity. Noise impacts during operation would be less than significant.

MITIGATION MEASURES

Mitigation Measure 4.7-1

I'SOT will ensure that muffler systems shall be used on all heavy equipment during construction activities.

Mitigation Measure 4.7-2

As required by the Modoc County General Plan, I'SOT will submit building permits for the project to the Modoc County Planning Department for review for consistency with the noise element and other elements.

EFFECTS OF THE NO ACTION ALTERNATIVE

If the project were not constructed due to lack of DOE funding, there would be no adverse effects related to noise from Alternative B, the "No Action" alternative; however, the project could proceed without DOE funding contingent upon alternative funding, with effects from Alternative A potentially worse without DOE participation because no mitigation would be required (except NPDES required items). The following measures would not be implemented without DOE involvement: 4.7-1 and 4.7-2. Without funding by DOE, I'SOT would not be reimbursed for costs resulting from permitting efforts, engineering consultation, and system installation costs. No data gathering system would be installed for DOE research and development (R&D) purposes.

4.8 Infrastructure and Service Systems

SIGNIFICANCE CRITERIA

The project would have a significant effect on the environment if it would:

- Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects
- Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects
- Have insufficient water supplies available from existing entitlements and resources, or need new or expanded entitlements
- Be served by a landfill with insufficient capacity to accommodate the project's solid waste disposal needs
- Violate federal, state, and local statutes and regulations related to solid waste
- Result in the failure to maintain acceptable service ratios, response times or other performance objectives for any of fire protection, police, health, school and park services

METHODOLOGY

This analysis was performed by evaluating available data, information, reports and personal communications. These materials are listed in Section 7.0, References and in Section 6.0, List of Preparers. No additional data collection or field investigations were performed.

IMPACT OVERVIEW

Project impacts on infrastructure and service systems would be less than significant with the implementation of the district heating system. The goal of the proposed action is to reduce dependence on the use of costly propane gas by the I'SOT community. Implementation of the proposed system would allow I'SOT to use renewable geothermal energy for space heating and water heating. This is a beneficial effect of the project.

EFFECTS OF THE PROPOSED PROJECT

Water

As detailed in Section 4.10, Socioeconomics, implementation of the proposed project would not result in an increase in population, and would therefore not cause an increase in potable water use.

Wastewater

As detailed in Section 4.10, Socioeconomics, implementation of the proposed project would not result in an increase in population, and would therefore not cause an increase in municipal wastewater generation. None of the geothermal effluent will be discharged to the existing wastewater treatment system at I'SOT. I'SOT has obtained an NPDES permit form the Central Valley Regional Water Quality Control Board for the discharge of geothermal effluent to the Pit River. The permit contains monitoring

and sampling conditions that I'SOT must comply with to insure that water quality would not be impaired by the discharge.

Make-up water will be drawn from the on-site groundwater well to replace the volume of hot water drawn for domestic use from the distribution pipelines. The use of this make-up water would not result in an increase in wastewater generation.

Stormwater

The construction of the mechanical building and the food service/laundry building would decrease the amount of permeable land on the project site. This increased area of impermeability would be insignificant compared to the area of permeable lands surrounding the buildings both on and around the project site.

Electricity

The combination of the 7.5 horsepower pump (hp) in the geothermal well and the 2.5 hp circulation pump would cause an increase in electricity demand for the I'SOT community. In year 2000, the Surprise Valley Electrification Company (SVEC) was consulted regarding these power needs associated with the mechanical and control building. In August 2000, SVEC installed an additional power pole to meet the proposed increased demand (Merrick 2002b).

Solid Waste

As detailed in Section 4.10, Socioeconomics, implementation of the proposed project would not result in an increase in population, and would therefore not cause an increase in municipal solid waste generation.

The granulated activated carbon (GAC) mercury removal system would generate mercury-contaminated GAC, which may be classified as hazardous waste. I'SOT has a service agreement with US Filter who will service the filters, change the carbon, and place the spent carbon into Department of Transportation certified drums. US Filter would take a sample and submit the spent carbon to a laboratory for mercury analysis to determine which reactivation or disposal method is most appropriate (King 2002a).

Carbon with sufficiently low mercury content would be sent to US Filter reactivation facilities. Low mercury content carbon would be sent to the US Filter West States non-hazardous reactivation facility in Red Bluff, California. Higher mercury content carbon would be sent to the US Filter West States hazardous reactivation facility in Parker, Arizona (King 2002b). These activities are part of normal business operations for US Filter and would not affect solid waste disposal services in Modoc County. Carbon with mercury content too high for acceptance at the US Filter West States reactivation facilities would need to be either landfilled or incinerated. If the carbon is classified as non-hazardous, it would be sent to the Canby Transfer Station, then to the Alturas Transfer Station, and then ultimately to the Lockwood Landfill near Reno, Nevada (Hironymous 2002a). Carbon considered hazardous would likely be sent to the Kettleman Hills Landfill, in Kettleman City, California (Hironymous 2002b; King 2000c). The Lockwood Landfill, operated by the Reno Disposal Company, has a projected lifespan of 23 years (Franchi 2002). The Kettleman Hills Landfill has a projected lifespan of 6 to 7 years, with an additional 300 acres permitted for future landfill use (Vasquez 2002). The proposed project would not have a significant impact on waste disposal capacity at either the Lockwood or Kettleman Hills landfills.

Emergency Services

As detailed in Section 4.10, Socioeconomics, implementation of the proposed project would not result in an increase in population, and would therefore not result in an increased demand for fire protection, police protection, health or educational services.

MITIGATION MEASURES

The effects of the proposed action would be less than significant. No mitigation is required.

EFFECTS OF NO ACTION ALTERNATIVE

If the project were not constructed due to lack of DOE funding, there would be no adverse effects related to infrastructure and services from Alternative B, the "No Action" alternative; however, the project could proceed without DOE funding contingent upon alternative funding, with effects from Alternative A potentially worse without DOE participation because no mitigation would be required (except NPDES required items). Without funding by DOE, I'SOT would not be reimbursed for costs resulting from permitting efforts, engineering consultation, and system installation costs. No data gathering system would be installed for DOE research and development (R&D) purposes.

4.9 Aesthetics

SIGNIFICANCE CRITERIA

The project would have a significant effect on the environment if it would:

- Noticeably increase visual contrast and reduce the scenic quality rating, as seen from any high sensitivity foreground or middleground viewpoint;
- Block or disrupt existing views or reduce public opportunities to view scenic resources; or
- Cause visual resource conditions resulting that would conflict with policies and regulations governing aesthetics.

A direct visual impact would be the disruption of a scenic view attributable to a proposed project. An example of this would be the construction of a new four-story office building in a mixed-use residential/commercial area such that the new building would block panoramic views of scenic resources from existing residences and/or introduce new light sources. Cumulative effects can result from individually minor but collectively significant actions taking place over time.

METHODOLOGY

The aesthetics analysis in this section is based upon current scenic conditions from the project area roadways, as well as from any potential vantage points in the project area. Project construction would take place both north and south of State Route 299. In addition, a directional bore for the 3-inch discharge pipeline would be constructed beneath SR 299 at Post Mile 22.30. Other county roads adjacent to the construction of the food service/laundry building and mechanical building are County Road 161 and County Road 203 respectively.

IMPACT OVERVIEW

The proposed action would not have a permanent, adverse effect on scenic or visual resources in the vicinity. The proposed action would be of short duration with no tall structures or equipment used during construction. The project elements that would be visible after construction include one small new building and one larger building within the interior of the I'SOT property, surrounded by existing buildings.

EFFECTS OF PROPOSED ACTION – ALTERNATIVE A

Long Range Views

The Region of Influence (ROI) can generally be limited to five miles, beyond which distance features lose defining details. The construction activities would be visible from a distance, but not prominent due to the small crews that would work on the project.

The proposed pipeline would be buried and not visible after construction activities. The proposed buildings would be adjacent to several existing buildings. The views from a long-range distance would not be substantially affected, as it may be difficult to distinguish the new buildings.

Short Range Views

Motorist traffic and pedestrians traveling along the county roads and Highway 299 would view construction within the project area during the approximately four-week construction period. The activities would occur in the early spring when tourist traffic is less than during the summer. Construction of the discharge pipeline would be adjacent to County Road 54 within I'SOT-owned dry grazing land and up to 1,500 ft away from the road. See the photo in Figure 3.9-1 for the view from County Road 54 to the pipeline construction area. Construction activities would be performed between 6 a.m. to 9 p.m. during daylight hours so that no additional lighting would be required. Disturbed areas would be revegetated with plants similar to those in adjacent areas. Construction activities would be of limited duration so that effects to visual resources would be less than significant.

The mechanical building and the food service/laundry building would be designed using construction materials and colors that blend with the natural surroundings to minimize the visual contrast with the surrounding landscape. Lighting would be designed to keep glare at a minimum. The project would not result in a new source of substantial light or glare that would adversely affect day or nighttime views in the area. The project operational elements would not be visible from Highway 299. The project would not conflict with the Visual Resource Quality objectives in the USDA Guidelines or the policies Modoc County General Plan. The effects of the proposed project on aesthetics would be less than significant.

MITIGATION MEASURES

No mitigation is required.

EFFECTS OF NO ACTION ALTERNATIVE

If the project were not constructed due to lack of DOE funding, there would be no adverse effects on aesthetics from Alternative B, the "No Action" alternative; however, the project could proceed without DOE funding contingent upon alternative funding, with effects from Alternative A potentially worse without DOE participation because no mitigation would be required (except NPDES required items). Without funding by DOE, I'SOT would not be reimbursed for costs resulting from permitting efforts, engineering consultation, and system installation costs. No data gathering system would be installed for DOE research and development (R&D) purposes.

4.10 Socioeconomics

SIGNIFICANCE CRITERIA

Impacts would be considered significant if the proposed action would:

- Affect population in an area, either directly or indirectly, so that the projected County growth rate is decreased
- Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere (a "substantial number" refers to one housing unit)
- Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere (a "substantial number" refers to one person)
- Substantially impact the economies of those communities affected by the proposed project or take a significant amount of land from owners
- Cause a disruption in the balance between employment opportunities and available housing in the area
- Disproportionately affect low-income and minority populations

METHODOLOGY

Impacts analysis for the project is based on projected increases or decreases to the population, housing availability, employment, income and sales, and public finance from the project within the Town of Canby and Modoc County. Projected impacts on identified socioeconomic characteristics are compared to baseline conditions identified in 3.10 Socioeconomics. Determination of environmental justice effects is based on potential impacts to low income or minority populations in close proximity to the study area or on utilization by these populations of resources affected by the project. Compliance with applicable federal, state, or local regulations regarding socioeconomics is also considered.

IMPACT OVERVIEW

Socioeconomic impacts of the proposed project would be less than significant as the project would have minimal or no effects on demographic or economic characteristics of Canby or Modoc County. The proposed project is not expected to disproportionately affect any minority or low-income populations.

EFFECTS OF ALTERNATIVE A

Population

It is anticipated that 6 to10 workers will be employed at any one time during the construction phase of the project. Workers would be obtained from the local population. One new employee would be needed during operation of the proposed facilities. The personnel requirement of the proposed project would not be a significant impact on the population of Modoc County.

A near-future substantial population growth at the I'SOT community is not anticipated to result from the proposed project. Population growth can be viewed as a beneficial impact on Modoc County as the county has experience a general decline in population in the recent decades.

Housing

The project workers would reside in Canby at their homes. The project would not displace any resident. The project would benefit the community residents, as implementation of the district heating system would lower dependency on the high cost of propane for heating. The housing requirement of the proposed project would not be a significant impact on the housing of Modoc County.

Employment

About 6 to 10 workers would be employed during the construction phase, which would last about 3.5 months, assuming no delays. One new employee would be needed during operation of the proposed facilities, projected to last about 50 years. Workers would be obtained from within the I'SOT community. Because of the relatively small number of workers needed, no "boom-bust" type of impact would be expected on the local labor pool or economy. Impacts on employment would be less than significant.

Income and Sales

An estimated three or less tractor-trailer loads of construction material would be needed for the project. These materials would be purchased from appropriate vendors outside of Modoc County. Construction equipment would be maintained at the I'SOT Auto Shop, located a half-mile away on industrially zoned I'SOT property.

I'SOT spends between $21,000-$42,000 annually in propane costs for residential space heating and domestic hot water (Merrick 2002). This project would create the direct-use system to reduce costs and dependence on propane for power up to 95%. The project would have a positive economic impact on the I'SOT community.

Construction of the discharge pipeline would not significantly affect agricultural production as the disturbed surface along the pipeline route would be covered and returned to its original condition after the 20-30 working day construction period (See Land Use, Section 3.6).

Public Finance

Funding for the project would be obtained from the California Energy Commission and the Department of Energy. The project currently does not require public funding from Modoc County; no impacts are anticipated.

Environmental Justice

The proposed project would be located on privately owned lands in the Town of Canby in Modoc County. The project would have minimal environmental impacts. The proposed project is not expected to disproportionately affect any minority or low-income populations. The Town of Canby is not considered a low-income community relative to average income in the County. No low-income communities would be affected by the project.

The I'SOT project would not directly affect the environmental or human health conditions of any Native Americans or other minority communities. Potential for impacts on Native American tribes in the area have been reduced through appropriate scoping and consultations. Opportunities for public participation have been and will continue to be provided through the public scoping process, on-going consultation with Native American tribes in the project vicinity, and the public comment process.

Implementation of the mitigation measures outlined in Section 4.5 Cultural Resources would be required and would further reduce project impacts to Native American tribes. The potential for project effects on the local Native Americans, tribal land use and associated spiritual values, and the results of consultations with the Pit River Tribe are described in Section 4.5 Cultural Resources.

MITIGATION MEASURES

The project would reduce I'SOT's costs for water and space heating. No mitigation is required for socioeconomic impacts from the project.

EFFECTS OF THE NO PROJECT ALTERNATIVE

If the project were not constructed due to lack of DOE funding, there would be no adverse socioeconomic effects from Alternative B, the "No Action" alternative; however, the project could proceed without DOE funding contingent upon alternative funding, with effects from Alternative A potentially worse without DOE participation because no mitigation would be required (except NPDES required items). Without funding by DOE, I'SOT would not be reimbursed for costs resulting from permitting efforts, engineering consultation, and system installation costs. No data gathering system would be installed for DOE research and development (R&D) purposes.

4.11 Transportation and Traffic

SIGNIFICANCE CRITERIA

The project would be considered to have a significant effect on the environment if it would cause an increase in traffic that is substantial in relation to the existing traffic volumes and or exceed the design capacity of the affected road network. The project may also have a significant effect on the environment if project traffic or access would conflict with established land uses in the area. The project would also be considered to have a significant effect on the environment if it were to increase traffic to a degree that would degrade the integrity or structural condition of any roads during construction or operation.

METHODOLOGY

The transportation analysis in this section is based on current operating conditions of project area roadways, as well as anticipated traffic volumes that would be generated by the proposed project. Anticipated project traffic volumes are based on estimates of maximum daily vehicle trips that would occur during construction and operation of the proposed project. The projected trip generation was developed by I'SOT based on construction and project operation provided in Chapter 2.

The measurement of traffic/circulation impacts typically is accomplished at signalized intersections by estimating level of service (LOS) and volume/capacity (V/C) ratios. Since the project is in a rural area with very low traffic volumes, projected traffic is compared to the latest average daily traffic (ADT) from counts taken by Caltrans and Modoc County.

IMPACT OVERVIEW

The traffic would be insignificant in volume and short in duration during the construction phase. Construction workers would be hired locally and are expected to drive from their homes in the Canby area using private vehicles. Workers would access the sites by using Highway 299E, County Road 203, County Road 161, and County Road 83. Construction activities for the new buildings and pipelines would be expected to generate a maximum of 30 round trips per day. Given the currently low level of use of the roads in the vicinity and the short-term nature of the proposed construction activities, the additional trips generated by construction of the proposed action are not expected to result in an adverse impact on circulation in the area.

The operation phase would generate one additional trip per day above pre-construction levels. One I'SOT employee is expected to make a daily, one-hour system maintenance visit to the mechanical room during operations. The proposed project would not substantially increase traffic on regional roadways or cause roadway capacities to be exceeded.

EFFECTS OF PROPOSED ACTION –ALTERNATIVE A

Projected Traffic Volume

The proposed action would result in the generation of 20 trips per day during construction and 1 trip per day during projection operation. The proposed action would result in minimal increases in traffic. The following construction-related vehicles would be used during project construction:

- 1 backhoe or excavator for trenching distribution and discharge pipelines and to prepare the sites for the 2 buildings to be constructed
- 1 twenty cubic yard dump truck to haul bedding for trenches, hauling approximately 3 loads per day
- 1 concrete truck to pour foundations at both buildings
- 1 water truck to minimize dust during construction
- Between 6-10 construction worker vehicles to be parked at Building 3, then carpooled to work sites
- 1 portable toilet for worker's use during construction

Equipment would be left at the construction site after work is completed for the day. On non-construction days the equipment would be stored wherever the task ended last. The listed construction equipment is anticipated to be in operation five days a week for approximately 60-70 days. Average daily traffic is expected to be approximately 20 trips per day during construction activities for construction workers. In addition to these vehicles, it is estimated that no more than 53 tractor-trailer loads of construction materials would be required during project construction. It is estimated that the water truck would generate 4 trips per day.

Construction workers' parking would be in the lot at Building Group A in front of Building 3 along County Road 203 (see Figure 2.2-4). The empty lot located to the west of the Building Group A would be the drop-off site for the project materials as it is convenient and centrally located to all construction sites. Materials would be stored at this Central Site (CS) until they are picked up and installed. The total daily trips from construction workers, construction equipment, and transfer of construction materials are estimated to be 30 trips per day maximum. Construction activities, and thus construction-related traffic, would take place during daylight hours from March to May, typically from 7 a.m. until 8 p.m.

Effects on Road Traffic

Highway 299 and the county roads are designed to adequately accommodate the estimated increase in traffic volumes during construction and operation of the proposed project. The additional trips generated by construction of the proposed action would not be expected to adversely affect traffic volumes or traffic conditions along these roads. The state and County conducted estimates of traffic on roadways that would be affected by the proposed project; the estimates are shown in Table 4.2-1.

As shown in Table 3.11-1, State Route 299 has maximum traffic of 180 vehicles per day. State Route 139 north of the junction with 29, has peak traffic of 150 vehicles per day. As shown in Table 3.11-2, County Road 161 has Average Annual Daily Traffic (AADT) of 98 vehicles per day and County Roads 54, 82, and 83 have an average AADT of 300 to 400 vehicles. The County conducted traffic counts for a typical week volume when no special events were occurring in and around Canby.

The Modoc County General Plan does not establish levels of service for County roads. The goal in the Circulation Element of the General Plan is for circulation is to maintain an efficient, safe, and environmentally sound comprehensive circulation and transportation system (Mintier Harnish 1988b). Due to the short duration of construction activities and the addition of one vehicle trip per day during operation, traffic associated with the proposed action would not be significant.

Table 4.11-1: AADT Traffic for State and County Roads* and Project Traffic

Mile Description	Average Annual Daily Traffic	Estimated Maximum Project Traffic
State Route 299		
21.75Jct. Rte. 139 Northwest	1400	30
40.28Alturas, Juniper Street	2900	30
State Route 139		
0.23North Jct. Rte. 299; Canby West	970	30
County Road 82 Junction of 83	640	30
County Road 82 North/South by RR tracks	300	30
County Road 83 P.O. by 82	378	30
County Road 161 North end of 82	98	30
County Road 54 South of Canby by second bridge	240	30

Notes: The above figures for State Routes represent *Ahead* AADT. Ahead is defined as the number of vehicles after a count station. AADT for County Roads are the most recent counts.

SOURCE: Caltrans, Morris, and MHA 2002

Construction of the proposed project would require the installation of the pipeline underneath the existing Highway 299. The proposed pipeline is to be installed using the "bore and jack" method, which equates to drilling a horizontal hole underneath the roadway from one side to the other, and slipping the pipe through the bored hole. The majority of the bore and jack process occurs along the roadway's shoulders. There is a possibility that during the process traffic along the roadway may be slowed or may be controlled for one-way movement with the aid of signage, and a flagman. The duration of the bore and jack process combined with the relatively minimal traffic volume alone highway 299 is not expected to result in a significant degradation of traffic movement.

Effects on Structural Integrity of Project Area Roads

Highway 299 and the county roads are designed to adequately accommodate the estimated increased traffic volumes during project construction and operation. The roads were designed to accommodate heavy vehicle traffic for logging operations. A logging truck is considered the legal load limit (80,000 lbs.) that triggers the county requirement for a Special Use Permit (Morris 2002b). The concrete truck maximum loaded weight would be 58,000 lbs. and the 3,000-gallon water truck maximum weight would be 46,440 lbs. These would be the heaviest and most frequently used trucks during construction. The heaviest load of materials would be the distribution piping at approximately 26,000 lbs. on one semi load. The gross vehicle weights for the backhoe, dump truck, and water truck would not exceed the 80,000 lb. weight limit; therefore, the proposed project would not have a significant effect on the structural integrity of these roads.

In 2001, Modoc County re-paved county roads 54, 82, 83, and the paved portion of 161 in Canby. I'SOT worked with the County Road Department to install 10" culverts underneath County Roads 161 and 83

during the September 2001 repair and repaving of those roadways. The project pipelines would be slipped through those existing conduits, thereby negating the need for bore and jack processes at those locations. (Merrick 2002d). These existing culverts eliminate the prospect of damage to the affected roadways that could result from the bore and jack process.

Boring under Highway 299 could have the potential to damage roadways due to vehicle loads or construction activities. Caltrans would review construction documents prior to initiation of the horizontal directional drilling (HDD) process. If Caltrans determines that there exists a potential for roadway damage a surety bond may be required to be posted with Caltrans. The purpose of the bond would be to ensure adequate funding to repair any damage to the roadway in the event that the applicant does not correct any damage. A determination of roadway conditions prior to construction would be documented through the making of a videotape record of all roadway surfaces, shoulders, signage, and other features in the vicinity of construction activities and along the local route of delivery vehicles.

MITIGATION MEASURES

Mitigation Measure 4.11-1

I'SOT will ensure that construction activities comply with all conditions of the Caltrans Encroachment Permit. These measures would minimize the chance of roadway damage during the jack and bore (HDD) process and would include the following:

a. All equipment used on the paved surface of the State highway shall be rubber tired or rubber tracked, and meets the weight requirements for operation on a State highway.
b. Any trench or excavation within 15 ft of the edge of the traveled way or 10 ft from the edge of pavement, whichever is greater, shall be closed.
c. All work authorized herein shall be performed during daylight hours only. No work shall be performed during inclement weather.
d. The minimum depth of cover over the bore casing within the State's right-of-way shall be 7.5 ft for high-risk uncased gas mains or 6 ft and 5 ft below any drainage facility.
e. No open cutting of the roadway prism is permitted.
f. Trenches and boring pits outside of the highway prism shall be backfilled with material approved by State's representative.
g. HDD operators are required to have basic training on HDD rigs via the dealerships – Vermeer, Ditch Witch, American Auger, etc., and have proof of training in their possession.

I'SOT will make a videotape before and after HDD operations to document roadway integrity has been unchanged or to determine if permittee is liable for damages to the State highway caused by his operation. I'SOT will repair any damage caused by the construction, as required by Caltrans.

Mitigation Measure 4.11-2

I'SOT will ensure that no vehicle used in construction or material delivery shall exceed the design load limit of the various roadways that may be used during construction.

Mitigation Measure 4.11-3

I'SOT will ensure that no construction equipment that utilizes tractor treads shall travel upon any public roadway.

Mitigation Measure 4.11-4

I'SOT will ensure that no construction equipment shall operate or park within 5-feet of either edge of a pavement edge.

EFFECTS OF NO ACTION ALTERNATIVE

If the project were not constructed due to lack of DOE funding, there would be no adverse traffic effects from Alternative B, the "No Action" alternative; however, the project could proceed without DOE funding contingent upon alternative funding, with effects from Alternative A potentially worse without DOE participation because no mitigation would be required (except NPDES required items). The following measures would not be implemented without DOE involvement: 4.11-1, 4.11-2, 4.11-3 and 4.11-4. Without funding by DOE, I'SOT would not be reimbursed for costs resulting from permitting efforts, engineering consultation, and system installation costs. No data gathering system would be installed for DOE research and development (R&D) purposes.

4.12 Human Health and Safety

SIGNIFICANCE CRITERIA

Human health and safety related impacts that could be considered significant include those that would:

- Create a potential public health hazard
- Involve the use, production, or disposal of materials which pose a hazard to people
- Interfere with emergency response or evaluation plans

METHODOLOGY

Health and safety analysis for the project was conducted by identifying the surrounding receptors that may be subject to health and safety impacts and the hazardous materials that would be associated with the project. The manner in which the identified materials would be handled is analyzed for sufficient precautionary measures. Physical hazards that may result from project implementation and associated adverse impacts are also identified. The potential degree of impact from identified hazards is analyzed based on physical conditions, proposed project measures, and regulatory standards. Additional safety and preventative measures are recommended as needed.

IMPACT OVERVIEW

The project would have the potential for spills and hazards associated with oils and lubricants used during project construction. The project would also result in potential for fire hazards. Implementation of proposed measures would reduce hazard potential to less than significant levels. The project would also have the potential for pipeline spills during operation. Incorporation of recommended mitigation measures would decrease potential for and magnitude of leakage hazards to less than significant levels.

SENSITIVE RECEPTORS

Receptors of human health and safety impacts that may result from the project include occupants of the surrounding I'SOT mobile and group homes, rural medical-dental-behavioral health clinic, dining hall, and school. Receptors also include agriculture and custom haying workers along the discharge pipeline route and motorists along State Route 299. The 6 to 10 workers required during project construction may also be exposed to potential project-related hazards.

EFFECTS OF ALTERNATIVE A (PROPOSED PROJECT)

Hazardous Materials

Materials of concern for accidental spillage and leakage that would be used during project construction or operation include:

- Petroleum products
- Heavy metals collected in filters
- Geothermal fluid

Lubricating or Fuel Oils and Petroleum Products. Some hazardous materials from project-related activities (i.e., fuels, oils) would be present on-site during construction activities. The likelihood of substantial spills and discharges in this area would be low due to the limited amount of chemicals that would be used or transported. Hazardous chemicals to be transported include fuels, oils, and lubricants used during construction. The potential discharge of oils or petroleum products could occur from equipment leakage and would involve a very small volume.

Possible locations for accidental spills during construction are throughout the project area and along the route from the project site to the equipment maintenance site. The construction equipment would be maintained at the I'SOT Auto Shop, located a 0.5-miles away on industrially zoned I'SOT property. Implementation of Mitigation Measure 4.12-2 would reduce the potential for equipment leakage to a less than significant level.

Use of the propane boiler for back-up heating may result in propane leakage. The propane boiler would require a 1,500 to 2,000 gallon propane storage tank to provide one week's backup operation at peak rated rates. The propane boiler would be located in the mechanical and control building, thus spills from the boiler would be contained within the building. Propane leakage may occur outside the building during transport. Implementation of Mitigation Measure 4.12-2 would reduce the potential for propane leakage to less than significant.

Hazards related to spills of lubricating or fuel oils and petroleum products include:

- Possible fire hazard
- River water, soil, and vegetation contamination

Fluid spills are not expected to be in large amounts. The risk of fire would not be significant because I'SOT would maintain fire fighting equipment and trained fire fighters in the vicinity. Effects to soils, vegetation, and surface water would be limited because of the limited amount of the materials to be used. I'SOT would clean up spills according to hazardous materials requirements of the County and state.

Mercury. Possible spills may also occur from transport of discarded mercury (Hg) and contaminated carbon from the filtration system (discussed under Waste Disposal below) when the system reaches saturation and is cleaned. Discarded filter material would be treated as a hazardous material by the licensed vendor and disposed of in a Class 1 landfill outside Modoc County.

The geothermal resource contains a maximum of 231 nanograms per liter (ng/L) of mercury (Basic Laboratory 2002). The mercury would be removed from the geothermal fluids using Granular Activated Carbon (GAC). The GAC filters are designed to filter geothermal fluid (water) before discharge into the Pit River. Removal efficiency decreases with increased flow rates. Any remaining mercury that would be discharged would be diluted in the Pit River. Section 4.3, Hydrology and Geothermal Resources provides further information on possible mercury contamination of the Pit River.

Geothermal fluid from the geothermal well (ISO-1) has an average mercury level of 187 ng/L and a maximum of 231 ng/L (Basic Laboratory 2002). At 99% removal efficiency, the GAC filtration system is expected to remove 185 nanograms of mercury for every liter of geothermal fluid at average flow, and 229 nanograms of mercury for every liter of geothermal fluid at peak flow. It is estimated that flow into the filter would be at about 37 gpm 17% of the year, at 10-30 gpm 45% of the year, and at 10 gpm 38% of the year. Fluid flow is not expected to reach 60 gpm because the well has not been able to flow at 60 gpm.

Peak use discharge to the filter skid would be 37 gal/min (gpm) or 168 L/min. At this flow rate, assuming initial mercury concentration at 231 ng/L and a projected 98% removal factor, the filters would remove 226 nanograms of mercury for every liter of geothermal fluid. Projected mercury collection at the filters, assuming peak demand throughout the year and maximum mercury concentrations in the geothermal fluid, would be approximately 20 grams per year. This projected maximum accumulation is based on Basic Laboratory tests that have yielded a possible efficiency factor for peak flow. Actual accumulated mercury per year may be less than 20 grams. Potential for mercury spills would be less than significant because of the safety procedures I'SOT would follow for handling mercury. Any spills of mercury would occur in the building and would be cleaned up using standard operating procedures appropriate for mercury.

Waste Disposal

Hazardous wastes would not be produced during construction. During project operation and in the event that the activated carbon filters reach saturation, the GAC filters would be cleaned by a licensed vendor and the contaminated carbon would be replaced with fresh activated carbon. The lifespan of the filters is not known; the filters would be analyzed monthly. Upon filter saturation, a licensed vendor would process the contaminated carbon for mercury recovery. Discarded filter material would be treated as a hazardous material by the licensed vendor and disposed of in a Class 1 landfill outside Modoc County.

The potential for spills from the GAC filters during removal and transport of mercury-contaminated carbon would be less than significant. The filters have about 2,000 lbs of granular activated carbon and would be cleaned upon saturation by a licensed vendor (the lifespan of these filters is unknown). Analysis of the filters in the system would be conducted on a monthly basis. Likelihood of spills from maintenance of the filtration system would be minimal because a licensed vendor (US Filter) would perform maintenance according to standard procedures for handling mercury materials.

Pipeline Spills

If fluids of high temperatures were released outside of the system, there would be minimal impacts. Likelihood of pipeline leaks would also be minimal at the discharge pipeline as it would not be pressurized; flow along the discharge pipeline would depend on gravity. The geothermal fluid would be at approximately 200˚F at the well head. Most of the heat in the fluid would be dissipated during space heating. The geothermal fluid would have a relatively low temperature in the discharge pipeline (80˚F). Fluids of this temperature would not have an adverse effect on vegetation. Due to the porous nature of the soil, fluids would quickly percolate into the soil minimizing the effect. If a leak in the pipeline occurs, the system would be shut down and replaced with the back-up propane boiler until repaired.

Potential spills of filtered geothermal fluid may occur along the unpressurized portion of the discharge pipeline. Based on conversation with the RWQCB (Rohrbach 2002b) it was determined that given the specifications of the discharge pipeline, the pipeline leak monitoring method initially outlined in the WDR (Appendix D) required more detail. The 3-foot deep pipeline would be laid on a gravel bed, directing leaking fluids downward. Surface pooling of leakage would be unlikely and measurements of flow would be more effective at leak detection (Rohrbach 2002b). Mitigation Measure 4.3-2 (see 4.3 Hydrology and Geothermal Resources) would enable monitoring for pipeline leaks, and would therefore minimize the potential duration and magnitude of impacts due to leakage. Pipeline leaks would not directly affect human receptors or wildlife because the pipelines would be buried.

The pressurized portion of the pipe is not expected to be an area of concern regarding pipeline leaks as it would run a very short length (less than 8 feet) from the well to the mechanical and control building, within the I'SOT community. Most of this pipe run would be inside of the mechanical and control building and there would be enough flex joints along the segment to take up any thermal expansion or contraction. Thermal expansion and contraction would be minimal and not an issue of concern; thermal expansion and contraction would be an issue of concern if the pipe run would be several hundred feet. The thermal expansion and contraction would also be minimal as the temperature of the fluid would be relatively low (180^0F to 200^0F).

The following issues are potential areas of concern regarding pipeline leaks:

- **Groundwater mercury contamination.** The pressurized portion of the pipeline is not a segment of concern regarding leakage because it runs a very short length and because there would be enough flex joints to accommodate the expected minimal thermal contraction and expansion. The pipeline segment of concern for leakage would be the unpressurized portion of the discharge pipeline after the GAC filters. The unpressurized portion of the pipeline would run 5,400 feet along predominantly grazing land. Thermal expansion and contraction would not be an issue of concern along the discharge pipeline because water temperature would be about 80˚F. Mercury content in the geothermal fluid would decrease significantly after filtration. The Human Health Limit in the California Toxics Rule (CTR) for consumption of water and organisms is 50ng/L for mercury. After filtration, mercury levels in the effluent would range from 2 to 19 ng/L, below the 50 ng/L Human Health Limit. The 50ng/L limit is not protective of aquatic wildlife; vegetation and wildlife would not be affected by groundwater contamination. Section 4.3 Hydrology and Geothermal Resources provides further information on impacts of pipeline leakage on groundwater.
- **Groundwater arsenic and boron contamination**. Arsenic levels in the geothermal fluid range from 99 – 110 µg/L. The Safe Water Act Maximum Contaminant Level (MCL) for arsenic is 10 µg/L. The highest concentration of boron in the geothermal fluid is 4,090 µg/L. Boron is not a priority pollutant; however, the receiving water objective established in Order No. R5-2002-0079 is 600 µg/L. Concentrations of arsenic and boron would not increase over time. Implementation of Mitigation Measure 4.3-1 (see 4.3 Hydrology and Geothermal Resources) would reduce potential for pipeline leaks to less than significant levels.
- **Vegetation impacts.** The pipeline would be buried and laid in gravel so spilled material would percolate downward. The geothermal fluid would have a relatively low temperature in the discharge pipeline (80˚F). Fluids of this temperature would not have an adverse effect on vegetation. Vegetation in the area is too shallow-rooted to uptake any metals associated with potential spillage (see 4.4 Biology for further discussion), which would occur below 3 feet from the surface.
- **Wildlife impacts.** The pipeline would be buried and laid in gravel so spilled material would percolate downward. Due to the porous nature of the soil, fluids would quickly percolate into the soil. The geothermal fluid would have a relatively low temperature in the discharge pipeline (80˚F). No direct hazards on wildlife would result from leaks along the unpressurized discharge pipeline because the pipeline would be buried and leaks would not travel up to the surface. There would be no adverse impacts to grazing animals because surface vegetation would not be affected by leaks in the buried pipeline and the local vegetation is too shallow-rooted to uptake metals associated with pipeline leaks.

- **Contamination of yards along pipeline.** The pressurized portion of the pipeline has enough flex joints along the segment to take up any thermal expansion or contraction, which may lead to leakage. The pressurized pipeline is also less than 8 feet and would mostly be contained within the mechanical building. There is little likelihood of hazards from the pressurized pipeline. The unpressurized portion of the discharge pipeline would be buried and leaks form that segment would not directly affect humans. Due to the porous nature of the soil, fluids would quickly percolate into the soil minimizing the effect.

Implementation of Mitigation Measures 4.3-1 and 4.3-2 (see 4.3 Hydrology and Geothermal Resources) would reduce potential for pipeline leaks to less than significant levels. Implementation of Mitigation Measure 4.12-6 would minimize impacts of pipeline leaks to less than significant levels.

Fire

Potential sources of fire from the proposed project include:

- Sparks from welding or related operations (cutting, grinding, etc.)
- Broken glass, if not properly disposed
- Cigarettes, if carelessly discarded
- Hydrogen peroxide spills (if it is used)

Potentially flammable/combustible chemicals that would be used in the proposed project include oil and fuel. Common natural sources of fire include lightning strikes. Environmental conditions such as weather and the "light fuel" grasslands in the project area may further contribute to fire potential from the project. Mitigation 4.12-3 to 4.12-5 would reduce potential for fire hazards to less than significant.

Well Blowout

Well blowouts are accidental, uncontrolled releases of geothermal fluids such as steam, gases, or hot water from a geothermal well. Blowouts may occur during well drilling and during utilization. The potential concerns regarding accidental releases of geothermal fluids include effects to surface water and shallow groundwater resources, hazards to workers' health and safety, and release of hydrogen sulfide (during drilling). A well blowout usually occurs from over pressurization of either the well casing, control valve or formation and almost all well blowouts occur in high-pressure geothermal areas. The potential for a blowout to occur at the proposed project is very low because the project is using an existing well and the geothermal resource at the project is a lower pressure resource. The existing well requires a submersible pump to produce the resource. The existing well reaches a depth of 2,105 feet and taps into a low-temperature resource (180°F to 200°F) suitable for direct use.

Blowouts usually occur in high-temperature, high-pressure wells. Of the hundreds of geothermal wells in the United States, the Geothermal Resources Council has records for only seven blowouts (BLM et al. 1998), all of which were controlled within a few days time. In the unlikely event of a blowout, the geothermal fluids would flow from the well into the adjacent pasture. The primary impact of this discharge would be the temporary effect of high temperature water on the existing grass and pasture vegetation. The chemistry of the geothermal fluid is slightly higher in total dissolved solids than the cold water wells in the area used for pasture watering which could increase the salinity of the soils in the spill area.

Emergency Response

The proposed project construction and operation would not cause a significant interference with emergency access in the project region. The pipeline would cross Highway 299 but is not expected to result in a significant degradation of traffic movement (see Section 4.11 Transportation and Traffic). The project would not result in a significant effect due to interference with emergency access.

MITIGATION MEASURES

Mitigation Measure 4.12-1

Prior to project commencement, I'SOT will submit a site construction and safety plan to the Director of the Modoc County Planning Department for review and approval. The purpose of the plan shall be to ensure public safety during all phases of project construction through:

a. The installation of safety signage, placed as appropriate within the construction corridor, that warns of risks associated with on-site construction activities and outlines measures to be taken to ensure safe use of facilities near construction areas and avoidance of active construction equipment
b. The installation of temporary safety fencing to restrict or prevent public access to active on-site construction sites or equipment

Mitigation Measure 4.12-2

Prior to project commencement I'SOT will submit to the Director of the Modoc County Planning Department for review and approval a safety plan. The purpose of the plan is to minimize the exposure of the public to potentially hazardous materials during all phases of the project through:

a. Appropriate methods (e.g., Best Management Practices) and approved containment and spill-control practices (e.g., spill control plan) for transport and storage of chemicals and materials on-site
b. Safety signage, placed as appropriate along the construction corridor during construction or repairs, that warns of risks associated with on-site construction materials and outlines measures to be taken to ensure safe use of facilities near construction areas and avoidance of construction materials
c. Temporary safety fencing during construction or repairs to restrict or prevent public access to active on-site construction materials or chemicals

Mitigation Measure 4.12-3

I'SOT will ensure that all construction equipment will be equipped with fire potential reduction equipment, such as but not limited to spark arresters, mufflers, etc.

Mitigation Measure 4.12-4

I'SOT will ensure that fire preventative measures are taken during potentially hazardous operations, such as welding.

Mitigation Measure 4.12-5

I'SOT will ensure that fire fighting equipment is supplied to the project site. Fire detectors, fire extinguishers, and hand-held fire fighting equipment would be available and maintained at the mechanical control building as well as the food service/laundry building for the duration of the project.

EFFECTS OF ALTERNATIVE B (NO ACTION)

If the project were not constructed due to lack of DOE funding, there would be no adverse effects on human health and safety from Alternative B, the "No Action" alternative; however, the project could proceed without DOE funding contingent upon alternative funding, with effects from Alternative A potentially worse without DOE participation because no mitigation would be required (except NPDES required items). The following measures would not be implemented without DOE involvement: 4.12-1, 4.12-2, 4.12-3, 4.12-4 and 4.12-5. Without funding by DOE, I'SOT would not be reimbursed for costs resulting from permitting efforts, engineering consultation, and system installation costs. No data gathering system would be installed for DOE research and development (R&D) purposes.

4.13 Unavoidable Adverse Impacts

A number of unavoidable adverse effects that would occur if the proposed action were implemented based on the analysis conducted for this document. Adverse impacts that cannot be avoided are described below. Each of these effects is discussed in detail in Sections 4.1 through 4.12. Many adverse effects would be avoided through mitigation. None of these effects are considered to be significant.

Meteorology/Air Quality

Temporary unavoidable adverse impacts would occur from dust production during the proposed construction, trenching, and transportation activities. Dust would be generated from vehicle movement over soil cleared of vegetation, trenching for pipeline installation, and materials transport. Vehicle and generator exhaust would also be emitted during construction and transport activities. Watering for dust suppression and use of vehicle cover during material transport would reduce dust emissions and emission controls would minimize vehicle exhaust. These unavoidable effects would be less than significant.

Geology/Soils and Mineral Resources

Building and pipeline construction requires 13.8 acres of vegetation clearing and surface grading. Temporary loss of vegetative cover will temporarily cause a minor increase in the potential for erosion. This is an unavoidable effect, but is less than significant.

Hydrology and Geothermal Resources

Effluent discharge will increase levels of mercury, arsenic, and boron in the Pit River. These contaminants will all be within permissible levels as determined by the Central Valley Regional Water Quality Control Board in the NPDES waste discharge conditional permit (Appendix C). Levels of these contaminants will be monitored as part of the permit conditions. This impact is adverse but not significant.

The production of up to 60 gpm of geothermal fluid would be an adverse but not significant impact.

Biological Resources

Construction of the pipeline will require vegetation clearing in jurisdictional wetlands. Temporary loss of 0.03 acres of wetland vegetation will cause an adverse and unavoidable effect; this effect would be mitigated by measure 4.4-1that requires that the wetland vegetation be replaced after construction is completed.

Mitigation measures will avoid unavoidable adverse effects to sensitive plant species. The discharge of the geothermal fluid to the Pit River will result in the bioaccumulation of mercury in fish, which is considered an adverse effect, but not significant. The increase in mercury consumption of bald eagles from eating the fish is considered adverse, but not significant.

Cultural Resources

Mitigation Measures 4.5-1, 4.5-2, and 4.5-3 would avoid adverse effects to cultural resources if they are encountered during surface disturbance to pipeline construction so they would then be less than significant.

Land Use

Construction will require some disturbance to land use in agricultural areas owned by the I'SOT Community. This adverse effect would be temporary in nature and implementation of measure 4.3-1 would reduce this effect to less than significant.

Noise

Activities such as vegetation clearing, surface grading, and construction would produce unavoidable and adverse noise during the 70-day construction period. Use of muffler devices on equipment as required under Mitigation Measure 4.7-1 would reduce noise emissions. Noise impacts during construction are expected to be significant but temporary, and would not affect receptors outside the I'SOT community.

Aesthetics

Construction activities for the pipeline would be close to existing county roads and will be visible to varying degrees from short-range viewpoints along these roads, depending on the amount of screening provided by trees at each site. The proposed action will also be visible to dispersed motorists passing by the construction on County Road 54 and State Route 299. The changes to viewsheds during construction would be adverse but temporary and not significant.

Transportation and Traffic

Construction of the buildings, distribution lines, and discharge pipeline will require approximately 30 vehicle trips per day maximum including movement of construction equipment during non-construction days. A temporary increase in traffic will cause an unavoidable effect to traffic along Highway 299 and County Roads 161, 82, and 83. This effect would be short in duration and less than significant. A potential exists for roadway damage during construction equipment movement and boring under Highway 299. The incorporation of Mitigation Measures 4.11-1, 4.11-2, 4.11-3, and 4.11-4 would reduce this potentially adverse effect.

Human Health & Safety

Operation of the pipeline provides potential for pipeline leakage into immediate surroundings. Implementation of Mitigation Measure 4.4-1 would minimize the potential for pipeline leakage. If an accident caused the pipeline to break or leak, the effect would be adverse and temporary. Monthly monitoring as required by Mitigation Measure 4.3-2 and immediate repair of detected leaks as required under Mitigation Measure 4.12-6 would reduce adverse impacts of potential pipeline leaks to less than significant levels.

EFFECTS OF THE ALTERNATIVES

If the project were not constructed due to lack of DOE funding, there would be no adverse effects from Alternative B, the "No Action" alternative; however, the project could proceed without DOE funding contingent upon alternative funding, with effects from Alternative A potentially worse without DOE participation because no mitigation would be required (except NPDES required items). Without funding by DOE, I'SOT would not be reimbursed for costs resulting from permitting efforts, engineering consultation, and system installation costs. No data gathering system would be installed for DOE research and development (R&D) purposes.

4.14 Irreversible or Irretrievable Commitment of Resources

The Council on Environmental Quality's NEPA Guidelines (40 CFR 1502.16) requires the discussion of any irreversible or irretrievable commitments of resources that would be involved with the proposed action or alternatives.

The majority of the environmental effects that would be generated by the proposed action and alternatives are reversible. Construction activities will result in short-term, temporary effects on lands and resources. The duration of the majority of the effects will occur only during construction, a period expected to be no longer than 70 days. Mitigation measures have been identified to ensure that lands and resources affected by construction of the action or alternatives are returned to their pre-construction condition, thereby reversing the effects.

Construction of the action and alternatives will result in the consumption of non-renewable fossil fuels for the transportation of equipment, construction materials, and personnel. Construction of the action and alternatives will also result in the use of steel, concrete, and other non-renewable construction materials. The use of those materials is considered a use of irretrievable resources, although those materials can be recycled for subsequent use. The commitment of these resources would be relatively small, short-term (construction only) and focused toward a specific goal.

The action and alternatives will utilize waters produced from geothermal resources. Those waters will be discharged into the Pit River after their use. This is considered an irreversible commitment of resources. The level of withdrawal from the geothermal resource (approximately 40 gpm) is relatively low compared to the potential production from the geothermal resource and therefore is not considered a significant effect on the resource.

5: CUMULATIVE IMPACTS

5.1 Introduction

NEPA requires that agencies consider the cumulative impacts of a proposed action or project. NEPA regulations define a cumulative effect as the effect on the environment that results from the incremental effect of the action when added to the effects of other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes the other actions and regardless of land ownership on which the other actions occur. An individual action when considered alone may not have a significant effect, but when its effects are considered in sum with the effects of other past, present, and reasonably foreseeable future actions, the effects may be significant (40 CFR 1508.7 and 1508.8, and FSH 1909.15 Section 15.1).

This cumulative impact analysis considers impacts of the proposed action and other projects that have been proposed, or are reasonably foreseeable to take place in the vicinity of the proposed action. The primary activities considered in the analysis of cumulative impacts are other geothermal projects and other activities in the project vicinity that may occur at the same time as the proposed action.

The geographic area considered for cumulative impacts is generally considered to be a 5- to 8-mile radius from the proposed project area, although boundaries of analysis are dependent upon the type of impact to be assessed. The proposed project would occur in the 2003 spring season (March to June).

The effects of geothermal projects vary with the type of activity (exploration or development, well drilling or power plant operation) and whether the geothermal resource is high temperature or low temperature. High temperature resources usually result in the development of power production facilities. Low temperature resources (such as in the Canby area) usually support direct-use project such as district heating, aquaculture, or food drying, although power can be produced from low temperature resources.

The effects of the activities for construction and operation of the proposed direct use project are described in Chapter 4 of this document. In general, effects of the proposed project include surface disturbance for construction and operation of pipelines, mechanical building, and the food service building. Construction activities create noise and dust; mitigation measures are applied to reduce effects. Pipelines require surface disturbance for the trenching construction activities. Effluent discharge contributes to water quality effects. The surface disturbance and noise results in effects to biological resources; mitigation measures reduce the effects to less than significant levels for all parameters.

5.2 Potential Cumulative Projects

MODOC COUNTY

The cumulative impact analysis considers impacts of the proposed project along with the potential impacts of other projects that are reasonably foreseeable to take place near the proposed project. Modoc County has indicated that there are no approved and un-built or proposed projects in the general vicinity of the proposed Canby Geothermal project that, combined with the proposed project, could be identified as potentially generating cumulative environmental impacts.

OTHER PROJECTS

Bureau of Land Management

There are no activities currently planned within a 10-mile radius of Canby in the nearby BLM lands for early 2003 (Humm 2002).

Modoc National Forest

The following projects were reported by staff to be scheduled in the Modoc National Forest within a 10-mile radius of Canby in the early part of 2003 (Bryan 2002 and Read 2002):

- Timber Sale and Thinning of 1,500 acres in the vicinity of Rail Mountain 4.5 miles northwest of the project area)
- Thinning in the Badger/Eagle area of 300 acres in the Rail Mountain/Duncan Reservoir area, with 30-40 acres to be completed by July 2003 (6.5 miles northwest of the project area)
- Wildlife burning of 80 acres at Washington Mountain between March to May 2003 (4.5 miles west of the project area)
- Underburning of vegetation in the Hackamore area 2 miles north of Westlake Butte by Washington Mountain, with 1,000 of the 2,000 acres to be completed between March to May of 2003 (4.5 miles west of the project area)

These projects have the potential to result in cumulative impacts for traffic and air quality.

Caltrans

There are no road improvement projects currently planned along Highway 299 or 139 in the vicinity of Canby by Caltrans for early 2003 (Fawver 2002).

Kelley Hot Springs

Another ongoing geothermal direct use project is a privately operated aquaculture project at Kelley Hot Springs (KHS). The KHS project utilizes naturally flowing geothermal fluids from the same geothermal reservoir that serves the I'SOT well. The NPDES permit granted by the Regional Water Quality Control Board prescribes conditions for the discharge by the aquaculture project. Geothermal fluid is not actively extracted from the resource for this use and thus these operations do not cause an impact on the geothermal resource. This project does not alter the volume of KHS geothermal waters flowing to the Pit River.

CUMULATIVE IMPACTS

The cumulative impacts of the proposed projects are described below. Measures are proposed as conditions of the project, which would reduce all impacts to less than significant levels. Cumulative effects of the proposed project with other projects identified within a 10-mile radius indicate potential effects only to traffic and air quality.

Air Quality

The air quality study area is generally the air basin. The proposed and cumulative projects would emit PM_{10} from construction and criteria pollutants from cars, trucks, generators, and earthmoving equipment. The project would result in low emissions of pollutants that would be emitted through use of the back-up propane boiler, although implementation of the project would decrease total propane-related emissions in Canby. Emissions from timber burning (4-5 miles away) may travel to the project area. Air emissions from the proposed direct use project would be short-term and temporary and would not be expected to represent a cumulatively significant impact on air quality in the region. Emissions controls on equipment and watering of construction sites for dust control would help avoid the potential for cumulative air quality effects.

The Kelley Hot Springs geothermal project would not have a cumulative effect on air quality because the proposed and existing direct-use geothermal projects not involve significant air emissions during operation.

Geology, Soils, and Mineral Resources

The study area for the project is the Modoc Plateau. There are no approved and un-built or proposed projects identified in the general vicinity of the proposed Canby Geothermal project that would combine with the proposed project to create cumulatively significant impacts to geology or soils.

Hydrology and Geothermal Resources

Surface water. The project study area for surface water is the Warm Springs Valley Drainage Basin, a sub-basin of the Pit River Basin. The proposed project would cumulatively contribute pollutants to the Pit River. Kelley Hot Springs (KHS) is approximately 2 miles upstream from the proposed discharge point and releases approximately 400 gpm of geothermal fluid into the Pit River. The proposed Canby project includes mitigation measures to minimize contaminants in the discharge and the project will meet the requirements of the RWQCB to protect water quality. The KHS geothermal fluid contains mercury and arsenic levels above what is expected to be discharged from the proposed project after mercury abatement. Since the volume of the proposed discharge is very small (less than 60 gpm and approximately 10 percent of that of KHS) and levels of both mercury and arsenic are lower in the

proposed project discharge, this project is not expected to have a significant cumulative impact on Pit River water quality.

Groundwater. The project study area for groundwater is the Alturas Groundwater Basin. The proposed project does not include use of potable groundwater. The project would not contribute to groundwater use in the region. The proposed project includes measures to avoid groundwater contamination and would not cause a cumulative effect on groundwater.

Geothermal Resources. The project geothermal resource study area aquifer is considered to extend from Kelley Hot Springs to Canby. The only geothermal project in the region that may combine to have cumulative impacts would be the project at Kelley Hot Springs. The Kelley Hot Springs project only uses geothermal fluids that are naturally discharged. The proposed project has only a small withdrawal of geothermal fluids (less than 60 gpm) and would not cumulatively combine to cause a significant adverse effect on the geothermal resource.

Biology

The biological cumulative impact study area would be a 10-mile radius from the town of Canby. The proposed action would result in the surface disturbance of approximately 13.8 acres, much of which has been previously disturbed by farming operations. The temporary loss of 0.03 acres of wetland would not cumulatively contribute to the loss of wetlands in the region. The proposed project would not represent a significant additive effect to that of the timber projects because there is no timber affected. The cumulative loss of habitat from the proposed project is not a significant loss of habitat because of the abundance of similar habitat in the region. The proposed mitigation measures would further reduce or minimize any potential habitat impacts. The proposed project would not add a significant effect to cumulative impacts to vegetation and wildlife in the area.

The proposed project would be adding additional mercury to the Pit River downstream of Kelley Hot Springs; however, the additional discharge amount is less than significant and is not expected to harm bald eagles or other wildlife. Mitigation measures will be carried out to monitor mercury levels in the water and in fish tissue to prevent mercury limits that could cause an adverse effect from being reached. The cumulative contribution of mercury to the Pit River would result in less than significant effects on fish and wildlife.

Cultural Resources

Archaeological and Historic Resources. The area of cumulative effect is the Canby project study area. The proposed action would not affect any known archaeological or historic resources. No tribal sacred sites have been identified in the project area in a search performed by the California Native American Heritage Commission. The mitigation is designed to ensure avoidance of cultural resource or sites (if they are identified) so that no adverse effect to cultural resources can occur from implementation of the proposed project.

An effect to resources at this site, if it occurs, would not be cumulatively significant because mitigation would be implemented. The proposed project would not contribute to cumulative effects to resources in the vicinity of Canby or the Pit River. The project would not contribute to a cumulative effect on cultural resources in the region.

Traditional Cultural Values. The study area for cumulative effects to traditional cultural values includes the Pit River area. Native American groups have expressed concern about geothermal activities in the region. Pit River Tribe members indicated that alterations in the existing environment associated with the district heating project could constitute effects on the cultural integrity of the sites if identified. There are no identified traditional cultural properties in the Canby project area; therefore no cumulative impacts to site access or integrity are anticipated.

Land Use, Agriculture, and Recreation

Land Use. The land use study area is Modoc County. The construction effects of the district heating system are short-term and temporary and would not result in a cumulatively significant impact on existing, farming, ranching, or other land uses in the area. The district heating project would not represent new land use in the area since other geothermal projects have been and continue to be underway. Direct use geothermal projects are consistent with the existing Modoc County General Plans.

Agriculture. The study area for agricultural and farmland effects would be Modoc County. The district heating system would result in short-term and temporary impacts to agricultural lands due to construction of the pipeline. The temporary effects due to installation of the pipeline in pastureland are less than significant. Construction would occur over an approximately three-month period and include coordination with the local rancher. The pipeline would be buried at a depth of 3 ft., which would not interfere with normal agricultural practices in the project area. No other projects are planned that would affect agriculture, so there would be no significant cumulative impact on agriculture.

Recreation. The study area for recreation would be the town of Canby. The proposed project would have no effect on recreation within the project area.

Noise

The project study area for noise would be within a 2-mile radius of the project. The project would produce short-term and localized construction noise. Cumulative noise generated from traffic during construction would not significantly affect ambient noise along access routes. Project operation would produce minimal amounts of noise only audible within the project area. There are no projects in the area that would combine with the proposed project to cause a cumulative effect.

Infrastructure

The infrastructure study area would be Modoc County. Section 4.8, Infrastructure and Service Systems, presented the conclusion that implementation of the proposed action would not impact utility or service systems. The proposed project, in combination with cumulative projects would not result in significant adverse cumulative impacts to public services, including police, schools, fire protection, emergency services, water supply, sanitary sewer, sold waste or public utility systems. The proposed project would not bring long-term residents to the area and therefore would not cause a cumulative increase in the demand for services.

Aesthetics

The visual resource study area would be the town of Canby and the surrounding vantage points. The surface disturbance for the discharge pipeline would be visible from County Road 54. State Route 299 would be crossed during boring for the discharge pipeline, but effects to visual resources would be

minor and temporary (for less than one week). The district heating system would not result in a significant cumulative aesthetic effect in the project area because no other projects have been identified as planned for construction in the same timeframe and the project would not contribute substantial new construction that would result in permanent effect on the visual landscape.

The areas of disturbance for the proposed action are several miles from long-range viewpoints and would be difficult to distinguish from that distance. The contribution of the proposed action is considered minor because the existing well site and the farmland has been cleared of vegetation during previous farming operations.

Socioeconomics

The study area for socioeconomic impacts would by Modoc County. The proposed project would have very limited effects on the socioeconomics of the region. The workers that stay in the area would temporarily contribute to the local economy. Economic benefits from reducing energy costs would be limited to the I'SOT community. The cumulative impacts would not be significant. The proposed project would not disproportionately affect Native Americans or any other low-income or minority population in the area by itself or in combination with other projects.

Transportation Systems

The project study area for traffic effects is a 10-mile radius from the project. The proposed project would add to the cumulative traffic on the surrounding county roads and SR 299 during construction. The project traffic effects would be minimal and temporary in nature.

The project may coincide with the timber sale, thinning, and burning activities north and west within a 10-mile radius of the proposed project during construction in early 2003. The timber activity traffic and the project access would both use SR 299. The direct use project traffic would use County Road 54, 83, 161, and 203 to bring in the equipment and workers to the Canby District Heating project area. Most of the project traffic would be passenger cars traveling daily to the parking area site on SR 299 and equipment traffic along County Roads 54, 83, 161, and 203. The proposed project construction would occur over a period of approximately 70 days. An Encroachment Permit from Caltrans includes conditions for the boring activity at SR 299. A potential for damage to road integrity could occur from boring under SR 299; however the cumulative traffic effect of the proposed project would not be significant. The incorporation of Mitigation Measures 4.11-1 and 4.11-2 would reduce the traffic impact of construction to less than significant and would not result in a substantial contribution to cumulative traffic in the region.

Human Health and Safety

The project study area for hazards would be Modoc County. Cumulative risk of fire is not anticipated to result from the project, as fire prevention measures would be employed during project implementation. Other projects within the study area would involve vegetation burning. Fire prevention measures that the project proponents would employ would reduce the risk of fire. All projects would adhere to Modoc County requirements and would be subject to the emergency fire response programs.

Transport of hazardous materials for all projects within 10 miles would be subject to county and other regulations pertaining to transport and storage of regulated materials. A licensed vendor would handle

transport of mercury from the project area. Cumulative risk from transport of hazardous materials is not anticipated for the project.

The proposed project would not have cumulative effects on human health and safety due to the regulations and procedures in place to minimize effects. The discharge pipeline would be monitored monthly to check for leaks. After a seismic event, the pipeline would be checked immediately for potential breakage to minimize effects to human health and safety.

CUMULATIVE EFFECTS OF ALTERNATIVES

The No Action alternative would avoid all contributions to cumulative effects in the project area if the project could not find additional funding. The project may go forward without DOE funding; the effects of this alternative would be the same as the proposed action.

CONCLUSION

The proposed project would have a less than significant contribution to cumulative impacts within the Canby project study area.

6: LIST OF PREPARERS AND AGENCIES AND PERSONS CONTACTED

6.1 List of Preparers

This section lists those individuals who either prepared or participated in the preparation of this EA.

LEAD AGENCIES

United States Department of Energy and National Renewable Energy Laboratory

Contributor	*Position*
Maureen Jordan	Technical Monitor National Renewable Energy Laboratory
Steven Blazek	NEPA Compliance Officer Department of Energy
Roselle Drahushak-Crow	Document Manager Department of Energy

CONSULTANT TEAM

This EA was prepared for and under the direction of the lead agency by MHA Environmental Consulting, Inc. of San Mateo, California. The following staff contributed to this report:

MHA Environmental Consulting, Inc.

Contributor	*Position*
Laurie McClenahan	Project Director
Janet Meth	Project Manager
Maria Patricia Martelino	Environmental Analyst
Andrew Gentile	Environmental Analyst
Tania Treis	Environmental Analyst
Ted Slowik	Environmental Scientist

MHA Subconsultants

Contributor	*Position*
Frank Galea	Wildlife Biologist Galea Wildlife Consulting
Amy Gilreath	Cultural Resources Far Western Anthropological Research Group, Inc.
Jill Haizlip	Hydrogeologist Geologica
David McClain	Geothermal Resources Analyst DW McClain & Associates
Kristiaan Stuart	Botanist, Wetlands Scientist Stuart Consulting

6.2 Agencies and Persons Contacted

The following agencies and persons were contacted during the preparation of this document.

Contact	*Position/Affiliation*
David Alvord	Planner Modoc County Planning Department
Keith Bryan	Admin Offices Modoc National Forest
Mark Fawver	Public Affairs California Department of Transportation
Kate Haas	Assistant Air Pollution Control Officer Modoc County Air Pollution Control District

Contact	*Position/Affiliation*
Tony Hawkes	Environmental Contaminants US Fish and Wildlife Service
Ron Kettler	Proprietor Kelley Hot Springs aquaculture facilities
Dale Merrick	Project Manager I'SOT
Phillip Gene Morris	Road Department Engineer Modoc County Department of Public Works
Bob Raffety	Permits California Department of Transportation
Tom Ratcliff	Forest Biologist USFS Modoc National Forest
Richard Read	Forest Supervisor Secretary Modoc National Forest
Stewart Reid	ESA Specialist US Fish and Wildlife Service
Jim Rohrbach	NPDES CV Regional Water Quality Control Board
Ken Romberger	Biologist USFS Modoc National Forest, Big Valley Ranger District
Robert Sneickus, ASLA	National Landscape Architect United States Department of Agriculture
Jeff Solberg	Marketing/Technical Services California Hydronics Corporation
Grant King	Sales Representative/Engineer US Filter West States
Rich Hironymous	Deputy Director of Public Works Modoc County
Richard King	Manager Anderson Landfill
Ed Vasquez	Customer Service Representative Waste Management, Inc.

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8:
RESPONSE TO COMMENTS

8.1 Introduction

A total of four letters with 23 comments were received from various agencies and members of the public concerning the Draft Environmental Assessment (EA) for the proposed Canby Geothermal District Heating Project. Three of these letters were comments on the Draft EA, while one letter, from the U.S. Fish and Wildlife Service, provided comments on the Biological Assessment (BA). The U.S. Fish and Wildlife comments were included in the EA comments as they relate to the same issues presented in the EA. In addition, verbal comments were received from the Pit River tribe in a meeting in Canby, CA on September 10, 2002, and January 16, 2003. Also included in the response to comments is the Pit River tribe's Memorandum of Agreement (MOA).

8.2 Comments Received

The comment letters received on the Draft EA have been grouped by agency (federal and state), ~~and~~ members of the public, and tribes. The letters are given a letter designation (A for agency, P for public individuals, and T for tribes), as are the comments in each letter. The commenter and the letter numbers are listed below. In the case of the U.S. Fish and Wildlife Service, three different staff members provided responses to the Biological Assessment (BA). As previously stated, these comments have been included here. Where the comment refers to specific text in the BA, a reference has been made to that document.

FEDERAL AGENCIES

A1. U.S. Fish and Wildlife Service

STATE AGENCIES

A2. Office of Planning and Research
A3. Central Valley Regional Water Quality Control Board

PUBLIC INDIVIDUALS

P1. Peggy Brown

TRIBES

T1. Pit River Nation (Verbal comments received at meetings held on September 10, 2002, and January 16, 2003).

T2. Pit River Nation Draft MOA.

The labeled comment letters are included here. The Pit River Nation's draft MOA has also been included with the proceeding letters, with each action requested in the MOA labeled and addressed in the responses below. Two tribal meetings were held between I'SOT representatives and the Pit River Tribes' tribal representatives to discuss project components and concerns. Four verbal comments were presented at these meetings:

- T1-1. A Tribal monitor was requested during construction (this comment was originally made at the first meeting in September 2002)
- T1-2. Chlorine content of the discharge effluent could have potential impact on water quality
- T1-3. The project could have cultural significance to the Tribe
- T1-4. The Tribe requested a Memorandum of Agreement concerning mitigation of potential impacts to cultural resources.

8.4 Responses to Comments

This section presents responses to all of the comments received on the Draft EA during the review period. Each comment letter received is numbered according to the numbering system identified above (Ax, Px, and Tx). Each comment in each letter received has a number (Px-1). Responses are provided to each written comment. Where a response to a comment has been provided in another response, the reader is referred to the previous response.

The NEPA Guidelines indicate that the Final EA should receive and consider comments on the Draft EA. This section provides responses to environmental issues raised regarding the environmental effects of the proposed project. Comments that state opinions about the overall merit of the project or comment on the project description are generally not responded to unless a specific environmental issue is raised within the context of the specific comment made. The final document as well as comments and responses on the document are all considered by the decision-maker (DOE).

All changes to the Draft EA are described in the response and referenced by the page number on which the original text appears in the Draft EA. Added text is underlined; and deleted text is ~~stricken~~ within the included document text.

A1

Tony Hawkes, Environmental Contaminants
US Fish and Wildlife Service

A1-1 **Response:** Comment noted. The language modifications suggested refer to text contained in the Biological Assessment (BA). Upon subsequent agreement with Tony Hawkes and Dale Merrick, the the GAC filters would be replaced if mercury concentrations were within 90% of

the discharge limit, even though the original comment called out for replacement at 10%. The BA has been modified as requested by the commenter and per the subsequent agreement.

Mitigation Measure 4.3-3 was created to incorporate GAC filter replacement if mercury concentration levels in the effluent are found to be 45 ng/L or more (90% of discharge limit).

A1-2 **Response:** Mitigation Measure 4.4-4 was improved to reflect the NPDES permit, and states that monitoring will be performed monthly for 6 months and quarterly thereafter. Coordination with appropriate agencies was added into the measure.

A1-3 **Response:** Comment noted. The language modifications suggested refer to text contained in the Biological Assessment (BA). The BA has been modified as requested by the commenter.

A1-4 **Response**: Text was added to Section 4.3 Hydrology and Geothermal Resources pages 4.3-5 and 4.3-6 to explain why river mercury concentration data of 9.7 ng/L for2001was discarded from the analysis. Additional data on Pit River flow rates in 2001was obtained from the USGS, which demonstrated drought conditions explaining the unusually high mercury concentration and is presented on pages 4.3-5 and 4.3-6.

A1-5 **Response:** Mitigation Measure 4.4-5 was improved with provisions to contact and coordinate with pertinent agencies if fish tissue mercury concentrations average above 5 ng/g since the projected increase in fish tissue concentration is only to 0.895 ng/g. Contact would be made and actions taken before the threshold level of 100 ng/g is reached.

A1-6 **Response:** Comment noted. The language modifications suggested refer to text contained in the Biological Assessment (BA). The BA has been modified as requested by the commenter.

A1-7 **Response:** The BA was corrected to state that the water quality data was collected by Dale Merrick of I'SOT. The statement, "there is not a direct correlation between the high level of methyl mercury in the water and the level of methyl mercury in pike minnow" was removed from the BA as it is inaccurate. This statement does not appear in the EA.

The explanation for low fish tissue concentrations by movement of fish up and downstream was removed in the text in Section 4.4 Biological Resources, page 4.4-14. The comment was added in the same paragraph that another possible explanation for low tissue concentrations compared to water concentrations may be that the relatively high methyl mercury concentrations observed during the summer months is ephemeral.

The mercury concentrations above and below Kelley Hotsprings were reversed in the EA, section 3.4 Biological Resources, page 3.4-10. The statement was also added, "There appears to be no statistically significant difference in mercury level through this section of the Pit River."

A1-8 **Response:** Comment noted. The language modifications suggested refer to text contained in the Biological Assessment (BA). The BA has been modified as requested by the commenter.

Stewart Reid, Endangered Species Biologist
US Fish and Wildlife Service

A1-9 **Response:** Text was added in section 3.4 Biological Resources, page 3.4-10 under the heading "Current Fish Bioaccumulation," clarifying the role of pike minnow in the bald eagle diet, and that these fish show the highest rates of bioaccumulation in the eagle diet. Text was added clarifying the data results for Sacramento sucker, which had less mercury in their tissue and actually comprise a larger portion of bald eagle diet. The tissue concentrations used in the analysis were for pike minnow, which would represent a worst-case scenario.

A1-10 **Response:** Comment noted. The language modifications suggested refer to text contained in the Biological Assessment (BA). The BA has been modified as requested by the commenter.

A1-11 **Response:** A full description of the Modoc sucker was included under the heading "Wildlife" under the subheading "Special-Status Wildlife Species at Site," on page 3.4-7. In this section text was included stating that Modoc suckers have also been found in larger sections of Rush Creek, including drainage ditches, and Ash Creek.

A1-12 **Response:** Presence of Modoc sucker downstream of the Project area is addressed on page 3.4-7, and 4.4-16. Refer to Response to Comment A1-14 for further explanation on possible presence in the main stem of the Pit River.

A1-13 **Response:** Comment noted. The language modifications suggested refer to text contained in the Biological Assessment (BA). The BA has been modified as requested by the commenter.

A1-14 **Response:** The Turner Creek Drainage is 7 miles downstream. The previously stated distance of 20 miles was a calculation error clarified by Stewart Reid. The known location of Modoc suckers is addressed on page 3.4-7, and 4.4-16. Currently, the closest known Modoc sucker occupied area in the project vicinity is the Turner Creek drainage which begins about 7 miles downstream from the Pit River discharge point and up from its confluence with the Pit River, where the project effects would be unlikely to extend (Reid pers. Comm. 2002b). This is a spawning site. No Modoc suckers were found in the main stem of the Pit River. The location of Modoc suckers was adjusted from 20 to 7 miles where appropriate in the document.

A1-15 **Response**: The brief sentences describing the genetic data were discarded because although no genetic Modoc suckers were identified, low numbers may be present and non-detectable by the test. Refer to Response A1-19.

A1-16 **Response:** Comment noted. The language modifications suggested refer to text contained in the Biological Assessment (BA). The BA has been modified as requested by the commenter.

A1-17 **Response:** Green catfish is a typographical error. The correct type of fish is green sunfish. The text was appropriately changed in section 3.4 Biological Resources, page 3.4-6.

A1-18 **Response:** Comment noted. The language modifications suggested refer to text contained in the Biological Assessment (BA). The BA has been modified as requested by the commenter.

A1-19 **Response:** Text in section 4.4 Biological Resources, page 4.4-16 and 4.4-17 was changed to indicate that there might be a few Modoc suckers, undetectable to surveys, in the main stem of the Pit. An additional analysis of mercury concentration threats to Modoc sucker was presented, and determined that the project would have a less than significant impact on Modoc suckers because the mercury levels found in tissue would be well below standards for

protection of aquatic life, and only a few if any Modoc suckers would be subject to the increased mercury level in the river.

Doug Laye, Biologist
US Fish and Wildlife Service

A1-20 **Response:** Text was added into Section 3.4 Biological Resources pages 3.4-7 that states, "The other 2-3 nests are around 5 miles away and would utilize the Pit River for food, but would also take fish from some of the reservoirs in closer proximity to their nest sites than the river. Since these eagles could be influenced by other factors, nest success was not reviewed."

A2 *Christine Asiata*
Governor's Office of Planning and Research State Clearinghouse

A2-1 **Response:** As stated in Section 1.4-7 CEQA analysis was performed for this project. The Operational Office of the DOE provided a matching grant to I'SOT along with the California Energy Commission for material funding for the district heating system. In January 1999, I'SOT responded to a geothermal Research and Development solicitation from the CEC and was awarded a materials only award for $304,525. The California Division of Oil, Gas, and Geothermal Resources (DOGGR) as the lead agency, conducted an environmental review for the well drilling under the California Environmental Quality Act (CEQA), resulting in a Negative Declaration in September 1999. The Modoc County Planning Department as lead agency, conducted an environmental review for the use of the geothermal well and development of a district heating system under CEQA, resulting in an Initial Study/Mitigated Negative Declaration in September 2001.

A3 *James Rohrbach, Water Resource Control Engineer*
Central Valley Regional Water Quality Control Board

A3-1 **Response:** The comment is noted. Mitigation Measure 4.3-2 was modified to add that the leakage limit will be set as the manufacturer's estimate for leakage under the project's operating conditions.

P1 *Peggy Brown*

P1-1 **Response:** As stated in Section 2.2.3-9, the proposed 5,400 ft. long discharge pipeline is routed to cross fields, run along a levee road, and traverse a small portion of wetlands all owned or controlled by the I'SOT community. Refer to Figure 2.2-5 for detail. The pipeline is entirely on I'SOT property. This final route that follows the levee road was selected to minimize environmental impacts to the wetlands.

T1 *Pit River Nation (Verbal comments received at meetings held on September 10, 2002, and January 16, 2003).*

T1-1 **Response:** Mitigation Measure 4.5-1 addresses the request for a Tribal monitor during construction activities. I'SOT would hire a tribal monitor to be in attendance to check for any previously undiscovered cultural resources or human remains.

T1-2 **Response:** Chlorine is not a constituent of the geothermal fluid as characterized in the Report of Waste Discharge, item 4 (Appendix C). The project would not contribute to chlorine levels in the Pit River and therefore, would not have an impact on water quality.

T1-3 **Response:** As part of its Mitigation Action Plan for this project, certain mitigation efforts to protect indigenous cultural resources are required as a condition of funding to I'SOT. Mitigation Measure 4.5-1 would minimize effects to resources encountered during excavation activities through use of a Tribal monitor. Mitigation Measure 4.5-2 would minimize effects to any prehistoric or historic resources discovered during site construction activities. Mitigation Measure 4.5-3 would minimize effects to prehistoric archaeological deposits that include human remains or objects considered "cultural items" according to the Native American Graves Protection and Repatriation Act (NAGPRA).

All mitigation efforts are detailed in the Mitigation Action Plan, dated March 7, 2003, and attached as Appendix K. The required mitigation efforts address the issues raised by the Pit River Nation.

T1-4 **Response:** The Pit River Nation provided its comments in the form of a draft Memorandum of Agreement (MOA) between the tribe and the Department of Energy. The draft MOA is included with the preceding comment letters. DOE determined that an MOA between DOE and the Pit River Nation is not appropriate in this instance because DOE's relationship to the project is limited to partial funding through NREL's subcontract with I'SOT for the project's construction and operation for three years. The project is being conducted by I'SOT on land privately owned by I'SOT for the long-term benefit of the I'SOT community. The best means of protecting indigenous cultural resources would be through a direct relationship between I'SOT and the Pit River Nation. Therefore, DOE has instructed NREL that I'SOT must properly address the required mitigation in cooperation with the Pit River Nation as a required condition of funding. The subcontract will outline the method of implementation of the required mitigation measures.

T2. *Pit River Nation* (*Requested Actions in draft MOA submitted to DOE on January 27, 2003)*.

T2-1 **Response:** Consistent with NEPA implementing guidelines, it is DOE's policy to integrate community and public concerns into the decision-making processes. Pursuant to NEPA, DOE would invite the Pit River Tribe's participation in its evaluation of potential impacts to the environment that could result from DOE funding decisions, including cultural resources.

T2-2 **Response:** Mitigation Measure 4.5-1 addresses the request for a Tribal monitor during construction activities. I'SOT would hire a tribal monitor to be in attendance to check for any previously undiscovered cultural resources or human remains. I'SOT would coordinate operational and safety issues onsite with the Tribal monitor.

T2-3 **Response:** Mitigation Measure 4.5-3 addresses the request for the handling of any human remains discovered during excavation activities. If remains were uncovered, I'SOT would halt excavation, coordinate with the Tribal representative, and contact the proper authorities.

T2-4 **Response:** Mitigation Measure 4.5-2 addresses the request for collecting and documenting any uncovered cultural resources. Should prehistoric or historic resources be encountered during site construction activities, construction activities within 50 feet of the discovery would be suspended until a qualified consulting archaeologist has assessed the materials. I'SOT would coordinate any collection and documentation with the Tribal monitor.