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Bonneville
Power
Administration

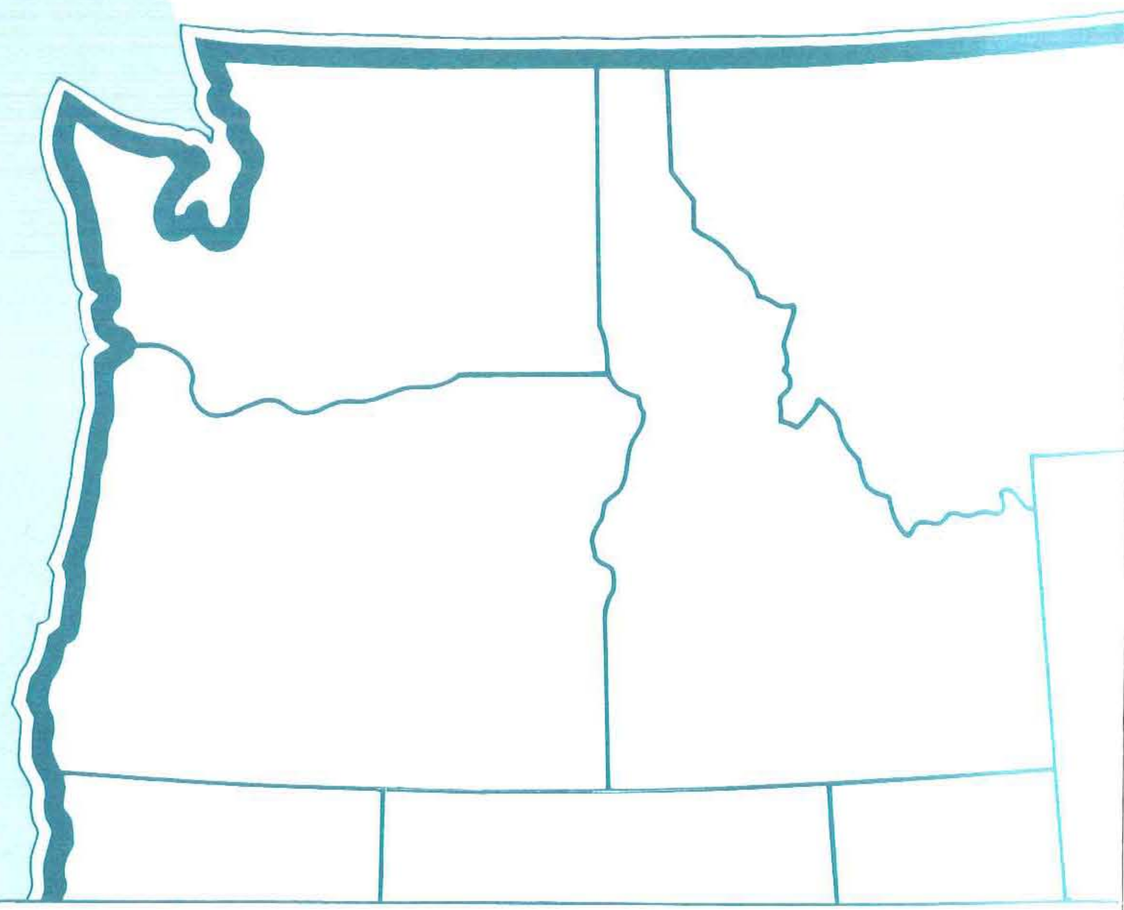
Final Environmental Impact Statement

INITIAL NORTHWEST POWER ACT POWER SALES CONTRACTS

U.S. Department
of Energy

January 1992

Volume 2:
Appendices A - L



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(VS6-PG-1746I)

APPENDIX A

Appendix A

Ninth Circuit Court Opinion In
Forelaws on Board v. Johnson
743 F.2d 677 (1984)

FORELAWS ON BOARD, an unincorporated association; and Lloyd Marbet, Plaintiffs,

v.

Peter JOHNSON, as Administrator of the Bonneville Power Administration, Department of Energy; James Edwards, as Secretary of the Department of Energy and the United States of America, Defendants.

No. 82-7319.

United States Court of Appeals, Ninth Circuit.

Argued and Submitted March 6, 1984.

Decided Sept. 25, 1984.

As Amended Jan. 21, 1985.

Linda K. Williams, Portland, Or., for plaintiffs.

George M. Galloway, Washington, D.C., for Pacific Power & Light Co.

Eric Redman, Seattle, Wash., for Martin Marietta Aluminum.

Frank W. Ostrander, Portland, Or., for Northwest Power Planning Council.

David J. Adler, Portland, Or., for Peter Johnson, Dept. of Energy.

Original Proceeding to Review the Bonneville Power Administration Offer of Initial Contracts Pursuant to the Pacific Northwest Electric Power Planning and Conservation Act.

Before SCHROEDER, FARRIS, and REINHARDT, Circuit Judges.

SCHROEDER, Circuit Judge.

This is a challenge to the Bonneville Power Administration's offers of long term contracts for power delivery pursuant to the Pacific Northwest Electric Power Planning and Conservation Act (Regional Act), 16 U.S.C. § 839–839h (1982), without compliance with the requirements of the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. §§ 4321–4361 (1976). We have previously held that this is a review of final agency action which, under the Regional Act, must be filed originally in this court rather than in the district court. *Forelaws on Board v. Johnson,* 709 F.2d 1310 (9th Cir.1983) (*Forelaws* I).

Plaintiffs seek an order compelling the preparation of an Environmental Impact Statement and enjoining operation of the contracts. We hold that an Environmental Impact Statement is required and should be utilized in connection with consideration of any further amendments, to which NEPA will also apply and for which additional EIS's may be required. We decline, however, to enjoin operation of the contracts pending completion of the initial EIS.

Statutory Background

On December 5, 1980, the Regional Act became law. It is a "unique piece of energy legislation" designed to allocate the finite supply of inexpensive hydroelectric power, generated on the Columbia River System, among competing consumers as well as to provide for the acquisition of new energy resources. *See Central Lincoln Peoples' Utility District v. Johnson,* 735 F.2d 1101, 1106 (9th Cir.1984). In the early 1970's, BPA, faced with increasing demand for low-cost hydroelectric power and possible power shortfalls, notified its nonpreference customers that their power contracts would not be renewed and informed its preference customers that it could not satisfy any load growth after 1983. ***Aluminum Co. of America v. Central Lincoln Peoples' Utility District,*** — U.S. —, 104 S.Ct. 2472, 2477–78, 81 L.Ed.2d 301 (1984). In response to the resulting confusion, Congress passed the Regional Act, which was designed to avert "regional civil war" by allocating BPA's finite supply of hydroelectric power between competing consumers and by providing for the acquisition of new energy resources. *See Central Lincoln Peoples' Utility District v. Johnson,* 735 F.2d 1101, 1106 (9th Cir.1984). The Regional Act required BPA to offer new long-term contracts to both preference and nonpreference customers "[a]s soon as practicable within nine months after December 5, 1980." 16 U.S.C. § 839c(g)(1). Each customer was given one year from the date of the offer to accept the contract. 16 U.S.C. § 839c(g)(2). Thus, within 21 months of the Act's effective date, a new system of contracts allocating BPA's supply of hydropower was to be in place.

The Act also required BPA to encourage energy conservation by its customers as well as to take measures to protect the environment of the Pacific Northwest. 16 U.S.C. § 839b, d, f(j). Congress said the Act was to be "construed in a manner consistent with applicable environmental laws." 16 U.S.C. § 839. The questions presented in this case thus implicate two of the Acts' most important objectives: a new system of contracts governing BPA's delivery of power to its customers and an energy program for the Pacific Northwest that is sensitive to environmental concerns.

Procedural Objections to this Suit

Before reaching the merits of the case, there are two preliminary procedural objections by the defendant BPA, and intervenors Martin Marietta Aluminum, Public Power Council, and Pacific Power & Light Company, relating to plaintiffs' standing and the timeliness of the action.

[1] Intervenor Martin Marietta contends that Forelaws lacks standing because it has not alleged that BPA's contract offers caused it any injury within the zone of interest to be protected by NEPA, citing *Port of Astoria, Oregon v. Hodel,* 595 F.2d 467, 474 (9th Cir.1979). The complaint, however, alleges that plaintiff Forelaws is an environmental group whose members live in the Pacific Northwest and that one of its members, Mr. Marbet, is a resident of that region and a consumer of electric power there.[1] Those allegations coupled with the allegations of the environmental consequences of the contract are sufficient to establish standing. *See United States v. SCRAP,* 412 U.S. 669, 683–90, 93 S.Ct. 2405, 2414–17, 37 L.Ed.2d 254 (1972) (even general allegations of potential harm by one who lives in or uses an area demonstrate standing); *Pacific Legal Foundation v. State Energy Resources, Etc.,* 659 F.2d 903, 911–12 (9th Cir.1981), *cert. denied,* 457 U.S. 1133, 102 S.Ct. 2956, 73 L.Ed.2d 1348 (1982). *See also Sierra Club v. Morton,* 405 U.S. 727, 739, 92 S.Ct. 1361, 1368, 31 L.Ed.2d 636 (1972) ("[A]n organization whose members are injured may represent those members in a proceeding for judicial review.").

[2] The timeliness question arises from the confusion generated by the statute's provision that suits challenging final actions of the BPA administrator "shall be filed within the United States court of appeals for the region ... within ninety days ...." 16 U.S.C. § 839f(e)(5). The complaint in this case was not actually filed with the clerk of this court until more than 90 days after the action being challenged. However, it is undisputed that Forelaws attempted to file a complaint the day before the expiration of the 90-day period, but the clerk of this court rejected the complaint because normally this court does not have jurisdiction of original complaints. In fact the plaintiffs had also filed a complaint in the district court, and jurisdictional issues were still in litigation. *See Forelaws I,* 709 F.2d at 1311–13. Our clerk's mistaken rejection of the complaint when it was timely offered should not bar its consideration, and it should be deemed timely filed. *See Loya v. Desert Sands Unified School District,* 721 F.2d 279, 280–81 (9th Cir. 1983). We therefore must consider the merits of plaintiffs' claim that BPA has violated NEPA by failing to prepare an environmental impact statement.

The Contracts' Environmental Significance

[3] Section 102(2)(C) of NEPA, 42 U.S.C. § 4332(2)(C), requires that federal agencies, "to the fullest extent possible,"

1. The name Forelaws on Board is apparently derived from Barry Commoner's "four laws of ecology." B. Commoner, *The Closing Circle* (1971).

do a detailed statement of the environmental impact of any proposed major federal action which would significantly affect the quality of the environment.[2] BPA did not prepare an environmental impact statement in connection with its contract offers. It did what it termed an "Environmental Report," a document not contemplated by NEPA, and which did not analyze in detail any possible adverse environmental consequences of the contracts and ways that they might be avoided. The environmental report did not, in short, do what an environmental impact statement is supposed to do, and what plaintiffs contend under the provisions of NEPA, the agency was required to do.

BPA does not deny that these 145 contracts of 20-year duration constitute major federal action. It argues that the contracts themselves do not significantly affect the human environment. It also argues more strenuously that the time limitations of the Regional Act indicate Congress's intent to waive NEPA's application to these contracts by making it impossible for the agency to comply with NEPA. We deal with each of these arguments in turn.

BPA initially contends that because Congress has mandated it to offer contracts, BPA had no discretion with respect to contract terms that might have varying effects upon the environment. Because the principal purposes of NEPA include making considerations of environmental concerns a part of the decision-making process, *see Weinberger v. Catholic Action of Hawaii*, 454 U.S. 139, 143, 102 S.Ct. 197, 201, 70 L.Ed.2d 298 (1981), other circuits have developed the principle that an EIS is not required where the agency's action is "mandatory." *See, e.g., Pacific Legal Foundation v. Andrus*, 657 F.2d 829, 839–40 & n. 13 (6th Cir.1981) (mandatory agency duty to list endangered species upon specified factual finding); *South Dakota v. Andrus*, 614 F.2d 1190, 1193 (8th Cir.), *cert. denied*, 449 U.S. 822, 101 S.Ct. 80, 66 L.Ed.2d 24 (1980) (non-discretionary acts not subject to NEPA); *Natural Resources Defense Council, Inc. v. Berklund*, 609 F.2d 553, 558 (D.C.Cir.1979) (NEPA not applicable when Secretary has no discretion as to coal leases).

The difficulty with BPA's position that the contract action was completely mandated by statutes is that, as BPA recognized in its environmental report, "the administrator possesses a great deal of discretion in contract matters." This includes contract provisions directly aimed at environmental concerns. Congress expressly authorized the administrator to include, in the contracts, provisions designed to achieve the Act's environmental purposes, such as encouragement of conservation, development of renewable resources, fish and wildlife protection and enhancement. The content of these contract provisions is not mandated but is clearly discretionary. *See Aluminum Co. of America v. Central Lincoln Util. Dist.*, — U.S. —, —, 104 S.Ct. 2472, 2484, 81 L.Ed.2d 301 (1984) ("Because the Regional Act does not comprehensively establish the terms on which power is to be supplied ... under the new contracts, it is our view that the [BPA] has broad discretion to negotiate them.").

BPA nevertheless argues that we should regard its discretion as limited principally to matters of power allocation which, it

2. Section 102(2)(C) of NEPA requires that:

[T]o the fullest extent possible: ...

(2) all agencies of the Federal Government shall ...

(C) include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on—

(i) the environmental impact of the proposed action,

(ii) any adverse environmental effects which cannot be avoided should the proposal be implemented,

(iii) alternatives to the proposed action,

(iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and

(v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

42 U.S.C. § 4332 (Supp.1982).

argues, as a matter of law, cannot affect the human environment. It relies upon our decision in *City of Santa Clara v. Andrus*, 572 F.2d 660 (9th Cir.1978), and *Sierra Club v. Hodel*, 544 F.2d 1036 (9th Cir.1976), for the proposition that federal agency actions that merely allocate federal power to different customers do not significantly affect the environment.

Although BPA accurately characterizes the holding of these cases, they do not control this case. *City of Santa Clara* and the relevant portion of the *Sierra Club* decision involved a simple determination of which customers were entitled to a finite supply of power. *See City of Santa Clara*, 572 F.2d at 680; *Sierra Club*, 544 F.2d at 1039–41. The contracts in this case involve considerations of far greater historic and regional import and significantly affect the environment. For example, by defining the federal base system and "new large single loads" the contracts help determine the magnitude of BPA power obligations in the future and thus will have an impact upon long-range regional energy plans. *See Port of Astoria, Oregon v. Hodel*, 595 F.2d 467, 477–78 (9th Cir.1979) (holding that action creating significant new commitments of BPA power affecting future regional energy planning requires an environmental impact statement).

In addition, the contracts significantly affect the environment because they involve important policy choices affecting energy conservation. Incentives for conservation which could have been included in the contracts were suggested by several commentators during the time the agency was developing its proposals.[3] These incentives included rate schedules that reward users who succeed in reducing demand; encouragement of utilities to attach conservation related conditions to electric service; shortfall allocation plans which take into account utility conservation policies, and implementation of tiered rates to increase the incentive to conserve. BPA did in fact include certain measures in the contracts to encourage conservation, but they were fewer and weaker than those proposed by several public groups. In the absence of an environmental impact statement, we do not know to what extent BPA considered the merits of the other proposals and their feasibility from an environmental standpoint.

Still other significant environmental aspects of the contracts are the fish and wildlife provisions, the most often commented upon environmental provisions of this statute. Several sections of the Act detail BPA's fish and wildlife responsibilities, 16 U.S.C. § 839(3)(6), b(e)(2), (h)(10) & (11), which include planning, management, protection, mitigation, and enhancement. *See generally* Blumm, *Implementing the Parity Promise: An Evaluation of the Columbia Basin Fish and Wildlife Program*, 14 Envtl.L. 277 (1984). In the record before BPA, a great many groups suggested provisions which would mitigate fishery damage and improve conservation efforts.[4] As the National Marine and Fishery Service pointed out to BPA, a major purpose of the Regional Act was to treat fish and wildlife interests as coequal partners in management of the Northwest hydrosystem. Again, without an EIS, we do not know to what extent these proposals were evaluated as feasible alternatives to the provisions eventually proposed.

Also undercutting BPA's present position is the fact that, despite the repeated insistence by plaintiffs and other groups, BPA never, throughout the period that it was developing its contract proposals, argued that the contracts were not federal

3. In response to BPA's draft prototype power sales contracts published in the July 12, 1981 *Federal Register*, a number of groups including the Natural Resources Defense Council, the Environmental Protection Agency, Fair Electric Rates Now, and the Oregon Department of Energy commented on the conservation provisions.

4. Comments on the July 12, 1981 draft prototype sales contracts were received from groups including the Columbia River Citizens Compact, the Northwest Steelhead Salmon Council, the Upper Skagit Tribes, the National Marine and Fisheries Service, the Columbia River Fisherman's Protective Union, and the Washington Department of Fisheries.

actions significantly affecting the environment. Rather, its "Environmental Report" reflects acknowledgement of environmental consequences of a contract but defended the noncompliance with NEPA on grounds of time constraints. We therefore hold that the contracts are significant federal actions affecting the environment and turn to the issue of time constraints.

The Regional Act's Statutory Time Constraints as Implied Waiver of NEPA Requirements

BPA's principal argument in this case is that the statutory deadlines for contract offer and acceptance made it impossible to prepare an EIS. The Regional Act, which was effective December 5, 1980, gave BPA until September 5, 1981, or nine months to offer the contracts. 16 U.S.C. § 839c(g)(1). Customers then had up to one year from the date of the offer to accept the contracts. 16 U.S.C. § 839c(g)(2).

NEPA's legislative history reflects Congress's concern that agencies might attempt to avoid any compliance with NEPA by narrowly construing other statutory directives to create a conflict with NEPA. Section 102(2) of NEPA therefore requires government agencies to comply "to the fullest extent possible." The Senate and House conferees, who added that language to the statute, explained it in the following manner:

> The purpose of the new language is to make it clear that each agency of the federal government shall comply with the directions set out in ... [Section 102(2)] unless the existing law applicable to such agency's operations expressly prohibits or makes full compliance with one of the directives impossible .... Thus, it is the intent of the conferees that the provision 'to the fullest extent possible' shall not be used by any Federal agency as a means of avoiding compliance with the directives set out in section 102.... [N]o agency shall utilize an excessively narrow construction of its existing statutory authorizations to avoid compliance.

Conference Report, 115 Cong.Rec. (Part 29) 39702–703 (1969), *quoted in Calvert Cliffs' Coordinating Committee, Inc. v. United States Atomic Energy Commission*, 449 F.2d 1109, 1114–15 (D.C.Cir.1971).

This Circuit recently echoed the conferees' concern for ensuring NEPA compliance. In *State of California v. Block*, 690 F.2d 753 (9th Cir.1982), we held that a section of the National Forest Management Act did not preempt NEPA because neither the statute nor its legislative history supported a NEPA exemption. *Id.* at 775. *See also Southeast Alaska Conservation Council, Inc. v. Watson*, 697 F.2d 1305, 1310 (9th Cir.1983) (compliance with environmental statutes strictly construed).

There is nothing in the legislative history or the language of the Regional Act suggesting that Congress intended an exemption from NEPA requirements. On the contrary, given the clear statutory emphasis on environmental concerns, *see* 16 U.S.C. § 839, b, d, f(j) & (k), an exemption from NEPA requirements is inconsistent with the congressional objectives of the Regional Act.

BPA, however, seeks to bring itself within the principle announced by the Supreme Court in *Flint Ridge Development Co. v. Scenic Rivers Association of Oklahoma*, 426 U.S. 776, 96 S.Ct. 2430, 49 L.Ed.2d 305 (1976). The Supreme Court there considered whether an EIS was required prior to a real estate developer's filing a disclosure statement under the Interstate Land Sales Full Disclosure Act, when that Act required that the statement be effective 30-days after filing. Observing that the preparation of an EIS often required many months, the Supreme Court held that NEPA presented "an irreconcilable and fundamental conflict" with the 30-day requirement of the Interstate Land Sales Act. The 30-day requirement led the Court to conclude that when there is a "fundamental conflict of statutory duty," NEPA is inapplicable. *Id.* at 791, 96 S.Ct. at 2440.

BPA argues that the contract offer requirements fall squarely within *Flint Ridge* because BPA had only 30 days to prepare an EIS. Its argument is based not so much on what Congress required in the statute as it is on the schedule which BPA actually followed in the nine-month period which Congress provided for the development of a contract offer. During that period, BPA did not prepare an EIS but it did negotiate with customers, hold public meetings, and issue draft prototype contracts. Its activities can be summarized on the following time line:

> December 5, 1980—Regional Act takes effect.
>
> December 31, 1980—BPA puts together a list of the types of contracts to be offered as well as negotiating teams for each type.
>
> January 23, 1981—Organization meeting for negotiating teams held. Teams, made up of BPA employees and customer groups, meet three days per week, all day, from February until August to consider various contract provisions. Notice of meeting mailed to all interested parties and posted at BPA headquarters.
>
> Mid-May, 1981—BPA holds three public meetings in Seattle, Boise, and Portland to receive public comment about the contracts. Sends summaries of the meeting with responses to the comments to all interested parties on June 8.
>
> June 11, 1981—Draft prototype contracts available for public inspection. *See* 46 Fed.Reg. 31238 (1981). BPA opens 30-day comment and review period.
>
> July 13, 1981—End of comment period.
>
> Late July to early August, 1981—Status drafts mailed to customers; contracts individualized.
>
> August 28, 1981—Contracts offered to BPA customers.
>
> September 5, 1981—End of statutory nine-month period.

BPA's position is that under the procedures it followed, which included six months of active negotiations before issuance of prototype contracts for inspection, the EIS would have had to have been prepared between June 11, 1981 when the prototype contracts became available and July 13, 1981, the end of the comment period, and before BPA began final contract preparation. If such a restrictive time schedule was mandated in this case, then, under *Flint Ridge*, there would be a statutory conflict and an EIS need not have been prepared.

BPA's position, however, represents the type of "excessively narrow construction" that NEPA cautions against.[5] The root of BPA's interpretation is its perception that the September 5, 1981 offers were already to have been negotiated and acceptable to the customers. Section 839c(g)(1) states:

> As soon as practicable within nine months after December 5, 1980, the Administrator shall commence necessary negotiations for, and offer, initial long-term contracts....

16 U.S.C. § 839c(g)(1). The only time limitation is that the Secretary begin negotiations and offer contracts within nine months. The statute allows a further year before acceptance is required. 16 U.S.C. § 839c(g)(2). BPA argues that it could not begin an EIS until it had a "proposal" for federal action, or until the draft prototype contracts were available on June 11. But it does not explain why it was required to negotiate for six months before developing the contract proposals. Representatives John Dingell and Richard Ottinger, chairmen of subcommittees of the House Energy and Commerce Committee, pointed out in a July, 1981 letter to the Administrator, which is a part of the record in this case, that BPA moved "with greater speed than necessary in initiating contract negotiations." After making the initial offer mandated within nine months of the Act's passage, "[t]he customers and BPA had a whole year to negotiate and execute a contract."

In fact the statute did not mandate the schedule which BPA followed. BPA could have used the initial nine months to formu-

5. Giving full deference to BPA's interpretation of the Bonneville Power Act, which it administers, *see Aluminum Co. of America v. Central Lincoln People's Utility District*, — U.S. —, 104 S.Ct. 2472, 81 L.Ed.2d 301 (1984); *Chevron USA v. NRDC*, — U.S. —, 104 S.Ct. 2778, 81 L.Ed.2d 694 (1984), we find its position is unreasonable, particularly when viewed in the light of the congressionally mandated objectives of NEPA.

late a proposal, perform an EIS, and still have met the statutory deadline for making its contract offer and commencing negotiations. If necessary, BPA could have utilized a "fast track" EIS schedule to speed the process. *See* 40 C.F.R. § 1506.10(d).

Finally, the Supreme Court has recognized in *Vermont Yankee Nuclear Power Corp. v. Natural Resources Defense Council,* 435 U.S. 519, 551, 98 S.Ct. 1197, 1215, 55 L.Ed.2d 460 (1978), that NEPA requires an agency to address all significant alternatives to a proposed action. *See* 42 U.S.C. § 4332(2)(C). Under the "arbitrary and capricious" standard of review authorized by the Administrative Procedures Act, 5 U.S.C. § 706(2)(A), a court may require an agency's decision to be "based on a consideration of relevant factors." *Citizens to Preserve Overton Park v. Volpe,* 401 U.S. 402, 416, 91 S.Ct. 814, 824, 28 L.Ed.2d 136 (1971). This requirement that an agency examine alternative courses of action has long been a part of the APA's standard of review, *see The Supreme Court, 1982 Term,* 97 Harv.L.Rev. 70, 236-37 (1983), and has recently been reaffirmed by the Supreme Court. *See Motor Vehicle Manuf. Ass'n v. State Farm Insur. Co.,* 463 U.S. 29, 103 S.Ct. 2856, 77 L.Ed.2d 443 (1983).

[4] Major policy choices affecting both energy conservation and the preservation of fish and wildlife were made by BPA during its negotiation of over 140 power contracts. But without an EIS, we cannot know to what extent the many alternative proposals put forth by other groups and agencies were evaluated as alternatives to the provisions eventually adopted by BPA. Given BPA's statutory duty both to conserve energy use and to preserve fish and wildlife, 16 U.S.C. §§ 839(3)(6), 839b(e)(2), (h)(10) & (11), and the multitude of alternative proposals suggested by government agencies and citizen groups, the failure to prepare an EIS demonstrating that the agency has considered all significant alternatives violates both NEPA and the APA.

[5] Given the language and history of this Act, the lack of any mandated deadlines remotely similar to the 30 days in *Flint Ridge,* and the broad construction we are compelled to give NEPA, we must conclude that there is no irreconcilable conflict between the Regional Act and NEPA requirements and that BPA violated NEPA when it offered contracts without developing an EIS.

Remedy

Having agreed with plaintiffs that an EIS should have been prepared prior to the offer of contracts, and having disagreed with the government that Congress had mandated a time schedule which made preparation of an EIS impossible, we face the question of remedy. Forelaws asks this court not only to order BPA to comply with NEPA by preparing an environmental impact statement, but to enjoin the operation of the contracts until the EIS is prepared.

[6] Forelaws correctly points out that an injunction is the most common judicial response to a NEPA violation, *see, e.g., American Motorcyclist Association v. Watt,* 714 F.2d 962, 965-66 (9th Cir.1983). The purpose of enjoining government action pending preparation of the environmental impact statement is, generally, to maintain the *status quo* while additional environmental data is obtained, in order to preserve the decision makers' opportunity to choose among policy alternatives. *See State of Alaska v. Andrus,* 580 F.2d 465, 485 (D.C.Cir.1978); *see also* F. Grad, *Treatise on Environmental Law,* § 9.03(b) (1980).

[7] In this unusual case, the major federal action subject to the requirements of NEPA constitutes ongoing 20-year contracts, most of which are now in the third year of their term. They have gone into effect pursuant to a statutory mandate requiring implementation of a contractual system no later than 21 months after enactment of the Regional Act, or by September, 1982. The history of the Regional Act reflects a certain amount of urgency in preventing "an emerging customer struggle for BPA power." *Central Lincoln Peoples' Utility District,* 104 S.Ct. at 2476.

At this point in the history of the Regional Act, there is at least a clear tension between NEPA's charge to the agency to evaluate the effects of action upon the environment and the command of the Regional Act that the contracts be in place within 21 months of its passage. NEPA, however, allows for some flexibility in remedy because Congress has mandated compliance with NEPA procedures "to the fullest extent possible." Faced with reconciling NEPA and the Regional Act, we conclude that an injunction of the operation of the contracts themselves is inappropriate. *See National Audubon Society, Inc. v. Watt,* 678 F.2d 299, 309–10 (D.C.Cir.1982) (NEPA does not give the Secretary of Interior unlimited discretion to put off construction of a water development project that was statutorily authorized, relying upon *Gulf Oil Corporation v. Morton,* 493 F.2d 141, 146 (9th Cir.1973)).

Our decision not to enjoin the operation of the contracts does not render the case moot or deprive plaintiffs of any meaningful relief. The contracts will be in force for seventeen more years. Provisions in the contracts themselves contemplate changes in terms. All the contracts allow periodic adjustment of rates. All the contracts contain a clause setting forth the procedures for amendment. Most important for NEPA purposes, all the contracts include language "by which the parties ... agree to negotiate amendments to the power sales contracts, as necessary" to coordinate the conservation, renewable resource, and fish and wildlife provisions with the regional plan. 46 Fed.Reg. 44344 (1981). Thus, the contracts are not completed projects for which an EIS will no longer be useful. Rather, they are agreements with the flexibility to accommodate the ongoing, changing relationship among BPA, its customers, and the public interest represented by the Regional Council established under the Act. 16 U.S.C. § 839b(a).

As the Supreme Court pointed out in *Catholic Action of Hawaii,* 454 U.S. at 143, 102 S.Ct. at 201, the purpose of NEPA is "to inject environmental considerations into the federal agency's decision-making process" and "to inform the public that an agency has considered environmental concerns in its decision-making process." *Id.* 102 S.Ct. at 201; *see also* 40 C.F.R. § 1502.1. BPA's "Environmental Report" was not a sufficiently detailed analysis to inform BPA and the public of the environmental consequences of the choices represented by the contracts. Even less informative was the finding of no significant impact (FONSI) which BPA filed in connection with the contract amendments of October, 1982.[6] Only a full environmental impact statement will inform BPA, its customers, the public and the Regional Council of all the environmental consequences of the contracts and serve as a guide to future actions. BPA must, therefore, perform an EIS on the contracts.

It is so ordered. The panel will retain jurisdiction over any further proceedings related to enforcement of this order.

6. Forelaws attempted to argue in this action that the October, 1982 contract amendments required an EIS. Because the amendments were clearly a "final action" within the meaning of the Regional Act, and because Forelaws did not separately challenge them or amend its complaint in the action to include them within the ninety days provided by the Act, the challenge is time barred.

APPENDIX B

Appendix B

Guide to Northwest Power Act Contracts

Appendix B

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APPENDIX B

OVERVIEW OF THE 1981 GENERIC CONTRACTS

Copies of the generic Power Sales Contracts, along with detailed indexes for the utility and DSI Power Sales Contracts and a copy of the General Contract Provisions (GCPs), are contained in Appendix A. The following overviews will describe key features of these contracts. They are meant to be informative for readers who are not familiar with the contracts. They do not supply interpretations of the contracts and cannot substitute for reading the contracts themselves to understand important provisions.

The Northwest Power Act required BPA to offer initial new long-term Power Sales Contracts within 9 months of the effective date of the Act to: (1) requesting public body and cooperative customers and investor-owned utility customers; (2) existing DSI customers; (3) existing Federal agency customers; and (4) electric utility customers requesting participation in BPA's residential exchange program.

The Power Sales Contracts contain many provisions that are specifically required by the Northwest Power Act or other laws. Certain sections of the Northwest Power Act set forth the general power sales contract frameworks to be offered to certain types of customers. The generic Power Sales Contracts are based on these frameworks. The Power Sales Contracts contain much additional detail and many other provisions necessary to accomplish the intent of the parties.

Section 5(b) of the Northwest Power Act contains a general description of the contract that must be provided to requesting Pacific Northwest customers which are publicly owned utilities or cooperatives, investor-owned utilities, or Federal agencies. The Northwest Power Act requires BPA to offer to meet the firm power load of regional customers to the extent that firm power load exceeds firm resources of the customer (specifically defined in sections 5(b)(1)(A) and (B)). This is commonly referred to as a requirements contract.

Section 5(c) of the Northwest Power Act contains a general description of the purchase and sale agreements that implement the Residential and Small Farm Power Exchange (Residential Exchange). This section originally placed limits on the percentage of residential load which may be exchanged, allowing for gradual phase-in. It also specifies that cost benefits are to be passed through directly to Residential Exchange loads and provides for a consultation process to develop a methodology to compute each exchanging utility's "average system cost." It further provides that BPA may purchase cheaper power, if available from other sources, in lieu of the power that the utility offers to exchange.

Section 5(d) of the Northwest Power Act contains the general framework for the contracts to be offered to BPA's DSI customers. Section 5(d) requires BPA to offer initial contracts to the DSIs, providing them with an amount of power equal to the amount the customer is entitled to under its then-existing contract. Section 5(d) also specifies that these DSI contracts shall provide a portion of BPA's reserves for regional firm loads.

THE UTILITY POWER SALES CONTRACT

This contract applies to all BPA utility and Federal agency customers. In the past, different contracts were written for individual customers. Terms varied, depending largely on whether the utilities had significant resources of their own which they could operate, or whether they operated their own automatic generation control systems. These individual differences are now addressed in a standard contract by including provisions applicable to each different purchasing basis.

The following are some of the key features of these contracts:

B.1 BPA Obligation to Maintain Sufficient Resources to Serve Firm Load

Because BPA was given authority to acquire new resources under the Northwest Power Act for the first time, BPA Power Sales Contracts included a best efforts obligation on BPA to acquire resources if necessary to provide service to its firm loads. References to this obligation are found in the Utility Power Sales Contract under Section 5, BPA's Decision in Acquiring Resources to Serve Loads; Section 7, Allocation Provisions in the Event of Planning Insufficiencies; and GCP 44, Resource Acquisition and Management. Under GCP 44, BPA is required to use its authority to acquire resources under the Northwest Power Act and also its short-term power purchase authority under the Transmission System Act of 1974.

B.2 Acknowledgment of Northwest Power Act Policies Regarding Resource Priorities and Fish and Wildlife

The contracts acknowledge BPA's obligations under the Act to give resource acquisition priority to conservation resources and renewable resources. BPA's obligations with respect to fish and wildlife are also acknowledged. These Northwest Power Act policies are referred to in section 5; Section 6, Interpretation of Fish and Wildlife Responsibilities; GCP 44; and GCP 45, Cooperation with Regional Council. The desirability of applying Northwest Power Act resource priorities to activities of the purchasing utility is also acknowledged in section 5, and in Section 12, Purchasers Firm Resources.

B.3. Provisions in the Event of Resource Insufficiencies

These provisions are contained primarily in section 7 and in an exhibit setting forth allocation formulas. Federal Base System resources are identified. Statutory notice provisions are incorporated, such as BPA's obligation to give 5 years notice of power insufficiencies to investor-owned utilities prior to giving notice of insufficiency to preference customers. Notice of insufficiency may not be given to preference customers unless their loads exceed the capability of the Federal Base System resources.

B.4 Types of Purchasers

Section 13 of the utility contract sets forth the criteria for which purchasing basis shall apply to a specific customer. Figure B-1 shows the relationship between the customer's loads, its own resources, and its purchase from BPA under the different purchasing types. Customers that do not own resources of significant size which they can control will be designated as purchasers on the Metered Requirements basis. Most of BPA's customer utilities are Metered Requirements purchasers. Under this purchasing basis, the customer purchases from BPA an amount of power equal to its actual firm loads less the actual output of its resources, if any. These customers are generally in BPA's own generation control area, so that BPA's resources respond automatically to changes in their loads.

Customers that do own resources of significant size are designated as purchasers under one of three different Computed Requirements forms. These customers are generally not in BPA's control area and therefore operate a generation control area of their own. 1/ BPA's resources do not generally respond automatically to changes in the loads of these customers. Instead, they must request amounts of power to be generated and transmitted by BPA to them in a process called "scheduling."

Computed Requirements customers are responsible for serving a portion of their own loads with the assured capability of their own firm resources. BPA is obliged to provide power to the extent that a customer's loads exceed its assured capability. Computed Requirements customers may purchase under one of three different forms: Actual Computed Requirements, Planned Computed Requirements, and Contracted Requirements. These differ from each other in the degree to which BPA assumes the responsibility for meeting actual loads which may differ from forecasted loads.

Under the Actual Computed Requirements basis, BPA assumes a great deal of this responsibility. After each month, the amount of power the customer had a right to receive from BPA, that is, its Computed Requirement, is figured for the month. Under the Planned Computed Requirements basis, the customer sets its BPA energy and capacity purchases for the coming Operating Year. The customer then must be responsible for acquiring additional power if loads are

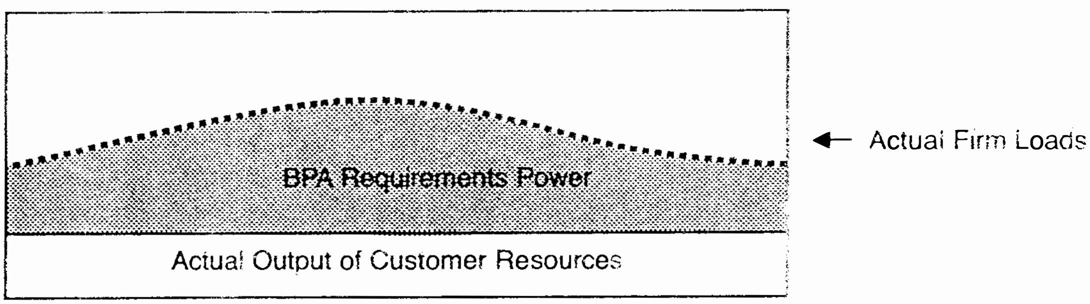
1/ A few Computed Requirements customers are within BPA's generation control area, and therefore do not operate control areas of their own. BPA's resources respond automatically to their changing loads. These customers do not schedule amounts of power from BPA, but, instead, account for their Computed Requirements purchases after the fact.

Fig. B-1

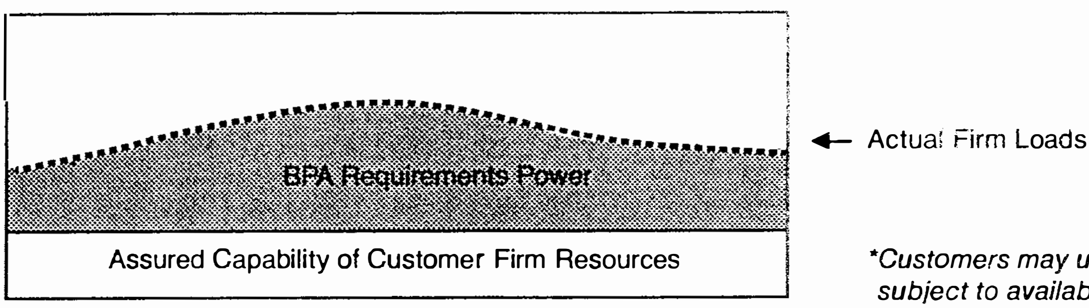
Different Purchasing Methods Available Under The Utility Power Sales Contract

These diagrams are schematic. Actual load and resource shapes vary constantly.

Metered Requirements Contract

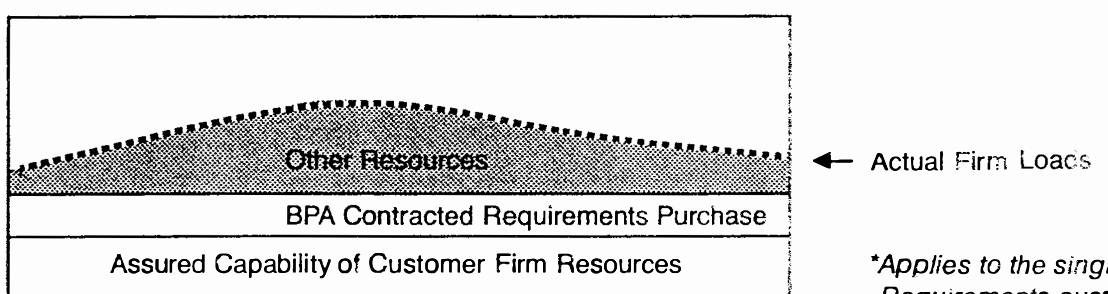


Actual Computed Requirements Contract*



**Customers may use some other resources subject to availabiltiy charge in rate schedules.*

Contracted Requirements Contract*



**Applies to the single Planned Computed Requirements customer.*

larger or shaped differently than forecast. Under the Contracted Requirements basis, the customer sets its BPA energy and capacity purchases for 7 years in advance. The Contracted Requirements customer has limited rights to change this 7-year schedule of purchases. These rights are similar to the notice provisions for firm resource changes, explained below.

B.5 Purchaser's Firm Resources

Section 12, Purchaser's Firm Resources, establishes an exhibit consisting of a table for each customer showing all the resources that the purchaser will use to serve its own load. (See Table B-1 showing an example Firm Resources Exhibit (FRE).) The assured capability of these resources is used to define the limits of BPA's obligation to provide firm requirements power to the utility. (See Table B-2 showing an example Assured Capability Exhibit.) Assured Capability is calculated each year in accordance with the provisions of section 16.

The utilities are required to give BPA advance notice of changes in firm resources. The notice requirements are contained in section 12(b)(1)-(14). In general, the peak capability may be changed with 5 years notice and the energy capability may be changed with 7 years notice. There are some shorter notice requirements which may apply if the change would cause no detriment to BPA or is beyond the control of the purchaser for various reasons.

The notice requirements of section 12(b) for FRE changes are as follows:

Resource Additions (Decrease Purchase from BPA)

- Peak capability may be added for the fifth year; energy capability may be added for the seventh year.
- Any Firm Resource may be added for any year if in accordance with BPA's annual program which implements the plan (e.g., BPA's Resource Program).
- Any Firm Resource may be added for any year if BPA can dispose of surplus without adverse economic effect. For purposes of this paragraph, BPA load-resource balance will not include purchases BPA is not committed to at the time of determination.
- Renewable or cogeneration resources of 50 aMW or less may be added for the Operating Year 30 months from the January 1 when first shown in the FRE. PURPA-qualifying facilities may be added at any time, but the customer must use best efforts to give BPA early notice of the resource.
- If a resource acquisition option has been granted to BPA, a Firm Resource may be added within 2 years of the date BPA declined to exercise such option.

Table B-1
FIRM RESOURCE EXHIBIT

P.L. 96-501 5 (b) (1) (A) Firm Resources

a. Generating Resources

Name of Resource	Number of Units	Peak [1/] Capability (MW)	Purchaser's Percent of Resource Dedicated to Firm Load under this Agreement	Date of Resource Addition	Date of Resource Removal
Wanapum [5/]	10	986.0 [4/]	4.0140%	7/1/86	8/31/86
Wanapum [5/]	10	986.0 [4/]	5.0500%	9/1/86	6/30/87
Wanapum [5/]	10	986.0 [4/]	4.0140%	7/1/87	8/31/87
Wanapum [5/]	10	986.0 [4/]	2.7000%	9/1/87	—
Priest Rapids [5/]	10	912.0 [4/]	3.3140%	7/1/86	8/31/86
Priest Rapids [5/]	10	912.0 [4/]	4.3500%	9/1/86	6/30/87
Priest Rapids [5/]	10	912.0 [4/]	3.3140%	7/1/87	8/31/87
Priest Rapids [5/]	10	912.0 [4/]	2.0000%	9/1/87	—

b. Contract Resources

Name of Resource	Supplier	Identifying Number [2/]	Resource Addition	Resource Removal
PURCHASES				
CSPE	CSPE	14-03-47291	7/1/86	
Supplemental and Entitlement Capacity	Bonneville	14-03-47454 14-03-47455	3/	3/
OBLIGATIONS				
Canadian Entitlement Return	Purchaser	14-03-47454 14-03-47455	3/	3/
Restoration	Purchaser	14-03-48221	7/1/86	—

P.L. 96-501 5 (b) (1) (B) Firm Resources

a. Contract Resources

Name of Resource	Supplier	Identifying Number	Resource Addition	Resource Removal
PURCHASES				
Swift Project [5/]	Pacific P&L	PUD No. SW6	7/1/86	

1/ At full reservoir for hydroelectric resources.

2/ Purchaser's entitlement to a Firm Resource supplied pursuant to a contract purchase which is not tied to the capability of a generating project shall be determined from the contract identified herein.

3/ Purchaser's entitlement to Firm Resource is based on Purchaser's share of Priest Rapids and Wanapum.

4/ Pre-encroached value and unadjusted for derated units.

5/ These resources include all rights or obligations for Restoration pursuant to the Pacific Northwest Coordination Agreement (Contract No. 14-03-48221).

Table B-2*
ASSURED CAPABILITY

ENERGY (ave. Megawatts)

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
Estimated Firm Load	369.0	403.0	375.0	428.0	461.0	417.0	493.0	474.0	455.0	431.0	415.0	411.0
Plus: Canad Ent Alloc	1.6	1.6	2.1	2.1	2.1	2.1	2.1	2.1	2.1	1.9	1.9	1.9
Less: Priest & Wanapum	-34.7	-33.3	-45.0	-47.0	-42.1	-41.8	-39.6	-53.0	-32.7	-43.0	-40.0	-41.9
Less: Swift	- 8.7	- 7.3	- 8.6	-18.4	-25.4	-44.5	-54.3	-26.2	-18.3	- 0.0	-15.8	-19.1
Less: CSPE	- 9.2	- 9.2	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	-10.8	- 8.6	- 8.6	- 8.6
Comp Avg Engy Reqmt '86-87	318.0	354.8	312.7	353.9	384.8	322.0	390.4	386.1	395.3	381.3	352.5	343.3
Estimated Firm Load	373.0	407.0	379.0	432.0	464.0	420.0	497.0	477.0	458.0	435.0	419.0	415.0
Plus: Canad Ent Alloc	1.5	1.5	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8
Less: Priest & Wanapum	-34.7	-33.3	-22.4	-23.4	-21.0	-20.8	-19.7	-26.4	-16.2	-21.4	-20.1	-21.0
Less: Swift	- 8.7	- 7.3	- 8.6	-18.4	-25.4	-44.5	-54.3	-26.2	-18.3	- 0.0	-15.8	-19.1
Less: CSPE	- 8.6	- 8.6	-10.2	-10.2	-10.2	-10.2	-10.2	-10.2	-10.2	- 8.1	- 8.1	- 8.1
Comp Avg Engy Reqmt '87-88	322.5	359.3	338.7	380.9	408.3	345.4	413.7	415.1	414.2	406.3	375.8	367.6
Estimated Firm Load	377.0	411.0	383.0	435.0	468.0	423.0	500.0	481.0	462.0	439.0	423.0	419.0
Plus: Canad Ent Alloc	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Less: Priest & Wanapum	-22.3	-21.3	-22.4	-23.4	-21.0	-20.8	-19.7	-26.4	-16.2	-21.4	-20.1	-21.0
Less: Swift	- 8.7	- 7.3	- 8.6	-18.4	-25.4	-44.5	-54.3	-26.2	-18.3	- 0.0	-15.8	-19.1
Less: CSPE	- 8.1	- 8.1	- 9.5	- 9.5	- 9.5	- 9.5	- 9.5	- 9.5	- 9.5	- 7.7	- 7.7	- 7.7
Comp Avg Engy Reqmt '88-89	338.7	375.1	343.3	384.5	412.9	349.0	417.3	419.7	418.8	410.7	380.2	372.0
Estimated Firm Load	381.0	415.0	387.0	439.0	472.0	426.0	504.0	485.0	465.0	442.0	427.0	423.0
Plus: Canad Ent Alloc	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7
Less: Priest & Wanapum	-22.3	-21.3	-22.4	-23.4	-21.0	-20.8	-19.7	-26.4	-16.2	-21.4	-20.1	-21.0
Less: Swift	- 8.7	- 7.3	- 8.6	-18.4	-25.4	-44.5	-54.3	-26.2	-18.3	- 0.0	-15.8	-19.1
Less: CSPE	- 7.7	- 7.7	- 9.0	- 9.0	- 9.0	- 9.0	- 9.0	- 9.0	- 9.0	- 8.0	- 8.0	- 8.0
Comp Avg Engy Reqmt '89-90	343.1	379.5	347.8	389.0	417.4	352.5	421.8	424.2	422.3	413.3	383.8	375.6

*This sample, Assured Capability Exhibit, shows energy only.

- Resources which qualify for priority under section 9(i)(3) of the Northwest Power Act may be added on 2-year notice. Section 9(i)(3) provides a priority for projects which were under construction on the effective date of the Northwest Power Act, were offered to BPA for sale, but were not accepted by BPA for purchase within 1 year of the offer.

- If BPA has a firm power deficit, a Firm Resource may be added for any year. BPA load/resource balance shall not include purchases unless BPA has actually committed itself to make the purchase.

Resource Deletions (Increase Purchase From BPA)

- A Firm Resource may be deleted if use is permanently discontinued due to loss of resource or loss of contract rights. (If returned to the Exhibit later, the same rules apply as if it were a new resource.) For obsolescence or retirement, the customer must consult with BPA, but the resource may be deleted even if BPA is required to purchase replacement power.

- A Firm Resource may be deleted in any year if BPA has a firm power surplus in the first operating year of the removal.

- A resource may be deleted in any year if an equivalent amount of resource is added.

- A resource may be deleted or added at any time if it is the result of a transfer of resources among BPA customers such that there is no net change in the total load on BPA.

- Resources may be added or removed if there is a resource transfer between the purchaser and BPA.

- Shorter notice is allowed for pre-Northwest Power Act contracts which contain shorter notice provisions for withdrawals.

General

- Resources may be added or deleted for other reasons with BPA written consent.

B.6 New Large Single Loads

Section 8, Determination of New Large Single Loads, deals with the Northwest Power Act provisions requiring that new large single loads be separately identified and be subject to different rates. Section 9, Limitations on Increases of Single Loads, also sets forth some limitations on BPA's obligation to serve load increases. Unlike the new large single load provisions, the section 9 limitations were not specified in the Act. They are similar to provisions in BPA contracts which pre-date the Act. The section 9 provisions limit BPA's obligation to serve such loads if they increase by more than 35 aMW in 1 year or more than 75 aMW in 5 years to allow BPA time to acquire resources to serve large increases in industrial loads.

B.7 Billing Provisions, References to Rates

Billing provisions for Metered Requirement customers are in section 15, and for Computed Requirement customers in section 19. Section 8, Equitable Adjustment of Rates, contains the general contract provisions regarding the establishment of rates and conservation surcharges.

THE DSI POWER SALES CONTRACT

The quality of service to DSIs under the Northwest Power Act contract is somewhat different than it was prior to the Act. Prior to 1975, there was no uniform quality of service to the DSI customers. Contract terms varied from customer to customer. Some DSIs had contracts for 100 percent firm service, while others did not. BPA sold large amounts of interruptible power to some DSIs in some years. These interruptible power sales were supported with use of provisional energy, i.e., borrowing energy from later in the critical period for use early in the critical period.

Between 1961 and 1971, Modified Firm (MF) contracts were negotiated with the DSIs. These contracts were also nonuniform. Most DSIs received firm service under the MF contracts equal to 75 percent of their load, but some DSIs received contracts for 100 percent of their requirements. Any portion of DSI load not served as firm under these contracts was served with nonfirm energy, or with borrowed firm energy (provisional energy) provided under separate agreements.

In 1975, Industrial Firm (IF) contracts were negotiated with the DSIs as part of the implementation of Phase II of the Hydro-Thermal Power Program. BPA and the DSIs operated under these contracts on an interim basis--because of the need to complete an EIS on the Hydro-Thermal Power Program--until the Northwest Power Act contracts, which are the subject of this EIS, were signed in 1981. The IF contracts provided service to 100 percent of each DSI's load with a single grade of power known as Industrial Firm power. The IF contracts divided each DSI load into quartiles, each of which was subject to specific rights for BPA restriction. The IF contracts provided for nonfirm and borrowed firm (Advance Energy) for serving the First Quartile. Separate Provisional Energy Agreements were, therefore, unnecessary. The IF contracts specified a single rate for power, including that for the First Quartile. The DSIs were compensated for any interruptions, including those to the First Quartile, through an "availability credit."
The following are some of the key features of the current DSI contracts:

B.8 Contract Term and Termination

Section 2, Term of Contract, sets forth term and termination provisions. It provides that the DSIs cannot terminate their contracts and purchase from another supplier unless BPA determines that there would be no adverse impact on BPA.

B.9 Sale and Purchase of Power

Section 4, Sale and Purchase of Power, provides that BPA shall sell to a DSI, and the DSI shall purchase from BPA, Industrial Firm Power in an amount up to and including the DSIs' Contract Demand as specified by the DSIs' Operating Demand, Curtailed Demand, or Restricted Demand, as each is in effect from time to time. This provision precludes the need for a DSI to acquire resources or additional service from another utility except possibly for a plant expansion (see section 4(d), or for industrial replacement energy (IRE). 2/

B.10 Establishment of Demand Levels

Section 5, Amount of Power, defines important terms relating to demand levels. Contract Demand is the maximum level of power that can be taken by a DSI under its contract. Operating Demand may be less than Contract Demand and can be changed more flexibly. Technological Allowances for certain technical improvements and plant modifications may be used for limited increases to Operating Demand and Contract Demand. Wheel Turning Load, which is load at a DSI plant that is not integral to its industrial process and is not part of a Technological Allowance, may be served by BPA or by a local utility.

B.11 Establishment of the Four Quartiles

Each DSIs' load is divided into four quartiles, of which three are firm load for which BPA must plan resources. Section 7, Restriction of Deliveries, describes the restriction rights which apply to each of the four quartiles. Section 8, Operations, describes the operations that BPA will engage in to provide service to the First Quartile. See Appendix C, Section 3, on Borrowing Techniques Used by the Coordinated System, for an explanation of these operations.

The section 7 restriction rights are summarized below.

First Quartile:

- Power Sales Contract language states that BPA may restrict the First Quartile at any time for any reason to protect BPA's firm loads. BPA's firm loads include the other three quartiles of DSI load, as well as other firm customers.

- If BPA has previously shifted FELCC (see Appendix C for description of FELCC shifting), BPA must attempt to purchase power at "Reasonable Cost" before restricting the DSI First Quartile.

2/ IRE is purchased on behalf of DSIs and at their expense by BPA under the terms of a separate contract. IRE is purchased by DSIs under specified conditions to replace power from BPA.

Second Quartile:

- BPA can restrict the Second Quartile because of

  -- Resource delays, including conservation;
  -- Unexpected poor performance of resources, including conservation, or
  -- A governmental order causing delay or shut-down of resources.

- Before restricting the second quartile, BPA has an obligation to purchase or recall energy from any source, including the industrial purchasers.

- There are no Second Quartile restriction rights for the purpose of meeting unanticipated load growth or for the region's failure to plan adequate resources.
- Second Quartile restriction rights provide reserves for those Federal system and conservation resources listed in an annual BPA notice issued each June 1 to the industries.

Third Quartile:

- BPA may restrict the Third Quartile in the amount of a DSI's obligation to replace shifted FELCC, Advance Energy, or Flexibility Energy. (See Appendix C.)

- Each June 1, BPA provides to all DSIs a notice of potential third quartile restrictions related to shifted FELCC.

Fourth Quartile:

- BPA has no Fourth Quartile restriction rights per se. The load may, however, be restricted as necessary under the forced outage and stability reserve provisions outlined below.

All Quartiles:

- **Forced Outage and Stability Reserves**. When necessary to minimize restrictions of BPA's Firm Obligations, BPA can restrict the industries. This restriction right is not directly related to the concept of "Quartiles." For forced outages and stability purposes, BPA can restrict the DSIs as follows:

  -- One-hundred percent of Operating Demand for 15 minutes (which may be followed by a 30 minute restriction of 50 percent of the load operating at the time of the original restriction;

  -- Fifty percent of the load "then operating" for 2 hours per day;

  -- Twenty-five percent of the Operating Demand subject to various limitations in section 7(b)(3) of the DSI contract.

B.12 BPA Resource Obligation

BPA must plan to have sufficient firm resources to serve three quartiles of the DSI load. Section 12, Mid-Term Contract Review, provides for the parties to review the status of BPA's plan and existing resources. It also provides that BPA will promptly proceed to attempt to acquire resources for DSI load in the years after the expiration of the current contract if DSIs request new Power Sales Contracts by the end of the twelfth year (1992). If BPA acquires resources or makes other expenditures to serve DSI load for the period following expiration of these initial contracts, and the DSI fails to sign the new contract after a good faith offer by BPA to negotiate, the DSI must reimburse BPA for unrecoverable costs.

THE RESIDENTIAL PURCHASE AND SALE AGREEMENTS (RESIDENTIAL EXCHANGE)

The background of the residential exchange concept will aid an understanding of this issue. The purpose of the residential exchange was to provide access to the Federal Base System for residential and rural consumers in the region served by BPA customers that are not entitled to preference under the Bonneville Project Act, that is, IOUs. The program was created largely in response to a proposal made by the State of Oregon prior to the passage of the Northwest Power Act. Under this proposal, the State would have created a new municipal corporation to apply for an allocation of BPA's then limited amounts of power to serve the State's domestic and rural customers. The residential exchange program was a compromise conceived under the provisions of the Northwest Power Act that allowed immediate access to the FBS for these types of consumers, without placing the entire immediate need to acquire resources on BPA.

The following are some of the key features of these contracts:

B.13 Mutual Purchases

Sections 2 and 3 provide for BPA and the utility to "purchase" equal amounts of power from each other. The utility will pay BPA at the rate that applies to its preference customers (the priority firm or PF rate) and BPA will pay the utility's average system cost, as finally determined by the administrator.

B.14 In Lieu Purchase by BPA

Section 4 allows BPA to purchase from a cheaper source than the utility, while continuing to supply power to the utility at the PF rate. BPA's Residential Exchange contracts allow BPA to purchase resources other than the utility's exchange power under certain circumstances and after 7 years notice. BPA must give 7 years notice before making a purchase in lieu of exchange under the Residential Exchange contracts. The purchase in lieu of exchange must last at least 5 years. Some parties argue that BPA surplus cannot be purchased as the in lieu resource, but BPA's position is that this is not prohibited by the contract. Alternative 3.4 discusses this more fully.

B.15 **Average System Cost Exhibit**

The methodology for determining the average system cost of a utility is contained in Exhibit C to the Residential Exchange Agreement. It provides that the BPA Administrator may change the methodology for calculating average system cost after a consultation process and approval by the Federal Energy Regulatory Commission (FERC). Exhibit C is changed whenever the methodology is changed. BPA adopted its present methodology in 1984.

B.16 **Residential Load Exhibit (Exhibit D)**

The utility residential and farm loads eligible for the exchange are specified according to requirements set forth in Exhibit D. The load information is updated periodically.

B.17 **Pass-Through of Benefits**

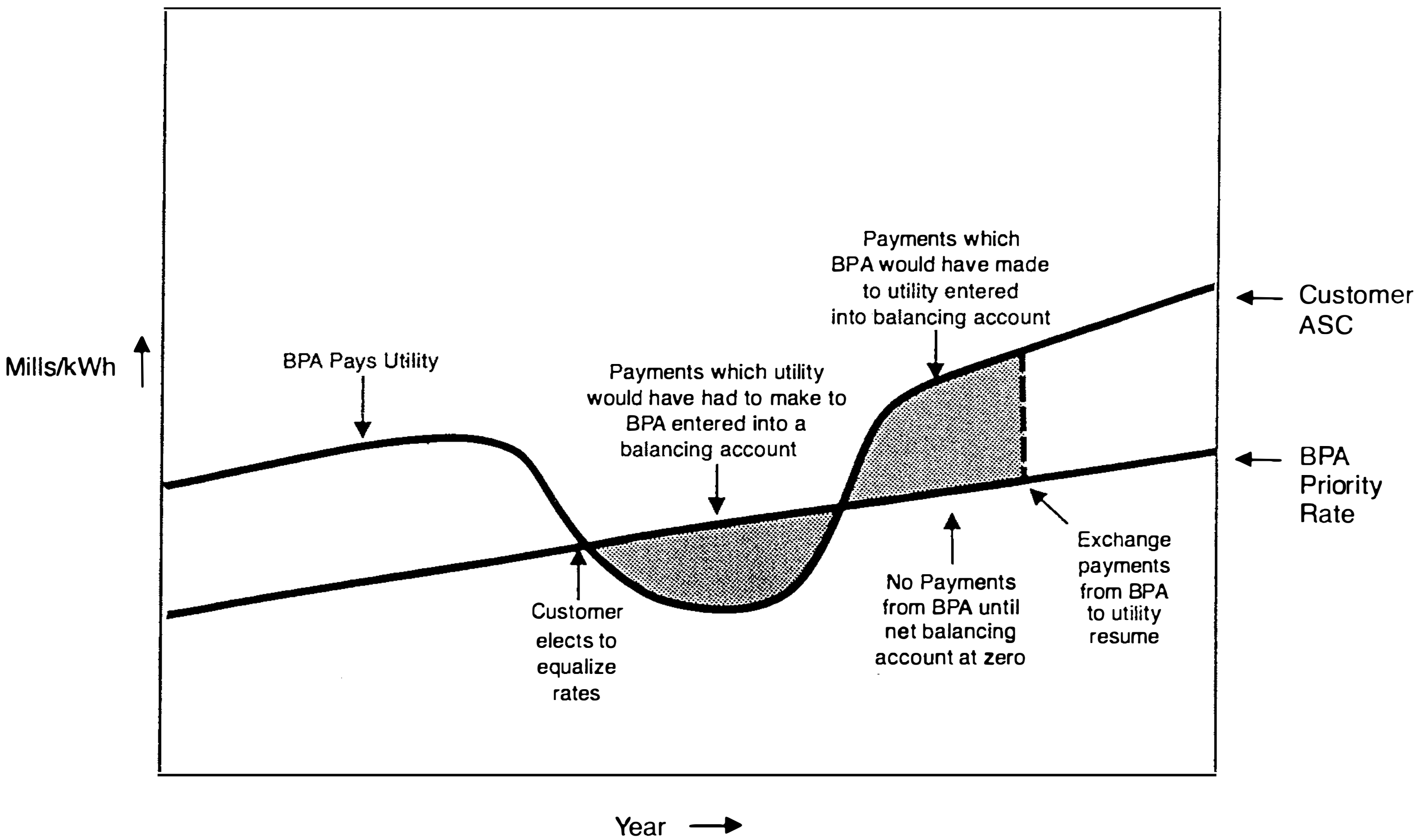
Section 8 requires any reduction in wholesale power costs resulting from the residential exchange to be passed through to the residential and farm loads that are defined in Exhibit D.

B.18 **No Net Disbenefit**

Section 10, Election to Equalize Rates, sets forth provisions dealing with the possibility that a utility's average system cost might at times be less than BPA's PF rate. It is intended to prevent the utility from being forced to pay BPA during such times, but also limits the amount of later benefits the utility can receive. (See Figure B-2.)

Figure B-2

Effect of Election to Equalize Rates



APPENDIX C

Appendix C

Guide to Hydro Operations in the Pacific Northwest Coordinated System

Appendix C

Table of Contents

APPENDIX C

This appendix has three sections. Section 1 describes important terms essential to an understanding of Pacific Northwest hydro operations planning. Section 2 describes the processes of periodic operations planning undertaken by BPA and other Pacific Northwest parties. Section 3 describes borrowing techniques which allow Coordination Agreement parties to shape the availability of firm energy from month to month and from year-to-year of the critical period.

SECTION 1: IMPORTANT TERMS

C.1 Federal Columbia River Power System (FCRPS) as a Multi-Use System

The Federal Columbia River Power System serves multiple purposes in addition to power generation: flood control, navigation, recreation, irrigation, fishery benefits, and other such nonpower uses. BPA markets the power from FCRPS projects pursuant to the Bonneville Project Act and other Federal legislation and orders. FCRPS projects are operated by the U.S. Army Corps of Engineers and the Bureau of Reclamation. BPA and these agencies have Memorandums of Understanding recognizing each others' responsibilities and establishing operating arrangements. Nonpower uses and electric power production are brought together in the development of "operating constraints" (see discussion of Operating Constraints below), and "operations planning" (see Section 2 of this appendix).

C.2 The Pacific Northwest Coordination Agreement (Coordination Agreement)

The electric utilities of the Pacific Northwest plan and operate their systems in a coordinated manner. BPA plays a major role in this planning. This planning is carried out under the specifications of the Agreement for Coordination of Operations among Power Systems of the Pacific Northwest, also known as the Pacific Northwest Coordination Agreement. The Coordination Agreement's major provisions deal with preparation of the Annual Operating Plan, and the monthly, weekly, and daily operations of the parties' generating systems. Coordination of reservoir operations is given special attention, particularly when there is diverse ownership of generating plants downstream from a reservoir.

The Coordination Agreement provides for a Coordination Contract Committee, which is responsible for preparing studies and the required Annual Operating Plan. The committee receives technical assistance from the Northwest Power Pool Coordinating Group.

The Agreement does not cover two significant aspects of coordination: long-range planning of new resources, and short-term hour-by-hour coordinated operation of generating facilities.

All major generating utilities in the Pacific Northwest are parties to the Coordination Agreement, except The Idaho Power Company. Idaho Power does coordinate its Brownlee Reservoir operations in concert with the Agreement to a certain extent. Joint planning is essential because the system utilities are interconnected electrically through shared transmission facilities, and hydraulically through the effect of released water on downstream hydroelectric projects. The advantages to the region of operating a coordinated system are:

- ability to take advantage of more efficient operation of hydro resources;
- ability to exchange power among member utilities;
- assistance gained during emergency outages of transmission lines or generators;
- ability to take advantage of diversities among systems in loads, generation, and maintenance outages; and
- reduced overall costs from coordinated use of all facilities and elimination of duplicative or multiple generation, transmission, and control facilities.

Reservoir-owning parties and parties with downstream generating plants coordinate storage and release of water and interchange power among systems to achieve more efficient use of the hydro system for the region and greater guarantees of meeting firm load.

C.3 Operating Constraints

FCRPS plants are operated to produce power within "operating constraints," some of which describe the physical operating limits of the project, and some of which prioritize the use of the project between power and nonpower uses. Operating constraints may limit maximum or minimum reservoir levels, project outflows, spills, rates of change of outflows, or many other operating parameters. These limits are often different for various times of the year.

Operations planning is another important guide to FCRPS operation, and to the trade-offs between power and nonpower functions of each project.

At the time each hydroelectric project is designed, numerous operating parameters are defined. These include the maximum and minimum reservoir elevations, minimum outflows, and other parameters. Operating limits sometimes include maximum rates of change of reservoir levels or outflows. Some may be the direct result of physical design parameters: for example, the minimum reservoir elevation may be determined by the vertical placement of the outlet works. Some may be to preserve existing river uses. A good example of this is the minimum project outflow. Some operating constraints may be established to obtain benefits for uses other than power, for example, minimum outflows may be established to provide water for irrigation or for downstream navigation. Minimum reservoir elevations may be established to permit navigation or recreation on the reservoir. Flood control operation of typical Pacific Northwest reservoirs results in some of the most complex operating constraints. These usually vary both seasonally and with forecasts of runoff. To the extent these constraints are established during the design phase, they are taken into account in the studies which determine the feasibility of the project. After a project begins operating, additional operating constraints may have to be established, possibly because some effect of operations was overlooked in the design phase or because conditions have changed. Hopefully, these constraints will not be so great as to undo the feasibility of the project.

While some constraints are very definite, for example those based on the physical characteristics of the project, others may be simply a priority of use. Not infrequently, nonpower constraints can be met without adversely impacting power production. However, when similar constraints are applied to many FCRPS projects, meeting them all may become impossible. Some constraints are more definite, while others express a desire for a certain operation if it is possible without impacting other uses.

C.4 Water Budget

As mentioned previously, the Northwest Power Act gave BPA significant new responsibilities to mitigate the effects of the development and operation of the FCRPS on fish and wildlife. These activities are conducted with the guidance of the Northwest Power Planning Council's Fish and Wildlife Program. One of the first measures taken by BPA and hydroproject operators to carry out the Council's first Program was the implementation of the first Water Budget in 1983. BPA treats the Water Budget as a firm operating constraint that allows for the Fish Passage Managers to request certain levels of flow in the Columbia and Snake Rivers between April 15 and June 15 to help juvenile salmon and steelhead achieve their downstream migration to the sea. For the Water Budget, water is reserved in the reservoirs and is released, either through the turbines or as spill, depending on the demand for energy, at times and in quantities as specified by the Fish Passage Managers within the guidelines of the Water Budget plan. The Water Budget results in an amount of Firm Energy Load Carrying Capability (FELCC - see following discussion of FELCC) to be produced in the April 15 to June 15 period which is in excess of the demand for firm energy. It results in an overall decrease in the amount of firm power which can be produced to meet the region's firm loads. This decrease is borne collectively by the Coordination Agreement parties. Affected parties, including BPA, attempt to store the excess firm energy from April 15 to June 15 outside the Columbia River Basin or market it.

C.5 Annual Spill Plans

Until mainstem Columbia and Snake River projects are properly screened to protect fish runs, the Council's Fish and Wildlife Program calls for spills of water to carry fish over dams instead of letting the fish pass through the turbines. Enough spill must be provided to protect at least 90 percent of the young fish at each project through the middle 80 percent of the runs. The

Program calls for project owners and operators to develop and implement spill plans. These plans list percentages of spill for specific projects. Development and implementation of spill plans are multiparty efforts involving fishery agencies and Tribes and project owners and operators. BPA and fishery agencies and Tribes have developed a 10-year spill agreement which would set forth spills at specific projects pending completion of other acceptable bypass methods.

C.6 The Critical Period

The critical period is that portion of the historical 50-year streamflow record which, when combined with draft of all available reservoir storage, will produce the least amount of energy, with energy used according to seasonal load patterns. At present, the coordinated system's critical period is about 3 1/2 years long, encompassing the historical period from September 1928 through February 1932.

Prior to the construction of the three "Canadian Storage" reservoirs and the Libby dam, the coordinated system's critical period was about 9 months long, encompassing the historical months from September 1936 through April 1937. The data on actual water conditions that prevailed during the critical period are used with current data on loads and resources to determine FELCC.

C.7 Firm Energy Load Carrying Capability (FELCC)

FELCC is the level of energy capable of being produced by the hydrogeneration system using all of the reservoir storage in combination with critical period streamflows. FELCC is used to determine the levels to which the coordinated system's reservoirs may be drafted to produce firm energy. As will be described in Section 2, FELCC for the multi-year critical period is calculated for the Final Regulation. The Coordination Agreement's published annual operating program includes the firm energy load carrying capability (FELCC) for each month of the coming operating year for the coordinated system and for each participant.

C.8 Refill

Each year, Coordinated System Operations endeavor to refill reservoirs each summer to what is referred to in the Coordination Agreement as "normal top elevation." Operations during the year are constantly analyzed in light of best available data to check their effect on probability of refill. (See also Variable Energy Content Curves in Section 2 below.) If refill standards are not achieved, Coordination Agreement parties must adopt the FELCC for a critical period year other than the first year. In such a case, FELCC Shift is not available. (See Section 3 below.) If first year FELCC is not adopted, parties may have to increase expensive thermal operations, make outside purchases, or use restriction rights such as those in the DSI Power Sales Contracts. (See Alternative 4.3, Increase Quality of Service to DSI First Quartile.)

SECTION 2: THE OPERATIONS PLANNING PROCESS

C.9 Annual Operating Plan

Each year, an operating plan is prepared for the next July-June operating year. It combines the operating characteristics of thermal and hydroelectric plants, load forecasts, and historical streamflows to determine system capabilities. It uses monthly (sometimes half-month) time increments. It describes loads and resource capabilities in terms of two quantities--average energy for monthly periods, and peakload or generating capability during the month. The purpose of the Annual Operating Plan is to determine how much load can be served with existing resources.

C.10 Determination of The Multi-Year Critical Period and FELCC

Preparation of the Annual Operating Plan starts in February of each year. Participants in the Coordination Agreement (BPA, various investor-owned utilities, public utilities, and hydroelectric project operators) submit loads, resources, and operating constraints for a multiyear period (that is, each year they submit data for the next 4 years) for use in developing an Annual Operating Plan. The Northwest Power Pool Coordinating Group then uses a computerized model to produce the Actual Energy Regulation study to determine the critical period for the coordinated system and the total FELCC for the coordinated system and for each member system. The planning model takes into account the constraints imposed on the system (flood control, navigation, irrigation, the Water Budget, and other factors).

An important concept of the Coordination Agreement is that the energy studies are made by using the total coordinated system as if it were a single-ownership system.

C.11 Permitted Changes

In preparing the Annual Operating Plan, individual systems in the coordinated system determine thermal plant capabilities, planned maintenance, outages, power sales and purchases, and constraints on reservoir draft rates of individual reservoirs. The goal is to match generation more closely to load. These changes may somewhat reduce the coordinated system's capabilities from those developed for a single-ownership system, but changes are carefully limited in order not to invalidate the basic concept of operating a single system of resources to meet a single load.

C.12 The Final Regulation

After permitted changes have been made, the final study results are published. The published results of the final regulation include the FELCC for each month of the year for the coordinated system and for each participant. These numbers normally come from the first year of the critical period in the study just completed. If coordinated system reservoirs have failed to refill during the summer, they may come from the second, third, or even fourth year in a study completed in a prior year. The results of the Final Regulation are important because they determine the extent to which the coordinated system's reservoirs may be drafted to produce firm power if normal or better flows occur. (When lower than normal flows occur, proportional draft points, described below, are used.) If a participant has used the Coordination Agreement to shape its FELCC into a pattern different from its firm load (for example, to increase an amount of marketable surplus as described in Section 3 below), this will be reflected in that participant's and the coordinated system's monthly FELCC shape.

C.13 The Critical Rule Curve--Levels to Meet Firm Loads

After permitted changes have been made, the results of the final regulation study are published. Two important guides to seasonal reservoir operations are developed from the studies. One is the "critical rule curve." It is a tabulation for each reservoir of the end-of-month elevation that corresponds to the reservoir's draft under critical period streamflow conditions to produce the firm energy capability. Because the critical period is longer than one year, several critical rule curves are necessary to describe each reservoir's draft regime during the first-year, second-year, third-year, and fourth-year of the critical period. The critical rule curves for an individual system or for the coordinated system can be constructed by converting the remaining storage in each reservoir at the end of the month to units of energy, then totalling all reservoirs in the system. The critical rule curve is an important guide to operations. If the coordinated system reservoirs are below the critical rule curve level, then the reoccurrence of one or possibly more historical sequences of low streamflows could result in the inability of the system to generate its firm energy capability, even if all its reservoirs were drafted empty. Thus, operation of the coordinated system reservoirs below their critical rule curves could jeopardize the system's ability to meet its firm loads for the remainder of the critical period.

C.14 Energy Content Curve--Levels to Protect Refill

A second rule curve developed from the final study is the "energy content curve." The energy content curve for each reservoir is the higher of its critical rule curve or the lowest level from which the reservoir would have a 95 percent probability of refilling by the following July 31. Refill probabilities are based on an analysis of 50-year historical streamflows at the reservoir.

The energy content curve is a very important guide to operations. In order to protect the system's ability to develop its firm energy capability in future years, systems are not permitted to generate energy in excess of their FELCC loads if their system of reservoirs is below the energy content curve as long as such energy can be stored. This means that the use of streamflows to refill a reservoir is given priority over their use for generating nonfirm energy. Thus, the energy content curve is the primary guide that system operators use to determine whether nonfirm energy is available for sale from their systems. The energy content curve also defines the rights and obligations of parties to receive or deliver in lieu energy, and rights and obligations between reservoir operators and downstream plant operators regarding the release of stored water for use at downstream plants (or delivery and return of energy in lieu of such releases).

C.15 Periodic Updates--Variable Energy Content Curves

Almost every year, an analysis of snowpack, precipitation, and other variables will indicate that current-year conditions are better than conditions during the historical year on which the energy content curve was based. In accordance with procedures in the Coordination Agreement, each reservoir operator prepares forecasts of each reservoir's volume of spring snowmelt runoff as soon after the beginning of each month, January through July, as the necessary data become available. Statistical formulas are applied to the hydrometeorological observations and the resulting forecasts are used to compute a "variable energy content curve" similar to the energy content curve prepared prior to the operating year. The variable energy content curve is the best estimate of the lowest level to which the reservoir may be drafted without jeopardizing the coordinated system's ability to refill the reservoirs. Once it becomes available, the variable energy content curve supersedes the energy content curve for all purposes under the Coordination Agreement.

C.16 Proportional Draft Points

Reservoirs may be operated to their proportional draft points instead of their critical rule curves if this is necessary to develop the FELCC of the coordinated system. This is likely to happen during years of below-normal to well-below-normal water. Proportional draft points are determined by assuming that historical critical water conditions were present and that loads were exactly equal to FELCC. The reservoirs are drafted proportionally between their critical rule curves. The Northwest Power Pool Coordinating Group, in producing the Actual Energy Regulation study for the Northwest utilities, also produces the proportional draft points. The time span of the Actual Energy Regulation covers the present month and the month following. This study is done at least twice a month, and is based on estimated streamflows and FELCC, which may cause the end of month proportional draft points to change significantly. This causes the project operators to continually reassess the planned operation of their reservoirs and, if necessary, change their operations to increase or reduce drafts on their projects to adhere to the proportional draft points.

C.17 Weekly Planning

Each week, BPA personnel prepare an operating plan for the FCRPS encompassing the coming month. This plan is divided into 10 one-day intervals, a 1-week interval, and a 2-week interval. The plan reflects the current levels of reservoirs, the operational status of thermal plants, balances in certain types of power sales, and other system conditions. The load forecasts used in this plan, while based on the trend and general magnitude of the monthly load estimates used in resource planning and the Annual Operating Plan, are updated as much as possible. The weekly operating plan forecasts reflect recent trends relative to the operating plan and current weather forecasts. The weekly operating plan also differs from the Annual Operating Plan in that forecasted probable streamflows are used, based on current streamflow levels and weather forecasts.

The most recent energy content curves (or proportional draft points) are used to guide the weekly operation of major storage reservoirs. The weekly plan regulates the water level behind pondage projects such as Bonneville Dam, as opposed to the Annual Operating Plans, which use monthly intervals and assume no net water regulations at pondage projects during the month.

BPA personnel preparing the weekly operating plan are in frequent contact with the Corps of Engineers, the Bureau of Reclamation, entities operating thermal plants supplying BPA, and utility and industrial customers of BPA. Information coming from all these sources is reflected in BPA's weekly operating plan. A large, complex computer program is used to make the necessary calculations and simulate water regulation of the river. Normally, the weekly plan is based on forecasts of loads and streamflows most likely to occur, although occasional situations call for special studies, such as studies using streamflow levels that have some low probability of occurring. These weekly operating plans are one of the important tools used by BPA management in making decisions regarding availability of nonfirm energy for Northwest utility and industrial customers and surplus energy for export from the region. The weekly plan permits BPA managers to anticipate operating capability, and is used to determine the best manner of project operation for the near term. It also can be used to determine the probable Federal generating system ability to meet requests of nonpower interests for special river operations.

The weekly operating cycle supplies some of the information BPA managers use to make major decisions regarding reservoir operations, service to nonfirm loads, operation of thermal resources, operations for nonpower purposes such as Water Budget and flood control, and power purchases where such purchase is optional.

SECTION 3: BORROWING TECHNIQUES USED BY THE COORDINATED SYSTEM

C.18 Borrowing Techniques Used by All Coordinated System Parties

FELCC Shift

- As described in Section 2 above, FELCC for the coordinated system is first determined as a whole amount for the multiyear critical period, distributed across the years as necessary to meet firm obligations. This is done pursuant to a submittal of data from the parties, made approximately February 2 of each year. The previously described lengthening of the critical period to more than 1 year introduces some difficult to understand but important concepts into the annual planning and operating processes. FELCC Shift is a planning mechanism by which the Coordinated System plans to generate more FELCC in one portion of the critical period while generating less in another. Usually, FELCC is shifted into the first year of the critical period, resulting in deeper drafts of reservoirs. This borrowed water has a high probability of being restored each year by normal annual snowpack and runoff.

- In early April, the parties again submit data, this time specifying "Estimated Adjusted Firm Energy Loads," and indicating how much FELCC they desire for each month. This Estimated Adjusted Firm Energy Load must equal the average critical period FELCC previously developed. This data submittal shows the parties' desires for FELCC shift and for shaping of energy among the months of an operating year.

- These amounts are required to average the same as that participant's generating system capability during the critical period and to meet certain other constraints on their monthly distribution. The month-to-month shaping of FELCC to the extent permitted affects the monthly distribution of the coordinated system's hydro generation, and therefore the end-of-month levels of reservoirs shown in the critical period study. After the final regulation is completed, these become the basis for each participant's FELCC and for the critical rule curves of the coordinated system's reservoirs.

- The combined requests for shifting and shaping cannot result in a need for generation which exceeds the amount of power the system can produce within its various operating constraints. Constraints set by the U.S. Army Corps of Engineers and the Bureau of Reclamation on end-of-year drafts limit the total amount of system FELCC shift.

- Other constraints on FELCC shift are imposed by the Coordination Agreement. Parties may not shift FELCC so as to create a surplus in one period at the expense of a deficit in another period. If there is surplus FELCC for the critical period, parties may move it forward. If there were an overall deficit in FELCC for the critical period, parties may delay it to a later year. If the system fails to refill such that planning must be based on a second or third year of the critical period, FELCC shift is not available.

Flexibility Energy

- The Coordination Agreement allows parties to make limited changes in the amounts of FELCC allocated to each month of the Operating Year. A Flexibility Account is kept for each party showing the accumulated increases or decreases for an Operating Year. The amounts of FELCC increased in an early month must be balanced by corresponding decreases in later months, and vice versa. Each Flexibility Account starts at zero on July 1 of each Operating Year and must be brought to zero by the end of the Operating Year, or the end of the critical period, if the critical period ends within an Operating Year.

The amounts of monthly changes are limited by a number of constraints in the Coordination Agreement. For example, at any time, the net total of increases in monthly FELCC shown in the Flexibility Account may not exceed 5 percent of that party's FELCC remaining between that date and the date on which the Flexibility Account balance must be brought to zero.

- All the above-described borrowing techniques are used by BPA and other parties to the Coordination Agreement for service to their customers. Flexibility Energy is especially important for BPA's Actual Computed Requirement customers to match their FELCC to actual load. In addition, a party with firm surplus FELCC or with loads which underrun the estimates used in preparing the AOP may use Flexibility to better market this energy.

C.19 Use of Borrowing Techniques for DSI Customers

Under the Northwest Power Act, BPA is to continue to plan firm resources to serve 75 percent of the total DSI requirements in addition to its other firm loads. As stated in the Senate Energy Report (p. 59) for the Northwest Power Act, the balance of the DSI load is to be served with resources which are in excess of critical planning amounts but which are operated to meet the entire DSI load "as if it were firm."

As explained in Appendix B, BPA divides the DSI load into four quartiles. BPA is not obligated to acquire resources to meet the First Quartile of the DSI load; instead, BPA uses techniques to serve the First Quartile that are defined in the DSI Power Sales Contract. Aluminum smelters may elect service under the Variable Rate contract, which will then temporarily supercede the Power Sales Contract provisions regarding rates and quality of service. These techniques include nonfirm energy when available, borrowed firm energy from future months or years (FELCC Shift, Advance Energy, and Flexibility Energy), and Surplus Firm Energy Load Carrying Capability (Surplus FELCC). Advance Energy is a borrowing technique which is primarily relevant to DSI service. FELCC Shift and Flexibility Energy are borrowing techniques used by all Coordination Agreement parties for various purposes.

Advance Energy

- Advance energy is energy which is produced by drafting a particular reservoir below the lowest level otherwise permitted under the Coordination Agreement. The resulting energy is delivered to a customer with the provision that the customer replace it if the delivering party later determines that it needs the energy to meet its firm obligations.

- With respect to BPA use of this technique, the U.S. Army Corps of Engineers and the Bureau of Reclamation have defined limits within which BPA may draft specified reservoirs. Coordination Agreement parties other than BPA have generally not used this technique except to retain and market the energy produced at their downstream plants when BPA makes provisional drafts from Federal reservoirs.

- Advance Energy has its beginning in the 1950s, when BPA delivered what was then called provisional energy to its DSIs during fall months. This energy was produced by drawing water from the Hungry Horse reservoir. The limited energy available was delivered "provisionally" to serve DSI interruptible loads when nonfirm energy was not available. (The amount of interruptible load was not the same percentage of each DSIs' load under the pre-Northwest Power Act contracts in place at this time.) If BPA later needed the energy which that increment of water was planned to produce to meet BPA's firm loads, the DSIs would replace the energy, even, if necessary, by reducing their firm loads. This contractual agreement called for the energy to be replaced only if BPA needed the energy the water could have produced, but for the provisional drafts, treating that water as the last water to be released from the reservoir. Only once--following the 1974 drought--was return energy requested.

- Later, but before the Northwest Power Act, this arrangement was expanded to use other major Federal reservoirs and the name was changed to Advance Energy. Many documents use the term provisional energy, but the DSI Power Sales Contract uses the term Advance Energy. The practice of provisional drafting of reservoirs was formalized in section 9(n) of the Pacific Northwest Coordination Agreement.

FELCC Shift

- FELCC Shift is also used to serve the DSI First Quartile. FELCC Shift used to serve the First Quartile of DSI customers is the same borrowing technique as is used by Coordination Agreement parties for various loads. However, DSIs are subject to future restrictions of their Third Quartile loads if coordinated system reservoirs fail to refill, the year from which the shift was made is adopted, and BPA needs the energy to meet its firm obligations. Other customers are not subject to such restriction rights though they may have to bear the costs of purchases or operation of more expensive resources. Advance Energy differs from FELCC Shift in that FELCC Shift is done at the time the Annual Operating Plan is prepared, whereas the Advance Energy operation is not reflected in the annual planning process. Also, Advance Energy had, in the past, been reserved by BPA for use only for its DSI loads, and is still used predominantly for that purpose. FELCC Shift is used by BPA for service to DSI loads and other markets, and is used by other regional utilities for various purposes.

Flexibility Energy

- BPA uses its Coordination Agreement flexibility rights to shape its FELCC among months of an Operating Year for service to the DSI First Quartile, among other purposes.

Combination of Techniques

- During DSI contract negotiations, negotiators realized that FELCC shift could not provide full service to the First Quartile load throughout a contract year following reservoir refill. Instead, the contract provides for the use of FELCC Shift, Advance Energy, and use of Coordination Agreement flexibility accounting until the date of availability of the forecast, determined by BPA to be the first reliable forecast, of the Columbia River Basin volume runoff. This date is considered to be January 10. The DSI Power Sales Contract calls for all three techniques--FELCC Shift, Flexibility Energy, and Advance Energy--to be used by BPA to serve the First Quartile loads up to the date of that forecast. This was done mainly because studies made at the time of the negotiations indicated that use of all three of these devices would be needed to meet the First Quartile load for the entire period from about Labor Day to January 10.

APPENDIX D

Appendix D

Glossary

GLOSSARY

The words below are defined for the reader as they are used in this Environmental Impact Statement.

AC - (See Alternating current.)

aMW - (See Average megawatts.)

Absolute - Being fully as indicated; independent of any other value or standard; not comparative or relative (opposed to relative).

Access - (See Intertie access.)

Acid deposition - The combination of oxides of nitrogen and sulfur, in the air, with water, forming acid rain or snow, which may adversely affect water resources and plant and animal life.

Acre-foot - The volume of water that will cover an area of 1-acre to a depth of 1 foot.

Advanced Energy - Electric energy delivered by BPA to industrial customers in lieu of restricting firm power deliveries when the Federal Columbia River Power System's reservoirs are being filled. BPA may call this energy if it is later needed to meet BPA's firm loads.

Air basins - Defined areas which generally confine the air-borne pollutants produced within them. Air pollutants tend to circulate and mix together within a basin.

Alluvial fan - A low cone-shaped deposit of sediment laid down by a swift-flowing stream as it enters a plain or an open valley, commonly in dry regions with interior drainage.

Alpha - In the field of statistics, the probability (percentage) of erring by rejecting the null hypothesis when it is actually true.

Alternating current (AC) - Term applied to an electric current or voltage that reverses its direction of flow at regular intervals and has alternately positive and negative values, the average value of which (over a period of time) is zero.

Ambient Air - Ambient air is the air surrounding a particular spot, such as a power plant.

Anadromous Fish - Fish species that spawn and initially rear in fresh water, migrate and mature in the ocean and return to fresh water as adults.

Applicable rate - The rate(s) contained in rate schedules for service of a defined type.

Aquatic biota - The plant and animal life of a water body, considered as a total ecological entity.

Aquifer - Any geological formation containing water, especially one that supplies water to wells, springs, etc.

Artifact - An object of any type made by human hands. Tools, weapons, pottery, and sculptured and engraved objects are representative artifacts.

Average megawatts (aMW) - The average amount of energy (number of megawatts) supplied or demanded over a specified period of time.

Avoided-cost methodology - A method used to determine the payments from utilities to qualifying facilities (QF's) under PURPA. The utility pays the QF an amount based on the costs for power the utility avoids by purchasing power from the QF.

Baseload - In a demand sense, a load that varies only slightly in level over a specified time period. In a supply sense, a plant that operates most efficiently at a relatively constant level of generation.

Benthic insects - Insects living on the bottom of reservoirs or streams.

Block slump - The (usually limited) downward displacement of a mass of earth as a unit, often caused by excessive soil saturation.

Boreal - Pertaining to the forest areas and tundras of the North Temperate zone and Arctic region.

Bottom-ash - Uncombusted materials which accumulate in the bottom of a boiler and which must be removed and, generally, disposed of as solid waste.

Brackish - Containing some salt. Brackish water often results where fresh waters meet the ocean.

Buffering capability - The ability of a material to resist a change in pH (acidity or basicity) when an acid or base is added.

Bypass - Water released from a project which does not go through the turbines or over the spillway. Bypass may include leakage, navigation lock releases, and fish ladders.

cfs - (See Cubic feet per second.)

CFM VI - (See Common Forecasting Methodology VI.)

Capacity - The amount of power that can be produced by a generator or carried by a transmission facility at any instant. Also, the service whereby one utility delivers firm energy during another utility's period of peak usage with return made during the second utility's offpeak periods; compensation for this service may be with money, energy or other services.

Capacity additions - Proposals to increase the power carrying capability of the Intertie--the Third AC/COTP and the DC Terminal Expansion Project.

Capacity/energy diversity exchange - A transaction in which one utility provides another with capacity service during its peak season, with compensation as the delivery of additional amounts of energy to the first utility during its peak season. This type of exchange benefits utilities that do not peak at the same time, if deliveries and returns can be made at the time of each utility's system peak.

Capacity/energy exchange - A transaction in which one utility provides another with capacity service in exchange for additional amounts of firm energy (exchange energy) usually during offpeak hours or money under specified conditions.

Capital costs - The costs to construct a power plant, including the costs of materials, permits, and interest on borrowing.

Capital investment in new resources - (see Capital costs)

Carrying capacity - The amount of energy that a Transmission facility can carry under specified conditions.

Cogeneration - The generation of power in conjunction with (usually) an industrial process, using waste heat from one process to fuel the other.

Common Forecasting Methodology VI (CFM VI) - Filings of projected loads, costs, and prices by California utilities to the California Energy Commission.

Composite retail rates - The average retail rates calculated for (1) all the publicly owned utilities and (2) all the investor-owned utilities in the Pacific Northwest.

Computed Requirements - BPA utility customers with large power generating resources, or shares of large resources, purchase power on the basis of computed requirements. This means that the customers' entitlement to power is computed within certain minimums and maximums. This differs from metered requirements which entitles a customer to whatever it needs during a month to serve its regional firm load. All computed requirements customers "assure" the capability of their firm power generating resources. Some computed requirements customers may purchase all of the firm power needed to serve the remainder of their firm load. Other computed requirements customers fix in advance the amount of power they are going to purchase from BPA either for a year or for 7 years based on estimates of their power needs which exceed their assured capability.

Coordination Agreement - An agreement among several of the region's largest generating utilities and BPA which provides rules for operation of the parties' hydroelectric projects as if they were all owned by a single entity. This agreement makes the best use of the water and storage capability of the region by assuring that the whole system is operated as if it was all owned by a single entity.

Critical Rule Curve - A set of end-of-month reservoir contents which take the reservoir from full to empty during a critical period. Critical rule curves are used to guide reservoir operation during actual operation.

Crustaceans - Aquatic creatures such as barnacles and crabs, which have a segmented body, an exterior shell-like skeleton, and paired, jointed limbs.

Cubic feet per second (cfs) - A unit of measurement pertaining to flow of water. One cfs is equal to 449 gallons per minute.

Cultural resources - The nonrenewable evidence of human occupation or activity as seen in any district, site, building, structure, artifact, ruin, object, work of art, architecture, or natural feature that was important in human history at the national, State, or local level.

DC - (See Direct current.)

DSI - (See Direct-service industries.)

Dam passage - The percentage of fish which get from one side of a dam to the other alive.

Damage functions - Mathematical expressions based on scientific and socioeconomic observations which can be used to relate exposure to an environmental condition to an economic or social condition.

Declining block rate structure - In a rate schedule for a particular customer class, a structure that specifies lower kWh rates as consumption increases for specified ranges of usage.

Decremental cost - The cost that a utility could avoid by not operating a power plant; a utility's decremental cost is considered by some regulators to be a "fair" rate for the utility to pay for purchased power.

Deoxygenation - The depletion of dissolved oxygen in water.

Detailed Fisheries Operating Plan - A Columbia River hydroelectric system operation manual prepared by fish and wildlife agencies and Indian Tribes for fish passage related to the mainstem Columbia River.

Dewater - (a) To remove water from a solution containing wastes in order to concentrate and then dispose of the wastes. (b) To divert or remove water from a stream or river channel in order to construct or rebuild dams and related hydroelectric facilities.

Direct current (DC) - Term applied to an electric current or voltage which may have pulsating characteristics, but which does not reverse direction at regular intervals.

Direct Service Industries (DSIs) - Industrial customers (primarily aluminum companies) which purchase energy directly from BPA.

Dispatch - The monitoring and regulation of an electrical system to provide coordination; or the sequence by which electrical generating resources are called upon to generate power to serve changing amounts of load.

Displacement - The substitution of less-expensive energy (usually hydroelectric energy transmitted from the Pacific Northwest or Canada) for more expensive thermal energy produced in California. Such displacement means that the thermal plants may reduce or shut down their production, saving money and often reducing air pollution as well.

Dissolved gas concentrations - The amount of chemicals normally occurring as gases, such as nitrogen and oxygen, which are held in solution in water, expressed in units such as milligrams of the gas per liter of liquid.

Distribution costs - Costs faced by a utility that sells electricity at retail to consumers, the costs of transporting the power from the transmission substation to the consumer.

Double-circuit - The placing of two separate electrical circuits on the same row of towers. For alternating current, each circuit consists of three separate conductors or bundles of conductors.

Downstream Migrant Survival - The survival of an individual juvenile salmon or steelhead from the time it enters the mainstem Snake or Columbia rivers, until it gets below Bonneville Dam.

Drawdown - The distance that the water surface of a reservoir is lowered from a given elevation as water is released from the reservoir (drafted).

Economy energy - Nonfirm energy that can be generated on a partially loaded generating unit, or purchases of energy, at a price less than decremental cost. Economy energy is unconditionally interruptible.

Electrostatic precipitators - Devices used to remove particulate air pollutants from an air stream by establishing an electric charge on the particles which then are attracted to an oppositely charged collector.

Emergence - Migration of hatched salmon fry up through the gravel of a redd preparatory to continuing their life cycle in open water.

Endangered - A plant or animal species which is in danger of extinction throughout all or a significant portion of its range because its habitat is threatened with destruction, drastic modification, or severe curtailment, or because of overexploitation, disease, predation, or other factors; federally endangered species are officially designated by the U.S. Fish and Wildlife Service and published in the FEDERAL REGISTER.

Energization - The point at which a completed energy facility is put into operation.

Energy Content Curve (ECC) - A set of end-of-month reservoir contents which assure a high probability of refilling the reservoirs.

Energy losses - The difference between power supplied and power received, due to dissipation by the transmission line or other facility.

Energy surplus - A condition in which a utility system can supply more energy than is demanded; the energy may be nonfirm, due to water conditions, or firm, due to excess generating capability.

Entrainment - The drawing of fish and other aquatic organisms into tubes or tunnels carrying water for cooling purposes into thermal plants or for generating purposes into hydroelectric plants. Entrainment increases mortality rates for those organisms.

Environmental Impact Statement (EIS) - A document prepared by a Federal agency on the environmental impact of its proposals for legislation and/or other major actions significantly affecting the quality of the human environment. EISs are used as tools for decisionmaking and are required by the National Environmental Policy Act of 1969.

Equilibrium values - For the projection of BC Hydro's retail power rates for the EIS, the rates that reflect an economic equilibrium of supply and demand, considering the cost to supply the power (less revenues from secondary sales) and the loads.

Estuary - A coastal inlet where salt water meets fresh water, as at a river's mouth.

Eutrophication - The increase of aquatic vegetation (at the expense of animal life) as more plant nutrients are supplied.

Exchange energy - Under a capacity/energy exchange contract, the energy that must be generated or purchased by a utility as compensation for capacity service that was provided by another utility.

Export sales - The sales of electricity from one region to another.

Extraregional - Any entity or place not within the Pacific Northwest.

FCRPS - (See Federal Columbia River Power System.)

Federal Base System - Resources consisting of hydroelectric facilities of the Federal government, as well as Washington Nuclear Project No. 1 and No. 2, and 70 percent of No. 3, part of the Hanford Nuclear Project, and a portion of the Trojan Nuclear Project, along with a few other miscellaneous power generating resources. BPA uses these resources to serve the firm energy loads of its customers. When BPA allocates power during periods of insufficiency, it is the Federal Base System resources that are used in the allocations formula.

Federal Columbia River Power System (FCRPS) - The hydroelectric dams on the Columbia River financed by the U.S. Treasury, which operate as a coordinated generation system, and for which BPA serves as the power marketer.

Federal Energy Regulatory Commission - A Federal agency which reviews hydroelectric projects and submitted applications for operating licenses.

FELCC Shift - (See Firm Energy Load Carrying Capability.) A planning action, under the Coordination Agreement, in which they hydrosystem generates more electricity in one portion of the critical period while generating less in another portion of the period. Usually FELCC is shifted into the first year of the critical period, resulting in lower reservoir levels.

FGD - (See Flue-gas desulfurization.)

Fingerlings - Young or small fish, especially very small salmon or trout.

Firm - In the power industry, guaranteed or assured. May refer to a guaranteed supply of power, to guaranteed access to a means to transmit power, or, with reference to loads, to guaranteed service for a defined need. Usually defined for a given period of time.

Firm Energy Load Carrying Capability (FELCC) - The level of energy capable of being produced by the hydrogeneration system using all of the reservoir storage in combination with critical period streamflows. (Critical period refers to that portion of the historical 40-year streamflow record which produces the least amount of energy, with energy being used according to seasonal load patterns.)

Firm energy load carrying capability - The minimum level of energy that can be produced and shaped to load during the period it would take reservoirs to be drafted from full to empty under critical streamflow conditions.

First Quartile - The DSIs electric operating demands are divided into four quartiles. The upper quartile (also called first or top) is that portion of the DSI's electric load which BPA may restrict for any reason or which DSI's may curtail for any reason.

Fish ladder - A series of ascending pools constructed to enable salmon or other fish to swim upstream around or over a dam.

Fish passage facilities - Features of a hydroelectric or other type of dam to enable fish to move around, through, or over them without harm.

Fish Spill Plan - A plan to provide a certain percentage of the total flow of a project as spill, for Federal and non-Federal projects.

Flaring - The practice of disposing of a waste combustible gas by burning it in a open flame without recovery of heat and, typically, at the top of a stack.

Flow rate - The volume of a fluid which passes a point in a defined channel per unit of time.

Flow regimes - The pattern of flow as it changes with time over the course of some specific time period.

Fluctuation zone - The area between the maximum and minimum water levels in a reservoir.

Flue-gas desulfurization (FGD) - The process of removing sulfur dioxide and other oxides of sulfur from gases generated by combustion or some other process before they are discharged to the atmosphere.

Fly-ash - Particulate matter remaining after combustion of a material which is entrained into the gas stream, and which may in large part be captured by an air pollution control device and, generally, disposed as a solid waste. Fly-ash not so captured is discharged as particulate matter into the atmosphere.

Foodweb - The interlocking pattern of food chains that results from their interconnection with one another; a way of presenting the flow of energy through an ecosystem.

Forced outage - The unexpected failure of some part of the power system to perform its function.

Forebay - The portion of the reservoir at a hydroelectric plant which is immediately upstream of the generating station.

Formula allocation - Conditions established by the NTIAP for allocating access to the Intertie, specified by formula.

Fossil fuel - A combustible, carbonaceous material formed from the remains of ancient plants and animals. Common fossil fuels include coal, natural gas, and derivatives of petroleum such as fuel oil and gasoline.

Functional capacity - The actual power carrying capability of a transmission line.

Fuel conversion efficiencies - The ratio (commonly expressed in percent) of the heating value of the fuel used per unit time to the power output of a generating plant.

General Contract Provisions (GCPs) - Power sales contract provisions contain detailed information on charges, rates, delivery, equipment, billing, metering, and other provisions required by statute. These provisions are common to all BPA power sales contracts and are also contained in other BPA contracts. (All references to GCP Form PSC-1, dated 8-25-81.)

Geothermal (energy) - The heat energy available in the rocks, hot water, and steam in the earth's subsurface.

Groundwater - The supply of fresh water under the earth's surface in an aquifer or soil.

Hydraulic head - The vertical distance between the surface of the reservoir and the surface immediately downstream of the turbine and dam.

Hydraulic residence times - The average travel time for a particle of water through a reservoir or other body of water.

Hydro Block - The electrical energy available from the hydro system which is divided into various portions or "blocks," depending on conditions applied to its use.

Hydrocarbons - Chemical compounds containing hydrogen and carbon. Some hydrocarbons may become air pollutants. Some hydrocarbon air pollutants are carcinogenic, and some react with other air pollutants to form photochemical smog.

Hydroelectric - With reference to a power system, the production of electric power through use of the gravitational force of falling water.

Hydrology - The localized conditions relating to the occurrence, circulation, distribution, and properties of ground and surface waters.

Hydrostatic testing - The use of pressurized water to test a tank, pipeline, or other equipment for leaks.

IOU - (See Investor-owned utilities.)

Investor-Owned Utilities (IOU's) - Privately owned utilities whose programs are financed by private (nongovernment) investors in the utility's stocks and bonds. (In contrast to publicly owned utilities.)

ISW - (See Inland Southwest.)

Impoundment - The accumulation of water in a reservoir.

Incubation - The period between fertilization of an egg and its hatching.

Inland Southwest (ISW) - For the purposes of this EIS, the States of Nevada, Arizona, Colorado, Utah, and New Mexico.

Instantaneous flow rate - The minimum amount of flow required (usually in terms of fish survival and functioning) at a given moment in time.

Interruptibility - The extent to which the flow of power can be stopped for a given period of time. By agreement, the supply of interruptible power can be shut off to a customer on relatively short (hours or a few days') notice.

Inundation - The flooding or covering up of an area with water. Inundation occurs when a reservoir is first filled.

Juvenile - The stage in the life cycle of anadromous fish when they migrate downstream to the ocean.

kcfs - One thousand cubic feet per second. A measure of speed and volume of water flow. (See Cubic feet per second.)

Kilowatthour (kWh) - The common unit of electric energy equal to 1 kilowatt of power supplied to or taken from an electric circuit for 1 hour. A kilowatt equals 1,000 watts.

LCMM - (See Least Cost Mix Linear Program Model.)

LP - (See Marketing Linear Program Model.)

LTIAP - (See Long Term Intertie Access Policy.)

Laissez-faire - A hypothetical hands-off policy of Intertie access that would allow the Intertie to be used on a first-come, first-served basis; no restrictions would be imposed on access to the Intertie for new resources.

Larvae - The newly hatched, earliest stage of anadromous fish.

Lead Federal agency - The Federal agency charged with primary responsibility for evaluating in conformance with the National Environmental Policy Act the potential environmental effects of a project involving Federal action.

Leakage - An amount of water which leaks around a dam without passing through the turbines, spillway gates, or navigation locks.

Lockage - An amount of water which passes through the navigation locks and does not pass through the spillway gates or turbines of a dam.

Least Cost Mix Linear Program Model (LCMM) - A linear program computer model that estimates the amount of regional generation and conservation resources that should be acquired to yield a least-cost resource mix to meet a given firm load over a 20-year planning horizon.

Least cost mix of resources - The combination of generating (including conservation) resources that would meet a given amount of load at a given time or for a given period most economically.

Leveed islands - An area of land completely surrounded by water protected from flooding during high water by levees, embankments of earth rimming the island.

Levelized - Of costs, a method of calculating equal, periodic payments or receipts from unequal cost data for the same time period, considering the time value of money.

Linear regression analysis - The derivation of a mathematical relationship between dependent and independent variables based on a random sample of observations.

Littoral zone - The shallower waters near the shore of a reservoir or lake.

Load - The amount of electric power or energy delivered or required at any specified point or points on a system. Load originates primarily at the energy-consuming equipment of the customers.

Load growth - Increase in demand for electricity.

Load management - Influencing the level and shape of the demand for electrical energy so that it matches resources available as well as long-run objectives and constraints.

Load profiles - Information on the shape of customers' demands for electricity over time.

Load/resource balance - The point at which the demand for electricity matches or balances the amount and type of resources available to serve that demand.

Long Term Intertie Access Policy (LTIAP) - The policy being developed by BPA to allocate use of the Federal portion of the Intertie for the long term, an indefinite period that would at least encompass long-term power sales (up to 20 years) and long-term transmission contracts.

Low water years - Years in which less water than usual is received in a river system producing power from water flow. This is usually a consequence of reduced rain/snow fall over the fall and winter months.

MW - (See Megawatts.)

Macroinvertebrates - Nonmicroscopic animals without a spine.

Marginal energy costs - For a generating resource, the cost to produce one more kilowatthour of electricity.

Marketing Linear Program Model (LP) - A linear program computer model that calculates decremental cost for each utility in the Southwest.

Megawatts (MW) - A megawatt is one million watts, an electrical unit of power.

Microclimate - The climate of a small area, as of houses, of plant communities, or of urban communities.

Mine-mouth - Used to refer to thermal generating plants located close enough to the fuel source (generally coal) that no long-distance fuel transport is necessary.

Minimum generation constraints - For thermal power plants, the minimum level of operation that must be maintained to keep the plant ready to generate power when needed.

Model Conservation Standards - A conservation program developed in accordance with the Pacific Northwest Power Act by the Northwest Power Planning Council to define and adopt cost-effective conservation standards as one of the region's electric generating resources.

New Large Single Load (NLSL) - Any load associated with a new facility, and existing facility, or an expansion of an existing facility which:

- -- is not contracted for, or committed to, as determined by BPA, by a public body, cooperative, investor-owned utility, or Federal agency customer prior to September 1, 1979; and which

- -- will result in an increase in power requirements of such customer of 10 average megawatts or more in any consecutive 12-month period.

Nitrogen supersaturation - A condition of water in which the concentration of dissolved nitrogen exceeds the saturation level of the water. Excess nitrogen can lead to bubbles of nitrogen in the circulatory systems of fish.

Nominal dollars - For economic analysis, dollars in the year specified, not adjusted for the effects of inflation or the time value of money.

Nonfirm energy - Energy available due to water conditions better than critical, sold on an interruptible (nonguaranteed) basis.

Northwest Power Act - (See Pacific Northwest Electric Power Planning and Conservation Act.)

Northwest Power Planning Council (Council) - The Pacific Northwest Electric Power and Conservation Planning Council, established by the Northwest Power Act. They are charged with devising a regional electric energy plan for the Pacific Northwest and a regional program to protect, mitigate, and enhance fish and wildlife in the Columbia River Basin. The Council is composed of two appointed representatives from the States of Oregon, Idaho, Washington, and Montana.

Null hypothesis - A statistical hypothesis to be tested and accepted or rejected in favor of an alternative; specifically, the hypothesis that an observed difference is due to chance alone and not due to a systematic cause.

Nutrient loading - The quantity of elements or compounds essential as raw materials for organism growth and development which are dissolved or suspended in a sample of water.

Offpeak hours - Period of relatively low system demand for electrical energy, as specified by the supplier (such as the middle of the night).

Outplantings - Fish hatched and initially reared in a hatchery, which are then planted into natural habitats to continue juvenile rearing.

Overburden - The topmost layers of soil. In this EIS, the 30-50' layers of soil stripped off to reveal coal seams in the process of strip mining.

PCB's - (See Polychlorinated biphenyls.)

PF rate - (See Priority Firm rate.)

PNW - (See Pacific Northwest.)

PSD - (See Prevention of Significant Deterioration increments.)

PURPA - (See Public Utilities Regulatory Policy Act.)

Pacific Northwest (PNW) - For this EIS, the States of Washington, Oregon, and Idaho; the portion of Montana west of the Continental Divide; and areas in Montana, Nevada, and Wyoming surrounding coal plants that serve the PNW.

Pacific Northwest Electric Power Planning and Conservation Act - Signed into law December 5, 1980, the Act provides for coordinated planning of the Pacific Northwest's energy future, through a Regional Planning Council with representation from Oregon, Idaho, Montana, and Washington.

Paired t-test - A statistical comparison between two sets of data used to determine to what extent they are dissimilar.

Passage survival - The survival rate of migratory fish through, around, or over dams or other obstructions in a stream or river.

Peak loads - The maximum electrical demand in a stated period of time. It may be the maximum instantaneous load or the maximum average load within a designated interval of the stated period of time.

Percolation - The movement of water through the subsurface soil layers, usually continuing downward to the groundwater and water table reserves.

Photochemical smog - A type of air pollution resulting when sunlight induces chemical reactions of other pollutants, notably nitrogen dioxide and hydrocarbons. Elevated ozone levels are an indicator of photochemical smog since ozone is one of the products of the photochemical reaction.

Phytoplankton - The plant portion of the floating or weakly swimming organisms, often microscopic in size, in a body of water.

Plume - The discharge of gas and other pollutants into ambient air, or the discharge of polluted or heated water into a body of water from its source to the point where the discharge is no longer identifiable since it has mixed with the ambient air or the water.

Plunging flows - Water flow over a very steep surface or off of a precipice into a pool. This situation is one which produces high levels of dissolved gases in the water, such as nitrogen supersaturation.

Polychlorinated biphenyls (PCB's) - A group of noncombustible synthetic insulating/dielectric fluids used in certain electrical equipment; found to be very persistent in the environment and strongly suspected of having carcinogenic effects.

Pool Mortality - Death that occurs to a juvenile salmon or steelhead as it migrates through the pool or reservoir of a run-of-the river project.

Power pool - A power pool is two or more electric systems interconnected and coordinated to supply power in the most economical manner for their combined load requirements and maintenance program.

Power Sales Contracts - Contracts which establish the terms and conditions of BPA's power sales. The maximum term of power sales contracts established by the Bonneville Project Act is 20 years. All such contracts specify the quantity of the sale and the rate schedule or schedules to be used for billing, and incorporate the General Rate Schedule Provisions and the applicable General Contract Provisions. Generally they include a description of the point or points of delivery and specify the voltage or voltages at which the power will be delivered. Other provisions cover special conditions applicable to the specific customer.

Pre-emergent fry - Fish after they have hatched from their eggs but before they have left their incubation environment.

Predation - The capturing of prey as a means of maintaining life.

Preference customers - Cooperatives and public bodies (States, public utility district, counties, and municipalities, in the Northwest which have been given preferential rights by Congress to federally generated hydroelectric power.

Prevention of significant deterioration (PSD) increment - Any one of several incremental changes in ambient total suspended particulate or sulfur dioxide concentrations established by the Environmental Protection Agency to protect existing air quality from being degraded significantly through new developments, such as construction and operation of a new air pollution source.

Priority Firm (PF) rate - The priority firm (PF) rate schedule is for sale of firm power to be used within the Pacific Northwest by public bodies, cooperatives, Federal agencies, and IOU's participating in the residential and small farm exchange under Section 5(C) of the Northwest Power Act.

Project outflow - The volume of water per unit of time downstream from a project.

Public Utilities Regulatory Policy Act (PURPA) - Enacted in 1978, it is the Federal legislation that requires utilities to purchase electricity from qualified independent power producers at a price that reflects what the utilities would otherwise have to pay for the construction of new generating resources.

Pumped Storage - An arrangement whereby electric power may be generated during peak load periods by hydroelectric plants using water previously pumped into a storage reservoir during offpeak periods.

Qualifying Facilities (QF's) - Renewable and cogeneration resources developed under the Public Utilities Regulatory Policy Act of 1978.

Real cost escalations - The increase in cost over a period of time due solely to the time value of money; that is, adjusted for price inflation.

Real discount rate - The factor used to compute the present value of a future amount, which adjusts solely for the time value of money and does not include price inflation.

Reclamation - The restoration of land to resemble its original condition or an acceptable substitute as to shape, vegetation, and wildlife; reclamation takes place after an area has been stripmined or after an energy facility has been built.

Record of Decision - The document notifying the public of a decision taken on a power project, together with the reasons for the choices entering into that decision. The Record of Decision is published in the FEDERAL REGISTER.

Recordation - The making of appropriate records (following National Park Service guidelines) to insure that a permanent record of a cultural resource's present appearance and context are made before the resource is disturbed through destruction, demolition, or inundation. Such a record might consist of written description, photographs, and so on.

Redds - Gravel nest created by female salmon or trout where its eggs are laid, subsequently hatched, and fry emerge.

Regional - Referring to the characteristics of an area, as opposed to those of a surrounding or adjacent area. Generally used in this EIS to distinguish between the Pacific Northwest and Canada or California or the Inland Southwest. (See Extraregional.)

Regional Council's Energy Plan - A plan to encourage conservation and efficient use of electric power and the development of renewable resources within the Pacific Northwest. The Northwest Power Act mandated the development of the program.

Regional Council's Fish and Wildlife Program - A program to protect, mitigate, and enhance fish and wildlife. The Northwest Power Act mandated this Program.

Relative - Considered in relation to a Base Case condition; comparative; not absolute or independent (opposed to absolute).

Relative change in survival - The difference in survival between the two alternatives divided by the Base Case survival value. The change in survival in relation to the Base Case survival.

Reliability level - For a power system, a measure of the degree of certainty that the system will continue operation for a specified period of time.

Relic collecting - The seeking out and removal of artifacts or other cultural resources by private persons. The practice consequently excludes opportunities for study or preservation of the site, and often results in destruction of artifacts, the site itself, and/or nearby sites.

Renewable resources - Resources for energy which are continually replenished. Water, for instance, is a renewable resource, while coal which is converted into carbon dioxide, water, and ash when burned is not.

Replication - A copy or reproduction of a cultural artifact. Replication is most often done for rock art or engravings, by making a mold or cast of the work.

Reserve margins - For a power plant or transmission facility, extra capacity above the amount projected to be needed, to allow for unanticipated demand for power, equipment failure, or other unforeseen events.

Reservoir draft rate - The rate at which water, released from storage behind a dam, reduces the pool elevation of the reservoir.

Reservoir elevations - The various levels reached by water stored behind a dam.

Resident fish - Fish species which reside in fresh water during their entire life cycle.

Residential Exchange Program - An exchange of power prescribed by section 5(c) of the Northwest Power Act. Pacific Northwest utilities sell BPA an amount of power equal to their residential and small farm load, in exchange for less-expensive Federal electricity. The cost benefits are directly passed on by the utilities to their residential and small farm consumers, in the form of lower retail rates to those customers.

Residual fuel oil - Fuel oil that remains after separation of valuable distillates (such as gasoline) from petroleum through distillation.

Resource dispatch - For this EIS, the order of access or the monitoring of power resources for access to the Intertie.

Resource mix - The different types of resources used to generate power (e.g., hydroelectric, thermal, etc.) within a given area or for a given utility.

Resource schedule - The planned schedule of when and what resources will be available in the future to serve load in a given area or of a given utility.

Retrofit - To weatherize an existing structure.

Riprap - Broken rock, cobbles, or boulders placed on the bank of a stream or river for protection against the erosive action of water.

Run-of-the-River Dams - Hydroelectric generating plants that operate based only on available streamflow and some short-term storage (hourly, daily, or weekly).

Run-of-River Plant - A hydroelectric plant with little or no ability to regulate flow.

Running costs - Also called variable costs--the costs that are incurred or are increased when a power plant operates.

Salmonids - Fish belonging to the family of salmonidae, including salmon, trout char, whitefish, and allied freshwater and anadromous fish.

Scheduling Utilities - Pacific Northwest scheduling utilities include Bonneville Power Administration, Seattle City Light, Tacoma City Light, Grant County PUD, Douglas County PUD, Chelan County PUD, Pend Oreille PUD, Eugene Water and Electric Board, Cowlitz County PUD, Snohomish County PUD, Montana Power Company, Idaho Power Company, Pacific Power & Light Company, Portland General Electric Company, Puget Sound Power & Light, and Washington Water Power Company. Utilities that either operate a generation control area or are within BPA's control area that schedule with BPA.

Scoping - The definition of the range of issues requiring examination in studying the environmental effects of a proposed action. Scoping generally takes place through public consultation with interested individuals and groups, as well as with agencies with jurisdictions over parts of the project area or resources in that area. Scoping is mandated by the Council on Environmental Quality regulations.

Secondary power - The excess above firm power to be furnished to a customer when, as, and if available.

Secondary revenues - Revenues received from sales of secondary energy, which is the energy produced in excess of firm power due to favorable water conditions.

Secondary sales - Surplus power, both firm and nonfirm, in the Pacific Northwest that is available for sale to the Pacific Southwest.

Sedimentation - The settling of material (such as dust or other particles) into water and eventual deposition on the bottoms of streams, rivers, and so on.

Settling ponds - A pond into which water containing suspended solid material is discharged to allow the solid material to separate from the water by gravity.

Shaping - The scheduling and operation of generating resources to meet load of changing levels. Load shaping on a hydro system usually involves the adjustment of storage releases so that generation and load are continuously in balance.

Short-run marginal cost - The cost per unit of buying (or the amount saved by not buying) or producing a specified amount of a product in the near future.

Short-term sales - Sales made for a relatively short period of time.

Simulation - The representation of an actual system by analogous characteristics of some device easier to construct, modify, or understand, or by mathematical equations.

Slag - In the context of this EIS, molten or solidified ash formed from noncombustible material in a fuel by chemical action and fusion at boiler operating temperatures.

Sludge - The wet, solid or semisolid material formed when particulate air pollutants and/or sulfur dioxide is removed by a wet scrubber air pollution control device.

Slurry pipeline - A means of coal transport in which the coal is finely ground, mixed with water, and run through a pipeline to its destination, where it is dewatered and combusted.

Small hydro - Generating resources which use running water to generate electric energy, but which are small in generating capacity. BPA generally considers small hydro projects to be those capable of producing 25 average MW or less.

Smolt - A juvenile salmon or steelhead that is migrating to the ocean and is in a physiological state to transition from fresh to salt water.

Snowmelt freshet - Increased streamflow from the melting of accumulated snowfall.

Spawning - The act of fish releasing and fertilizing eggs.

Spill (forced) - Water for which there is not storage capability in the system reservoirs and which could not be used for power production because the resulting flows would exceed turbine capacity.

Spill (inadvertent/overgeneration) - An amount of water which could have been used to generate electricity but was not because of lack of available market, and inability to store for later use.

Spill (programmed or planned) - Water intentionally passed through a hydroelectric project without producing electricity. This is usually done for fisheries mitigation proposes.

Spoil piles - Heaps of soil and other material removed during surface mining, and later used to reclaim the site.

Sport fish - Fish which are sought by recreational fishermen.

Spot market - A market for electricity characterized by negotiation almost solely on the basis of price, for relatively short-term sales.

Storage reservoirs - Reservoirs maintained behind dams for the purpose of retaining excess water readily available during springtime flows as snow melts. Retained water is then released, as necessary, during periods of lower flow in order to maintain necessary levels of power production. (Water may also be released for other purposes, such as navigation, irrigation, and maintenance of life support for fish.)

Storage rights - Rights provided to BPA for use of storage in Canadian reservoirs.

Stratification (chemical) - The separation into layers differentiated by chemical composition.

Stratification (thermal) - The separation into layers differentiated by temperature.

Subalpine - A terrestrial zone of high upland slopes, immediately below the timberline, characterized by conifer forest consisting of spruce and fir.

Subscription - A proposed offer to Pacific Northwest generating utilities that after completion of the Third AC project would allow them to buy a portion of 800 MW of uprated Intertie.

Subyearling - A juvenile salmonid, normally a fall or summer chinook salmon, that hatches and migrates to the ocean in the same year.

Surplus capacity - The amount of excess Intertie capacity available after reserving sufficient capacity for sale of BPA surplus firm and nonfirm energy.

Surplus energy - Generally energy generated that is beyond the immediate needs of the producing system. Specifically for BPA, firm or nonfirm electric energy generated at Federal hydroelectric projects which would otherwise be wasted if there was not a market for the energy.

Surplus firm energy - Energy that can be generated and guaranteed to be provided, but is excess to demand.

Surplus firm power - Power that can be provided on a guaranteed basis, that is excess to system demand, and that can be provided in an agreed upon shape.

Surplus nonfirm energy - An excess of interruptible energy that is available due to water conditions better than critical.

Surplus peaking capacity - Electric peaking capacity for which there is no demand in the Pacific Northwest at the rate established for the disposition of such capacity.

System Refill - The coordinated hydro system is considered full, for the purposes of the IDU EIS modeling, when the amount of water stored in reservoirs is equal to 94 percent of the total available space.

System Stock Survival - The survival of migrating juvenile salmon or steelhead of a particular fish stock from the point of entry into the hydroelectric system to a point below Bonneville Dam.

TSP - (See Total suspended particulates.)

Tailwater - The water surface immediately downstream from a dam or hydroelectric powerplant.

Thermal resources - Generating plants which convert heat energy into electric energy. Coal, oil, and gas-fired power plants and nuclear power plants are common thermal resources.

Thermal Structure - Reservoirs stratify into three layers in summer months: light warmer water on surface, a thermocline of cooler water, and a layer of cold oxygen deficient water on bottom. Rapid drawdowns cause this stratification to breakdown, reducing production of food organisms, and cooling water temperatures.

Thermally enhanced oil recovery - A process by which heavy crude petroleum underground is subjected to live steam, which reduces the oil's viscosity so it can flow up the pipe to the surface. Steam from the process can be used to cogenerate energy, which can be sold to utilities pursuant to PURPA. Thermally enhanced oil recovery is being used in California's San Joaquin Valley.

Total Suspended Particulates (TSP) - An air pollution term referring to all matter contained in a sample of air which is in solid or liquid form regardless of its particle size or chemical composition.

Trace elements - Pollutants, often metals in ionic or chemically combined form, which appear in very small concentrations in water, or in reference to air pollution, which constitute a very small part of the total amount of particulate pollution by weight.

Transfer capability - The amount of power that can be transmitted between one interconnected system and another, based on installed facilities.

Transfer capacity - (See Transfer capability.)

Transmission grid - An interconnected system of electrical transmission lines and associated equipment for the transfer of electric energy in bulk between points of supply and points of demand.

Transmission losses - Power lost in transmission between one point and another.

Turbidity - A measure of the optical clarity of water, which depends on the light scattering and absorption characteristics of both suspended and dissolved material in the water.

Turbine Capacity - The maximum amount of water that can be passed through the turbines of the dam at any instant.

Utility retail rates - The prices for electricity that a utility charges its classes of consumers.

Variable ECC - The January through July portion of the ECC. It is based on expected amount of spring runoff with available forecasts. The variable can be no higher than the Base ECC.

Venting - The release of limited amounts of gases or vapors to maintain pressures within tanks, pipes, and other equipment involved in oil and natural gas processing and transportation within design limits.

Water Budget - A part of the Pacific Northwest Power Planning Council's Fish and Wildlife Program calling for a volume of water to be reserved on a planning basis and released when and if needed to augment stream flows in order to assist in the downstream migration of juvenile salmon and steelhead.

Water conditions - The overall supply of water to operate the Pacific Northwest hydroelectric generating system at any given time, taking into account reservoir levels, snowpack, needs to provide water or retain water to meet various operating constraints (such as the Water Budget, flood control, flow constraints, etc.), weather conditions, and other factors.

Wholesale rates - The prices for electricity that a utility charges for power that will be resold. In BPA's case, BPA also charges wholesale rates to its DSI customers because they buy at relatively high voltage.

Yearlings - Juvenile salmon and steelhead that migrate to the ocean, often spending a full year rearing in fresh water.

Zooplankton - Aquatic animals which cannot actively swim against the current and which cannot make their own food by photosynthesis.

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APPENDIX E

Appendix E

Affected Environment: Supporting Material

APPENDIX E

AFFECTED ENVIRONMENT: SUPPORTING MATERIAL

Appendix E contains supplemental data on generation resources, both hydro and thermal, and the study region's natural environment as described in Chapter 3 of the text, Affected Environment. Tables E.1-4 list characteristics of the region's generating resources. Tables E.5-7 are concerned with air quality. Tables E.8-10 describe water quality and fish. Table E.11 lists wildlife species in the study area and its subareas.

TABLE E.1

FEDERAL COLUMBIA RIVER POWER SYSTEM
GENERAL SPECIFICATIONS OF PROJECTS EXISTING, AUTHORIZED OR LICENSED, AND POTENTIAL NAMEPLATE RATING OF INSTALLATIONS
September 24, 1985

Project	Type	Operating Agency 1/	State	Stream (if H) City (if Fuel)	Initial Date in Service	Number of 2/ Units	Nameplate Rating-kW	Number of Units	Nameplate Rating-kW	Number of Units	Nameplate Rating-kW	Number of Units	Nameplate Rating-kW
Minidoka	H	BR	ID	Snake	05/07/09	7	13,400					7	13,400
Boise Rvr Div	H	BR	ID	Boise	05/00/12	3	1,500					3	1,500
Black Canyon	H	BR	ID	Payette	12/00/25	2	8,000					2	8,000
Bonneville	H	CE	OR-WA	Columbia	06/06/38	18-2	1,076,600					18-2	1,076,600
Grand Coulee	H	BR	WA	Columbia	09/28/41	24-3	6,163,000			6	4,200,000	30-3	10,363,000
Anderson Rnch	H	BR	ID	S Fk Boise	12/15/50	2	40,000			1	13,500	3	53,500
Hungry Horse	H	BR	MT	S Fk Flathead	10/29/52	4	285,000					4	285,000
Detroit	H	CE	OR	N Santiam	07/01/53	2	100,000					2	100,000
McNary	H	CE	OR-WA	Columbia	11/06/53	14	980,000	6	747,000 3/			20	1,727,000
Big Cliff	H	CE	OR	N Santiam	06/12/54	1	18,000					1	18,000
Lookout Point	H	CE	OR	M Fk Willamette	12/16/54	3	120,000					3	120,000
Albeni Falls	H	CE	ID	Pend Oreille	03/25/55	3	42,600					3	42,600
Dexter	H	CE	OR	M Fk Willamette	05/19/55	1	15,000					1	15,000
Chief Joseph	H	CE	WA	Columbia	08/28/55	27	2,069,000			13	1,573,000	40	3,642,000
Chandler	H	BR	WA	Yakima	02/13/56	2	12,000					2	12,000
Palisades	H	BR	ID	Snake	02/25/57	4	118,750			2	135,000	6	253,750
The Dalles	H	CE	OR-WA	Columbia	05/13/57	22-2	1,807,000					22-2	1,807,000
Roza	H	BR	WA	Yakima	08/31/58	1	11,250					1	11,250
Ice Harbor	H	CE	WA	Snake	12/18/61	6	602,880					6	602,880
Hills Creek	H	CE	OR	M Fk Willamette	05/02/62	2	30,000					2	30,000
Cougar	H	CE	OR	S Fk McKenzie	02/04/64	2	25,000	1	35,000			3	60,000
Green Peter	H	CE	OR	Middle Santiam	06/09/67	2	80,000					2	80,000
John Day	H	CE	OR-WA	Columbia	07/17/68	16	2,160,000	4	540,000			20	2,700,000
Foster	H	CE	OR	South Santiam	08/22/68	2	20,000					2	20,000
Lower Monumental	H	CE	WA	Snake	05/28/69	6	810,000					6	810,000
Little Goose	H	CE	WA	Snake	05/19/70	6	810,000					6	810,000
Dworshak	H	CE	ID	N Fk Clearwater	09/18/74	3	400,000	3	660,000			6	1,060,000
Grand Coulee PG	PG	BR	WA	Columbia	12/30/74	6	300,000					6	300,000
Lower Granite	H	CE	WA	Snake	04/15/75	6	810,000					6	810,000
Libby	H	CE	MT	Kootenai	08/29/75	5	525,000	3	315,000 4/			8	840,000
Lost Creek	H	CE	OR	Rogue	12/01/77	2	49,000					2	49,000
Libby Reregulating	H	CE	MT	Kootenai				3	76,400			3	76,400
Strube	H	CE	OR	S Fk McKenzie				1	4,500			1	4,500
Teton	H	BR	ID	Teton				3	30,000			3	30,000
Total Number of Units and Nameplate Rating						204-7	19,502,980	24	2,407,900	22	5,921,500	250-7	27,832,380
Total Number of Projects							31		3		0		33

1/ CE - Corps of Engineers, Br - Bureau of Reclamation, BPA - Branch of Generation Planning
2/ Numbers after dashes indicate auxillary units.
3/ McNary Second Powerhouse estimates includes six unites at 124,500 kW each.
4/ Libby Units 6, 7, 8 at 105,000 kW each have been deferred.

Table E.2

MAJOR THERMAL GENERATING RESOURCES IN THE PACIFIC NORTHWEST

Plant	Location	Net Capability (MW)
Nuclear		
Trojan	Rainier, OR	1,080
WPPSS No. 2	Hanford, WA	1,100
WPPSS No. 1 & 3 (suspended)	Hanford/Satsop, WA	2,490
Coal		
Colstrip No. 1	Colstrip, MT	330
No. 2	Colstrip, MT	330
No. 3	Colstrip, MT	700
No. 4	Colstrip, MT	700
Jim Bridger No. 1	Rock Springs, WY	500
No. 2	Rock Springs, WY	500
No. 3	Rock Springs, WY	500
No. 4	Rock Springs, WY	500
Centralia No. 1	Centralia, WA	640
No. 2	Centralia, WA	640
Boardman	Boardman, OR	530
Valmy No. 1 & 2	Valmy NV	522

Source: Western Systems Coordinating Council, "Summary of Estimated Loads and Resources" issued April 1986.

Table E.3

ELEVATION VARIATIONS IN PNW RESERVOIRS (feet)

Dam	Filled Elevation	Minimum Elevation	Drawdown Difference
Libby	2,459	2,287	172
Hungry Horse	3,560	3,336	224
Albeni Falls	2,062.5 */	2,050	15
Grand Coulee	1,290	1,208	82
Dworshak	1,600	1,445	155

*/ Normal full pool. Maximum lake elevation is 2076 feet.

Table E.4

LOCATIONS OF SELECTED COAL-FIRED POWER PLANTS AND LOCAL POPULATIONS

Plant	Utility	Location Co., State	County Pop.	Plant Site Community Population	Nearby */ Communities >1000
PACIFIC NORTHWEST					
Boardman	PGE	Morrow, OR	7,519	Boardman 1,261	Umatilla, 3199 Hermiston, 9,408 Stanfield, 1,568
Centralia 1-2	PPL	Lewis, WA	56,025	Centralia 11,555	Chehalis, 6,100 Tumwater, 6,705 Olympia, 27,447 Fords Prarie, 2,582 Raymond, 2,991
Colstrip 1-3	MPC	Rosebud, MT	9,899	Colstrip 1,476	
Jim Bridger 1-4	PPL	Sweetwater, WY	41,723	Rock Springs 19,458	Green River, 12,807
Valmy 1-2	SSP	Humbolt, NV	9,434	Valmy <1,000	Battle Mt., 2,749 Winnemucca, 4,140

Source: U.S. Department of Commerce, Bureau of the Census, General Social and Economic Characteristics, (states indicated) (Washington, D.C., USGPO, 1983)

*/ Nearby communities within approximately 40 miles of the plant site.

Table E.5

AMBIENT AIR QUALITY ($\mu g/m^3$)

	Year	Annual Average		24 Hour Maximum	
		SO_2	TSP	SO_2	TSP
PNW					
Centralia (1)	1984	<5	53	104	195
Boardman (2)	1984	–	83	–	247
Colstrip (3)	1984	3	16	27	43
Bridger (4)	1984	1	51	8	166
Valmy (5)	1984	<5	28	30	110

Note: Dash means that data are not available. 1981 data for concentrations and emissions were used for the air basin modeling.

Sources:
(1) Washington Air Programs (1985)
(2) Oregon Department of Environmental Quality (1984)
(3) Montana Air Quality Bureau (1985)
(4) Wyoming Air Quality Division (1984)
(5) Nevada Division of Environmental Protection (1984)

Table E.6

FEDERAL AIR QUALITY STANDARDS

Pollutant	Averaging Time	Federal Standards Primary (Health)	Federal Standards Secondary (Welfare)
Particulate (PM_{10}- particulate with aerodynamic diameter ≤ nominal 10 micrometers	Annual Arithmetic Mean	50 $\mu g/m^3$	50 $\mu g/m^3$
	24 hours (1)	150 $\mu g/m^3$	150 $\mu g/m^3$
		–	–
Total Suspended Particulate	Annual Geometric Mean	–	60 $\mu g/m^3$
	24 hours (1)	–	150 $\mu g/m^3$
Ozone	1 hour (1)	235 $\mu g/m^3$	235 $\mu g/m^3$
Carbon Monoxide	8 hours (1)	10 mg/m^3	–
	1 hour (1)	40 mg/m^3	–
Sulfur Dioxide	3 hours (2)	–	1300 $\mu g/m^3$
Nitrogen Dioxide	Annual Arithmetic Average	100 $\mu g/m^3$	100 $\mu g/m^3$
Lead	Calendar Quarter Arithmetic Mean	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$

<u>NOTES</u>:

$\mu g/m^3$ = Micrograms of pollutant per cubic meter of air.

$\mu g/m^3$ = Milligrams of pollutant per cubic meter of air.

(1) Not to be exceeded on more than 1 day per year.

(2) Not to be exceeded more than one time per year.

Source: 40 CFR Part 50 Revised as of July 1, 1987

Table E.7

COMPARISON BETWEEN EMISSIONS FROM POWER PLANTS AND TOTAL EMISSIONS FOR THE REGIONS IN WHICH THEY ARE LOCATED (1000 TONS/YR)

		Power Plants		Total Regional Emissions		
	Year	SO_2	TSP	SO_2	TSP	Region
PACIFIC NORTHWEST						
Centralia (1)	1984	55.9	0.88	68.2	27.0	SW WA
Boardman (2)	1984	2.9	0.55	3.1	13.5	Murrow Co.
Colstrip (3)	1984	6.1	2.10	6.1	5.1	Rosebud Co.
Bridger (4)	1984	45.9	8.80	128.9	43.8	SW WY
Valmy (5)	1984	3.7	0.16	3.8	0.26	Humbolt Co. */

*/ Permitted sources only (point)

Sources:
(1) Washington Air Programs (1985)
(2) Oregon Dept. of Environmental Quality (1984)
(3) Montana Air Quality Bureau (1985)
(4) Wyoming Air Quality Division (1984)
(5) Nevada Division of Environmental Protection (1984)

Table E.8

PRECIPITATION CONCENTRATIONS FROM WESTERN MONITORING STATIONS

	Site	Years	Length of record (yrs)	pH	Nitrate (eq/l)	Sulfate (eq/l)
1	Pinedale, WY	1982	1.0	5.16	11	22
2	Yellowstone, WY	1980-82	2.6	5.30	11	23
3	Glacier Nat. P., MT	1980-81	1.6	5.00	6	17
4	Craters of the Moon, ID	1980-81	1.4	5.16	8	19
5	Headquarters, ID	1982	0.5	5.44	6	05
6	Vines Hill, OR	1980-81	1.4	6.04	12	18
7	Pendleton, OR	1980-81	1.7	5.28	13	22
8	Alsea Guard, OR	1980-81	2.0	5.47	2	12
9	Schmidt Farm, OR	1980-81	2.0	5.43	4	11
10	Lost Creek, OR	1980-81	1.2	5.32	3	06
11	H. J. Andrews, OR	1980-81	1.6	5.44	2	07
12	Olympic NP, WA	1980-81	1.6	5.39	2	07

Source: Roth et al. (1985)
eq/l = equivalents per liter

Table E.9

CHARACTERISTIC FISH SPECIES OF THE COLUMBIA AND PEACE RIVER BASINS IN THE AFFECTED ENVIRONMENT

Water Resource	Characteristic Species	
Mainstem Peace River	Lake whitefish Rainbow trout Kokanee salmon Mountain whitefish	Arctic grayling Longnose sucker Northern pike Dolly Varden char
Williston Reservoir	Lake whitefish Mountain whitefish Arctic grayling Dolly Varden char Rainbow trout Kokanee Redside shiner	Northern squawfish Peasmouth Large scale sucker Longnose sucker White sucker Burbot Prickly sculpin
Peace River Canyon	Lake whitefish Mountain whitefish Arctic grayling Dolly Varden char Rainbow trout	Northern squawfish Longnose sucker White sucker Burbot
Johnson & Gething Creeks	Spawning habitat	
Mica Dam Reservoir & Tributaries	Dolly Varden char Rainbow trout Mountain whitefish	Burbot Squawfish Suckers
Duncan Reservoir	Rainbow trout	Dolly Varden Char
Duncan River	Kootenay Lake rainbow trout Kokanee	
Koocanusa Reservoir	Cutthroat trout Dolly Varden char	Mountain whitefish Burbot
Columbia Basin	Anadromous Steelhead trout Chinook salmon Coho salmon Sockeye salmon Shad	 White sturgeon Striped bass Eulachon Pacific Lamprey

Table E.9 (Continued)

Columbia Basin (cont.)

Resident

Cutthroat trout	Largemouth bass
Bull trout	Smallmouth bass
Rainbow trout	Black crappie
Brook trout	Bluegill
Lake trout	Pumpkinseed
Brown trout	Yellow perch
Dolly Varden	Black bullhead
Kokanee	Brown bullhead
Lake whitefish	Yellow bullhead
Pygmy whitefish	Suckers
Mountain whitefish	Carp
Slimy sculpin	Dace
Shorthead sculpin	Tench
Mottled sculpin	Shiners
Longnose sucker	Channel catfish
Largescale sucker	Chiselmouth
Peamouth	Burbot
Northern squawfish	Three spined stickleback
Northern pike	

Table E.10

CHARACTERISTIC FISH SPECIES INHABITING WATER RESOURCES SUPPLYING ELECTRIC GENERATING PLANTS IN THE AFFECTED ENVIRONMENT

Plant Name	Type	Associated Water Resource	Characteristic Species Present
Colstrip	Coal	Yellowstone River & Castlerock Reservoir	Sauger Channel Catfish Burbot Shovelnose Sturgeon Goldeye Flathead Chub
		Castlerock Reservoir	Walleye Pike Smallmouth Bass
Bridger	Coal	Green River & Flaming Gorge Reservoir	Brown Trout Rainbow Trout
Centralia	Coal	Skookumchuk River	Chinook Salmon Coho Salmon Chum Salmon Steelhead Cutthroat Trout
Boardman	Coal	Carty Reservoir	Sculpins Smallmouth Bass

TABLE E.11

CHARACTERISTIC WILDLIFE SPECIES IN FOUR PLANT COMMUNITY TYPES FOUND IN THE AFFECTED ENVIRONMENT

Forest/Woodland

Typical Mammals:
Mule Deer
Black Bear
Coyote
Bobcat
Red or Grey Fox
Mountain Lion
Raccoon
Striped Skunk
Long-tailed Weasel
Deer Mouse
Golden Mantled Ground Squirrel
Porcupine
Beaver
Shrews
Moles
Bats

In Northern Areas Only:
Marten
Mink
Mountain Beaver
Northern Flying Squirrel

Typical Birds:
Blue Grouse
Common Flicker
Hairy, Downy, and Three-toed Woodpeckers
Great Horned and Pygmy Owls
Hammond's, Western, and Olive-sided Flycatchers
Steller's Jay
Clark's Nutcracker
Common Raven
Black-capped and Mountain Chickadees
White- and Red-breasted Nuthatches
Hermit and Swainson's Thrushes
Ruby- and Golden-crowned Kinglets
Solitary Vireo
Yellow-rumped, Townsend's, Black-throated gray, and other Warblers
Evening and Pine Grosbeaks
Cassin's Finch
Pine Siskin
Red Crossbill
Dark-eyed Junco
Fox Sparrow

Shrubland

Typical Mammals:
Mule Deer
Coyote
Grey Fox
Mountain Lion
Bobcat
Striped Skunk
True Rabbits
Chipmunks
Ground Squirrels
Brush Mice
Woodrates
Ermine

Typical Birds:
Grouse
Flycatchers
Swallows
Scrub and Pinyon Jays
Thrashers
Black-billed Magpie
Wrens
Northern Mockingbird
Common Yellow Throat and Yellow-breasted Chat
Towhees
Sparrows
Oporornis Warblers

Pronghorn Antelope in Intermountain Sagebrush and Wyoming Basin
California Pocket Mouse in California Chaparral
Chisel-toothed Kangaroo Rat in Intermountain Sagebrush
Sagebrush Vole in Intermountain Sagebrush and Wyoming Basin

Grassland

Typical Mammals:
Mule Deer
Coyote
Fox
Bobcat
Badger
Kangaroo Rats

Pocket Mice
Pocket Gophers
Ground Squirrels
Prarie Dogs
Harvest Mice

White- and Black-tailed Jackrabbit

In the Great Plains:
Pronghorn Antelope
Black-footed Ferret (endangered)

Typical Birds:
Horned Lark
Shrikes
Western Meadowlark
Brewer's Blackbird
Sparrows

Typical Raptors:
Red-tailed Hawk
Rough-legged Hawk
Swainson's Hawk
Ferruninous Hawk

Northern Harrier
Burrowing Owl
American Kestrel
Prairie Falcon

Desert

Typical Carnivores:
Coyote
Spotted Skunk
Kit fox (endangered)

Typical Rodents:
Kangaroo Rats
White-tailed Antelope Squirrel
Botta's Pocket Gopher

Pocket Mice
Cactus, Northern and Southern Grasshopper Mice
Desert Cotton-tail

Typical Birds:
Gila Woodpecker
Elf Owl
Gambel's Quail
Cactus Wren
LeConte's Thrasher

Typical Birds: (cont.)
Roadrunner
Black-throated Sparrow

Endangered Reptiles:
Gila Monster
Desert Tortoise

APPENDIX F

Appendix F

Environmental Impacts of Generic Resource Types

APPENDIX F

ENVIRONMENTAL IMPACTS OF GENERIC RESOURCE TYPES

This appendix provides a summary of potential environmental impacts for the various types of resources that BPA or other utilities could use to meet electrical demand (load). The types of resources discussed include conservation, cogeneration, hydro, nuclear, coal, and combustion turbines (CTs). For detail on impacts related to specific existing resources, see Chapter 4 of this Environmental Impact Statement (EIS). Because of their number, all Tables are located at the end of this Appendix.

CONSERVATION

Indoor Air Pollution

One of the easiest and most economical ways to increase the efficiency of energy use in a home or business is to prevent loss of heated or cooled air from the building. Conservation programs often are based on tightening buildings; for example, caulking cracks and installing double- or triple-paned windows and storm doors in existing buildings. New buildings also may be built to standards that limit air infiltration. Efforts to tighten buildings may lead to problems of indoor air pollution and moisture problems caused by inadequate air flow into and out of the buildings. Inadequate air flow indoors can result in the buildup of pollutants produced in the building, such as gases and particles produced by combustion (for example, furnaces and people smoking); formaldehyde and other chemicals released by new building materials and furnishings; and chemicals used in cleaners and pesticides. Pollutants in the outside environment also may seep into buildings. The effect of tightening in this case is not clear, however: a tight building may either prevent pollutants from escaping or prevent pollutants from entering. In some situations, house tightening has been shown to reduce indoor concentration of pollutants. Indoor air pollution may lead to adverse health effects given exposure for long periods or to high concentrations.

Particulates are particles or fibers in the air that are small enough to be inhaled. They are suspended in tobacco smoke and wood smoke; are produced by unvented gas appliances, kerosene heaters, and asbestos construction materials; and come from soap powders, pollen, lint, and house dust. When inhaled, particulates may cause nose, throat, and eye irritation. When they lodge in the lungs, particulates may cause lung cancer, emphysema, heart disease, bronchitis, and respiratory infections. Particulates also carry radon and its progeny (see below).

Combustion gases include carbon monoxide and nitrogen oxides. They are colorless and odorless gases that are produced by kerosene heaters, wood stoves, and unvented gas appliances. Carbon monoxide, also found in tobacco smoke, can cause lung ailments and impaired vision and brain functions. In high concentrations carbon monoxide can be fatal. Nitrogen oxides can cause lung damage and lung disease.

Formaldehyde is a component of urea-formaldehyde foam insulation and some glues used in plywood, particle board, and textiles such as furniture, drapes, and carpet. Formaldehyde has especially been a problem in mobile homes, with their relatively small living area and construction with more particle board and plywood than conventional houses. However, new board standards for manufactured housing have solved this problem. Relatively high levels of formaldehyde are likely to be found in new houses and businesses, where materials have not had time to release much of the gas. Levels also increase with higher temperatures and humidity. Formaldehyde, a strong-smelling, colorless gas, can cause nose, throat, and eye irritation; studies have shown that it can cause nasal cancer in animals.

Other chemicals that may provide indoor air pollutants include those in synthetic materials, pesticides, aerosol sprays, cleaning products, and paints. These chemicals may irritate skin, eyes, nose, and throat, and affect the central nervous system and metabolic processes. Interactions of two or more chemicals may be particularly harmful.

Moisture is produced by leaks; activities using water such as laundry, dishwashing, bathing, and cooking; people breathing and perspiring; and the soil beneath the building. Moisture can aid the growth of mildew, mold, bacteria, and viruses. It also can act as a solvent for formaldehyde and other pollutants, increasing the rate of release of harmful gases.

Radon is a colorless, odorless, radioactive gas, a decay product of uranium. Radon seeps into homes and other buildings from the soil beneath and from some building materials such as concrete and brick. Radon quickly decays into several types of "progeny" that can be carried by particulates in the air to lodge in the lungs. Increased levels of particulates thus increase the potential levels of exposure to radiation from radon emissions, although radon unattached to particulates has a greater chance of sticking in the lungs. As radon progeny decay, they emit alpha radiation that may damage lung tissue. Prolonged exposure to radon increases the risk of lung cancer: between 5 and 15 percent of all lung cancers may be caused by radon (the Surgeon General attributes 85 percent of all lung cancers to smoking). Exposure to radon also may cause birth defects and genetic damage.

Currently little information exists related to acceptable levels or direct health effects of these indoor air pollutants, and individual sensitivity to each pollutant varies. BPA has performed extensive monitoring and research on radon, however. About 3.5 percent of the Northwest houses monitored so far appear to have levels of radon higher than BPA's "action level." BPA's current residential weatherization programs for existing homes include the following steps:

1. Informing residents about the sources of indoor air pollution and about practical steps to reduce indoor pollutants.

2. Offering to monitor each participant's house for radon levels.

3. Paying 85 percent of the cost of an air-to-air heat exchanger (up to $850) if radon levels exceed 5 pCi/l (picoCuries per liter of air) inside the house. For low-income participants, BPA pays 100 percent up to $1000.

In the Record of Decision for BPA's New Energy-Efficient Homes Programs, BPA states that it has decided to offer four "pathways" to guide construction of energy-efficient new homes. BPA designed the pathway concept to provide builders and consumers with a menu of construction methods. The selection of the four construction pathways chosen was based on balancing five major factors: environmental, economic, technical, public concerns, and legal. The chosen pathways exhibit health effects close to those assuming current construction practices were continued without change; substantial energy savings; and maximum program flexibility at reasonable cost. The chosen pathways all include several environmental mitigation requirements: exhaust fans for kitchens and bathrooms; designated air supplies for combustion appliances; information on indoor air quality; Housing and Urban Development product standards for formaldehyde emissions from structural board materials; and the offer of radon monitoring and radon source control.

Several methods can mitigate the impacts of indoor air pollution. The most effective mitigation is prevention. Homeowners should avoid or isolate from the living area building materials and household chemicals that are sources of harmful gases. Smoking should be discouraged. Fireplaces and woodstoves should have tight-fitting doors and sources of outside air for combustion. Fires should not be allowed to smolder. Dehumidifiers may be used to remove moisture from the air. Air-to-air heat exchangers and other types of mechanical ventilation systems may be used to provide ventilation needed to dilute all types of indoor air pollutants.

Sources:

Bonneville Power Administration 1983 Wholesale Power Rate Final Environmental Impact Statement, September 1983, p. IV-49-51.

BPA, Issue Backgrounder: Energy Efficient New Homes & Indoor Air Pollutants, August 1987.

BPA, Backgrounder: Understanding Indoor Radon, June 1987.

BPA, Report No. 10: Radon Monitoring Results from BPA's Residential Weatherization Program, January 1989, p. 2.

BPA, Final Environmental Impact Statement on New Energy-Efficient Homes Programs: Assessing Indoor Air Quality Options, Volume 1, August 1988, Summary.

BPA, New Energy-Efficient Homes Programs Record of Decision, February 1989.

Other Environmental Impacts

The most feasible types of conservation efforts include weatherization and other means of increasing the efficiency of energy use in buildings; increased efficiency of energy use by irrigation pumps and other machinery; and increased efficiency of transmission and distribution of electricity. Increasing the efficiency of energy use in buildings involves the production and transportation of insulation materials, weatherstripping, caulking, storm windows, infiltration barriers, and so on. It also could require the installation or replacement of machinery. Increasing the efficiency of irrigation pumps could require replacement of existing pumps wholly or in part. Increasing the efficiency of transmission and distribution also could require the replacement of equipment. All conservation efforts require personnel to audit and test existing buildings and equipment and to install or replace equipment and machinery.

Environmental impacts can be caused by the steps needed to provide the materials and machinery to the user. Such steps include: mining raw materials; manufacturing materials such as metals, glass, and insulation; fabricating the finished products; transporting the raw and finished materials; and installing the conservation measures at the point of use. Each step involves energy consumption and labor.

Sophisticated devices such as heat pumps and air-to-air heat exchangers require more raw material, manufacturing, and fabrication than construction materials such as insulation. They also may require more energy in transportation, more highly trained installers, and more maintenance.

Potential environmental impacts from manufacturing and transporting conservation devices and materials include increased energy use, air and water emissions, land use, employment, and other economic effects. Disposal of such devices and materials also could cause adverse impacts.

In general, however, the potential adverse environmental impacts that could result from the production and transportation of conservation materials are relatively insignificant. In addition, any adverse effects likely would be offset completely or partially by the environmental benefits of conservation. Because conservation measures result in increased efficiency of energy use, they could result in reduced operation and development of generation resources. Reduced operation and development of generation resources could result in less related environmental effects. A possible increase in employment for manufacturing, transporting, installing, and inspecting conservation measures could be a positive socio-economic effect.

Sources:

BPA, Final Environmental Impact Statement: The Role of the Bonneville Power Administration in the Pacific Northwest Power Supply System, December 1980, p. IV-123.

BPA, Environmental Assessment: Proposed Power System Changes to Implement the Water Budget, May 1983, Appendix C, p. C-1 - C-4.

COGENERATION

Cogeneration is the generation of power in conjunction with (usually) an industrial process, using waste heat from one process to fuel the other. Cogeneration is a well-established technology that was relatively common at manufacturing plants early in this century. Cogeneration peaked as an electricity generating technology in 1950, but declined as electric utilities developed larger central station generation with its economies of scale. With the passage of the Public Utility Regulatory Policies Act (PURPA) in 1978, interest in cogeneration has grown. The relative decline in fossil fuel (especially natural gas) prices and the growing availability of "off-the-shelf" equipment has increased the popularity of cogeneration.

The use of cogeneration can result in less wasted thermal energy and greater fuel efficiency than if industrial and electric generating processes were carried out separately. The efficiency of jointly producing electricity and (industrial) "process" heat is estimated to reduce fuel consumption on the order of 15-30 percent when compared with separate production. Cogeneration of electricity can result in reduced need for operating and building central-station generators, with a concomitant reduction in emissions and other environmental impacts.

Technology

Cogeneration technologies are of three basic types. The first type, the steam topping-cycle system, includes a steam generator in which fuel is fired to produce steam. The steam turns a turbine-generator first and then is used for process applications. In the second type, a bottoming-cycle system, residual heat left after process use is used to generate electricity. The third type, a gas turbine cogeneration cycle, uses a CT to drive a generator. The exhaust heat from the turbine is used for process applications, either directly or by way of a steam cycle.

Off-the-shelf equipment for the cogeneration of electricity and steam is available from several manufacturers. Flexible acquisition arrangements can meet the specific needs of most individual users. Available generators for steam topping- or bottoming-cycle systems can be fitted to use gas, oil, coal, wood wastes, red and black liquors, carbon monoxide and other gases, and other fuels. The gas turbine cogenerating systems generally use natural gas, #2 distillate, or naphtha fuels for commercial applications.

Potential

The region has about 790 megawatts (MW) of installed cogeneration capacity, most in the wood and paper industries. The largest percentage of the potential for cogeneration in the Pacific Northwest is in the same industry (paper and lumber). Other major industrial applications in the Northwest are chemicals and oil and food processing. Municipal sponsors account for some potential, also. Most cogenerators in the Northwest are expected to generate electricity for their own use only. Some, however, encouraged by PURPA, may sell excess power to their local utilities.

Energy production by cogenerators is difficult to predict. It depends on various factors, such as fuel prices, retail electricity prices, electricity buyback prices, and industrial production activity. When called upon to operate, however, cogeneration facilities generally have high availabilities, 80 percent or higher.

As might be expected, utilities that are faced with loss of load caused by cogeneration often offer special rates or service to retain the load of potential cogenerators. Because of reliability considerations, utility backup of cogeneration is required.

Expected Impacts

The types of environmental impacts to be expected from cogeneration facilities are approximately the same as those of the technology from which the system derives its energy. That is, for example, the expected impacts from a cogenerating facility that burns oil for fuel are similar to the impacts from either an industrial or a power-generating oil-fired plant. The impacts would be primarily local and may be greater than either the industrial or generation process alone. The type of process that fires fuel to produce steam first for generation and then for an industrial use typically burns 10 to 20 percent more fuel when cogenerating than when producing solely process steam. Depending on the fuel used and the efficiency of the plant, adding cogeneration of electricity to an industrial plant may increase the emission of particulates and gaseous products of combustion and may increase water pollution and consumption.

In particular, since the greatest potential for cogeneration in the Northwest is in the wood products industry, the result could be an increase in the release of particulate matter, heavy organic materials, and fine particles of inorganic ash. Particulates from wood burning are most often blamed for reduced visibility and respiratory irritation. Other products of combustion are sulfur dioxides, carbon monoxide, hydrocarbons, and nitrogen oxides. Other, lesser, potential environmental impacts of wood burning for cogeneration include water pollution from discharged waste water or from runoff. Domestic water supplies, fisheries, and recreational areas could be affected. Disposal of solid wastes from wood fuel burning generally is not an environmental problem as long as proper wet handling methods are used and there were no toxic chemicals in the wood fuel or the combustion process.

Mitigation

Existing facilities retrofitted for cogeneration may be required to add air pollution control equipment to handle the additional release of gases and pollutant-. Boilers and firing techniques designed for efficiency also can reduce emissions over those to be expected from less efficient facilities. Cogenerators also are required to comply with Federal, State, and local environmental regulations.

If cogeneration becomes a significant energy producer in a particular area, a net reduction in environmental impacts could occur if the need for central-station generating plants is reduced.

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HYDROELECTRIC

Hydroelectricity is a renewable resource. Water spins turbines, which drive generators to produce electricity. The Pacific Northwest has many streams with flow and head (difference in water level) sufficient to produce economical electrical energy. A hydro facility may have purposes in addition to power generation, including irrigation, navigation, flood control, recreation (for example, fishing, boating, and camping), and water supply for domestic and industrial use. Determining an acceptable balance of these often-conflicting uses is a matter for considerable debate within the region.

Large Hydro

Construction and operation of relatively large dams and major additions to those facilities have undeniably significant environmental impacts. During construction, dust and vehicle emissions can reduce air quality. Erosion, dust, and other discharges can reduce water quality and increase siltation. The influx of workers to the area may cause temporary environmental and socioeconomic effects as workers seek housing, transport, and food. The facilities themselves require huge quantities of earth fill, steel, and concrete.

The dams impound huge volumes of water, flooding and eroding extensive areas and disrupting land use, including wildlife and human habitat and cultural (such as historical) sites. Dams disrupt certain recreational uses of the river but permit others by the creation of reservoirs. Dams can assist irrigation and flood control by enabling water storage.

One of the most significant environmental impacts dams can have is harm to anadromous (migratory) and resident fish. Impounded water disrupts the migration of juvenile fish downstream to the ocean and adult fish upstream to spawning areas. Problems arise due to water turbidity, increased water temperature, and slow or absent current. Delay of migration can reduce the survival rate of juvenile fish and decrease spawning success of adults. Impounded water also can adversely affect the food chain, including the organisms eaten by fish and the species that prey on game/anadromous fish.

Lack of passage facilities can prevent migratory species from reaching spawning and rearing areas. Even with passage facilities, migration is generally impaired. Fish migrating downstream may be caught in the turbines and be killed; or, if stunned, fish may become prey to scavenger species on the downstream (tailwater) side of the dam.

The extent of turbine mortality depends, at least in part, on the type of turbine used. Bulb turbines, usually used on low-head hydro facilities, may result in less harm to fish than conventional types of turbines.

Water spilled at the dam can cause nitrogen supersaturation of fish in the tailwater, another potential cause of death. Reduction in numbers of fish can reduce the food supply for bald eagles and other animals.

Hourly, daily, and seasonal operations of the river for power purposes can conflict with other uses. Forebay (upstream side of the dam) and tailwater fluctuations can disrupt recreation and navigation for safety and access reasons. Fluctuations also can reduce the ability to withdraw water for irrigation and cause erosion of riverbanks. Animal habitats, nesting areas, and spawning gravels can be alternately stranded and flooded. The more the hydro system is used to meet peak rather than base loads, or to provide reserves and short-term replacement power, the more frequent and rapid (and thus harmful) fluctuations could be.

Increased Efficiency of Existing Hydro

The Northwest Power Planning Council (Council) has investigated the benefits and cost of increasing the efficiency of existing major hydroelectric facilities in the Northwest. Various retrofit measures potentially can improve project efficiency and capacity and energy capability. Improvements to turbine efficiency also appear to reduce the mortality of fish passing through the turbines. The Council has estimated that 112 MW of hydropower efficiency improvements are currently cost effective (individual measure costs range from 1 to 11 mills per kilowatthour in 1988 $). Increasing the efficiency of the hydro system could mitigate the significant environmental impacts of the facilities by reducing the impact per kilowatthour of generation. Hydropower Efficiency Improvements are included as a resource in the Council's 1989 Supplement to the 1986 Northwest Conservation and Electric Power Plan.

"Firming" Nonfirm

Another facet of hydropower facility efficiency is identified by the Council as "better use of the existing hydropower system." This strategy also is known as "firming" the nonfirm energy that is available in water years that are better than critical. The benefit of firming nonfirm energy is in making the availability of inexpensive nonfirm energy more reliable. The Council has identified several methods to back up the region's hydro resources: improved coordination of the U.S. and Canadian sections of the Columbia River; purchase of energy from existing power plants; load management techniques; and use of new power plants. These suggested methods for firming nonfirm energy could have significant environmental effects, particularly the methods involving use of existing or new power plants.

The Council has investigated cost-effective ways to firm the energy production of existing hydropower facilities and suggests using CTs. The Council's studies show that about 3500 MW of CT capacity may be cost effective to add to the region's power system before adding typical baseload generation such as coal plants. Firming the hydro system's nonfirm energy production with that amount of CTs would produce about 3000 MW of firm energy. See the CT section of this appendix for a discussion of CTs' potential environmental impacts.

Small Hydro

The region generally agrees that the Columbia River and the other regional streams will support no further major hydro development. However, sites do exist for small hydro installations, and small energy producers are encouraged by PURPA. Small hydro potential could come from three sources: presently existing plants; newly installed generation facilities at existing nonpower (for example, irrigation or flood control) dams; and generation facilities at new dams. Small hydro plants generally are low-head projects; reservoirs are small or nonexistent. Technology for small hydro is similar to that for large hydro, except that low-head projects often use a bulb turbine rather than the Francis or Kaplan turbines nearly always used for high-head projects. Bulb turbines may result in less harm to fish than conventional types of turbines.

Small hydro installations generally may be constructed at reasonable cost. The Council estimates that 410 average megawatts (aMW) of firm energy may reasonably be assumed to be available at a levelized cost of 60 mills per kilowatthour or less (1988 $). Construction times also are relatively short, although licensing may take considerable time.

The potential environmental impacts of small hydro facilities are similar to those for large hydro, but would be of proportionately smaller scale. Development of hydroelectric potential at an existing dam likely would result in less environmental harm than development of a new site. Site-specific considerations for small hydro development would include current and future recreational uses of the land and water; existing fish and wildlife migration, habitat and spawning areas; and historic and archaeological sites.

The Federal Energy Regulatory Commission (FERC) has jurisdiction over the terms of licenses that govern small hydro operating conditions. Many Federal laws apply to hydroelectric projects. The FERC review process addresses fish, wildlife, and environmental issues. Local, State, and Federal agencies intervene in the FERC licensing process to ensure that their interests are addressed. In addition, local and State regulations apply to hydro projects.

In particular, the Council has specified "conditions of development" in Section 1103(a) of its fish and wildlife program and Appendix II-B of its 1986 Northwest Power Plan. The Council also has established a protected areas rule, which designates stream reaches protected from hydro development. Hydropower development in these protected stream reaches could cause unacceptable risk of loss to fish and wildlife species, their productive capacity or habitat. BPA supports these "Protected Areas" in its Long-Term Intertie Access Policy by precluding intertie access for power from plants on protected stream reaches. The Council's designation of protected areas is based on the Pacific Northwest Hydropower Site Database developed by the Council, the U.S. Corps of Engineers, and BPA; and the Hydropower Assessment Study conducted by the Council, BPA, Federal agencies, States, and tribes.

Table F-1 presents information regarding environmental concerns associated with a small hydroelectric plant. Even if individual small hydro facilities have relatively minor environmental effects, the cumulative impacts of many small hydro facilities within a single river basin could be significant. BPA, the Council, regional interest groups, and the FERC licensing process all will monitor and assess cumulative impacts of small hydro facilities in the Northwest.

<u>Sources</u>:

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NUCLEAR

The Pacific Northwest receives electrical energy from two operating nuclear plants within the region, the Trojan plant, owned and operated by Portland General Electric Company (PGE), and the Washington Public Power Supply System (Supply System) Nuclear Plant (WNP) No. 2. Two other Supply System plants, WNP-1 and -3, are partially completed and are mothballed. If completed, they could supply power for the region's future needs. BPA and the Supply System are cooperating to develop a plan for partially refinancing the plants; future financing for preservation and completion is uncertain. (BPA and the Supply System also are considering repowering the Hanford Generating Project, which was powered by steam from the plutonium-producing Hanford N-Reactor. Repowering likely would use coal or natural gas rather than nuclear fuel to generate steam.)

Nuclear generation involves plant construction; uranium mining and preparation; fuel fissioning to generate electrical energy; spent fuel disposal; and plant decommissioning. All phases of plant construction and fuel processing use substantial quantities of energy, for transportation, machinery use, process use, and so on. Tables F-2 through F-10 show the natural resource use and environmental impacts of the steps in nuclear generation, which are discussed below.

Fuel Mining and Processing

Mining. The uranium for generating plants in the Northwest probably will be imported from outside the region. Uranium is mined by both underground and open-pit techniques; most of the current U.S. production of uranium comes from open-pit mines. Surface (pit) mining of uranium has several adverse environmental impacts. The mining necessary to support a 1,000-MW nuclear plant disturbs 54.6 acres per year. Mining produces significant amounts of air pollution from the operation of heavy mining equipment and the breakup of the uranium ore. Air pollution consists of particulates, sulfur dioxide, nitrogen oxides, and radon and radon daughters. Surface mining also can produce water pollution caused by runoff from piles of soil and mined surfaces. Air and water pollution contains heavy metals and low-level radioactivity. Radiation exposure is strictly monitored and limited for underground uranium miners. Radiation hazards are not significant in U.S. low-grade open-pit mines.

Milling. During milling, at the mine site, uranium is extracted from the ore and concentrated, using chemical and mechanical processes. The milling process produces significant amounts of particulate and thermal emissions and releases radioactive and other minerals into the air and water. It also results in close to 200,000 tons of radioactive solid waste (tailings) annually, which must be stabilized to prevent wind and water erosion.

Conversion. The refined uranium ("yellowcake") then is converted to a volatile uranium hexafluoride. Conversion occurs in only a few U.S. locations, which are outside the West. The conversion process results in air and water pollution, some of which is radioactive, and heat discharge to the air. The resulting radioactive sludge is held for reprocessing or burial.

Enrichment. Next the volatile uranium hexafluoride compound is enriched by means of gaseous diffusion or gas centrifuge. Enrichment in the U.S. is done by Department of Energy contractors in a few locations outside of the West. Enrichment uses substantial amounts of energy, water, and other resources, and results in air and water pollution and thermal discharge.

Fabrication. Fuel fabrication consists of chemical conversion of uranium hexafluoride to uranium dioxide and mechanical processing of the fuel pellets and fuel elements. Fuel fabrication results in air pollution as a result of the process itself and of the energy needed for the process. Air, water, and solid wastes all are radioactive to some extent; solid wastes must be buried. In addition, heat is released to the air.

Plant Construction and Operation

The environmental impacts of constructing a nuclear plant are similar to those for constructing any large generation plant or other industrial facility. Plant construction disturbs land areas, uses large quantities of building materials, and can have socioeconomic impacts due to the large number of workers employed.

The two most common types of reactors are boiling water and pressurized water. The Trojan plant is a pressurized water reactor; WNP-2 is a boiling water reactor. The two types have similar environmental effects.

In the reactor, atoms split in a chain reaction called fissioning, producing energy. The released energy heats water to steam. The steam turns a turbine, which drives an electrical generator. The plants use considerable amounts of water for cooling. The water, generally from a nearby river, is recycled through the plant, but that lost through evaporation must be made up. Levels of radioactivity in air and water discharges are low, and are regulated by Federal law. Water vapor from cooling towers carries harmful salts, which fall onto surrounding land areas. Nuclear plants also produce solid and other waste products, some of which are radioactive at a low level. For example, a boiling water reactor nuclear plant produces 18,900 cubic feet annually of wet low-level radioactive waste that must be embedded in concrete for disposal and 3,360 cubic feet annually of dry low-level radioactive waste that is encased in drums for disposal.

Fossil fuel emissions result from the periodic operation of auxiliary equipment, including diesel-powered emergency generators and pumps, for testing.

Spent nuclear fuel elements are removed periodically during refueling and generally are stored at the plants pending designation of a permanent disposal site. During decommissioning, the parts of a nuclear plant must be dismantled and stored safely for hundreds of years to prevent release of massive quantities of long-lived radiation. Final disposal of radioactive parts of decommissioned nuclear plants also will await establishment of a permanent radioactive waste disposal site.

Within the region, design is underway for the Hanford Waste Vitrification Plant, to be built near Richland, Washington. Construction of the plant is scheduled to start in mid-1990, with operation projected for 1999. At the plant, highly radioactive liquid wastes now held in underground storage tanks at Hanford will be solidified. The wastes, including chemicals, heavy metals, and other toxic materials, will be heated and poured into cylinders to harden. The vitrified wastes will be shipped offsite for permanent disposal underground. Operation of the plant will be for at least 15 years to complete processing the existing waste.

Sources:

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COAL

The Northwest receives power from 13 coal-fired generation plants. Because coal generation is a proven technology, in recent years coal plants have been considered to be the baseload resources of the future. The Western U.S. has about half of the nation's coal reserves, most near the surface and with low sulfur content. Because of low production costs and low sulfur content, most of the nation's incremental consumption of coal is expected to be met from Western sources.

Increasing knowledge about the "greenhouse effect," the possible warming of the Earth caused by growing amounts of carbon dioxide in the atmosphere, has made future coal use for power generation less certain. Acid precipitation, caused by emissions of sulfur dioxide and nitrogen oxides, also has been linked to coal-fired generation plants. In addition, several factors may affect the development of coal reserves in the West: resource scarcity, especially of water; high transport costs to primary coal-use regions in the East; and ecological fragility of many western coal-producing areas. Coal mining and use are regulated by Federal and State laws that restrict water use and impact on water quality, preclude mining in certain areas including prime farm land, restrict air emissions, and require reclamation of mine sites.

Coal generation involves coal mining and preparation and plant construction and operation. Tables F-11 through F-18 show the natural resource use and environmental impacts of the steps in coal generation, which are discussed below. This section also discusses advanced technologies for electricity generation with coal, including coal gasification and fluidized bed combustion.

Fuel Mining and Processing

Mining. Coal is mined at several sites in and near the Pacific Northwest, including sites in the States of Washington, Montana, Wyoming, and Utah. The coal in the West generally has low energy value and low sulfur content. Almost all of the coal mines from which regional plants receive their coal are surface (strip) mines. In surface mining, topsoil is removed for later use in reclamation. The area is blasted and the overburden (earth overlying the coal seam) is removed in long parallel cuts. The exposed coal is removed and loaded into trucks for transport to a coal cleaning area and then to rail lines or mine-mouth plant. Reclamation consists of grading the soil, replacing the topsoil, and replanting vegetation. Federal laws require mining companies to reclaim mined lands by approximating the original topography and planting suitable vegetation.

Mining disrupts land uses, including agriculture and grazing. Even with reclamation, the land is not returned to its original form and may not resume its former productivity. The solid waste produced by mining can eventually be used as fill for reclamation. Coal mining to support a 1000-MW coal plant would permanently disturb about 251 acres and temporarily disturb about 52 acres each year. Aquifers in mined areas may be disturbed and may be contaminated by mining wastes. New and expanded mining operations may have significant socioeconomic impacts if many new workers are attracted to the area.

Air pollution results from emissions of the diesel-powered equipment that digs and hauls coal and overburden. It also arises from dust raised by the wind and by vehicular operation. Dust suppression practices, including spraying the area with water, can reduce the particulates caused by wind erosion and movement of vehicles. Water pollution may occur when suspended solids are produced by runoff from piles of overburden. Under controlled conditions, coal pile drainage and runoff are collected and treated prior to discharge, which reduces suspended solids and results in a zero acid content. Surface coal mining causes noise during drilling, blasting, and operation of equipment.

Table F-13 assumes that a preparation plant is sited near the coal mine. Coal preparation or beneficiation includes removing impurities from the coal, sizing the coal, and removing sulfur. The degree and type of beneficiation depends on the type of coal. Coal from the Western States generally is relatively clean and does not require washing. However, the coal goes through a "breaking and sizing" process that results in noise and requires small amounts of recycled water for dust control. The breaking and sizing operation and loading and storage require the long-term disturbance of about 63 acres of land for a 1000-MW plant. Table F-14 shows the resource use and environmental impacts of beneficiation. Beneficiation results in air and water pollution and solid wastes, as shown on the table.

Coal plants receive coal by truck or train, depending on the plant's distance from the coal mine(s) that supply it. Coal that must be transported long distances generally is moved by unit trains. Unit trains are dedicated to this purpose and operate regularly between two fixed points. Coal also may be transported by conventional trains, which carry cargoes of various types in addition to coal. Transporting coal by either type of train results in similar types and levels of pollutants. Table F-15 lists the environmental effects of coal unit trains.

A 1000-MW plant requires, as an annual average, over 9000 tons of coal per day. Hauling by train results in noise, emissions from diesel fuel combustion, and wind-borne particulates. Air pollution consists chiefly of particulates, sulfur dioxide, nitrogen oxides, hydrocarbons, and carbon monoxide. Particulate emissions during transportation are estimated to be 2 percent of coal tonnage carried by conventional trains and 1 percent of tonnage carried by unit trains and trucks. Other methods of transport are barge, slurry pipeline, truck, and conveyer belt (used between the Jim Bridger Mine and Plant in Wyoming).

Plant Construction and Operation

Factors that must be considered when siting a coal-fired power plant include the current condition of the airshed and its ability to dilute the atmospheric discharges of the plant; availability of water for cooling; proximity to the transmission grid; proximity to and reliability of rail or water transportation for coal; and availability of land for disposal of ash and flue gas desulfurization products. About 156 acres of land must be dedicated to housing the plant and solid waste disposal for 30 years. Construction of a coal plant is similar to that of any large industrial facility.

Modern coal plants include pollution control devices including electrostatic precipitators or other devices to control particulate emissions; scrubbers to control sulfur dioxide emissions; onsite solid waste disposal to prevent loss during transport; and onsite water treatment so water may be recirculated to eliminate discharges. The Clean Air Act requires that power plants constructed after passage of the act include systems for control of nitrogen oxide, sulfur dioxide, and particulates. Coal plants are subject to Federal and State regulations regarding pollutants.

In a conventional generating plant, the coal is pulverized and burned in a boiler to generate steam to power a turbine. The turbine drives an electrical generator. Combustion of the coal produces a flue gas contaminated with several air pollutants, most notably sulfur dioxide, nitrogen oxides, and carbon monoxide. Emissions from coal plants result in acid precipitation, which corrodes building materials and harms aquatic and terrestrial life, including fish, forests, and food crops. Data on acid precipitation are being gathered to determine the long-term environmental effects.

In the 11 Western States, the second-largest source of sulfur dioxide and nitrogen oxide is electricity generation (nonferrous metal smelting produces more sulfur dioxide, and motor vehicles produce more nitrogen oxide). Acid deposition tends to be concentrated around the sources of emissions, although pollutants are transported by storms and prevailing winds. Acid deposition is extremely variable over time, depending on localized weather conditions; snowmelt patterns (snowmelt causes "pulses" of acidic water); and existing acidity of soil and water.

The West has many areas that are potentially sensitive to acidity. The thin soil of the mountains is not sufficient to neutralize the acid from precipitation runoff. The flora and fauna of fragile mountain and desert areas, because of the relatively short growing season, can take years to recover from acid damage. The deep snows that fall on the mountains can provide pulses of acidity during spring snowmelt.

Sulfur dioxide must be largely removed from combustion gases before discharge. A wet scrubber to perform this function could produce over 1200 tons of limestone sludge daily at a 1000-MW plant. The limestone waste has no value, even for fill, and could leach into groundwater. Dry scrubbers now available produce a dry waste for which handling and disposal are easier.

Combustion of coal also releases large amounts of carbon monoxide and carbon dioxide, both of which contribute to the "greenhouse effect." Carbon dioxide blocks the escape of heat radiation from the Earth; increasing amounts of carbon dioxide are thought to be causing a warming of the Earth that could change the Earth's climate. No systems for control of carbon dioxide emissions are in current use on power plants.

Scientists disagree about the long-term implications of the "greenhouse effect" and, indeed, whether it exists at all. Study of these issues is underway, however. For example, EPRI-sponsored experiments are underway to evaluate the feasibility of using algae and other plants to absorb the carbon dioxide output of thermal plants. Laboratory results are promising.

A 1000-MW coal plant burning coal with a 10-percent ash content will produce an average 900 tons of ash each day. Some of the ash is slag (bottom ash) from the boiler, and some is fly ash captured by the air pollution control device. Fly ash may be sold for uses such as for road building material. The other solid wastes must be disposed of in landfills.

Advanced Technologies

Two advanced technologies, gasification and fluidized bed combustion, can generate electricity using coal more efficiently and with less harmful emissions than conventional coal burning.

Gasification. Coal gasification is the conversion of coal or coal char to gaseous products by reaction with steam mixed with air or oxygen. The product is a low- to medium-Btu gas. To provide heat to enable the chemical reactions, generally some of the coal is burned. The resulting gas would be used as a substitute for natural gas in a CT or combined-cycle generator (see section on CTs, following).

Gasification was the original application of fluidized-bed combustion, discussed in the next section. A gasifier burns coal in a fluidized bed with less air than is required for complete combustion, resulting in a high concentration of combustible gases in the exhaust. Coal gasification is applied in several pilot plants in the U.S.; it is an option to be used if natural gas prices increase significantly. The environmental impacts of coal mining and transport are not eliminated by gasification, although generating electricity with synthetic gas would increase the efficiency of coal use.

Fluidized Bed Combustion. Fluidized bed combustion is a method of burning fuel in which the fuel is continually fed into a "bed" of particles supported by upflowing air. During fluidization, the bed of material expands (bulk density decreases); as the air velocity increases, the particles mix more violently. The proper air velocity, operating temperature, and bed material cause the bed to function as a chemical reactor.

For high-sulfur coal combustion, the bed may be composed of limestone. The limestone reacts with and absorbs the sulfur released during burning, reducing sulfur dioxide emissions. The alkali compounds in coal from the western U.S. can react with the sulfur dioxide to limit emissions, so the bed for low-sulfur coal could be simply coal ash. Fluidized-bed combustion also takes place at temperatures low enough (1400-1500°F or 760-840°C) that nitrogen oxide formation is inhibited. Fluidized bed combustion can meet Federal emission standards without the use of flue gas scrubbers, which improves the efficiency of fuel use and reduces capital and operating costs from standard coal generation.

Generation with fluidized-bed combustion involves immersing heat-transfer tubes within the hot fluidized bed. The high efficiency of heat transfer results in the need for relatively less tube surface area, reducing tube requirements and costs. This technology, and plants with pressurized fluidized-bed combustors, are being tested within the U.S.

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COMBUSTION TURBINES

Technology

CTs are rotary engines similar in design and operation to a turbojet aircraft engine. Outside air passes through a rotary compressor into a combustion chamber. The hot combustion gases flow through the turbine blades, turning a shaft that powers the turbine, air compressor, and electrical generator. In a simple cycle CT, the gases are then exhausted to the atmosphere through a muffling system. In a combined-cycle operation, the hot exhaust gases are used to produce steam in a boiler. The steam is used to produce additional power in a steam turbogenerator. Because of the time needed to heat the boiler, the steam portion of a combined-cycle CT cannot be used to meet short-term peakloads. Combined-cycle operations are most efficiently used during longer periods of high loads. CTs usually are powered by fossil fuels, either natural gas or oil, but also may use gaseous or liquid synthetic fuels.

CTs are relatively quick to build, and several manufacturers offer "turn-key" facilities. CTs also are relatively inexpensive to build, although their costs are extremely sensitive to site characteristics such as distance to gas lines and electrical transmission lines. Newer plants are designed to be more efficient and reliable than older facilities.

Potential

In the Northwest, CTs have in the past been used rarely, mainly to supplement baseload generation plants such as nuclear and coal. CTs tend to be operated infrequently and for short periods due to their design as peaking units, relatively high fuel and operating costs, and Federal and local regulations governing fuel use, emissions, and noise.

PGE, for example, used its 534-MW Beaver combined-cycle CT during the Trojan Nuclear Plant's 1989 spring refueling outage. PGE was able to sign 3-month supply contracts for natural gas, which made the short-term operation of the Beaver plant economical.

The Council has suggested the possibility of "firming" nonfirm hydro energy using CTs to back up existing hydropower facilities. The Council points out that the availability of natural gas is unknown: the regional gas transmission system may not be adequate to support future electric generation plants. CTs would require that gas transmission facilities be available, but might not require gas deliveries even every year because of their potential intermittent use. Table F-19 gives planning characteristics for CTs.

Expected Impacts

CT plants are manufactured, and have environmental impacts assumed to be typical of manufacturing facilities. At the turbine site, construction of access roads, gas and electrical transmission lines, fuel storage, and the plant housing building all have typical construction-related impacts. Impacts of construction are less for CTs than for larger generation plants, however.

Production of gas and oil have significant environmental impacts, but only an insignificant fraction of the impacts could be attributed to CTs in the Northwest using those fuels.

The operational effects of CTs include noise and air pollution. The emissions emitted in greatest quantity are nitrogen oxides, which result from high temperatures in the combustion chamber. Nitrogen oxides, as explained in the section on coal, are precursors of acid precipitation. Nitrogen oxides may be relatively cheaply and effectively reduced by water or steam injection into the gas turbine combustors. Water and solid waste pollution from this process is minimal. The most effective method of reducing emissions of sulfur oxide is to minimize the use of high sulfur fuel oil. The Environmental Protection Agency (EPA) has established standards limiting emissions of nitrogen oxides and sulfur oxide for new gas turbine generators. Oil storage and handling can result in additional emissions of hydrocarbons. Other emissions of concern are particulates and carbon dioxide, although combustion of natural gas produces less carbon dioxide than combustion of the same amount of coal.

To control noise impacts, sound deadening is normally required. Buffer space surrounding CTs also can reduce noise pollution. A combined-cycle plant of 300 MW may require a 400-acre parcel as an adequate noise buffer.

Simple-cycle CTs usually have negligible impact on water supply or quality. Water or steam injection for control of air pollution requires a supply of demineralized water and produces a waste stream containing the minerals removed from the water. Treatment of fuel oil to remove minerals also can result in water consumption and pollutants. Plant site runoff and oil spills are additional potential sources of water pollution.

Combined-cycle units require both demineralized water for use in the steam cycle and makeup water for cooling towers or ponds.

Sources

BPA, Environmental Assessment: Proposed Power System Changes to Implement the Water Budget, May 1983, Appendix C, pp. C-9 - C-10.

Bonneville Power Administration 1983 Wholesale Power Rate Final Environmental Impact Statement, September 1983, pp. IV-81-83.

Northwest Power Planning Council, 1989 Supplement to the 1986 Northwest Conservation and Electric Power Plan, Volume 1, pp. 55-57.

Table F-1

SMALL HYDROELECTRIC PLANT

REFERENCE ENERGY SYSTEM

Small hydroelectric plants are those with less than 15 MWe of capacity and usually fed by a dam with height not more than 65 ft. Impounding is generally less than 500 acres. Components of a typical system (not an exhaustive listing) include the dam, penstock, hydraulic turbine, generator(s) transformer, and other miscellaneous structures and equipment.

FACILITY OPERATING PARAMETERS

Size:	4 MWe
Annual Capacity Factor:	0.35 for new plants, 0.37 for retrofits
Annual Energy Production:	0.04×10^{12} Btu
Efficiency:	90%
Lifetime:	50 yr

RESOURCES USED

	Quantities Used: Reference Energy System Annual Usage — English Units	Metric Units	Per 10^{12} Btu Energy Produced	Remarks
Feed Materials				
Water	0.792×10^6 acre-ft	0.977×10^{12} l	19.8×10^6 acre-ft	Kinetic energy of falling or flowing water
Energy Requirements				
Auxiliary		Not Determined		
	Total Usage			
Construction Materials		Not Determined		Typical system components are listed in Reference Energy System description
Land		Not Determined		
Personnel				
Construction		Not Determined		
Operation and maintenance		↓		

COSTS

	Reference Energy System	Per 10^{12} Btu Energy Produced	Remarks
Facility*	(1981 $)		Reference years for costs are 1977 for construction and 1972 for operation and maintenance. The corresponding CCI averages (I_R) = 2577 (1977) and 1753 (1972). See Explanatory Notes Section.
Construction	10.3×10^6 total 0.109×10^6/yr	257×10^6 total 2.72×10^6/yr	
Operation and maintenance	0.054×10^6/yr	1.35×10^6/yr	
Environmental Controls			
Upstream fish passage facilities can cost between 27×10^3 to 134×10^3/m of elevation			Hydroelectric systems can have water quality and ecological impacts

*Costs are for "installed hydro-power at new dams."

Table F-1 continued

SMALL HYDROELECTRIC PLANT

ENVIRONMENTAL RESIDUALS

	Quantities Released			
	Reference Energy System Annual Levels			
	English Units	Metric Units	Per 10^{12} Btu Energy Produced	Remarks
Water Pollutants				
Thermal stratification in the reservoir can lead to a lowering of dissolved oxygen levels and elevated concentration of ammonia, hydrogen sulfide, iron, and manganese; shoreline erosion may result in increased turbidity				
Thermal Discharge				
Thermal stratification in the reservoir can result in discharged water being warmer in winter and cooler in summer than ambient river water				

PRODUCTS

	Quantities Produced			
	Reference Energy System Annual Production			
	English Units	Metric Units	Per 10^{12} Btu Energy Produced	Remark
Primary				
Electricity	0.012×10^9 kWh	0.012×10^9 kWh	0.293×10^9 kWh	

OCCUPATIONAL SAFETY AND HEALTH

Not Determined

Table F-2

OPEN PIT URANIUM MINING

REFERENCE ENERGY SYSTEM

Open pit mining is conducted when the ore body lies under relatively friable material at depths to 120 m. The components of the mining operation include onsite support facilities such as offices and warehouses, mine water pumped into local surface drainage or holding ponds, and mine spoils and ore storage areas.

FACILITY OPERATING PARAMETERS

Size:	528×10^3 tons/yr (actual output)
Annual Capacity Factor:	80%
Annual Energy Production:*	115×10^{12} Btu
Efficiency:	80% (recovery efficiency)
Lifetime:	20 yr

RESOURCES USED

	Reference Energy System Annual Usage: English Units	Reference Energy System Annual Usage: Metric Units	Per 10^{12} Btu Energy Produced*	Remarks
Energy				
Electricity	1.32×10^3 MWh	1.32×10^3 MWh	11.5 MWh	
Diesel fuel and lubricants	1.46×10^6 gal	5.53×10^6 l	12.7×10^3 gal	
Processing Materials				
Explosives		Not Determined		
Water				
Mine water from dewatering	2.00×10^3 acre-ft	2.46×10^9 l	17.3 acre-ft	
Sprays for dust control		Not Determined		
	Total Usage			
Construction Materials				
Concrete	16 tons	15 tonnes	0.14 ton	
Total steel and castings	3.73×10^3 tons	3.38×10^3 tonnes	32.40 tons	
Copper, brass, and bronze	46 tons	42 tonnes	0.40 ton	
Aluminum and castings	22 tons	20 tonnes	0.19 ton	
Manganese	17 tons	16 tonnes	0.15 ton	
Chromium	8 tons	7 tonnes	0.07 ton	
Nickel	0.23 ton	0.21 tonne	0.002 ton	
Cast iron	155 tons	141 tonnes	1.35 tons	
Land	300 acres	120 ha	2.6 acres	
Personnel				
Construction (4 yr)	115 workers		1 worker	
Operation and maintenance	400 workers		3.5 workers	

COSTS

	Reference Energy System	Per 10^{12} Btu Energy Produced*	Remarks
Facility			
	(1981 $)		Reference year for costs is 1978. 1978 CCI average (I_R) = 2776. See Explanatory Notes Section.
Construction (4 yr)	$\$76.0 \times 10^6$ total	$\$0.662 \times 10^6$ total	
Operation and maintenance	$\$29.2 \times 10^6$/yr	$\$0.253 \times 10^6$/yr	
Environmental Controls			
Diversion of surface waters	Not Determined		
Water spraying for dust control	↓		
Revegetation	↓		

*In electrical energy (output) at the reactor; see note on page 1.

OPEN PIT URANIUM MINING

ENVIRONMENTAL RESIDUALS

	Quantities Released			
	Reference Energy System Annual Levels			
	English Units	Metric Units	Per 10^{12} Btu Energy Produced*	Remarks
Air Pollutants				
Particulates	31 tons	28 tonnes	0.27 ton	
Sulfur dioxide	49 tons	45 tonnes	0.43 ton	
Oxides of nitrogen	29 tons	26 tonnes	0.25 ton	
Hydrocarbons	2.3 tons	2.1 tonnes	0.02 ton	
Carbon monoxide	0.12 ton	0.10 tonne	0.001 ton	
Radon and radon daughters	3.37×10^3 Ci	3.37×10^3 Ci	29.3 Ci	
Water Pollutants				
Suspended solids		Not Determined		
Dissolved solids		↓		
Trace elements				
Solid Wastes				
Overburden moved	16×10^6 tons	15×10^6 tonnes	0.14×10^6 tons	

PRODUCTS

	Quantities Produced			
	Reference Energy System Annual Production			
	English Units	Metric Units	Per 10^{12} Btu Energy Produced*	Remarks
Primary				
Uranium ore	0.53×10^6 tons	0.48×10^6 tonnes	4.6×10^3 tons	
U_3O_8 concentrate	1.06×10^3 tons	960 tonnes	9.2 tons	

OCCUPATIONAL SAFETY AND HEALTH

Not Determined

*In electrical energy (output) at the reactor; see note on page 1.

URANIUM MILLING

REFERENCE ENERGY SYSTEM

The model is a uranium mill described by the Nuclear Regulatory Commission in the Final Generic Environmental Impact Statement on Uranium Milling, NUREG-0706, Vol. I-III, September 1980. Tailings control and disposal includes retention basin, clay liner, evaporation pond, in situ solids filtration, and earth cover.

FACILITY OPERATING PARAMETERS

Size:	635 tons/yr uranium concentrate (yellowcake at 90% U_3O_8)
Annual Capacity Factor:	85%
Annual Energy Production:*	68.3 × 10^{12} Btu
Efficiency:	93% (recovery)
Lifetime:	15 yr

RESOURCES USED

	Quantities Used: Reference Energy System Annual Usage — English Units	Metric Units	Per 10^{12} Btu Energy Produced*	Remarks
Feed Materials				
Uranium ore (0.1% uranium)	620 × 10^3 tons	560 × 10^3 tonnes	9.1 × 10^3 tons	
Energy*				
Electrical	10.8 × 10^3 MWh	10.8 × 10^3 MWh	158 MWh	
Natural gas (process heat)	274 × 10^6 scf	7.76 × 10^6 m^3	4.0 × 10^6 scf	
Processing Materials				
Sulfuric acid	28 × 10^3 tons	25 × 10^3 tonnes	400 tons	
Sodium chlorite	860 tons	780 tonnes	13 tons	
Ammonium	680 tons	610 tonnes	10 tons	
Flocculent	37 tons	34 tonnes	0.54 ton	
Amine	9 tons	8 tonnes	0.1 ton	
Alcohol	25 tons	22 tonnes	0.4 ton	
Kerosene	280 tons	250 tonnes	4 tons	
Iron	150 tons	140 tonnes	2.2 tons	
Water				
Process water	320 acre-ft	390 × 10^6 l	4.7 acre-ft	
	Total Usage			
Construction Materials				
Concrete	250 × 10^3 ft^3	7.0 X $10^3 m^3$	3.7 × 10^3 ft^3	
Steel	1.7 × 10^3 tons	1.6 × 10^3 tonnes	25 tons	
Copper and aluminum	52 tons	47 tonnes	0.76 ton	
Wood	18 tons	16 tonnes	0.26 ton	
Plastics	18 tons	16 tonnes	0.26 ton	
Land				
Mill operations	120 acres	50 ha	1.8 acres	
Tailings	250 acres	100 ha	3.7 acres	
Uncommitted	370 acres	150 ha	5.4 acres	
Total	740 acres	300 ha	10.9 acres	
Personnel				
Construction (5 yr)	120 workers		1.76 workers	
Operation and maintenance	160 workers		2.34 workers	

*In electrical energy (output) at the reactor; see note on page 1.

URANIUM MILLING

COSTS

	Reference Energy System	Per 10^{12} Btu Energy Produced*	Remarks
Facility			
	(1981 $)		
Construction (5 yr)	$37.1 × 10^6 total	$0.54 × 10^6 total	
Operation and maintenance	$ 8.5 × 10^6/yr	$0.13 × 10^6/yr	
Environmental Controls			
Ore crushing/handling wet scrubbers	$155 × 10^3 total	$2.3 × 10^3 total	Total capital costs
	$18.8 × 10^3/yr	$0.275 × 10^3/yr	Operating costs per year
Yellowcake drying wet scrubbers	$50.4 × 10^3 total	$0.7 × 10^3 total	Total capital costs
	$6.2 × 10^3/yr	$0.091 × 10^3/yr	Operating costs per year
Tailings control and disposal	$13.7 × 10^6 total	$0.200 × 10^6 total	Includes capital and total operating costs over lifetime

ENVIRONMENTAL RESIDUALS

	Quantities Released			
	Reference Energy System Annual Levels			
	English Units	Metric Units	Per 10^{12} Btu Energy Produced*	Remarks
Air Pollutants				
Particulates	370 tons	340 tonnes	5.4 tons	
Sulfur dioxide	0.34 ton	0.31 tonnes	5.0 × 10^{-3} ton	
Oxides of nitrogen	28 tons	25 tonnes	0.41 tons	
Kerosene	24 tons	22 tonnes	0.35 ton	
Uranium-238, Uranium-234	0.160 Ci	0.160 Ci	2.3 × 10^{-3} Ci	
Thorium-230	0.122 Ci	0.122 Ci	1.8 × 10^{-3} Ci	
Radon	4.5 × 10^3 Ci	4.5 × 10^3 Ci	66 Ci	
Water Pollutants				
Water discharged	326 acre-ft	402 × 10^6 l	4.8 acre-ft	
• Sulfate	13 × 10^3 tons	12.1 × 10^3 tonnes	190 tons	
• Iron	440 tons	400 tonnes	6.5 tons	
• Manganese	22 tons	20 tonnes	0.32 ton	
• Selenium	0.88 ton	0.80 tonne	0.01 ton	
Uranium-natural	1.3 Ci	1.3 Ci	19 × 10^{-3} Ci	
Radium-226	0.1 Ci	0.1 Ci	1.4 × 10^{-3} Ci	
Thorium-230	36 Ci	36 Ci	0.53 Ci	
Solid Wastes				
Tailings	610 × 10^3 tons	560 × 10^3 tonnes	9.0 × 10^3 tons	
Uranium-natural	21.8 Ci	21.8 Ci	0.32 Ci	
Radium-226	156 Ci	156 Ci	2.3 Ci	
Thorium-230	156 Ci	156 Ci	2.3 Ci	
Lead-210, polonium-210, bismuth-210	0.3 Ci	0.3 Ci	4 × 10^{-3} Ci	
Thermal Discharge				
Process heat to air	280 × 10^9 Btu	300 × 10^{12} J	4.1 × 10^9 Btu	

PRODUCTS

	Quantities Produced			
	Reference Energy System Annual Production			
	English Units	Metric Units	Per 10^{12} Btu Energy Produced*	Remarks
Primary				
Yellowcake (90% U_3O_8)	635 tons	580 tonnes	9.3 tons	
Recoverables/Recyclables				
30% of the tailings liquid	135 acre-ft	166 × 10^6 l	1.99 acre-ft	

*In electrical energy (output) at the reactor; see note on page [1]

URANIUM MILLING

OCCUPATIONAL SAFETY AND HEALTH[b]

	Reference Energy System Annual	Per 10^{12} Btu Energy Produced[a]	Remarks
Deaths	0.47	0.007	1977 Data
Injuries	34	0.50	↓

[a]U.S. Atomic Energy Commission, Environmental Survey of the Uranium Fuel Cycle, WASH-1248, 1974.
[b]Oak Ridge National Laboratory, An Integrated Assessment of the Impacts Associated with Uranium Mining and Milling, ORNL/TM-6677, July 1979.

*In electrical energy (output) at the reactor; see note on page 1.

Table F-4

URANIUM HEXAFLUORIDE CONVERSION

REFERENCE ENERGY SYSTEM

Conversion of "yellowcake" uranium concentrate into a volatile uranium hexafluoride compound for enrichment by the gaseous diffusion process; uranium hexafluoride conversion by either the dry hydrofluor process or the wet solvent exchange process; offgas treatment to minimize airborne residuals; neutralization and impoundment of liquid wastes.

FACILITY OPERATING PARAMETERS

Size:	5.5×10^3 tons/yr (actual output)
Annual Capacity Factor:	80%
Annual Energy Production:*	655×10^{12} Btu
Efficiency:	100% (recovery efficiency)
Lifetime:	20 yr

RESOURCES USED

	Quantities Used: Reference Energy System Annual Usage — English Units	Metric Units	Per 10^{12} Btu Energy Produced*	Remarks
Feed Materials				
Yellowcake (75% U_3O_8)	7.34×10^3 tons	6.66×10^3 tonnes	11.2 tons	
U_3O_8 (purified)	5.5×10^3 tons	5.0×10^3 tonnes	8.4 tons	
Energy				
Electricity	46×10^3 MWh	46×10^3 MWh	71 MWh	
Natural gas	540×10^6 scf	15×10^6 m^3	0.83×10^6 scf	
Processing Materials				
Nitric acid		Not Determined		
Tributylphosphate		↓		
Hexane		↓		
Anhydrous ammonia		↓		
Hydrofluoric acid		↓		
Fluorine		↓		
Water				
Discharged to air	0.28×10^3 acre-ft	0.34×10^9 l	0.42 acre-ft	
Discharged to water	1.92×10^3 acre-ft	2.38×10^9 l	2.94 acre-ft	
Total	2.20×10^3 acre-ft	2.72×10^9 l	3.36 acre-ft	
	Total Usage			
Construction Materials				
Concrete	259×10^3 tons	235×10^3 tonnes	395 tons	
Steel and castings	8.19×10^3 tons	7.43×10^3 tonnes	12.5 tons	
Copper, brass, and bronze	120 tons	110 tonnes	0.19 ton	
Aluminum and castings	39 tons	36 tonnes	0.06 ton	
Manganese	39 tons	36 tonnes	0.06 ton	
Chromium	39 tons	36 tonnes	0.06 ton	
Nickel	7 tons	6 tonnes	0.01 ton	
Cast iron	98 tons	89 tonnes	0.15 ton	
Pumps and drivers	7×10^3 hp	5×10^6 W	0.01×10^3 hp	
Heat exchangers	30×10^3 ft^3	3×10^3 m^2	0.05×10^3 ft^2	
Nonnuclear pressure vessel	220 tons	200 tonnes	0.33 ton	
Land	65 acres	27 ha	0.10 acre	
Personnel				
Construction (3 yr)	200 workers		0.3 worker	
Operation and maintenance	300 workers		0.4 worker	

*In electrical energy (output) at the reactor; see note on page 1.

URANIUM HEXAFLUORIDE CONVERSION

COSTS

	Reference Energy System	Per 10^{12} Btu Energy Produced *	Remarks
Facility			
	(1981 $)		Reference year for costs is 1978. 1978 CCI average (I_R) = 2776. See Explanatory Notes Section.
Construction (3 yr)	$\$70.7 \times 10^6$ total	$\$0.108 \times 10^6$ total	
Operation and maintenance	$\$20.5 \times 10^6$/yr	$\$0.031 \times 10^6$/yr	
Environmental Controls			
Fluorine scrubbers	Not Determined		
Raffinate/waste ponds	↓		
Offgas filters/traps	↓		

ENVIRONMENTAL RESIDUALS

	Quantities Released			
	Reference Energy System Annual Levels			
	English Units	Metric Units	Per 10^{12} Btu Energy Produced *	Remarks
Air Pollutants				
Sulfur dioxide	850 tons	770 tonnes	1.3 tons	
Oxides of nitrogen	300 tons	270 tonnes	0.46 ton	
Hydrocarbons	30 tons	20 tonnes	0.04 ton	
Carbon monoxide	7 tons	6 tonnes	0.01 ton	
Fluoride	3.3 tons	3.0 tonnes	0.005 ton	
Uranium	4.1×10^{-3} Ci	4.1×10^{-3} Ci	6.2×10^{-6} Ci	
Radon and radon daughters		Not Determined		10 CFR 20 specifies allowable levels
Water Pollutants				
Fluoride	790 tons	710 tonnes	1.2 tons	
Sulfate	140 tons	120 tonnes	0.21 ton	
Nitrate	7 tons	6 tonnes	0.01 ton	
Chloride	7 tons	6 tonnes	0.01 ton	
Sodium *	105 tons	95 tonnes	0.16 ton	
Ammonium	50 tons	40 tonnes	0.07 ton	
Iron	1.3 tons	1.2 tonnes	0.002 ton	
Radium-226	92×10^{-3} Ci	92×10^{-3} Ci	0.14×10^{-3} Ci	10 CFR 20 specifies allowable levels
Thorium-230	41×10^{-3} Ci	41×10^{-3} Ci	0.063×10^{-3} Ci	
Uranium	1.2 Ci	1.2 Ci	1.8×10^{-3} Ci	
Solid Wastes				
Solid chemical effluents (nonvolatile ash containing iron, calcium, magnesium, copper, fluoride)	1.2×10^3 tons	1.1×10^3 tonnes	1.8 tons	
Low and intermediate level radioactive (buried)	24 Ci	24 Ci	36×10^{-3} Ci	
Thermal Discharge				
Heat discharged to air	0.54×10^{12} Btu	0.57×10^{15} J	0.83×10^9 Btu	

PRODUCTS

	Quantities Produced			
	Reference Energy System Annual Production			
	English Units	Metric Units	Per 10^{12} Btu Energy Produced *	Remarks
Primary				
Uranium hexafluoride	5.5×10^3 tons	5.0×10^3 tonnes	8.4 tons	

OCCUPATIONAL SAFETY AND HEALTH

Not Determined

*In electrical energy (output) at the reactor; see note on ---- *

Table F-5

URANIUM ENRICHMENT GASEOUS DIFFUSION

REFERENCE ENERGY SYSTEM

Gaseous diffusion enrichment plant using porous barriers and compressors arranged in series to produce uranium hexafluoride enriched to 4% uranium-235; onsite support facilities; tails storage; settling/neutralization ponds; waste burial grounds; feed vaporization and product recovery systems; steam plant.

FACILITY OPERATING PARAMETERS

Size:	12 × 10^3 tons/yr (enriched uranium-235 as uranium hexafluoride; tails assay 0.2% uranium)
Annual Capacity Factor:	80%
Annual Energy Production:*	2190 × 10^{12} Btu
Efficiency:	65.4% (recovery efficiency)
Lifetime:	20 yr

RESOURCES USED

	Quantities Used: Reference Energy System Annual Usage – English Units	Metric Units	Per 10^{12} Btu Energy Produced*	Remarks
Feed Materials				
Uranium hexafluoride (unenriched)	18 × 10^3 tons	17 × 10^3 tonnes	8.4 tons	
Energy				
Electricity	28 × 10^6 MWh	28 × 10^6 MWh	13 × 10^3 MWh	
Water				
Discharged to air	23 × 10^3 acre-ft	29 × 10^9 l	11 acre-ft	
Discharged to water bodies (at diffusion plant)	1.8 × 10^3 acre-ft	22 × 10^9 l	0.8 acre-ft	
Discharged to water bodies (at power plant)	3.07 × 10^6 acre-ft	3.8 × 10^{12} l	1.4 × 10^3 acre-ft	
	Total Usage			
Construction Materials				
Concrete	1670 × 10^3 tons	1510 × 10^3 tonnes	760 tons	
Total steel and castings	723 × 10^3 tons	656 × 10^3 tonnes	330 tons	
Copper, brass, and bronze	25.6 × 10^3 tons	23.3 × 10^3 tonnes	11.7 tons	
Aluminum and castings	16 × 10^3 tons	15 × 10^3 tonnes	7.5 tons	
Manganese	3.9 × 10^3 tons	3.6 × 10^3 tonnes	1.8 tons	
Chromium	5.0 × 10^3 tons	4.6 × 10^3 tonnes	2.3 tons	
Nickel	0.90 × 10^3 tons	0.82 × 10^3 tonnes	0.41 ton	
Cast iron	58.0 × 10^3 tons	52.7 × 10^3 tonnes	26.5 tons	
Steam turbogenerators	520 MWe	520 MWe	0.24 MWe	
Pumps and drivers	590 × 10^3 hp	440 × 10^6 W	0.27 × 10^3 hp	
Axial compressor	8300 × 10^3 hp	6200 × 10^6 W	3.8 × 10^3 hp	
Centrifuge compressors and drivers	22 tons	20 tonnes	0.01 ton	
Heat exchangers	7.9 × 10^6 ft^2	730 × 10^3 m^2	3.6 × 10^3 ft^2	
Land		Not Determined		
Personnel				
Construction (8 yr)	6.1 × 10^3 workers		2.8 workers	
Operation and maintenance	2.2 × 10^3 workers		1.0 worker	

*In electrical energy (output) at the reactor; see note on page 1.

Table F-5 continued

URANIUM ENRICHMENT GASEOUS DIFFUSION

COSTS

	Reference Energy System	Per 10^{12} Btu Energy Produced *	Remarks
Facility	(1981 $)		Reference year for costs is 1978. 1978 CCI average (I_R) = 2776. See Explanatory Notes Section.
Construction (8 yr)	14.7×10^9 total	6.71×10^6 total	
Operation and maintenance	0.98×10^6/yr	0.448×10^6/yr	
Environmental Controls			
Cooling towers	Not Determined		
Liquid waste systems	↓		
Neutralization pond	↓		
Filters	↓		
Fluorine scrubber	↓		

ENVIRONMENTAL RESIDUALS

	Quantities Released			Remarks
	Reference Energy System Annual Levels		Per 10^{12} Btu Energy Produced *	
	English Units	Metric Units		
Air Pollutants				
Particulates	113×10^3 tons	103×10^3 tonnes	51.8 tons	
Sulfur dioxide	431×10^3 tons	392×10^3 tonnes	197 tons	
Oxides of nitrogen	113×10^3 tons	103×10^3 tonnes	51.8 tons	
Hydrocarbons	1.1×10^3 tons	1.0×10^3 tonnes	0.5 ton	
Carbon monoxide	2.8×10^3 tons	2.6×10^3 tonnes	1.3 tons	
Fluoride	0.044×10^3 tons	0.04×10^3 tonnes	0.02 ton	
Uranium	0.18 Ci	0.18 Ci	83×10^{-6} Ci	
Technetium-99	0.74 Ci	0.74 Ci	0.34×10^{-3} Ci	
Ruthenium-106	0.010 Ci	0.010 Ci	4.6×10^{-6} Ci	
Water Pollutants				
Calcium	700 tons	600 tonnes	0.3 ton	
Chloride	900 tons	800 tonnes	0.4 ton	
Sodium *	900 tons	800 tonnes	0.4 ton	
Sulfate	700 tons	600 tonnes	0.3 ton	
Iron	44 tons	40 tonnes	0.02 ton	
Nitrate	260 tons	240 tonnes	0.12 ton	
Uranium	1.8 Ci	1.8 Ci	0.83×10^{-3} Ci	
Technetium-99	9.6 Ci	9.6 Ci	4.4×10^{-3} Ci	
Solid Wastes				
Equipment components		Not Determined		
Sludges		↓		
Thermal Discharge				
Heat discharged to water	226×10^{12} Btu	238×10^{15} J	103×10^9 Btu	
Heat discharged to air	68×10^{12} Btu	72×10^{15} J	31×10^9 Btu	
Noise Pollution				
In-plant		Not Determined		
Cooling tower		↓		

PRODUCTS

	Quantities Produced			Remarks
	Reference Energy System Annual Production		Per 10^{12} Btu Energy Produced *	
	English Units	Metric Units		
Primary				
Enriched uranium-235 in uranium hexafluoride	12.0×10^3 tons	10.9×10^3 tonnes	5.49 tons	
Byproducts				
Uranium-235 in tails	22 tons	20 tonnes	0.01 ton	Tails 0.2% uranium

OCCUPATIONAL SAFETY AND HEALTH

Not Determined

*In electrical energy (output) at the reactor; see note on page

Table F-6

URANIUM ENRICHMENT GAS CENTRIFUGE

REFERENCE ENERGY SYSTEM

The gas centrifuge enrichment process uses a system of centrifuges to enrich uranium in uranium-235 to 2–4%. System components include production facilities; feed, product, and tails withdrawal systems; decontamination facilities; recirculating and sanitary water systems; sewage systems; etc.

FACILITY OPERATING PARAMETERS

Size:	10 × 10³ tons/yr (tails assay 0.2%)
Annual Capacity Factor:	80%
Annual Energy Production:*	1821 × 10¹² Btu
Efficiency:	65.4%
Lifetime:	20 yr

RESOURCES USED

	Quantities Used: Reference Energy System Annual Usage — English Units	Metric Units	Per 10¹² Btu Energy Produced*	Remarks
Feed Materials				
Uranium hexafluoride	15 × 10³ tons	14 × 10³ tonnes	8.4 tons	
Energy				
Coal	66.8 × 10³ tons	60.7 × 10³ tonnes	36.7 tons	Heating and process steam
Gasoline and diesel fuel	208 × 10³ gal	786 × 10³ l	114 gal	
Electricity	2.0 × 10⁶ MWh	2.0 × 10⁶ MWh	1.1 × 10³ MWh	
Water				
Discharged to air	890 acre-ft	1.1 × 10⁹ l	0.49 acre-ft	
Discharged to water	1.82 × 10³ acre-ft	2.24 × 10⁹ l	1.00 acre-ft	
	Total Usage			
Construction Materials				
Concrete	600 × 10³ tons	540 × 10³ tonnes	330.00 tons	
Steel	280 × 10³ tons	250 × 10³ tonnes	151.00 tons	
Aluminum	25 × 10³ tons	23 × 10³ tonnes	14.00 tons	
Copper	4.9 × 10³ tons	4.5 × 10³ tonnes	2.70 tons	
Zinc	0.22 × 10³ tons	0.20 × 10³ tonnes	0.12 ton	
Transformer cooling oil	0.33 × 10³ tons	0.30 × 10³ tonnes	0.18 ton	
Paving materials	1.3 × 10³ tons	1.2 × 10³ tonnes	0.70 ton	
Miscellaneous metal products	1.2 × 10³ tons	1.0 × 10³ tonnes	0.63 ton	
Land	840 acres	340 ha	0.46 acre	
Personnel				
Construction (7 yr)	5.1 × 10³ workers		2.8 workers	
Operation and maintenance	1.8 × 10³ workers		1.0 worker	

COSTS

	Reference Energy System	Per 10¹² Btu Energy Produced*	Remarks
Facility	(1981 $)		Reference year for costs is 1975. 1975 CCI average (I_R) = 2212. See Explanatory Notes Section
Construction (7 yr)	$5.7 × 10⁹ total	$3.13 × 10⁶ total	
Operation and maintenance	$755 × 10⁶/yr	$0.415 × 10⁶/yr	
Environmental Controls			
Filters	Not Determined		
Liquid waste processing	↓		
Neutralization facilities	↓		
Cooling towers	↓		
Fluorine scrubbers	↓		

*In electrical energy (output) at the reactor; see note on page 1.

URANIUM ENRICHMENT GAS CENTRIFUGE

ENVIRONMENTAL RESIDUALS

	Quantities Released			
	Reference Energy System Annual Levels			
	English Units	Metric Units	Per 10^{12} Btu Energy Produced*	Remarks
Air Pollutants				
Particulates	40 tons	30 tonnes	0.02 ton	
Sulfur dioxide	840 tons	760 tonnes	0.46 ton	
Oxides of nitrogen	670 tons	610 tonnes	0.37 ton	
Hydrocarbons		Negligible		
Carbon monoxide	18 tons	16 tonnes	0.01 ton	
Uranium (total isotopes)	56×10^{-3} Ci	56×10^{-3} Ci	31×10^{-6} Ci	
Water Pollutants				
Condensate				
• Water	3.70×10^3 tons	3.36×10^3 tonnes	2.03 tons	
Aqueous waste				
• Water	560 tons	510 tonnes	0.31 ton	
• Nitric acid	90 tons	80 tonnes	0.05 ton	
• Aluminum nitrate	110 tons	100 tonnes	0.06 ton	
Noncondensable gas				
• Oxides of nitrogen	1.8 tons	1.6 tonnes	0.001 ton	
Radiation				
• Uranium (total isotopes)	6.0×10^{-3} Ci	6.0×10^{-3} Ci	3.3×10^{-6} Ci	
Solid Wastes				
Failed rotors		Not Determined		
Thermal Discharge				
Heat dissipated from steam plant	360×10^9 Btu	380×10^{12} J	0.2×10^9 Btu	
Noise Pollution				
In-plant		Not Determined		

PRODUCTS

	Quantities Produced			
	Reference Energy System Annual Production			
	English Units	Metric Units	Per 10^{12} Btu Energy Produced*	Remarks
Primary				
Enriched uranium-235 in uranium hexafluoride	1.00×10^3 tons	9.08×10^3 tonnes	5.49 tons	
Byproducts				
Uranium-235 in tails	18 tons	16 tonnes	0.01 ton	0.2% uranium in tails

OCCUPATIONAL SAFETY AND HEALTH

Not Determined

*In electrical energy (output) at the reactor; see note on page 1.

Table F-7

FUEL FABRICATION PLANT

REFERENCE ENERGY SYSTEM

Fuel fabrication is accomplished by chemical conversion of uranium hexafluoride to uranium dioxide and mechanical processing including pellet production and fuel element fabrication loaded in zircalloy or stainless steel tubes, fitted with end caps, and welded.

FACILITY OPERATING PARAMETERS

Size:	990 tons/yr
Annual Capacity Factor:	80%
Annual Energy Production:*	619 × 10^{12} Btu
Efficiency:	100% (uranium-235 output vs. uranium-235 input)
Lifetime:	20 yr

RESOURCES USED

	Quantities Used: Reference Energy System Annual Usage — English Units	Reference Energy System Annual Usage — Metric Units	Per 10^{12} Btu Energy Produced*	Remarks
Feed Materials				
Uranium-235 enriched in uranium hexafluoride	3.40 × 10^3 tons	3.08 × 10^3 tonnes	5.49 tons	
Energy				
Electricity	44 × 10^3 MWh	44 × 10^3 MWh	71 MWh	
Natural gas	93 × 10^6 scf	2.6 × 10^6 m^3	0.15 × 10^6 scf	
Processing Materials				
Aqueous ammonia		Not Determined		
Nitric acid (70%)		↓		
Sodium hydroxide (50%)		↓		
Sulfuric acid (70%)		↓		
Water				
Discharged to water	410 acre-ft	510 × 10^6 l	0.67 acre-ft	
	Total Usage			
Construction Materials				
Concrete	46.2 × 10^3 - 275 × 10^3 tons	42.0 × 10^3 - 250 × 10^3 tonnes	74.70–444.0 tons	
Total steel and castings	7.43 × 10^3 - 27.8 × 10^3 tons	6.74 × 10^3 - 25.3 × 10^3 tonnes	12.00–45.00 tons	
Copper, brass, and bronze	360 - 3.22 × 10^3 tons	330 - 2.92 × 10^3 tonnes	0.59-5.20 tons	
Aluminum and castings	170–885 tons	150–800 tonnes	0.27-1.43 tons	
Manganese	50–130 tons	40–120 tonnes	0.08–0.21 ton	
Chromium	62-93 tons	56–84 tonnes	0.10–0.15 ton	
Nickel	12-18 tons	11-17 tonnes	0.02–0.03 ton	
Cast iron	300–560 tons	280–510 tonnes	0.49–0.90 ton	
Steam turbines	0 - 6.2 × 10^3 hp	0 - 4.6 × 10^6 W	0–10 hp	
Pumps and drivers	6.2 × 10^3 - 25 × 10^3 hp	4.6 × 10^6 - 18 × 10^6 W	10–40 hp	
Heat exchangers	0 - 18 × 10^3 ft^2	0 - 1.7 × 10^3 m^2	0–30 ft^2	
Land	7.4 acres	3.0 ha	0.012 acre	
Personnel				
Construction (2-3 yr)	400-2.1 × 10^3 workers		0.7-3.4 workers	
Operation and maintenance	990-2.1 × 10^3 workers		1.6-3.4 workers	

*In electrical energy (output) at the reactor; see note on page 1.

FUEL FABRICATION PLANT

COSTS

	Reference Energy System	Per 10^{12} Btu Energy Produced*	Remarks
Facility			
	(1981 $)		
Construction (2-3 yr)	$248 × 10^6 - 792 × 10^6 total	$0.400 × 10^6 - 1.28 × 10^6 total	Reference year for costs is 1978. 1978 CCI average (I_R) = 2776. See Explanatory Notes Section.
Operation and maintenance	$177 × 10^6 - 257 × 10^6/yr	$0.287 × 10^6/yr - 0.415 × 10^6/yr	
Environmental Controls			
High-efficiency particulate aerosol filter system	Not Determined		
Scrubbers and dryers	↓		
Waste lagoons	↓		
Sanitary waste system	↓		

ENVIRONMENTAL RESIDUALS

	Quantities Released			Remarks
	Reference Energy System Annual Levels		Per 10^{12} Btu Energy Produced*	
	English Units	Metric Units		
Air Pollutants				
Sulfur dioxide	681 tons	618 tonnes	1.10 tons	
Oxides of nitrogen	170 tons	160 tonnes	0.28 ton	
Carbon monoxide	6.2 tons	5.6 tonnes	0.01 ton	
Uranium	5.1 × 10^{-3} Ci	5.1 × 10^{-3} Ci	8.3 × 10^{-6} Ci	
Water Pollutants				
Nitrogen as ammonia	280 tons	260 tonnes	0.46 ton	
Nitrogen as nitrate	681 tons	618 tonnes	1.10 tons	
Fluoride	120 tons	110 tonnes	0.19 ton	
Uranium	0.51 Ci	0.51 Ci	0.83 × 10^{-3} Ci	
Thorium-234	0.26 Ci	0.26 Ci	0.42 × 10^{-3} Ci	
Solid Wastes				
Calcium fluoride	743 tons	674 tonnes	1.20 tons	
Ammonia		Not Determined		
Fluorine		↓		
Sulfur oxide		↓		
Nitrate		↓		
Uranium (buried)	5.9 Ci	5.9 Ci	9.6 × 10^{-3} Ci	
Thermal Discharge				
Heat dissipated	200 × 10^9 Btu	300 × 10^{12} J	0.4 × 10^9 Btu	

PRODUCTS

	Quantities Produced			Remarks
	Reference Energy System Annual Production		Per 10^{12} Btu Energy Produced*	
	English Units	Metric Units		
Primary				
Uranium (uranium dioxide) fuel elements	990 tons	900 tonnes	1.6 tons	

OCCUPATIONAL SAFETY AND HEALTH

Not Determined

*In electrical energy (output) at the reactor; see note on page 1.

Table F-8

PRESSURIZED WATER REACTOR NUCLEAR POWER PLANT

REFERENCE ENERGY SYSTEM

Pressurized water reactor nuclear-powered electric generating plant using 3.3% enriched uranium-235 fuel; onsite storage of spent reactor fuel; maximum recycling of liquid radioactive wastes; filtration of building exhausts; onsite water treatment of river supply water; natural draft wet cooling towers.

FACILITY OPERATING PARAMETERS

Size:	1×10^3 MWe
Annual Capacity Factor:	70%
Annual Energy Production:*	21×10^{12} Btu (6.13×10^6 MWh)
Efficiency:	33%
Lifetime:	30–40 yr

RESOURCES USED

	Quantities Used: Reference Energy System Annual Usage — English Units	Metric Units	Per 10^{12} Btu Energy Produced*	Remarks
Feed Materials				
Uranium fuel (3.3% uranium-235)	26.7 tons	24.2 tonnes	1.27 tons	33% of core annually
Water				
Power plant make-up water	16×10^3 acre-ft	19×10^9 l	0.74×10^3 acre-ft	Wet cooling
	Total Usage			
Construction Materials				
Concrete	250×10^3 yd^3	190×10^3 m^3	11.9×10^3 yd^3	
Metal conduit	500×10^3 ft	150×10^3 m	24×10^3 ft	
Cable tray	100×10^3 ft	30×10^3 m	4.8×10^3 ft	
Large process pipe	160×10^3 ft	50×10^3 m	7.6×10^3 ft	
Small pipe	200×10^3 ft	60×10^3 m	9.5×10^3 ft	
Wire and cable	7×10^6 ft	2.1×10^6 m	0.3×10^6 ft	
Land				
Site area	1.85×10^3 acres	749 ha	88.1 acres	
Low-level radioactive waste disposal area	0.02 acre	0.008 ha	0.9×10^{-3} acre	
Personnel				
Construction (9 yr)	2.31×10^3 workers		110 workers	
Operation and maintenance	230 workers		11 workers	

COSTS

	Reference Energy System	Per 10^{12} Btu Energy Produced*	Remarks
Facility	(1981 $)		
Construction (9 yr) Operation and maintenance	Total life cycle costs (excluding ultimate decommissioning and decontamination) ≅ 97.0 mills/kWh		Includes capital, operation and maintenance, and fuel costs for a plant scheduled to begin operation in 1985. Reference year for costs is 1976. 1976 CCI average (I_R) = 2401. See Explanatory Notes Section.
Environmental Controls			Included in facility costs

*In electrical energy (output) at the reactor; see note on page 1.

PRESSURIZED WATER REACTOR NUCLEAR POWER PLANT

ENVIRONMENTAL RESIDUALS

	Quantities Released			
	Reference Energy System Annual Levels			
	English Units	Metric Units	Per 10^{12} Btu Energy Produced *	Remarks
Air Pollutants				
Noble gases	1.80×10^3 Ci	1.80×10^3 Ci	85.7 Ci	10 CFR 50 and 40 CFR 190 specify individual concentration limits
Carbon-14	6.2 Ci	6.2 Ci	0.30 Ci	
Tritium	800 Ci	800 Ci	38.1 Ci	
Fossil fuel air emissions	53 tons	48 tonnes	2.5 tons	
Airborne water from cooling tower evaporation losses	3.8×10^9 gal	14.4×10^9 l	0.18×10^9 gal	
Water Pollutants				
Activated corrosion and fission products	0.12 Ci	0.12 Ci	0.006 Ci	10 CFR 50 and 40 CFR 190 specify individual concentration limits
Tritium	302 Ci	302 Ci	14.4 Ci	
Total suspended solids	Metric units are universally used	12.9×10^3 mg/l	Depends on flow, which varies widely	40 CFR 423 specifies allowable increases in river concentrations
Total dissolved solids		2860 mg/l		
Iron		180 mg/l		
Chloride		360 mg/l		
Chromium		0.30 mg/l		
Copper		0.73 mg/l		
Zinc		0.84 mg/l		
Solid Wastes				
Low-level solid radwaste	5.83×10^3 Ci (5.90×10^3 ft^3)	5.83×10^3 Ci (167 m^3)	278 Ci (280 ft^3)	
Thermal Discharge				
Heat dissipated to atmosphere	42×10^{12} Btu	44×10^{15} J	2×10^{12} Btu	

PRODUCTS

	Quantities Produced			
	Reference Energy System Annual Production			
	English Units	Metric Units	Per 10^{12} Btu Energy Produced *	Remarks
Primary				
Electricity	6.1×10^6 MWh	6.1×10^6 MWh	0.29×10^6 MWh	
Recoverables/Recyclables				
Spent nuclear fuel	26.7 tons	24.3 tonnes	1.30 tons	

OCCUPATIONAL SAFETY AND HEALTH

	Reference Energy System Annual	Per 10^{12} Btu Energy Produced *	Remarks
Deaths	0	0	
Injuries	0.5-3.0	0.02-0.14	
Radiation Exposure	428 man-rem	20.4 man-rem	

*In electrical energy (output) at the reactor; see note on page 1.

Table F-9

BOILING WATER REACTOR NUCLEAR POWER PLANT

REFERENCE ENERGY SYSTEM

General Electric Company's standardized BWR/6 reactor with the Mark III containment design. Natural draft cooling towers. Fuel is 3% enriched uranium-235; onsite storage of liquid radioactive wastes; filtration of building exhausts; onsite water treatment of river supply water; and natural draft wet cooling towers.

FACILITY OPERATING PARAMETERS

Size:	1×10^3 MWe
Annual Capacity Factor:	70%
Annual Energy Production:*	21×10^{12} Btu
Efficiency:	33%
Lifetime:	30-40 yr

RESOURCES USED

	Quantities Used: Reference Energy System Annual Usage — English Units	Metric Units	Per 10^{12} Btu Energy Produced*	Remarks
Feed Materials				
Uranium fuel (3.0% enriched uranium-235)	34 tons	31 tonnes	1.6 tons	One-fourth of core annually
Processing Materials		Not Determined		
Water				
Make-up water for cooling towers and miscellaneous plant services	16.9×10^3 acre-ft	21×10^9 l	0.8×10^3 acre-ft	Natural draft wet cooling towers used.
	Total Usage			
Construction Materials				
Concrete	4.5×10^6 ft^3	130×10^3 m^2	210×10^2 ft^3	
Reinforcing steel	17×10^3 tons	15×10^3 tonnes	810 tons	
Structural steel	8.7×10^3 tons	7.9×10^3 tonnes	420 tons	
Land				
Site land requirements, transmission route, disrupted land surface (site), and committed land	3.38×10^3 acres	1.38 ha	161 acres	For two 1250-MWe units with cooling towers
Personnel				
Construction (9 yr)	2.3×10^3 workers		110 workers	
Operation and maintenance	230 workers			

COSTS

	Reference Energy System	Per 10^{12} Btu Energy Produced*	Remarks
	(1981 $)*		
Facility			
Construction (9 yr) (with interest during construction)	Total life cycle costs (excluding ultimate decommissioning and decontamination) = 108 mills/kWh.		Includes capital, fuel, and operation and maintenance plant costs for a plant scheduled to begin operation in 1985.
Operation and maintenance			
Environmental Controls			Included in facility costs

*Reference year is 1978; 1978 CCI average (I_R) = 2401. See Explanatory Notes section.

*In electrical energy (output) at the reactor; see note on page 1.

BOILING WATER REACTOR NUCLEAR POWER PLANT

ENVIRONMENTAL RESIDUALS

	Quantities Released			
	Reference Energy System Annual Levels		Per 10^{12} Btu Energy Produced*	
	English Units	Metric Units		Remarks
Air Pollutants				
Gaseous radioactive effluents				10 CFR 50 and 40 CFR 190 specify individual concentration limits
• Noble gases	11×10^3 Ci	11×10^3 Ci	540 Ci	
• Tritium	110 Ci	110 Ci	5.2 Ci	
• Carbon-14	6.8 Ci	6.8 Ci	0.32 Ci	
• Iodine-131 (elemental)	64×10^{-3} Ci	64×10^{-3} Ci	3.0×10^{-3} Ci	
• Iodine-131 (nonelemental)	140×10^{-3} Ci	140×10^{-3} Ci	6.6×10^{-3} Ci	
Fossil fuel air emissions	210 tons			
Airborne water from cooling tower evaporation losses	3.8×10^9 gal	14.4×10^9 l	0.18×10^9 gal	
Water Pollutants				
Liquid radioactive effluents				10 CFR 50 and 40 CFR 190 specify individual concentration limits
• Tritium	35 Ci	35 Ci	1.7 Ci	
• Activation and fission products	0.1 Ci	0.1 Ci	5×10^3 Ci	
Dissolved solids				40 CFR 423 specifies allowable increases in river concentrations
• Sulfates	23 tons	21 tonnes	1.1 tons	
• Chlorine	0.9 ton	0.8 tonne	0.04 ton	
• Sodium	11 tons	10 tonnes	0.53 ton	
• Other	5.8 tons	5.3 tonnes	0.28 ton	
Solid Wastes				
Low-level solid radioactive wastes				
• Wet material embedded in concrete	19×10^3 ft^3	530 m^3	900 ft^3	
• Dry material in drums	3.3×10^3 ft^3	94 m^3	160 ft^3	
Water filtration waste products				
• Aluminum hydroxide	10 tons	9.1 tonnes	0.48 ton	
• Settled solids	8 tons	7.3 tonnes	0.38 ton	
Thermal Discharge				
Heat dissipated	61×10^{12} Btu	64×10^{16} J	2.9×10^{12} Btu	
Noise Pollution		Negligible		

*In electrical energy (output) at the reactor; see note on page 1.

BOILING WATER REACTOR NUCLEAR POWER PLANT

PRODUCTS

	Quantities Produced: Reference Energy System Annual Production — English Units	Metric Units	Per 10^{12} Btu Energy Produced*	Remarks
Primary				
Electric power	6.13×10^9 kWh	6.13×10^9 kWh	2.93×10^9 kWh	
Byproducts	Not Determined			
Recoverables/Recyclables				
Spent nuclear fuel containing				
• Uranium-235 nuclear fuel				
—Mass	616 lb	280 kg	29.3 lb	
—Energy equivalent	4.3×10^9 kWh (14.7×10^{21} Btu)	4.3×10^9 kWh (15.5×10^{24} J)	0.21×10^9 kWh (0.7×10^{21} Btu)	
• Fissile plutonium nuclear fuel				
—Mass	396 lb	780 kg	18.8 lb	
—Energy equivalent	3.4×10^9 kWh (10.5×10^{21} Btu)	3.4×10^9 kWh (11.1×10^{24} J)	1.6×10^9 kWh (0.5×10^{21} Btu)	
• Isotopes for medical and industrial applications	Not Determined			

OCCUPATIONAL SAFETY AND HEALTH

	Reference Energy System Annual	Per 10^{12} Btu Energy Produced*	Remarks
Deaths	0.0	0.0	
Injuries			
Number	0.51-3.0	0.02-0.14	
Total lost days	14-91	0.67-4.33	
Occupational Radiation Exposure	1.1×10^3 man-rems	53 man-rems	Average collective dose

*In electrical energy (output) at the reactor; see note on page 1.

Table F-10

COMMERCIAL HIGH-LEVEL NUCLEAR WASTE REPOSITORY

REFERENCE ENERGY SYSTEM

Deep Geologic Repository facility capable of handling solidified high-level wastes and transuranic wastes from the reprocessing of spent fuel; located 600-m deep in each of two candidate rock media, salt and basalt; retrievable emplacement for the first 5 yr of operation with optional permanent disposal; packaging facility included in surface operations. Construction time is 10 yr, mining operations taking place during the last 7 yr.

FACILITY OPERATING PARAMETERS

	Repository For Reprocessing Wastes	
	Salt	Basalt
Average Annual Capacity (MTHM):	3,000	3,000
Total Equivalent Capacity (MTHM):	62,000	56,000
Total Electrical Energy Represented:	49×10^{15} Btu	44×10^{15} Btu
Lifetime (yr):	19	18

RESOURCES USED

	Quantities Used: Reference Energy System Annual Levels — English Units Salt	English Units Basalt	Metric Units Salt	Metric Units Basalt	Per 10^{12} Btu Energy Produced * — Salt	Basalt	Remarks
Feed Material							
Water	7.1×10^6 gal	12×10^6 gal	27×10^6 l	45×10^6 l	1.5×10^3 gal	2.7×10^3 gal	
Energy							
Construction							
• Propane	8.5×10^3 ft^3	14×10^3 ft^3	0.24×10^3 m^3	0.40×10^3 m^3	1.7 ft^3	3.1 ft^3	
• Diesel fuel	0.63×10^6 gal	1.1×10^6 gal	2.4×10^3 m^3	4.0×10^3 m^3	130 gal	240 gal	
• Gasoline	0.48×10^6 gal	0.79×10^6 gal	1.8×10^3 m^3	3.0×10^3 m^3	97 gal	179 gal	
• Electricity	1.6×10^6 kWh	2.7×10^6 kWh	1.6×10^6 kWh	2.7×10^6 kWh	330 kWh	610 kWh	
Operation							
• Diesel fuel	3.5×10^6 gal	3.4×10^6 gal	13×10^3 m^3	13×10^3 m^3	1.3×10^3 gal	1.4×10^3 gal	
• Coal	81×10^3 tons	79×10^3 tons	74×10^3 tonnes	72×10^3 tonnes	32 tons	32 tons	
• Electricity	110×10^6 kWh	127×10^6 kWh	110×10^6 kWh	127×10^6 kWh	43×10^3 kWh	52×10^3 kWh	
• Steam	870×10^3 tons	860×10^3 tons	790×10^3 tonnes	780×10^3 tonnes	340 tons	350 tons	
Operational Materials							
Concrete	59×10^3 ft^3	63×10^3 ft^3	1.7×10^3 m^3	1.8×10^3 m^3	23 ft^3	25 ft^3	
Steel	4.8×10^3 tons	13×10^3 tons	4.4×10^3 tonnes	12×10^3 tonnes	1.9 tons	5.2 tons	
	Total Usage						
Construction Materials							
Concrete	3.9×10^3 ft^3	6.7×10^3 ft^3	110×10^3 m^3	190×10^3 m^3	79 ft^3	150 ft^3	
Steel	20×10^3 tons	33×10^3 tons	18×10^3 tonnes	30×10^3 tonnes	0.41 ton	0.75 ton	
Copper	260 tons	460 tons	240 tonnes	420 tonnes	5.4×10^{-3} ton	11×10^{-3} ton	
Zinc	68 tons	120 tons	62 tonnes	110 tonnes	1.4×10^{-3} ton	2.7×10^{-3} ton	
Aluminum	51 tons	85 tons	46 tonnes	77 tonnes	1.0×10^{-3} ton	1.9×10^{-3} ton	
Lumber	92×10^3 ft^3	155×10^3 ft^3	2.6×10^3 m^3	4.4×10^3 m^3	1.9 ft^3	3.5 ft^3	
Land							
Fenced, restricted	2000 acres	2000 acres	800 ha	800 ha	41×10^{-3} acre	45×10^{-3} acre	
Federally controlled	7900 acres	7900 acres	3200 ha	3200 ha	193×10^{-3} acre	179×10^{-3} acre	
Surface facilities	400 acres	540 acres	180 ha	220 ha	9.1×10^{-3} acre	12×10^{-3} acre	
Personnel							
Construction (10 yr)	2.0×10^3 workers	3.8×10^3 workers	–	–	0.22 worker	0.58 worker	
Operation	1.3×10^3 workers	1.5×10^3 workers	–	–	0.39 worker	0.48 worker	

*In electrical energy (output) at the reactor; see note on page 1.

COMMERCIAL HIGH-LEVEL NUCLEAR WASTE REPOSITORY

COSTS

	Reference Energy System: Salt	Reference Energy System: Basalt	Per 10^{12} Btu *: Salt	Per 10^{12} Btu *: Basalt	Remarks
	(May 1981 $)				
Facility					
Construction (10 yr)	1.6×10^9	3.1×10^9	33×10^3	70×10^3	
Operation and maintenance	1.6×10^9	2.4×10^9	33×10^3	55×10^3	

ENVIRONMENTAL RESIDUALS

Quantities Released

	Reference Energy System Annual Levels: English Units Salt	English Units Basalt	Metric Units Salt	Metric Units Basalt	Per 10^{12} Btu Energy Produced *: Salt	Basalt	Remarks
Air Pollutants							
Radiological							EPA is developing environmental standards that state the public health and environmental requirements to be met for disposal of high level nuclear waste. NRC will use EPA's regulation to set their standards to govern licensing, design, and operation of permanent waste disposal facilities. Tentative timetable for final regulations (FR) is May 1983.
• Construction							
—Radon-220	1.1×10^{-3} Ci	2.0 Ci			0.16×10^{-6} Ci	0.32×10^{-3} Ci	
—Radon-222	1.6×10^{-3} Ci	1.7 Ci			0.23×10^{-6} Ci	0.27×10^{-3} Ci	
—Lead-210	0.13×10^{-6} Ci	0.14×10^{-3} Ci			19×10^{-12} Ci	0.022×10^{6} Ci	
—Lead-212	1.7×10^{-6} Ci	3.0×10^{-3} Ci			0.24×10^{-9} Ci	0.47×10^{-6} Ci	
—Lead-214	1.6×10^{-3} Ci	1.7 Ci			0.23×10^{-6} Ci	0.27×10^{-3} Ci	
—Bismuth-210	1.6×10^{-3} Ci	1.7 Ci			0.23×10^{-6} Ci	0.27×10^{-3} Ci	
• Operation			Negligible				
Fossil fuel combustion Products							
• Construction							
—CO	1400 tons	2400 tons	1300 tonnes	2100 tonnes	0.20 ton	0.37 ton	
—Hydrocarbons	63 tons	100 tons	57 tonnes	94 tonnes	9.0×10^{-3} ton	17×10^{-3} ton	
—NO_x	270 tons	440 tons	240 tonnes	400 tonnes	0.038 ton	0.070 ton	
—SO_x	16 tons	27 tons	14 tonnes	24 tonnes	2.3×10^{-3} ton	4.2×10^{-3} ton	
—Particulates	16 tons	27 tons	14 tonnes	24 tonnes	2.3×10^{-3} ton	4.2×10^{-3} ton	
• Operation							
—CO	170 tons	170 tons	150 tonnes	150 tonnes	0.070 ton	0.067 ton	
—Hydrocarbons	58 tons	60 tons	53 tonnes	54 tonnes	0.023 ton	0.024 ton	
—NO_x	990 tons	1000 tons	896 tonnes	940 tonnes	0.35 ton	0.42 ton	
—SO_x	700 tons	670 tons	630 tonnes	610 tonnes	0.27 ton	0.27 ton	
—Particulates	30 tons	29 tons	27 tonnes	27 tonnes	0.011 ton	0.012 ton	
Dust							
• Construction							
—Hoist	1000 tons	1700 tons	930 tonnes	1600 tonnes	0.14 ton	0.278 ton	
—Arid	14,000 tons	23,000 tons	13,000 tonnes	22,000 tonnes	2.0 tons	3.8 tons	
Solid Wastes	2.4×10^6 tons	5.0×10^6 tons	2.1×10^6 tonnes	4.6×10^6 tonnes	340 tons	800 tons	
Water Pollutants			Not Determined				
Thermal Discharge	40×10^9 Btu	37×10^9 Btu	40×10^6 MJ	39×10^6 MJ	15×10^6 Btu	15×10^6 Btu	

OCCUPATIONAL SAFETY AND HEALTH

	Reference Energy System Annual Average: Salt	Basalt	Per 10^{12} Btu Energy Produced *: Salt	Basalt	Remarks
Nonradiological					
Disabling injuries	50	130	0.010	0.029	
Fatalities*	1.0	2.6	0.20×10^{-3}	0.59×10^{-3}	
Radiological					
Construction	0.026 man-rem	890 man-rems	3.7×10^{-6} man-rem	0.14 man-rem	
Operation	7.4×10^3 man-rems	7.2×10^3 man-rems	2.9 man-rems	2.9 man-rems	

*Fatalities include permanent disabling injuries.

*In electrical energy (output) at the reactor; see note on page 1.

Table F-11

Pulverized Coal-fired Powerplants: Planning Characteristics

	Twin 250 MW Units	Twin 603 MW Units
Primary Fuel	Subbituminous Coal	Subbituminous Coal
Alternate Fuel	None	None
Fuel Inventory	90 days coal @ rated capacity	90 days coal @ rated capacity
Location	Hermiston, Oregon	Hermiston, Oregon
Rated Capacity (Net MW)	2 units @ 250 MW/unit	2 units @ 603 MW/unit
Peak Capacity (Net MW)	262 MW/unit	633 MW/unit
Heat Rate (Btu/kWh)	11,005	10,856
Availability (%)	77	75
Seasonality	Insignificant seasonal variation	Insignificant seasonal variation
Siting & Licensing Lead Time (mos)	48	48
S&L Shelf Life (yrs)	5	5
Construction Lead Time (mos to first unit/complete plant)	60/72	72/84
Siting & Licensing Cost ($/kW)	$32	$23
S&L Hold Cost ($/kW/yr)	$0.90	$0.80
Construction Cost ($/kW)[1]	$1,749	$1,211
Fuel Inventory Cost ($/kW)	$44	$35
Fixed Fuel Delivery ($/kW/yr)[2]	$8.60	$8.60
Variable Fuel Cost (mills/kWh)	16.4	16.2
Fixed O&M ($/kW/yr)	$32.80	$20.50
Variable O&M (mills/kWh)	2.3	1.9
Capital Replacement	Incl. in O&M	Incl. in O&M
Operating Life (yrs)	40	40

1 Construction costs exclude interest and escalation incurred during construction.

2 Annual unit cost of purchase and maintainance of unit train rolling stock.

Table F-12

AFBC Coal-fired Powerplants: Planning Characteristics

	Single 197 MW Unit	Twin 509 MW Units
Primary Fuel	Subbituminous Coal	Subbituminous Coal
Alternate Fuel	None	None
Fuel Inventory	90 days coal @ rated capacity	90 days coal @ rated capacity
Location	Hermiston, Oregon	Hermiston, Oregon
Rated Capacity (Net MW)	1 unit @ 197 MW/unit	2 units @ 509 MW/unit
Peak Capacity (Net MW)	n/avail	n/avail
Heat Rate (Btu/kWh)	9,885	9,851
Availability (%)	81	74
Seasonality	Insignificant seasonal variation	Insignificant seasonal variation
Siting & Licensing Time (mos)	48	48
S&L Shelf Life (yrs)	5	5
Construction Time (mos to first unit/complete plant)	64	76
Siting & Licensing Cost ($/kW)	$41	$23
S&L Hold Cost ($/kW/yr)	$1.40	$0.50
Construction Cost ($/kW)[1]	$1,764	$1,268
Fuel Inventory Cost ($/kW)	$32	$32
Fixed Fuel Delivery ($/kW/yr)[2]	$8.60	$8.60
Variable Fuel Cost (mills/kWh)	14.7	14.7
Fixed O&M ($/kW/yr)	$37.10	$20.70
Variable O&M (mills/kWh)	4.8	3.1
Capital Replacement ($/kW/yr)	Incl. in O&M	Incl. in O&M
Operating Life (yrs)	30	30

1 Construction costs exclude interest and escalation incurred during construction.

2 Annual cost of purchase and maintainance of unit train rolling stock.

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WESTERN SURFACE COAL MINING (WITH PREPARATION PLANT)

REFERENCE ENERGY SYSTEM

Western surface mine with seam thickness of 23.1 ft. The overburden thickness is 100 ft (stripping ratio) 4/1 (cover/coal). The overburden removal is done by dragline stripping shovels. Bulldozers are used for backfilling and regrading. There is an onsite preparation plant using a wet method of cleaning the coal, and unit trains are used for final shipment. The capacity and production of this mine are relatively close. Terrain, topography, and overburden thickness limit the mine capacity. The estimated production is 85-90% of capacity.

FACILITY OPERATING PARAMETERS

Size:	Coal mine: 9.7 × 10^6 tons/yr Preparation plant: 8.73 × 10^6 tons/yr
Annual Capacity Factor:	85-90%
Annual Energy Production:*	Coal mine: 170 × 10^{12} Btu Preparation plant: 152 × 10^{12} Btu
Efficiency:	90% (preparation plant)
Lifetime:	40 yr

*Heating value of coal = 8750 Btu/lb.

RESOURCES USED

	Quantities Used: Reference Energy System Annual Usage — English Units	Metric Units	Per 10^{12} Btu* Energy Produced	Remarks
Feed Materials				
Raw coal in place	9.7 × 10^6 tons	8.8 × 10^6 tonnes	64 × 10^3 tons	Assumed to be a 40-yr supply
Energy				
Electricity	0.9 × 10^6 kWh	0.9 × 10^6 kWh	6.0 × 10^3 kWh	For preparation plant
Fuel	3.8 × 10^6 gal	14.5 × 10^6 l	25.0 × 10^3 gal	
Ammonium nitrate				
Fuel oil mixture	1.25 × 10^3 tons	1.13 × 10^3 tonnes	8.2 tons	
Water	Unquantifiable			
	Total Usage			
Construction Materials	Not Determined			
Land				
Mine	20 × 10^3 acres	8.09 × 10^3 ha	130 acres	Facilities land includes land for preparation plant and railroad-associated land
Solid waste storage	102 acres	4.05 ha	0.07 acre	
Facilities	16.8 acres	68 ha	0.11 acre	
Mining operations	35 acres	14.2 ha	0.23 acre	
Personnel				
Mine	210 workers		1.4 workers	
Preparation plant	20 workers		0.13 worker	

*Entries computed on basis of output from preparation plant throughout the Summary Sheet.

COSTS

	Reference Energy System (1981 $)	Per 10^{12} Btu Energy Produced (1981 $)	Remarks
Facility			
Capital			
• Mine	$251 × 10^6 total	$1.7 × 10^6 total	Reference year for cost is 1978; 1978 CCI average (I_P = 2776. See Explanatory Notes section and Append B.
• Preparation plant	($15.4-$148) × 10^6 total	($0.10-$1.0) × 10^6 total	
Operation and maintenance			
• Mine	≤ $64 × 10^6/yr	≤ $0.42 × 10^6/yr	
• Preparation plant	($8.9-$109) × 10^6/yr	($0.06-$0.71) × 10^6/yr	
Environmental Controls	Included in above costs		

Table F-13 continued

WESTERN SURFACE COAL MINING (WITH PREPARATION PLANT)

ENVIRONMENTAL RESIDUALS

	Quantities Released: Reference Energy System Annual Levels — English Units	Metric Units	Per 10^{12} Btu Energy Produced	Remarks
Air Pollutants				
Carbon monoxide	147 tons	133 tonnes	0.97 ton	Regulatory Compliance Standards* by component (air pollutants)
Hydrocarbons	47 tons	43 tonnes	0.30 ton	• Thermal Dryer
Oxides of nitrogen	734 tons	667 tonnes	4.8 tons	– Particulates: 0.031 gr/dscf
Sulfur dioxide	48 tons	44 tonnes	0.32 ton	– Opacity: 20%
Particulates	39 tons	35 tonnes	0.26 ton	• Pneumatic Coal Cleaning Equipment
Aldehydes	12 tons	11 tonnes	0.08 ton	– Particulates: 0.018 gr/dscf
Fugitive dust	107 tons	97 tonnes	0.70 ton	– Opacity: 20%
				• Processing and Conveying Equipment
				– Opacity: 20%
Water Pollutants				
For the Western Surface Mine, all water used in the mine activity is recycled. Amount is unquantifiable.				
Solid Waste				
Preparation plant	970×10^3 tons	880 tonnes	6.38 tons	
Noise Pollution		Not Determined		

*CFR 40 Part 60, Subpart V: Coal Preparation Plants (41 FR2232).

PRODUCTS

	Quantities Produced: Reference Energy System Annual Production — English Units	Metric Units	Per 10^{12} Btu Energy Produced	Remarks
Primary				
Coal (cleaned)	8.73×10^6 tons	7.92×10^6 tonnes	57.4×10^3 tons	Represents approximately a 90% recovery from ROM coal output

OCCUPATIONAL HEALTH AND SAFETY

	Reference Energy System Annual	Per 10^{12} Btu Energy Produced	Remarks
Deaths			
Surface mine	0.05	0.29×10^{-3}	
Preparation plant	0.014	0.082×10^{-3}	
Injuries			
Surface mine	13.1	0.08	
Preparation plant	1.8	0.01	

Table F-14

COAL BENEFICIATION

REFERENCE ENERGY SYSTEM

The system is comprised of a number of wet circuit coal beneficiation devices including crushers, scalping screens, rotary breaker, vibrating screens, jigs, thickeners, concentrating tables, flotation circuits, and thermal drying. These devices are designed to remove unwanted components from the raw coal, such as ash to improve the energy content or sulfur to reduce the sulfur oxide emissions. The resultant cleaned coal can then be utilized in a manner essentially identical to other unprocessed coal that has not undergone this degree of beneficiation.

FACILITY OPERATING PARAMETERS

Size:	2.857×10^6 tons/yr
Annual Capacity Factor:	83% (based on 230 days/yr of operation)
Annual Energy Production:	55.0×10^{12} Btu
Efficiency:	87.5%
Lifetime:	20 yr

RESOURCES USED

	Quantities Used: Reference Energy System Annual Usage — English Units	Quantities Used: Reference Energy System Annual Usage — Metric Units	Per 10^{12} Btu Energy Produced	Remarks
Feed Materials				
Coal (run-of-mine)	2.88×10^6 tons	2.59×10^6 tonnes	51.945×10^3 tons	
Energy				
Electricity	11×10^6 kWh	11×10^6 kWh	0.20×10^6 kWh	
Oil	32×10^9 Btu	34×10^{12} J	0.59×10^9 Btu	
Processing Materials		Not Determined		
Water				
Consumptive uses	200 acre-ft	250×10^6 l	3.7 acre-ft	
	Total Usage			
Construction Materials		Not Determined		
Land	240 acres	96 ha	4.3 acres	
Personnel				
Construction (1 yr)	440 workers		8.1 workers	
Operation and maintenance	82 workers		1.5 workers	

COSTS

	Reference Energy System	Per 10^{12} Btu Energy Produced	Remarks
Facility			
	(1981 $)		Reference year for costs is 1976. 1976 CCI average (I_R) = 2401. See Explanatory Notes Section.
Construction (1 yr)	$\$35.3 \times 10^6$ total	$\$0.63 \times 10^6$ total	
Operation and maintenance	$\$26.5 \times 10^6$/yr	$\$0.47 \times 10^6$/yr	
Environmental Controls	Not Determined		

Table F-14 continued

COAL BENEFICIATION

ENVIRONMENTAL RESIDUALS

	Quantities Released			
	Reference Energy System Annual Levels			
	English Units	Metric Units	Per 10^{12} Btu Energy Produced	Remarks
Air Pollutants				
Particulates	50 tons	40 tonnes	0.9 ton	Regulatory Compliance Standards* by component:
Sulfur dioxide	0.3 ton	0.2 tonne	0.005 ton	
Oxides of nitrogen	33 tons	30 tonnes	0.6 ton	
Hydrocarbons	11 tons	10 tonnes	0.2 ton	
Carbon monoxide	11 tons	10 tonnes	0.2 ton	
Water Pollutants				• Thermal Dryer
Total dissolved solids	1.82×10^3 tons	1.65×10^3 tonnes	33 tons	– Particulates – 0.031 gr/dscf
• Iron	0.4 ton	0.3 tonne	0.007 ton	
• Manganese	1.6 tons	1.5 tonnes	0.03 ton	– Opacity – 20%
• Aluminum	2.2 tons	2.0 tonnes	0.4 ton	
• Zinc	0.3 ton	0.2 tonne	0.005 ton	
• Nickel	0.16 ton	0.15 tonne	0.003 ton	• Pneumatic Coal Cleaning Equipment
Total suspended solids	33 tons	30 tonnes	0.6 ton	
• Iron	3.3 tons	3.0 tonnes	0.06 ton	
Ammonia	3.0 tons	2.0 tonnes	0.05 ton	
Sulfates	990 tons	900 tonnes	18.0 tons	– Particulates – 0.018 gr/dscf
Solid Wastes				– Opacity – 20%
Course cleaning	0.11×10^3 tons	0.1×10^3 tonnes	0.002×10^3 tons	
Primary cleaning	559×10^3 tons	508×10^3 tonnes	10.16×10^3 tons	• Processing and Conveying Equipment
Froth flotation	290×10^3 tons	260×10^3 tonnes	5.3×10^3 tons	
Breaking and sizing	0.11×10^3 tons	0.1×10^3 tonnes	0.002×10^3 tons	
Total	849×10^3 tons	768×10^3 tonnes	15.5×10^3 tons	– Opacity – 20%
Thermal Discharge				
		Not Determined		
Noise Pollution				
May affect workers but not nearby receptors				

*CFR 40 Part 60, Subpart V: Coal Preparation Plants (41 FR 2232)

PRODUCTS

	Quantities Produced			
	Reference Energy System Annual Production			
	English Units	Metric Units	Per 10^{12} Btu Energy Produced	Remarks
Primary				
Coal (cleaned)	2.00×10^6 tons	1.82×10^6 tonnes	36.4×10^3 tons	
Recoverables/Recyclables				
		Not Determined		

OCCUPATIONAL SAFETY AND HEALTH

Not Determined

Table F-15

WESTERN COAL UNIT TRAIN

REFERENCE ENERGY SYSTEM

Typical western unit train systems are comprised of 100 cars each holding 100 tons and four diesel locomotives of 3000 hp each. The train operates between two fixed locations on a dedicated basis. This example assumes a train traveling 700 mi one way and making 90 trips per year. Ten spare cars are reserved for each train system.

FACILITY OPERATING PARAMETERS

Size:	100 cars, 100 tons per car, 10×10^3 tons per train
Annual Capacity Factor:	Not determined
Annual Energy Production:	17.01×10^{12} Btu (coal transported)
Efficiency:	99.69% based on $\frac{\text{energy delivered}}{\text{energy loaded + energy expended}}$
Lifetime:	30 yr

RESOURCES USED

	Quantities Used			
	Reference Energy System Annual Usage		Per 10^{12} Btu Energy Produced	Remarks
	English Units	Metric Units		
Feed Materials				
Coal transported	900×10^3 tons	817×10^3 tonnes	52.9×10^3 tons	
Energy				
Diesel	221×10^9 Btu	233×10^{12} J	13.0×10^9 Btu	
	Total Usage			
Construction Materials				
Aluminum	43.2 tons	39.2 tonnes	2.54 tons	
Brass and bronze casting	17.4 tons	15.8 tonnes	1.02 tons	
Chromium	2.2 tons	2.0 tonnes	0.13 ton	
Copper	59.7 tons	54.2 tonnes	3.51 tons	
Iron		Not Determined		
Manganese	30.6 tons	27.8 tonnes	1.80 tons	
Nickel	0.51 ton	0.46 tonne	0.03 ton	
Steel	4.27×10^3 tons	3.88×10^3 tonnes	251 tons	
Land				
Land value has been excluded as it cannot be exclusively associated with coal transportation				
Personnel				
Construction		Not Determined		
Operation and maintenance	120 workers		7.02 workers	

COSTS

	Reference Energy System	Per 10^{12} Btu Energy Produced	Remarks
Facility	(1981 $)		
Construction	$\$9.80 \times 10^6$ total	$\$0.578 \times 10^6$ total	Reference year for cost is 1978. 1978 CCI average (I_R) = 2776. See Explanatory Notes Section.
Operation and maintenance	$\$8.74 \times 10^6$/yr	$\$0.513 \times 10^6$/yr	

WESTERN COAL UNIT TRAIN

ENVIRONMENTAL RESIDUALS

	Quantities Released			
	Reference Energy System Annual Levels			
	English Units	Metric Units	Per 10^{12} Btu Energy Produced	Remarks
Air Pollutants				
Particulates	2.38×10^3 tons	2.16×10^3 tonnes	140 tons	
Sulfur dioxide	90 tons	80 tonnes	5.0 tons	
Oxides of nitrogen	75 tons	68 tonnes	4.4 tons	
Hydrocarbons	61 tons	56 tonnes	3.6 tons	
Carbon monoxide	78 tons	71 tonnes	4.6 tons	
Aldehydes	14 tons	12 tonnes	0.8 ton	
Noise Pollution*				
In-cab noise level		≥ 112 dBA		Federal design levels:
100 ft from moving train		~ 95 dBA		55 dBA — residence
1000 ft from moving train		~ 75 dBA		75 dBA — open land
Whistle noise at 1000 ft		≤ 85 dBA		

*Noise cannot be expressd in terms of energy produced.

PRODUCTS

	Quantities Produced			
	Reference Energy System Annual Production			
	English Units	Metric Units	Per 10^{12} Btu Energy Produced	Remarks
Primary				
Coal transported	900×10^3 tons	817×10^3 tonnes	52.9×10^3 tons	

OCCUPATIONAL SAFETY AND HEALTH

Not Determined

WESTERN COAL CONVENTIONAL TRAIN

REFERENCE ENERGY SYSTEM

A conventional freight train is assumed to be made up of 85 freight cars, 17 of which carry 86 tons each of coal. The train may have multiple destinations and thus be made up of a mix of cars from many sources requiring more than one make-up and breakdown of the train during a single trip. This example assumes a 300-mi one-way trip using a diesel-powered locomotive. The train is assumed to make the equivalent of 20 round trips per year.

FACILITY OPERATING PARAMETERS

Size:	29×10^3 tons/yr (transported)
Annual Capacity Factor:	Not determined
Annual Energy Production:	0.548×10^{12} Btu (coal transported)
Efficiency:	98.3% based on $\frac{\text{coal delivered}}{\text{coal loaded + energy consumed}}$
Lifetime:	30 yr

RESOURCES USED

	Quantities Used: Reference Energy System Annual Usage — English Units	Metric Units	Per 10^{12} Btu Energy Produced	Remarks
Feed Materials				
Coal transported	29.1×10^3 tons	26.4×10^3 tonnes	53.04×10^3 tons	
Energy				
Diesel fuel	8.06×10^9 Btu	8.50×10^{12} J	14.7×10^9 Btu	
	Total Usage			
Construction Materials				
Aluminum	4.20 tons	3.82 tonnes	7.67 tons	
Brass and bronze	2.48 tons	2.25 tonnes	4.52 tons	
Chromium	0.30 ton	0.27 tonne	0.54 ton	
Copper	7.27 tons	6.60 tonnes	13.27 tons	
Iron		Not Determined		
Manganese	4.48 tons	4.07 tonnes	8.18 tons	
Nickel	0.066 ton	0.060 tonne	0.12 ton	
Steel	6.28 tons	5.71 tonnes	11.47 tons	
Land				
Land use value has been excluded as it cannot be exclusively associated with coal transportation				
Personnel				
Construction		Not Determined		
Operation and maintenance	2.92 workers		5.32 workers	

COSTS

	Reference Energy System	Per 10^{12} Btu Energy Produced	Remarks
Facility			
	(1981 $)		Reference year for cost is 1978. 1978 CCI average (I_R) = 2776. See Explanatory Notes Section.
Construction	$\$1.24 \times 10^6$ total	$\$2.27 \times 10^6$ total	
Operation and maintenance	$\$0.837 \times 10^6$/yr	$\$1.53 \times 10^6$/yr	

WESTERN COAL CONVENTIONAL TRAIN

ENVIRONMENTAL RESIDUALS

	Quantities Released			
	Reference Energy System Annual Levels			
	English Units	Metric Units	Per 10^{12} Btu Energy Produced	Remarks
Air Pollutants				
Particulates	75.8 tons	68.8 tonnes	138.4 tons	Includes particulates from locomotives and fugitive emissions
Sulfur dioxide	1.9 tons	1.7 tonnes	3.5 tons	
Oxides of nitrogen	2.2 tons	2.0 tonnes	4.0 tons	
Hydrocarbons	1.5 tons	1.3 tonnes	2.7 tons	
Carbon monoxide	2.0 tons	1.8 tonnes	3.7 tons	
Aldehydes, etc.	0.33 ton	0.30 tonne	0.6 ton	
Noise Pollution*				
In cab of locomotive		> 112 dBA		Federal design levels:
100 ft from moving train		~ 95 dBA		55 dBA — residence
1000 ft from moving train		~ 75 dBA		75 dBA — open land
Whistle noise at 1000 ft		≤ 85 dBA		

*Noise cannot be expressd in terms of energy produced.

PRODUCTS

	Quantities Produced			
	Reference Energy System Annual Production			
	English Units	Metric Units	Per 10^{12} Btu Energy Produced	Remarks
Primary				
Coal transported	29.0×10^3 tons	26.3×10^3 tonnes	52.9×10^3 tons	

OCCUPATIONAL SAFETY AND HEALTH

Not Determined

Table F-17

COAL-FIRED POWER PLANT — WESTERN COAL

REFERENCE ENERGY SYSTEM

The system is composed of a conventional steam electric power plant using typical western low-sulfur subbituminous coal supplied by a unit train operation. No cogeneration is included. Environmental control systems include electrostatic precipitators for particulate control, wet lime/limestone scrubbers for sulfur dioxide control, onsite solid waste disposal, and onsite water treatment for water recirculation to eliminate liquid discharges. The plant is assumed to be subject to current regulations.

FACILITY OPERATING PARAMETERS

Size:	500 MWe
Annual Capacity Factor:	80%
Annual Energy Production:	12×10^{12} Btu
Efficiency:	35%
Lifetime:	30 yr

RESOURCES USED

	Quantities Used: Reference Energy System Annual Usage — English Units	Quantities Used: Reference Energy System Annual Usage — Metric Units	Per 10^{12} Btu Energy Produced	Remarks
Feed Materials				
Run-of-mine subbituminous coal	2.11×10^6 tons	1.92×10^6 tonnes	0.18×10^6 tons	Low-sulfur coal (0.63% sulfur)
Processing Materials				
Limestone to sulfur dioxide scrubber	32×10^3 tons	29×10^3 tonnes	2.7×10^3 tons	
Fly ash (sludge fixing)	34×10^3 tons	30.8×10^3 tonnes	2.9×10^3 tons	
Water				
Dust control and SO_2 control make-up	445 acre-ft	0.55×10^9 l	37 acre-ft	Quality not critical
Cooling tower make-up water	4.9×10^3 acre-ft	6.1×10^9 l	409 acre-ft	Wet cooling only
	Total Usage			
Construction Materials				
Concrete	87.5×10^3 tons	79.5×10^3 tonnes	7.29×10^3 tons	
Carbon steel	26.1×10^3 tons	23.7×10^3 tonnes	2.18×10^3 tons	
Alloy steel	1.39×10^3 tons	1.26×10^3 tonnes	116 tons	
Stainless steel	465 tons	423 tonnes	38.8 tons	
Copper	736 tons	669 tonnes	61.3 tons	
Aluminum	231 tons	210 tonnes	19.2 tons	
Manganese	204 tons	185 tonnes	17.0 tons	
Chromium	121 tons	110 tonnes	10.1 tons	
Nickel	18.8 tons	17.1 tonnes	1.6 tons	
Cast iron	341 tons	310 tonnes	28.5 tons	
Land				
Power plant and solid waste disposal (ash and sludge)	5.2 acres	2.1 ha	0.4 acre	Sufficient land needed for a 30-yr lifetime
Personnel				
Construction	Not Determined			
Operation and maintenance				
• Power plant	135 workers		1.7 workers	

COSTS

	Reference Energy System	Per 10^{12} Btu Energy Produced	Remarks
Facility	(January 1981 $)		
Construction (5 yr)	$\$487 \times 10^6$ total	$\$40.6 \times 10^6$ total	Exclusive of fuel costs
Operation and maintenance	$\$5.4 \times 10^6$/yr	$\$0.45 \times 10^6$/yr	
Environmental Controls*			
Construction	$\$115 \times 10^6$ total	$\$9.6 \times 10^6$ total	Included in Facility Costs, above
Operation and maintenance	$\$2.8 \times 10^6$/yr	$\$0.23 \times 10^6$/yr	

*Includes baghouse, scrubbers, NO_x control, H_2O treatment, noise control, and solids handling.

COAL-FIRED POWER PLANT — WESTERN COAL

ENVIRONMENTAL RESIDUALS

	Quantities Released: Reference Energy System Annual Levels — English Units	Metric Units	Per 10^{12} Btu Energy Produced	Remarks
Air Pollutants				
Fugitive coal dust (unit train operation)	5.2×10^3 tons	4.7×10^3 tonnes	0.43×10^3 tons	
Sulfur dioxide	7.15×10^3 tons	6.49×10^3 tonnes	0.60×10^3 tons	(<0.6 lb/10^6 Btu*
Oxides of nitrogen	10.2×10^3 tons	9.26×10^3 tonnes	0.85×10^3 tons	0.50 lb/10^6 Btu*
Total suspended particulates	0.525×10^3 tons	0.48×10^3 tonnes	0.04×10^3 tons	0.03 lb/10^6 Btu*
Nonmethane hydrocarbons	0.32×10^3 tons	0.29×10^3 tonnes	0.03×10^3 tons	
Carbon monoxide	1.05×10^3 tons	0.95×10^3 tonnes	0.09×10^3 tons	
Carbon dioxide	3.7×10^6 tons	3.4×10^6 tonnes	0.31×10^6 tons	
Arsenic	128 lb	58.1 kg	10.7 lb	
Beryllium		Not Determined		
Cadmium	11.7 lb	5.3 kg	0.98 lb	
Manganese	0.6 lb	0.3 kg	0.05 lb	
Lead	32.1 lb	14.6 kg	2.68 lb	
Selenium	2.0 lb	0.9 kg	0.17 lb	
Uranium	718 lb	326 kg	59.8 lb	
Zinc	286 lb	130 kg	23.8 lb	
Radium-226	1.4×10^{-3} Ci	1.4×10^{-3} Ci	0.12×10^{-3} Ci	
Solid Wastes				
Coal preparation (at mine)	210×10^3 tons	190×10^3 tonnes	17.5×10^3 tons	
Boiler bottom ash (dry)	34×10^3 tons	31×10^3 tonnes	2.8×10^3 tons	
Boiler fly ash (dry)	101×10^3 tons	91.7×10^3 tonnes	8.4×10^3 tons	
Sulfur dioxide scrubber sludge (dry)	43×10^3 tons	39×10^3 tonnes	3.6×10^3 tons	
Total solid waste to onsite disposal	177×10^3 tons	161×10^3 tonnes	14.8×10^3 tons	
Thermal Discharge	21.0×10^{12} Btu	22.1×10^{15} J	1.7×10^{12} Btu	Cooling towers and stacks

*NSPS regulatory compliance level (70% reduction) for 0.63 percent sulfur coal with heating value of coal at 8100 Btu/lb.

PRODUCTS

	Quantities Produced: Reference Energy System Annual Production — English Units	Metric Units	Per 10^{12} Btu Energy Produced	Remarks
Primary				
Electricity	12×10^{12} Btu	13×10^{15} J	1.0×10^{12} Btu	
Byproducts				
Fly ash (for sale)	34×10^3 tons	31×10^3 tonnes	2.9×10^3 tons	
Recoverables/Recyclables				
Water to recycle	196×10^6 gal	742×10^6 l	16.3×10^6 gal	Zero-discharge design

OCCUPATIONAL SAFETY AND HEALTH

	Reference Energy System Annual	Per 10^{12} Btu Energy Produced	Remarks
Deaths			
Power plant	0–0.11	$0\text{–}9.5 \times 10^{-3}$	
Injuries			
Power plant	1.9–2.3	0.16–0.19	

Table F-18

ATMOSPHERIC FLUIDIZED BED COMBUSTION — WESTERN SUBBITUMINOUS COAL

REFERENCE ENERGY SYSTEM

Steam electric power generation facility utilizing a fluidized bed combustion system in which the small pieces of coal are suspended along with similarly sized bed material in a continuously moving mass of air. The bed material referred to as a sorbent and composed of crushed limestone or dolomite is responsible for the capture of a portion of the sulfur dioxide generated during combustion. Other environmental control systems include a baghouse filter with greater than 98% efficiency and conventional water treatment facilities as necessary. The lower combustion temperatures of the system also serve to minimize nitrogen oxide formation.

FACILITY OPERATING PARAMETERS

Size:	536 MWe
Annual Capacity Factor:	96%
Annual Energy Production:	15.2×10^{12} Btu
Efficiency:	34.4%
Lifetime:	20 yr

RESOURCES USED

	Quantities Used: Reference Energy System Annual Usage — English Units	Metric Units	Per 10^{12} Btu Energy Produced	Remarks
Feed Materials				
Coal (subbituminous western)	2.75×10^6 tons	2.50×10^6 tonnes	181×10^3 tons	8.05×10^3 Btu/lb
Processing Materials				
Limestone (sorbent bed material)	194×10^3 tons	177×10^3 tonnes	12.8×10^3 tons	
Water				
Consumptive uses	8.86×10^3 acre-ft	10.9×10^8 l	583 acre-ft	
	Total Usage			
Construction Materials		Not Determined		
Land	442 acres	179 ha	29.1 acres	
Personnel				
Approximately same as conventional power station of equivalent capacity				

COSTS

	Reference Energy System	Per 10^{12} Btu Energy Produced	Remarks
Facility			
	(1981 $)		Reference year for costs (facility only) is 1977. 1977 CCI average (I_R) = 2577. See Explanatory Notes Section.
Construction	381×10^6 total	25.1×10^6 total	
Operation and maintenance	7.42×10^6/yr	0.488×10^6/yr	
Environmental Controls			
Capital	49.6×10^6 total	3.3×10^6 total	

ATMOSPHERIC FLUIDIZED BED COMBUSTION — WESTERN SUBBITUMINOUS COAL

ENVIRONMENTAL RESIDUALS

	Quantities Released			
	Reference Energy System Annual Levels			
	English Units	Metric Units	Per 10^{12} Btu Energy Produced	Remarks
Air Pollutants				
Sulfur dioxide	26×10^3 tons	23×10^3 tonnes	1.7×10^3 tons	
Oxides of nitrogen	8.85×10^3 tons	8.03×10^3 tonnes	582 tons	
Particulates	2.22×10^3 tons	2.01×10^3 tonnes	146 tons	
Hydrocarbons	Approximately same values as conventional power station of equivalent capacity			
Carbon monoxide				
Water Pollutants				
Approximately same values as conventional power station of equivalent capacity				
Solid Wastes				
Dry weight	384×10^3 tons	349×10^3 tonnes	25.3×10^3 tons	
Thermal Discharge		Not Determined		

PRODUCTS

	Quantities Produced			
	Reference Energy System Annual Production			
	English Units	Metric Units	Per 10^{12} Btu Energy Produced	Remarks
Primary				
Electricity	4.45×10^9 kWh	4.45×10^9 kWh	0.293×10^9 kWh	
Byproducts		Not Determined		
Recoverables/Recyclables		Not Determined		

OCCUPATIONAL SAFETY AND HEALTH

Not Determined

Table F-19

Combustion Turbine and Combined-Cycle Projects: Planning Characteristics

	Simple-Cycle Combustion Turbines	Combined-Cycle Combustion Turbines
Primary Fuel	Natural Gas	Natural Gas
Alternate Fuel	No. 2 Fuel Oil	No. 2 Fuel Oil
Fuel Inventory	No. 2 Fuel Oil for 14 days operation at rated capacity	No. 2 Fuel Oil for 14 days operation at rated capacity
Location	Hermiston, Oregon	Hermiston, Oregon
Rated Capacity (Net MW @ 59 F)	2 units @ 139 MW/unit	420 MW
Peak Capacity (Net MW @ 35 F)	2 units @ 152 MW/unit	452 MW
Heat Rate @ HHV (Btu/kWh)	11,480	7,620
Availability (%)	85	83
Seasonality	Winter peaking	Winter peaking
Siting & Licensing Lead Time (mos)	24	24
S&L Shelf Life (yrs)	5	5
Construction Lead Time (mos)	24	36
Siting & Licensing Cost ($/kW)	$5	$6
S&L Hold Cost ($/kW/yr)	$0.50	$0.40
Construction Cost ($/kW)[1]	$535	$621
Fuel Inventory Cost ($/kW)	$14	$9
Fixed Fuel Delivery ($/kW/yr)	none	none
Variable Fuel Cost (mills/kWh)	36.3[2]	24.1[3]
Fixed O&M ($/kW/yr)	$0.63	$7.51
Variable O&M (mills/kWh)	0.5	0.1
Capital Replacement	Incl. in O&M	Incl. in O&M
Operating Life (yrs)	30	30

1 Construction costs exclude interest and escalation incurred during construction.

2 "Hybrid" gas contract (for backing up nonfirm hydropower).

3 "Hybrid" gas contract (for backing up nonfirm hydropower).. Firm gas service (for baseload plant) would be 27.9 mills per kilowatt-hour.

APPENDIX G

APPENDIX G

INFORMATION ON MODELS USED

G-1

The System Analysis Model and

Least Cost Mix Model

Description of Models and Their Use

SAM

The System Analysis Model (SAM) was used to generate data for the PSCEIS. SAM simulates, monthly for 20 years, the operation of the Pacific Northwest hydro/thermal system. It provides information regarding the reliability of the system, the expected operation of individual thermal resources, and the expected operation of the hydro system, including reservoir elevations, flows, and spill. SAM input includes information from The Least Cost Mix Model (LCMM) regarding future resource development.

The SAM simulates the Pacific Northwest's power system. It models the operation of existing and planned resources to meet load, season by season and month by month over a 20-year planning period. The model simulates both planning policies and operational policies, on a monthly basis.

The following major components of the region's power system are accounted for in SAM:

- policies of regional planning and operation,
- uncertainties of loads and resources,
- physics of hydro and thermal resources,
- nonpower constraints on the hydro system,
- transactions outside the region, and
- net regional revenue requirements.

The model makes assumptions about the region and the load to be served, so that the region defined for this model conforms to that mandated in the Pacific Northwest Power Act. The defined region, however, is assumed to be a single-owner system.

SAM models the region's energy resources: hydro, thermal (including nuclear plants, combustion turbines, and coal projects), and miscellaneous (such as renewables, cogeneration units, existing steam plants, small diesel generators). Conservation is also considered a resource.

SAM models uncertainty in the following:

- Regional load. The energy load reflects the variations in weather conditions and economic trends. SAM does not, however, consider load growth uncertainty.

- Major hydro. Hydro conditions are selected from a detailed 40-year historical record of individual project inflows.

- Thermal plants. The two sources of uncertainty modeled are the availability of a thermal plant and the arrival date for a new plant.

SAM simulates these uncertainties using a Monte Carlo process, randomly selecting values for each of these variables for each month of the study period (in this case, 20 years). SAM runs each study many times, each time selecting a new set of variables. For this EIS, each study was run 200 times. Each alternative used the same 200 sets of variables for each month of the 20 years. In most cases, values for the 200 simulations were averaged (monthly or annually). However, for certain analyses (for example, fish impacts), individual simulations were examined.

Given the loads, resources, and the established policies for the region, SAM operates the hydro system in conjunction with the non-hydro resources to meet observed loads in the most economic manner possible. Included in these policies are the following economic considerations:

- All available regional resources are used to meet firm regional load.
- A portion of the direct service industrial customer load is not firm and can be restricted and interrupted, but is met, provided that reasonably priced resources are available. (Note that this changes depending on the alternative being studied.)
- If the power outlook and streamflow forecast permit, the region sells energy to California.

SAM models three major decision points in operating a hydro system:

(1) the annual planning process, which determines how to shift and shape water over a two-year critical period; (2) the period planning process, which looks at such items as firm surplus, the runoff forecast, and refill, to determine the use of hydro over the following four months; and (3) the period operating process, which dispatches Pacific Northwest resources to meet loads in the most economic manner possible. If there is sufficient energy, economy energy sales are made to California, taking into account the Intertie Access Policy, available secondary energy from Canada, and the California market.

Included in SAM is a model of BC Hydro's resources and loads. BC Hydro's resources are run to meet its own loads; any additional energy is available for sale to the U.S. BC Hydro may use this energy to directly serve any unmet PNW load (firm or nonfirm), to displace higher cost PNW resources, or to sell to California markets.

Modeling of Power Sales Contracts in SAM. In SAM, the region is assumed to be a single-owner system, and regional resources are operated to meet the total regional load. With one major exception, specific provisions of individual Power Sales Contracts between BPA and its customers are not specifically modeled by SAM, and would have little or no effect even if they were modeled.

In other words, SAM is interested in knowing what the total regional firm load is, but not the breakdown of individual loads for each utility. Given the total load, the model will dispatch resources as required to meet that load.

The major exception to this is in the Direct Service Industries' loads. A portion of the DSI load is not firm and can be interrupted or restricted, but will be met as if it were firm if certain conditions are met. These provisions of the Power Sales Contracts and the way SAM models them are discussed in detail below under "Service to DSI Loads."

A more complete explanation of SAM is in the Pacific Northwest Utilities Conference Committee's Methods and Theory Manual, November 1983.

LCMM

The Least Cost Mix Model (LCMM) formulates projected loads, existing resources, potential new resources and their costs, and the potential for sale or resale of resources as a linear program. The objective is to minimize overall cost while meeting the load requirement. The LCMM considers the costs and benefits of adding or delaying construction of each available resource. The optimal mix and timing of potential new resources are selected. Construction schedules are provided for conservation, renewables, coal plants, combustion turbines, and WNP-1 and -3. The model selects a mix of resources in order to meet load (accounting for existing and committed capacity of resources), within the limits of project availability, reserve margins, hydro availability on a critical water basis, and maintenance requirements.

The LCMM was run for each alternative in which a different amount of DSI load was considered to be firm. Changing the amount of regional firm load leads to different resource requirements. Those alternatives (1.2 and 4.4) which result in a change in system operation but do not change the amount of firm load, did not require a separate run of the LCMM.

Model Assumptions

Loads

DSI loads are from BPA's January 1988 medium long-term DSI load forecast. Firm DSI loads range from 2245 average MW (aMW) in 1989 to 1924 aMW in 2008, while nonfirm loads range from 853 to 698 aMW in 2008. All other Pacific Northwest loads are based on BPA's July 1986 long-range medium load forecast reduced by Model Conservation Standards.

Sensitivities involving Pacific Northwest loads used low and high forecasts for DSI loads as well as total regional loads. Firm DSI loads ranged from 1991 to 527 aMW under the low load case, and from 2454 to 2494 aMW in the high case. Low nonfirm DSI loads ranged from 696 to 176 aMW, while the high loads were between 852 and 884 aMW. Regional loads range from 18,000 to 16,000 aMW in the low load case and from 19,000 to 30,000 aMW in the high case.

BC Hydro loads and resources are based on their March 1988 Twenty-Year Resource Plan. The Non-Treaty Storage Agreement was assumed to expire in 1993.

California loads are based on the medium Common Forecasting Methodology (CFM-6) forecast. These loads range from approximately 24,000 to 35,000 aMW over the study horizon. For sensitivity analyses, it was assumed the load varies plus (high) and minus (low) 2000 MW from the medium forecast.

Resources

The Pacific Northwest resources include existing hydro and thermal plants, and currently planned resources, as published in the 1987 Pacific Northwest Loads and Resources, excluding Hanford. Additional resources were included as chosen by the Least Cost Mix Model to achieve load/resource balance. See Figure G-1 - 1.

BPA's April 1988 medium long-term gas price forecast was assumed. Prices range from 22 to 44 mills/kwh over the study horizon. For the sensitivity analyses involving gas prices, the low and high long-term forecasts were used. Low gas prices range form 16 to 23 mills/kwh, while high gas prices range from 33 to 63 mills/kwh over the study horizon.

Service to DSI loads

The following gives an overview of DSI restriction rights as modeled in SAM. Under the alternative descriptions, only changes from the No-Action Alternative are mentioned. All assumptions for the alternatives are effective for the entire study horizon, 1989 through 2008. For more details regarding DSI load service as modeled in SAM see the Pacific Northwest Utilities Conference Committee's Methods and Theory Manual, November 1983.

No-Action Alternative

First Quartile:

The first quartile is interruptible. Resources are not planned to meet this load on a firm basis. However, the First Quartile may be served with surplus firm, nonfirm, or outside purchases. In addition, if the coordinated system has refilled at the end of July, shifted FELCC, provisional energy, and flexibility may be used to serve the First Quartile in the fall (September - December). These are limited respectively to 1,000,000 MWh, 800,000 MWh, and 750,000 MWh; however, this is currently sufficient to serve the entire fall First Quartile load. If shift, provisional, or flexibility have been committed to First Quartile service, the system is operated to meet this load during the fall as if it were firm. In exchange for service to the First Quartile with these borrowing techniques, future restriction rights to the Third Quartile load are granted.

Second Quartile:

The second quartile is considered to be firm with one exception. If a planned resource is delayed or does not perform as expected, restriction rights may be granted. These rights are the amount of the delay (or underperformance), limited by the lesser of the projected deficit for the current year and the amount of the second quartile.

Third Quartile:

The third quartile is also considered to be firm; however, it may be restricted as a result of using borrowing techniques to serve the top quartile. Depending on which technique was used, the restriction rights are granted either in the current year or the upcoming operating year. If the hydro system refills at the end of the year, any restriction rights for the upcoming year are canceled.

Additional notes:

The remaining quartile is modeled as entirely firm. SAM is an energy model and so does not consider restriction rights on a capacity basis. Also, restriction rights are not automatically exercised even though they are available. A reasonable attempt is made to serve the load prior to any restrictions occurring.

Alternative 1.2

For this alternative, borrowing techniques are no longer available for service to the top quartile. As a result, the top quartile may only be served with surplus firm, nonfirm, or outside purchases.

Alternative 4.1 (100 percent)

Under this alternative, all four quartiles are considered interruptible. Resources are not planned to meet any of this load. Instead it is to be served with surplus firm, nonfirm, or outside purchases. Borrowing techniques, however, are not available. Without a firm quartile there can be no associated restriction rights to backup the borrowed energy.

Alternative 4.1 (50 percent)

For this alternative, two of the four quartiles have the same interruption rights and service rights as does the top quartile currently. Resources are not planned for these two quartiles. The remaining two quartiles are still considered firm, with certain restriction rights. Since this firm portion is available to provide these restriction rights as backup, borrowing techniques are still allowed at their current levels. For modeling purposes, the second quartile was chosen to be the additional interruptible quartile. As a result, this alternative has no restriction rights due to plant delay.

Alternative 4.3

All loads under this alternative are firm. Resources are acquired to meet the top quartile load. There are no restriction rights for any quartile.

Alternative 4.4

Under this alternative, second quartile restriction rights due to plant delay are no longer allowed. Plant delay, however, still occurs as in the No-Action Alternative.

Table G-1-1

DSI Loads in SAM
Annual Average MW
Medium Northwest Loads

Year	No Action		Alt. 4.1, A		Alt. 4.1, B		Alt. 4.3	
	Firm	Interruptible	Firm	Interruptible	Firm	Interruptible	Firm	Interruptible
1989	2245	853	1496	1602	0	3098	3098	0
1990	2145	835	1430	1550	0	2980	2980	0
1991	2076	822	1384	1514	0	2898	2898	0
1992	1998	769	1332	1435	0	2767	2767	0
1993	1960	733	1306	1387	0	2693	2693	0
1994	1965	711	1310	1366	0	2676	2676	0
1995	1966	712	1311	1367	0	2678	2678	0
1996	1969	712	1313	1368	0	2681	2681	0
1997	1989	720	1326	1383	0	2709	2709	0
1998	1956	708	1304	1360	0	2664	2664	0
1999	1943	704	1296	1351	0	2647	2647	0
2000	1948	706	1299	1355	0	2654	2654	0
2001	1920	696	1280	1336	0	2616	2616	0
2002	1918	696	1279	1335	0	2614	2614	0
2003	1933	701	1289	1345	0	2634	2634	0
2004	1958	710	1306	1362	0	2668	2668	0
2005	1958	709	1305	1362	0	2667	2667	0
2006	1935	701	1290	1346	0	2636	2636	0
2007	1925	698	1283	1340	0	2623	2623	0
2008	1924	698	1282	1340	0	2622	2622	0

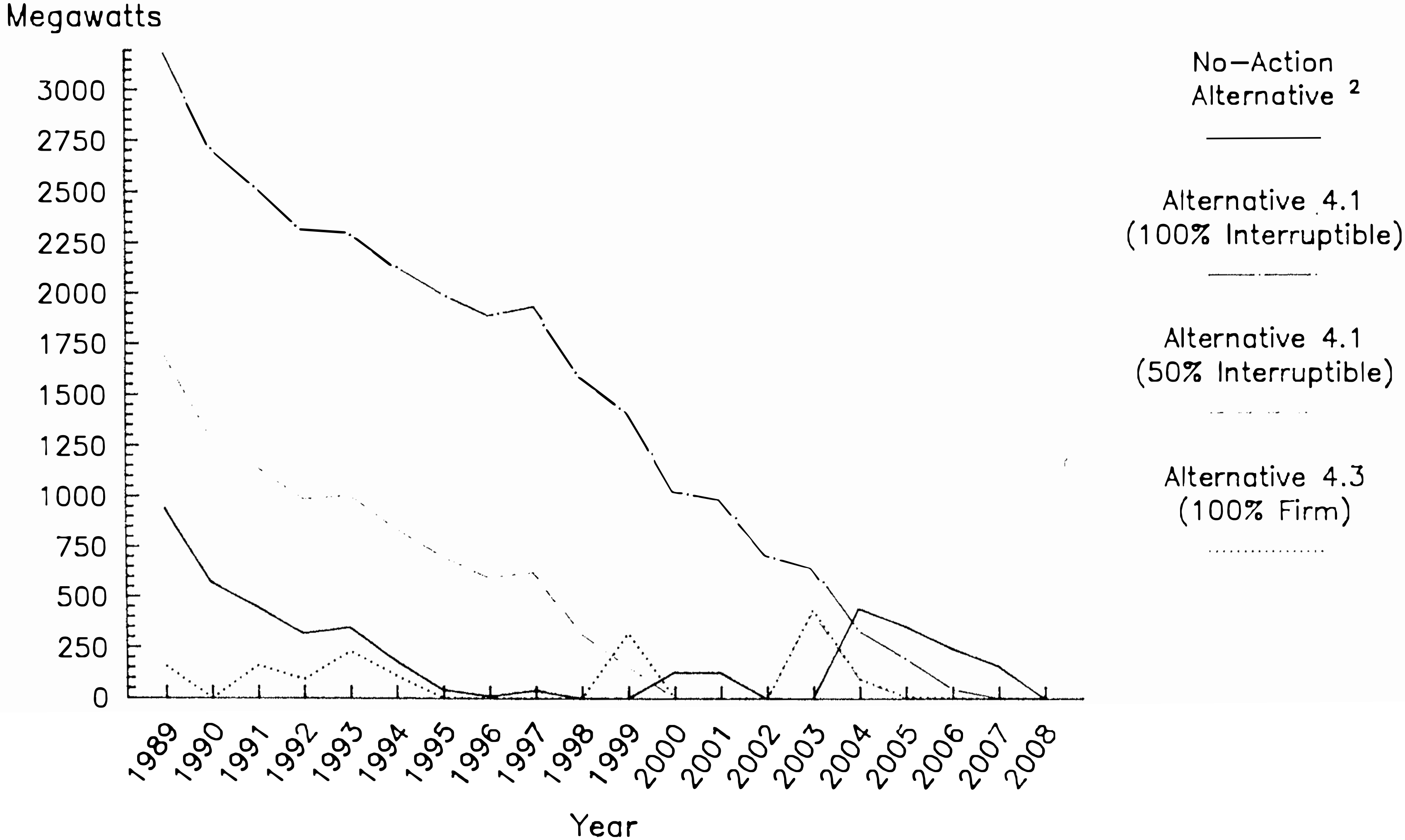
TABLE G-1-2

DSI Loads in SAM
Annual Average MW
High Northwest Loads

	No Action		Alt. 4.1, A		Alt. 4.1, B		Alt. 4.3	
Year	Firm	Interruptible	Firm	Interruptible	Firm	Interruptible	Firm	Interruptible
1989	2452	852	1635	1669	0	3304	3304	0
1990	2460	854	1640	1674	0	3314	3314	0
1991	2463	877	1642	1698	0	3340	3340	0
1992	2487	884	1658	1713	0	3371	3371	0
1993	2494	862	1663	1693	0	3356	3356	0
1994	2494	884	1663	1715	0	3378	3378	0
1995	2494	884	1663	1715	0	3378	3378	0
1996	2494	884	1663	1715	0	3378	3378	0
1997	2494	884	1663	1715	0	3378	3378	0
1998	2494	884	1663	1715	0	3378	3378	0
1999	2494	884	1663	1715	0	3378	3378	0
2000	2494	884	1663	1715	0	3378	3378	0
2001	2494	884	1663	1715	0	3378	3378	0
2002	2494	884	1663	1715	0	3378	3378	0
2003	2494	884	1663	1715	0	3378	3378	0
2004	2494	884	1663	1715	0	3378	3378	0
2005	2494	884	1663	1715	0	3378	3378	0
2006	2494	884	1663	1715	0	3378	3378	0
2007	2494	884	1663	1715	0	3378	3378	0
2008	2494	884	1663	1715	0	3378	3378	0

Fig. G-1-3

PNW Regional Load/Resource Balance[1]
Medium Load Forecast



1) with resource additions as determined by LCMM
2) same as Alternatives 1.2 and 4.4

RPSD—MonohonS
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G-2

Use of FISHPASS in Analysis

Use of FISHPASS in Analysis

The analysis of downstream anadromous fish passage survival, as it may be affected by changes in spill and flows, was performed using a modified version of the Corps of Engineers' FISHPASS model. (A detailed description of the FISHPASS model is given in the Corps' model documentation titled "FISHPASS Model Concept and Application," March 1986.) BPA's version of FISHPASS has been revised to include the Mid-Columbia Public Utility District dams, and to accept the spill and flow data from the SAM model.

BPA's FISHPASS model simulates downstream fish passage survival for anadromous fish passing the Lower Snake, Mid-Columbia, and Lower Columbia hydroprojects during the April through August period of downstream migration. Juvenile fish survival is calculated from the point of entry into the hydrosystem, to below Bonneville Dam. Survival projections are developed for species entering at specific projects (e.g. system survival to below Bonneville Dam is calculated for yearling chinook salmon entering the river system at Lower Monumental pool).

FISHPASS simulates project specific system survival for yearlings (spring chinook and Snake River summer chinook salmon), subyearlings (fall chinook and Mid-Columbia summer chinook salmon), steelhead trout, and sockeye salmon. Yearling, steelhead, and sockeye tend to migrate in the spring, April through June, and subyearling in the summer, June through August.

Analytical Methods. Given the time, location, and number of hatchery and natural stocks of fish entering each pool, and the project/species specific characteristics for dam passage survival, pool survival, and travel time; FISHPASS uses the flow and spill information from SAM to compute the system survival (from point of origin) and the overall system survival for each species. Inputs and assumptions for the FISHPASS model can be found following this explanation. A more detailed description of the FISHPASS model can be found in Appendix E-3 of the Final Intertie Development and Use EIS.

FISHPASS uses 40 rather than 200 random simulations from SAM to determine average survival for a given year. Analysis is then performed on 6 years of the 20 year sequence. In this case, the years of study are 1991, 1993, 1995, 1997, 2001, and 2003. The survival statistics evaluated include:

a. The relative change in mean survival. (Appendix H-1e). (This is determined by taking the difference in survival between each alternative and the No Action base case and dividing the difference by the base case survival.)

b. The frequency of change in relative survival being greater than and less than one and five percent. (Appendix H-1e).

A potential for impact is considered to occur if the change in relative survival exceeds one percent or if the decrease in frequency of a survival change greater than one percent exceeds 30 percent or the decrease in the frequency of a survival change greater than five percent, exceeds five percent.

A biological assessment for both the critical and non-critical stocks potentially effected by any of the alternatives is included in Appendix H1-c.

FISHPASS Model Assumptions and Input Parameters

The FISHPASS model was used to simulate downstream fish passage survival for anadromous fish passing the Lower Snake, Mid-Columbia, and mainsteam Columbia River hydroprojects during the April through August period of downstream migration. Simulated flows and spills from the SAM were used as input to the FISHPASS model to calculate the downstream survival, to below Bonneville. This Appendix provides additional information for the key FISHPASS model assumptions and input parameters.

The period average values of planned, overgeneration, and forced spill from the SAM were shaped into separate values of spill within a 24-hour period: (a) spill during planed fish-spill hours; and (b) spill during nonfish-spill hours. On a real-time operational basis, overgeneration spill can be shaped into the hours with the greatest benefit to fish (planned fish-spill hours), while forced spill is not controllable. Therefore, for the FISHPASS analyses, the planned and overgeneration spill are shaped into the fish-spill hours for the specific project, while the forced spill is maintained as a flat daily average rate occurring during both fish-spill and nonfish-spill hours. Table G-2 - 1 shows the fish-spill hours used in the analysis and the percent of fish in a given day which pass the dam during those spill hours.

The period average flows simulated by the SAM were modulated to daily values within each period before entry into FISHPASS using the 1986 historical (within period) flow shapes. the 1986 daily flows at Priest Rapids, Ice Harbor, and The Dalles were used to modulate (shape) the period average SAM data for the Mid-Columbia, Lower Snake, and Lower Columbia hydroprojects, respectively. The modulated flows for the SAM-FISHPASS runs were daily average values and were the same for both fish-spill and nonfish-spill hours. Spill rates were not affected by the daily modulation of period average flows.

Both hatchery and natural fish numbers for fish above Lower Granite Dam are based on dam counts as used in the 1987 development of the Corps of Engineers' Juvenile Fish Passage Plan. For other projects, hatchery fish release numbers and timing are based on 1986 hatchery release data reported in the Smolt Monitoring Program Annual Report by the Fish Passage Center. Natural fish numbers and migration timing are based on (a) the 1984 final report on Stock Assessment of Columbia River Anadromous Salmonids; (b) the 1985 report on Downstream Migrant Estimates for Rocky Reach and Rock Island; and (c) consultation with the National Marine Fisheries Service.

The planned fish spill at Federal projects is based on the Corps of Engineers 1987 Juvenile Fish Passage Plan with sliding scale spill at The Dalles, John Day, and Lower Monumental. Planned fish spill at Mid-Columbia PUD projects is based on the current Federal Energy Regulatory Commission stipulation agreement. Planned spill is only an interim protection that is assumed to be eliminated at each project when bypass improvements are completed.

Values and relationships used for spill efficiencies, dam passage parameters, and reservoir survival are provided in Tables G-2 - 2 and G-2 - 3 for the Mid-Columbia and Federal hydro projects. These values for the Mid-Columbia projects were based on consultation with the project managers. For the Federal projects, the values are those specified by the Council's Mainstem Fish Passage Advisory Committee (1986). The reservoir mortality rate for the Mid-Columbia projects was recently increased based on comments from the National Marine Fisheries Service and review of the testimony in the court proceedings for the Mid-Columbia Stipulation Agreement. The fish guidance efficiency values projected for future bypass improvements at Federal projects are best available estimates from the COE based on research and experience regarding current systems. For the Mid-Columbia projects, the values for future fish guidance efficiencies are the bypass system minimum design standards. Table E.3-4 gives both the current and future projected values of fish guidance efficiencies used the analyses and the dates when passage improvements are expected to occur.

Fish transportation at Lower Granite, Little Goose, and McNary are based on the current guidelines developed by the Fish Transportation Oversight Team (FTOT) comprised of fishery agencies, Tribes, and the Corps. Transportation survival is assumed to be 95 percent at Lower Granite and Little Goose, and 99 percent at McNary.

Overgeneration spill was allocated to different hydro projects based on the spill priority lists given in Table G-2 - 5 which were developed from a review of Fish Passage Center spill requests.

Table G-2 - 1

HOURLY FISH PASSAGE DISTRIBUTIONS

Project	Stocks	Spill Hours	Percent Fish *
Wells	Spring Chinook	20:00 - 6:00	71
	Summer Chinook	20:00 - 6:00	58
	Steelhead	20:00 - 6:00	58
	Sockeye	20:00 - 6:00	43
Rock Reach	All	20:00 - 6:00	43
Rock Island	All	20:00 - 6:00	71
Wanapum	All	20:00 - 6:00	58
Priest Rapids	All	20:00 - 6:00	58
Lower Granite	All	18:00 - 6:00	82
Little Goose	All	18:00 - 6:00	82
Lower Monumental	All	18:00 - 6:00	82
Ice Harbor	All	18:00 - 6:00	66
McNary	All	18:00 - 6:00	82
John Day	All	18:00 - 6:00	82
The Dalles	All	18:00 - 6:00	66
Bonneville	All	20:00 - 6:00	71

* Percent of the daily total of fish arriving at the project which pass during the given hours of spill.

Table G-2 - 2

DAM PASSAGE PARAMETERS

Project	Spill Efficiency 1/	Spill Mortality (%)	Turbine Mortality (%)	Collection Mortality (%)	Bypass Mortality (%)
Wells	80% Fish/21% Spill 94% Fish/30% Spill	0	15	1	1
Rocky Reach	y = 0.663x (range 20-80%)	0	15	1	1
Rock Island	y = exp (0.054x) (range 15-80%)	0	6.5	1	1
Wanapum	y = 15.42 ln(x) (range 20-85%)	0	11	1	1
Priest Rapids	ln (y) = 0.819 ln(x) (range 20-85%)	0	11	1	1
Federal Projects 2/	y = x	2	15	1	1

1/ Spill Efficiency - y = % fish spilled
x = % river spilled (instantaneous)
Spill outside ranges given for data are interpolated toward end points of 0% fish/0% spill and 100% fish/100% spill

2/ For The Dalles the following spill efficiency relationship is used for x/y: 0/0, 20/52, 41/80, 100/95

Table G-2 - 3

RESERVOIR FLOW/SURVIVAL RELATIONSHIPS (KCFS/%)

For Mid-Columbia Projects*

Rocky Reach	Rock Island	Wanapum	Priest
Flow/Survival	Flow/Survival	Flow/Survival	Flow/Survival
0/21.3	0/76.6	0/0	0/61.5
10/24.8	10/80.1	10/0	10/65.0
50/85.	50/96.0	50/79.4	50/93.0
100/92.5	100/98.0	100/89.7	100/96.5
250/97	250/99.2	250/95.9	250/98.6
750/97	750/99.2	750/95.9	750/98.6

For Snake River Projects*

Little Goose	Lower Monumental	Ice Harbor
Flow/Survival	Flow/Survival	Flow/Survival
0/53.0	0/61	0/58
12/54	12/62	12/59
50/67	50/73	50/71
75/79	75/83	75/81
100/87	100/90	100/89
125/92	125/94	125/93
150/92	150/94	150/93
175/88	175/91	175/90
1000/88	1000/91	1000/90

For Mainstem Columbia Projects

McNary	John Day	The Dalles	Bonneville
Flow/Survival	Flow/Survival	Flow/Survival	Flow/Survival
0/55	0/30	0/68	0/49
50/56	50/31	50/69	50/50
150/72	150/52	150/81	150/68
175/79	175/62	175/86	175/76
200/85	200/72	200/90	200/82
225/89	225/80	225/93	225/87
250/92	250/85	250/95	250/91
275/93	275/86	275/95	275/92
300/92	300/84	300/95	300/90
350/84	350/71	350/90	350/81
1000/84	1000/71	1000/90	1000/81

* Wells and Lower Granite use fish input data given as fish counts at the dam and there is no reservoir mortality applied to these fish numbers.

Table G-2 - 4

FISH GUIDANCE EFFICIENCIES (FGE)
(Percent)

Project	Yearling		S/Yearling		Steelhead		Sockeye		Year
	C	F	C	F	C	F	C	F	
Wells	80	80	70	70	80	80	70	70	n/a
R. Reach	0	70	0	50	0	70	0	50	1992
R. Island	0	70	0	50	0	70	0	50	1992
Wanapum	0	70	0	50	0	70	0	50	1995
Priest R.	0	72	0	50	0	72	0	50	1995
L. Granite	77	88	48	60	79	88	48	60	1995
L. Goose	77	88	48	60	79	88	48	60	1995
L. Monumental	2	73	2	35	4	74	2	35	1992
I. Harbor	0	78	0	35	0	92	0	35	1993
Sluiceway	51	0	51	0	51	0	51	0	n/a
McNary	75	90	40	60	75	90	40	60	1996
John Day	72	90	30	60	86	90	30	60	1997
The Dalles	0	80	0	63	0	83	0	63	1997
Sluiceway	40	0	40	0	40	0	40	0	n/a
Bonneville 1	76	76	30	30	78	78	30	30	n/a
Bonneville 2	19	65	24	24	35	50	24	24	1996

C = Current bypass FGE.
F = Future Bypass FGE
Year = Estimated date of bypass installation or upgrade.

Table G-2 - 5

PRIORITY LISTS FOR ALLOCATION OF OVERGENERATION SPILL WITHIN SAM 1/

APRIL

Project	Spill up to (kcfs)
Lower Monumental	5
Ice Harbor	5
Lower Monumental	12.5
Ice Harbor	12.5
The Dalles	15
Lower Monumental	20
Ice Harbor	20
The Dalles	30
John Day	30
Bonneville	30
Rock Island	10.4
Rocky Reach	10.4
Wells	10.4
Wanapum	16.7
Priest Rapids	16.7
Lower Monumental	25
Ice Harbor	25
The Dalles	40
John Day	40
Bonneville	40
Lower Monumental	40
Ice Harbor	40
The Dalles	60
John Day	60
Bonneville	60
Rock Island	20.8
Rocky Reach	20.8
Wells	20.8
Wanapum	33.3
Priest Rapids	33.3
Lower Monumental	25 percent of daily flow
Ice Harbor	30 percent of daily flow
The Dalles	40 percent of daily flow
Rock Island	41.7
Rocky Reach	33.3
Wanapum	41.7
Priest Rapids	50
Lower Monumental	40 percent of daily flow
Ice Harbor	40 percent of daily flow
John Day	40 percent of daily flow
Bonneville	40 percent of daily flow

Table G-2 - 5 (Continued)

MAY

Project	Spill up to (kcfs)
Lower Monumental	5
Ice Harbor	5
The Dalles	7.5
Lower Monumental	7.5
Ice Harbor	7.5
The Dalles	12.5
Lower Monumental	12.5
Ice Harbor	12.5
The Dalles	17.5
Lower Monumental	17.5
Ice Harbor	17.5
The Dalles	22.5
John Day	10
Bonneville	10
Rock Island	20.8
Rocky Reach	10.4
Wells	10.4
Wanapum	12.5
Priest Rapids	12.5
John Day	15
Bonneville	15
Lower Monumental	25
Ice Harbor	25
The Dalles	30
Lower Monumental	40
Rock Island	33.3
Rocky Reach	20.8
Wells	20.8
Wanapum	25
Priest Rapids	25
John Day	30
Bonneville	30
The Dalles	60
Lower Monumental	40
Ice Harbor	40
John Day	60
Bonneville	60
Lower Monumental	25 percent of daily flow
Ice Harbor	30 percent of daily flow
The Dalles	40 percent of daily flow
Rock Island	41.6
Rocky Reach	33.3
Wells	33.3
Wanapum	41.6
Priest Rapids	50
Lower Monumental	40 percent of daily flow
Ice Harbor	40 percent of daily flow
John Day	40 percent of daily flow
Bonneville	40 percent of daily flow

Table G-2 - 5 (Continued)

JUNE, JULY, AUGUST

Project	Spill up to (kcfs)
Rock Island	10.4
Wanapum	8.3
Priest Rapids	8.3
Wells	4.2
Rocky Reach	4.2
Lower Monumental	10
Ice Harbor	10
The Dalles	15
John Day	15
Bonneville	15
Rock Island	20.8
Wanapum	16.7
Priest Rapids	16.7
Wells	8.3
Rocky Reach	8.3
Lower Monumental	20
Ice Harbor	20
The Dalles	30
John Day	30
Bonneville	30
Rock Island	31.3
Wanapum	25
Priest Rapids	25
Wells	12.5
Rocky Reach	12.5
Lower Monumental	30
Ice Harbor	30
The Dalles	45
John Day	45
Bonneville	45
Rock Island	41.7
Wanapum	33.3
Priest Rapids	33.3
Wells	20.8
Rocky Reach	20.8
Lower Monumental	40
Ice Harbor	40
The Dalles	60
John Day	60
Bonneville	60
Wanapum	41.7
Priest Rapids	50
Wells	33.3
Rocky Reach	33.3

Lower Monumental	25 percent of daily flow
Ice Harbor	30 percent of daily flow
The Dalles	40 percent of daily flow
Lower Monumental	40 percent of daily flow
Ice Harbor	40 percent of daily flow
John Day	40 percent of daily flow
Bonneville	40 percent of daily flow

1/ Spill rates are in addition to planned spill, but include forced spill and are applied to monthly average flows in SAM. Total spill at Bonneville is limited to 60 percent of the monthly average flow.

(VS6-PG-1551I)

G-3

The Decision Analysis Model for Aluminum Industry Analysis

THE DECISION ANALYSIS MODEL FOR ALUMINUM INDUSTRY ANALYSIS

This document describes the analyses for the Draft Environmental Impact Statement (EIS) which were carried out using the Decision Analysis Model (DAM). This model was originally designed for Bonneville Power Administration's (BPA) Direct Service Industries (DSI) Option Study of 1985, an assessment of the economic effects of various policy options directed towards the DSI. Its selection as one principal analytical tool for the EIS was made because of several of its features.

1. The model was basically conceived to deal with the complexities of regional aluminum smelter economics. It allows consideration of a variety of policy or contract options relating to the Northwest aluminum industry.

2. The model combines condensed versions of several BPA system models, and therefore was much faster than attempting to perform these analyses using BPA's more detailed models such as the Aluminum Smelter Model or Systems Analysis Model (SAM).

3. The model focuses broadly on an overall picture of the Northwest's utility economics and operations and therefore produces a variety of outputs useful to the EIS. Some of these outputs, such as employment on a regionwide basis, are not produced by other BPA models and would have had to be derived exogenously had the DAM not been used.

For purposes of this discussion, only a brief overview of the DAM is provided. For a more detailed description, refer to the DSI Options Study - Final Report, parts 1 and 2, June 1985, and Appendix B of the Draft EIS Direct Service Industry Options, January 1986. The Decision Analysis Model links together three basic components of the region's power supply system: load forecasting, power system operation and capacity expansion, and rates and finances. In addition, it calculates changes in employment. Each of these areas have traditionally been modeled separately and in greater detail than in the DAM. The strength of the DAM is in its ability to integrate these diverse areas and thereby provide a reasonable method for assessing the relative merits of alternative policy or contract options across a broad spectrum of impacts. See Figure 1 for an overview of the DAM.

One of the model's unique characteristics is its ability to deal with the probabilistic nature of major variables which are inherently uncertain. These include regional load growth, availability of water for the operation of the hydro system, and the market price of aluminum. When the model is set to run in its probabilistic mode (which was the basis for this draft EIS analysis), a random draw is made for each of these variables in each run. Such a set of random values comprises one "game." Typically, a probabilistic run comprises 100 games. The results for all games are averaged together to find the expected value of the results. The DAM produces a number of different outputs, including electric load, aluminum industry production levels, power

Fig. G-3-1

SYNOPSIS OF THE DSI DECISION ANALYSIS MODEL

DSI DECISION ANALYSIS MODEL	EXPLANATION: WHAT IT DOES
LOAD FORECASTING	For each aluminum plant: o Takes cost and price information as inputs o Makes long-run investment or closure decisions based on expected profits o Makes short-run operational decisions For non-aluminum loads: o Can grow at base, high, or low rates o Lets price elasticity effects be felt
POWER SYSTEM OPERATION AND EXPANSION	o Simulates operation of system using random water years o Estimates export sales o Estimates long-run resource acquisitions o Estimates annual costs of power system o Estimates level of service to DSI interruptible load
RATE AND FINANCIAL ANALYSIS	o Estimates BPA rates by customer class o Derives BPA revenues o Estimates BPA cash flows
EMPLOYMENT IMPACT ANALYSIS	o Estimates employment impacts in the aluminum and non-aluminum sector

rates, and a variety of others. However, the simplest overall measure of relative economic impacts of alternatives is "customer benefits." For the aluminum customers this represents the present value of the discounted net cash flow resulting from the operation of the region's 10 smelters according to the production levels determined by the model. For the other customers,the net benefits refer to the present value of changes in total expenditures adjusted for changes in quantity consumed of electric energy. The DAM measures effects of a policy or contract option relative to an option of taking no action.

The model output should be viewed with some caution. The model is not as accurate as BPA's more detailed, specialized models in determining some of the impacts of the options. Also, any model is only a simplification of the operations of the "real world." While the quantification within the model implies that some precision exists, in practice only approximations are possible because of the limits of both the model structure and the quality of the available data.

The model is a useful tool for determining the relative changes caused by the different alternatives. Thus, valid comparisons among the alternatives can be made, but the absolute values of results should be viewed with caution.

Conclusions and interpretations based on the model output are, therefore, supplemented by judgment, results of other studies, knowledge of the DSIs gained through BPA's dealings with them over the years, the DSI Options Study, and other sources.

Aluminum Industry Modeling

The aluminum industry portion of the DAM models both the short-run (operational) and long-term (capacity) planning decisions of the region's 10 aluminum smelters. The logic employed in both the short-run and long-run portions of the model is based on previous industry modeling (e.g. the Aluminum Smelter Model) and traditional approaches to capital investment analysis (i.e., discounted net cash flow). Reliance was placed on past studies and analysis for the development of input parameters, most importantly aluminum production costs and prices. In the long-run portion of the model, current long-run marginal (i.e., both fixed and variable) costs of aluminum production for each smelter are compared to a long-run expected aluminum price (all costs and prices are in constant 1985 dollars). If the present value of the expected long-run price exceeds the present value of the long-run marginal costs of production over a 10-year planning period, the smelter is assumed to remain in operation.

The power rates calculated in the rates module of the DAM are based upon BPA's post-1985 rate design, and are determined by quarterly short-term operating level decisions within the model, and are aggregated to annual values. The power rates, along with other short-term marginal costs of aluminum production, are compared to forecasted quarterly aluminum prices to determine short-term profitability. The model increases production to full capacity if a smelter is profitable, and reduces production rates to the equivalent of one potline if it is not profitable. (This particular assumption is based on empirical observation of minimum operating levels during the past several years.)

Production levels directly determine electric load requirements through the electricity usage estimate for each smelter (in kWh/lb of aluminum produced). Loads are apportioned by type (i.e., firm and top quartile) and revenues to BPA from these load levels are determined.

Aluminum Prices and Production Costs

In these analyses, long-run aluminum prices of 70¢/lb. and 60¢/lb. (in 1985 dollars) were used. In the model this price is combined with a random component (with a standard deviation of 6¢/lb. to reflect market price uncertainty) used in the long-run capacity decision making portion of the DAM. In other words, with a long-term aluminum base price of 60¢/lb. and a standard deviation of 6¢/lb., two-thirds of the forecasted prices would fall between 54-66¢/lb. in 1985 dollars or 61-75¢/lb. in 1989 dollars. The remaining one-third of the prices would be beyond this range. For a 70¢/lb. long-term aluminum base price, the two-thirds of the forecasted prices would be between 64-76¢/lb. in 1985 dollars or 72-86¢/lb. in 1989 dollars. These long-term forecasted prices are combined in the model with short-term (essentially current) prices to derive the quarterly expected prices for use in the short-term operational decisionmaking portion of the DAM.

The power rates for the aluminum smelters are determined by a variable rate module in the model which calculates the rates based on the forecasted aluminum price.

The aluminum smelting production costs used in the model are essentially derived from two studies on regional smelter production costs conducted by independent industry analysts for BPA. These are: (1) Primary Aluminum Production Costs in the Pacific Northwest (PNW), John Moberly Associates, July 1984; and (2) Aluminum Costs and Supply Arrangements in the PNW, Resource Strategies, Inc., May 1985. These reports, as well as BPA's own estimates and analyses, are the basis for all the production costs used in the DAM. Table 1 summarizes the most recent aluminum production cost estimates used in the DAM.

Table 1: 1987/1988 Estimated Costs
DAM ALUMINUM PRODUCTION COSTS
(1985 $)

	Alumina Cents/Lb.	Wages $/Hr.	Other Cost Cents/Lb.
Vancouver	0.102	15.30	0.180
Wenatchee	0.110	21.60	0.176
Columbia Falls	0.125	15.30	0.162
Ferndale	0.102	21.60	0.169
Mead	0.112	18.90	0.184
Tacoma	0.102	18.90	0.183
Goldendale	0.104	15.30	0.194
The Dalles	0.113	15.30	0.187
Longview	0.102	21.60	0.190
Troutdale	0.104	21.60	0.187

Resource Operation and Development

The DAM makes a number of assumptions regarding the power system's operation and expansion. These assumptions relate to water conditions, intertie size, Southwest market sales, placement of future investor-owned utility loads on BPA, the future of WNP-1 and -3, etc. Generally these resource assumptions are the same as were used in the final BPA 1987 Resource Program. These assumptions are specified in Resource Analysis Documentation, 1987 Resource Strategy, Bonneville Power Administration, May 1987.

Required Rate of Return

The Required Rate of Return (RROR) in the DAM functions as a real (net of inflation) discount rate in the long-term capacity planning and decisionmaking module. As such, an increase in the RROR reduces the present value of future benefits of smelter modernization or increases in production capacity in the calculation of discounted net cash flow. Similarly a decrease in the RROR has the opposite effect, increasing the present value of future cash flows. The current analysis used a RROR of 20 percent. This high RROR is consistent with an assumption that firms would use a higher discount rate when evaluating potential investments in a situation characterized by a high degree of uncertainty.

Time Horizon

The DAM is designed to run over a 30-year period ending in the year 2015, although this can be varied. Model results are tabulated for the time periods 1986-92, 1993-99, and 2000-15.

Results

Results of the analysis are presented in terms of changes from the base case in rates, in aluminum loads, and in "regional net benefits" using units of millions of dollars, discounted to a net present value using a 3 percent real rate over 30 years. (Note that the discount rate used for comparing regional benefits is significantly lower than the rate assumed to be used by the aluminum industry for long-term decisionmaking with respect to regional smelters.)

G-4

The Joint BPA-Council Industrial Model

(used for New Large Single Load analysis)

THE JOINT BPA-COUNCIL INDUSTRIAL MODEL 1/

Industrial Sector. The industrial sector is the largest of the four consuming sectors. In 1988, the industrial sector consumed 6,491 aMW of firm electricity, accounting for 39 percent of the regional total.

Forecasts of industrial electricity use reflect production output forecasts for the various industrial sectors, the amount of energy used per unit of output, and the effects of electricity and other fuel prices on energy use. Table G-4-1 shows industrial sector forecasts of firm electricity use of selected years under all five cases. In the high case, consumption of electricity by the industrial sector grows to 11,013 aMW by 2010, an average annual growth rate of 2.4 percent. In the low case, industrial electricity use decreases due to significant reductions in direct service industry use while other industries remain largely unchanged. The more likely range of growth in industrial electricity use if from 0.1 percent to 1.3 percent per year, with medium case growth at 0.6 percent per year.

Table G-4-1
Pacific Northwest Industrial Sector
Forecasts of Firm Electricity Use
(aMW)

	ACTUAL	FORECASTS			GROWTH RATE (% PER YEAR)
	1988	1995	2005	2010	1988-2010
High	6,491	8,025	9,890	11,013	2.4
Medium-high	6,491	7,054	8,030	8,580	1.3
Medium	6,491	6,454	7,064	7,432	0.6
Medium-low	6,491	5,894	6,290	6,597	0.1
Low	6,491	5,094	5,107	5,204	-1.0

Industrial electricity use in the Northwest is highly concentrated in a few subsectors. Five industries (food, chemicals, paper, lumber, and metals) account for almost 90 percent of this. Metals production, primarily by Bonneville's 10 aluminum direct service industrial customers, accounts for nearly half the total. Direct service industrial customers accounted for 37 percent of industrial sector electricity use in 1988, or about 15 percent the total for all sectors. The aluminum smelters represent about 90 percent of electricity use by Direct Service Industries.

1/ For more detail, see Model Documentation--Draft Final Report, Charles Rivers Associates Report No. 642, Vol. 1, Ch. 3, September 12, 1982.

In addition to the firm electricity use described above, the direct service industrial customers consume varying amounts of nonfirm electricity, depending on economic and hydroelectric conditions. Including nonfirm power, the industrial sector used a total of 7,044 aMW in 1988. Only the firm portions are included in Table 11; however, the nonfirm portions are considered in system operation and electricity pricing analyses.

Methods of forecasting industrial electricity use vary substantially among subsectors. In general, forecasting methods are most detailed for activities that consume the greatest amounts of electricity. It is necessary to forecast industrial activity and electricity use individually for up to 40 industry components in order to obtain reliable forecasts of total industrial use.

The composition of the industrial forecast is shown in Table G-4-2. The subsectors are defined using the Standard Industrial Classification (SIC) code. Table 12 shows electricity use for each industrial subsector in 1981, the most recent year data is available at this level of detail.

There are four methods used to forecast industrial sector electricity use. They are: (1) key industry models; (2) econometric models; (3) simple relationships; and (4) assumptions. All of the forecasting methods, except assumptions, are driven primarily by forecasts of industrial production for each industrial subsector. In addition, each of these methods modifies the relationship between production and electricity use to reflect the effects of changing energy prices and other factors. The assumptions method is used to forecast the electricity requirements of both the aluminum and non-aluminum direct service industries. It is labeled as such because Bonneville forecasts these industries using models and methods that are separate from the main Bonneville and Council industrial process model.

The three largest non-direct service industries in terms of electricity use are forecast using Bonneville and Council key industry models. The key industry models are detailed approaches to forecasting electricity use. The three key industries are lumber and wood products, pulp and paper, and chemicals. First, each industry is further separated into the most energy intensive activities. For those activities, the uses of electricity are divided into several types, such as motors for specific processes, electroloysis, or lighting. The fraction of electricity use attributable to each of these end uses is estimated for an average plant. In the case of chemical production of phosphorous and chlorine, the model is specified separately for each of the six plants in the region.

The forecast requires a specification of how the share of end uses may change over time. In addition, the degree to which electricity for each type of end use could be conserved in response to price changes is specified. The degree of price response varies across forecast cases, being largest in the low case and smallest in the high case. Given these specifications, electricity use per unit of production changes as production and electricity prices change.

The key industry models require a great deal of data going beyond readily available sources. For this reason, specification of the key industry models relies heavily on the judgment and advice of industry representatives and trade organizations.

The remaining nonkey and non-direct-service industries are forecast using a variety of econometric forecasting equations. Econometric models consist of equations estimated from historical data. The equations attempt to measure the effect of industry production and energy prices on the use of different types of energy, including electricity. Because historical data are generally of poor quality at the industries subsector level, it is often difficult to obtain plausible relationships for econometric equations. Where econometric results appeared implausible, simple relationships between output and electricity use were used. In Table G-4-2, econometric equations obtained from the Oregon Department of Energy are noted as "ODOE." Equations obtained from Bonneville are labeled "AEA" for Applied Economic Associates, the consulting firm that estimated the equations. 2/

The subsectors whose forecasting methods are listed as "simple" are those for which econometric results were unsatisfactory. In these simple forecasts, electricity use is assumed to form at the same rate as production, but is modified by an assumed trend in electricity use per unit of production. There is substantial agreement in econometric models and other influences, energy use will grow with production.

There is much less agreement about the degree of influence price changes will have on energy use. To reflect this uncertainty, assumed changes in use per unit of production were varied across forecast cases. Electricity use per unit of production was assumed constant in the high case for subsectors that were forecast using the simple method. In the medium-high case, the electric intensity was assumed to decrease by 0.5 percent per year; in the medium-low case, by 1.5 percent per year; and in the low case by 2.0 percent per year. The medium case assumes a 1.0 percent per year reduction in electricity use per unit of output. These assumptions are similar to the range of econometric results which were more acceptable theoretically and behaviorally.

2/ Applied Economic Associates, Inc., Update and Re-estimation of the Northwest Energy Policy Project Energy Demand Forecasting Model, report to Bonneville Power Administration, December 1981.

Table G-4-2

Industrial Forecasting Methods by Industry Type

SIC CODE		INDUSTRY TYPE	1981 SHARE OF MFG ELECTRICITY (%)	FORECASTING METHOD	MODEL VERSION
MANUFACTURING					
20		Food & Kindred Products	4.1	Simple	
22		Textiles	.1	Econometric	AEA
23		Apparel	.1	Simple	
24		Lumber & Wood Products	6.8		
	2421	Sawmills & Planning Mills (2.8%)		Key Industry	
	2436	Softwood Veneer & Plywood (1.5%)		Key Industry	
	24XX	Remainder of SIC 24 (2.5%)		Simple	
25		Furniture	.1	Simple	
26		Pulp & Paper	21.0		
	2611	Pulp Mills (1.6%)		Key Industry	
	2621	Non-DSI Paper Mills (12.1%)		Key Industry	
	2621	DSI Paper Mills - Port Townsend (0.2%)		Assumption	
	2631	Paperboard Mills (4.4%)		Key Industry	
	26XX	Remainder of SIC 26 (2.7%)		Simple	
27		Printing & Publishing	.5	Econometric	ODOE
28		Chemicals	11.0		
	2812	Non-DSI Chlorine & Alakalies (1.9%)		Key Industry	
	2812	DSI Chlorine & Alkalies - Georgia Pacific, Pennwalt (1.1%)		Assumption	
	2819	Non-DSI Elemental Phosphorous (5.6%)		Key Industry	
	2819	DSI Elemental Phosphorous - DOE Richland (Federal Agency), Pacific Carbide (0.8%)		Assumption	
	28XX	Remainder of SIC 28 (2.2)		Econometric	ODOE
29		Petroleum Refining	1.4	Simple	
30		Rubber & Plastics	.5	Econometric	AEA
32		Stone, Clay, Glass, & Concrete	1.2		
	3291	DSI Abrasive Products - Carborundum (0.3%)		Assumption	
	32XX	Remainder of SIC 32 (0.9%)		Econometric	ODOE
33		Primary Metals	49.0		
	3334	DSI Aluminum (43.2%)		Assumption	
	3313	DSI Electrometallurgical (1.3%)		Assumption	
	3339	DSI Nonferrous NEC - Oremet (0.1%)		Assumption	
	33XX	Remainder of SIC 33 (4.4%)		Econometric	ODEO
34		Fabricated Metals	.8	Simple	
35		Machinery Except Electrical	.8	Simple	
36		Electrical Machinery	.4	Econometric	ODOE
37		Transportation Equipment	1.9	Simple	
38		Professional Instruments	.4	Simple	
39		Miscellaneous Manufacturing	.1	Simple	
XX		Residual Categories	.4	Simple	
MINING			n/a	Grows with Employment	

APPENDIX H

H-1a

Background on Fish, Wildlife, and Vegetation Impacts Due to Hydro Operations

Background on Fish, Wildlife, and Vegetation Impacts Due to Hydro Operations

Resident Fish. Resident fish are freshwater fish that live and migrate within the streams and lakes of the Columbia River Basin, but do not travel to the ocean as do anadromous fish. They have become particularly important to areas where anadromous fish runs have been blocked by natural or manmade obstructions. Resident fish continue to be a popular component of recreation associated with many of the storage reservoirs in the Columbia River Basin.

Production in Reservoirs. Drawdown of reservoirs for power production, irrigation, or flood control can affect game fish populations by altering the physical and biological characteristic within the reservoir. Lowered elevations reduce the productive shallow areas near the shoreline. This can result in reduced habitat (particularly spawning habitat) for both game fish and their food organisms. Increased reservoir fluctuations can change water temperatures or expose nests, killing the eggs. Table H-1a-1 contains information on critical months for spawning of resident game fish.

Table H-1a-1

Critical Months for Reservoir Game Fish Spawning

	Reservoir			
Species	Hungry Horse	Libby	Grand Coulee	Dworshak
Kokanee	N/A	Sept.-Nov.	Sept.-Nov.	Sept.-Nov.
Cutthroat	May-July	May-July	N/A	May-July
Rainbow Trout	April, May	April, May	April, May	April, May
Dolly Varden	Aug.-Oct.	Aug.-Oct.	N/A	Aug.-Oct.
Walleye	N/A	N/A	April, May	N/A
Smallmouth Bass	N/A	N/A	April-July	June-July
Mountain Whitefish	Nov.-Jan.	Nov.-Jan	Nov.-Jan.	Nov.-Jan.

The primary Federal reservoirs of concern are Hungry Horse and Libby reservoirs located in northwestern Montana, Grand Coulee on the Columbia River in central Washington, and Dworshak Reservoir on the Clearwater River in Idaho. Common game fish species in Hungry Horse include westslope cutthroat trout, Dolly Varden, and mountain whitefish. Westslope cutthroat being the primary species sought by angles. Westslope cutthroat generally spawn from May through July and achieve most of their growth during the September through November period. Common game fish species in Libby Reservoir include western cutthroat trout, rainbow trout, Dolly Varden, and kokanee salmon. Grand Coulee supports an economically valuable recreational fishery for walleye and rainbow trout. The most popular sport fish caught in Dworshak is the kokanee salmon followed by rainbow trout and smallmouth bass.

Information remains limited on the extent of biological impacts to resident fish associated with changes in seasonal draft of the reservoirs. Based on past consultations with the U.S. Army Corps of Engineers (Corps) and the Montana Department of Fish, Wildlife, and Parks (MDFWP), decreased reservoir elevations are considered to have the potential for adverse fishery impact if they occur during the April through November period of biological activity, September through November being most important for fish growth. Likewise, increases in reservoir elevations are considered to have the potential for fishery benefits when occurring in the same time period.

The changes in reservoir elevations associated with the various alternatives under study, as simulated by the Systems Analysis Model (SAM), were analyzed for Hungry Horse, Libby, Grand Coulee, and Dworshak. The following reservoir statistics were evaluated:

a. The average end-of-period elevations (14 periods, 20 contract years). Analyses were broken down into three groups by runoff condition: (1) the lowest 10 percent of the runoff years; (2) the middle 80 percent of the runoff years; and (3) the highest 10 percent of the runoff years (Appendix H-1j).

b. Frequency of end-of-period elevation changes from the No Action case greater than 5 feet for the years 1991, 1993, 1995, 1997, 2001, and 2005 (Appendix H-1k).

Production in Streams. The Kootenai River below Libby Dam and the Flathead River Below Hungry Horse Dam support important populations of resident game fish, specifically, kokanee in the Flathead river system and westslope cutthroat, rainbow trout, and Dolly Varden in the Kootenai River. Reduced flows below the dams can interfere with spawning, incubation, emergence, rearing, and migration of resident fish and can lower the production of aquatic fish food organisms. In addition, lack of high spring flushing flows can create sediment problems. To protect fish populations in the Kootenai River the Council has recommended that Libby Dam be operated to provide a minimum flow of 4 thousand cubic feet per second (kcfs) except in years of extremely low runoff, when no less than 3 kcfs should be provided.

To aid reproduction of kokanee in the Flathead River, the Council has recommended Hungry Horse Dam be operated to provide specified flows at Columbia Falls on the mainstem Flathead River. For spawning (October 15 through December 15), flows should be between 3.5 and 4.5 kcfs. An instantaneous minimum flow of at least 3.5 kcfs is recommended at Columbia Falls throughout incubation (July 1 through October 15).

The kokanee that spawn in the Flathead River system below Hungry Horse migrate upstream from Flathead Lake. Currently, this population of kokanee is severely depressed. Montana Department of Fish, Wildlife, and Parks is in the process of developing a mitigation plan for the Flathead system. It is uncertain at this time whether mitigation will include rebuilding the kokanee population.

The changes in flows in the Kootenai River below Libby Dam and in the Flathead River at Columbia Falls below Hungry Horse Dam were analyzed for all months of the years 1991, 1993, 1995, 1997, 2001, 2005. The following flow changes were evaluated:

a. The average change in flow for each period (Appendix H-1i).

b. The frequency of monthly average flows at Columbia Falls that are: (1) less than 3.5 kcfs (all periods); (2) greater than 4.5 kcfs October through December (kokanee spawning period); and (3) less than 4.5 kcfs January through September (kokanee incubation, emergence, and migration) (Appendix H-1i).

c. The frequency of occurrence of flows at Libby Dam that are less than 4.0 kcfs (Appendix H-1i).

Anadromous Fish

The Columbia River Basin supports a large number of anadromous fish (species which migrate downriver to the ocean to mature, then return upstream to spawn). The principal anadromous fish runs in the Columbia Basin are steelhead trout, and three species of salmon (chinook, coho, and sockeye). These fish remain an important resource to the Pacific Northwest both for their substantial economic value to the sport and commercial fisheries, and for their high cultural and religious value to Columbia River Basin Tribes and others.

The development of hydroelectric projects on the Columbia and Snake Rivers has reshaped the natural flows of the rivers. Runoff during the spring is retained in storage reservoirs for use during periods when flows are naturally low. Hydroelectric dams have transformed the rivers into a series of slow-moving lakes. Regulating river flows in this manner increases the capability to produce firm energy and provide flood control, irrigation and recreation benefits. But it reduces river flows during the spring and early summer when juvenile salmon and steelhead are migrating downstream to the ocean. Prolonged delays expose juveniles to predation and disease and can cause them to lose their ability to adapt to saltwater when they reach the ocean. Addition mortality occurs as fish attempt to pass each dam. Fish not guided through power house bypass systems or over spillways can sustain 5 to 30 percent mortality passing through generator turbines.

Water Budget and Flow. In 1982, the Council established a Water Budget to increase river flows during the April 15 through June 15 period. This coincides with the peak out-migration of spring fish, predominately yearling chinook, steelhead, and sockeye which depend on adequate river flow for a successful migration. The Water Budget is a specified volume of water totaling 4.64 million acre feet (maf). Fish Passage Managers are responsible to call upon this volume to enhance flows when it will provide the greatest benefit to migrating fish. Separate Water Budgets were established for the mid-Columbia and Snake Rivers. Priest Rapids and Lower Granite dams are the respective points of Water Budget measurement.

Flow data, as simulated from SAM was analyzed for The Dalles, Priest Rapids and Lower Granite dams for each period of the 20 contract years. An average decrease in flow of greater than 5 kcfs at Lower Granite and 10 kcfs at Priest Rapids, April through June was used to indicate the potential for delayed travel time (Karr 1982). Decreases of this magnitude would increase travel time by approximately 1 day for fish entering the Lower Snake or Mid-Columbia projects.

Analysis was broken out to shows effects of each alternative on flow during the lowest 10 percent of the water conditions (those in which the January through July runoff at The Dalles was less than 70 MAF), the middle 80 percent of the water conditions, and the highest 10 percent of the runoff conditions (The Dalles January through July runoff greater than 125 MAF). The following flow statistics were analyzed:

a. The mean change to monthly average flow at The Dalles, Priest Rapids, and Lower Granite (Appendix H-1f).

b. The frequency of Water Budget flows less than 115 kcfs at Priest Rapids during the second half of April and May (Appendix H-1h).

Hanford Reach Flow Regulation

In 1988 BPA and the mid-Columbia operators signed a long-term Vernita Bar Agreement which specifies protection requirements for fall chinook spawning, incubation and emergence on Vernita Bar (located downstream of Priest Rapids Dam). Mid-Columbia operators are required to reverse load factor (maintain low daytimes flows which moves generation to the nighttime) during the spawning season, approximately October 15 through November. This attempts to promote lower spawning elevations on the bar as spawning occurs primarily during daylight hours. Flows required for incubation and emergence are determined by the spawning elevations which occurred the preceding fall, but are not required to exceed 70 kcfs.

Simulated monthly average flows from SAM were evaluated at Priest Rapids. Analyses were broken out to shows effects in different water conditions; low, medium, and high. The following flow statistics were analyzed:

a. The frequency of flows greater than 125 kcfs in October and November at Priest Rapids (Appendix H-1g).

b. The frequency of flows less than 70 kcfs December through April at Priest Rapids (Appendix H-1g).

Spill. Anadromous fish must pass a series of dams on their way downstream to the ocean. Fish must either pass through the dams by way of the turbines or mechanical bypass systems (or be collected for transport by truck or barge), or pass over the spillway when water is being spilled. Until adequate bypass systems are installed at the dams, spill remains a necessary means of moving juveniles downstream.

To do this they must either pass through the turbines, find their way through mechanical bypass systems and continue their journey inriver (or be collected for transport via truck or barge), or pass over the spillway when water is being spilled. Until adequate bypass systems are installed at the dams, spill remains a necessary means of moving juveniles downstream.

Spill is of three types: planned fish spill; forced spill; and overgeneration spill. Planned fish spill is implemented by the Corps annually in conjunction with the "Juvenile Fish Passage Plan;" it also includes spill levels specified by FERC for non-Federal projects. Forced spill occurs when flows exceed the hydraulic capacity of the powerhouse at a particular project. Overgeneration spill is water that is spilled when energy markets are not sufficient to require full powerhouse generation. All three types of spill are useful in moving fish downstream. Changes in river operations have the greatest effect on overgeneration spill.

The change in mean monthly hydro system overgeneration spill was analyzed based on SAM data of 200 simulation for each period and for each year of the analysis (Appendix H-1d).

Survival. The analysis of downstream anadromous fish passage survival, as it may be affected by changes in spill and flows, was performed using a modified version of the Corps of Engineers' FISHPASS model. (A detailed description of the FISHPASS model is given in the Corps' model documentation titled "FISHPASS Model Concept and Application," March 1986.) BPA's version of FISHPASS has been revised to include the Mid-Columbia Public Utility District dams, and to accept the spill and flow data from the SAM model.

BPA's FISHPASS model simulates downstream fish passage survival for anadromous fish passing the Lower Snake, Mid-Columbia, and Lower Columbia hydroprojects during the April through August period of downstream migration. Juvenile fish survival is calculated from the point of entry into the hydrosystem to below Bonneville Dam. Survival projections are developed for species entering at specific projects: for example, system survival to below Bonneville Dam is calculated for yearling chinook salmon entering the river system at Lower Monumental pool).

FISHPASS simulates project-specific system survival for yearlings (spring chinook and Snake River summer chinook salmon), subyearlings (fall chinook and Mid-Columbia summer chinook salmon), steelhead trout, and sockeye salmon. Yearling, steelhead, and sockeye tend to migrate in the spring, April through June, and subyearling in the summer, June through August.

Analytical Methods. Given the time, location, and number of hatchery and natural stocks of fish entering each pool, and the project/species specific characteristics for dam passage survival, pool survival, and travel time; FISHPASS uses the flow and spill information from SAM to compute the system survival (from point of origin) and the overall system survival for each species. Inputs and assumptions for the FISHPASS model can be found in Appendix G-2. A more detailed description of the FISHPASS model can be found in Appendix E-3 of the Final Intertie Development and Use EIS.

FISHPASS uses 40 rather than 200 random simulations from SAM to determine average survival for a given year. Analysis is then performed on 6 years of the 20-year sequence. In this case, the years of study are 1991, 1993, 1995, 1997, 2001, and 2003. The survival statistics evaluated include:

a. The relative change in mean survival. (This is determined by taking the difference in survival between each alternative and the No Action Base Case and dividing the difference by the Base Case survival.) (Appendix H-1e.)

b. The frequency of change in relative survival being greater than and less than 1 and 5 percent (see following paragraph). (Appendix H-1e.)

A potential for impact is considered to occur if:

- the change in relative survival exceeds 1 percent; or
- the decrease in frequency of a survival change
  - greater than 1 percent exceeds 30 percent; or
  - greater than 5 percent, exceeds 5 percent.

A biological assessment for both the critical and noncritical stocks potentially effected by any of the alternatives is included in Appendix H.

Sensitivity Analyses. Six sensitivity studies were evaluated to determine their effect on the operation of the hydro system and on fish survival. They included: (1) high Pacific Northwest loads; (2) low Pacific Northwest loads; (3) high Pacific Southwest gas prices; (4) low Pacific Southwest gas prices; (5) high Pacific Southwest loads; and (6) low Pacific Southwest loads.

None of these six sensitivities caused the hydro system operate in a significantly different manner. Flows and reservoir operations remained within the limits examined for each alternative.

Vegetation and Wildlife

Reservoir elevations can affect wildlife, both directly and indirectly, through the timing, duration, and amount of release. Changes to system operations may result in increased fluctuations relative to existing system operations. However, all reservoir operations will always remain within the operational constrains set by the operating agencies and the physical characteristics of the dams.

The greatest effect on wildlife of reservoir water level fluctuations, in the Columbia River is through effects on wildlife habitat. This can occur in three ways. First, any effect on prey or browse species of plants or animals will have a corresponding effect on wildlife species. For example, water level fluctuations can affect shoreline vegetation, which may in turn affect deer and elk dependent on riparian browse, smaller mammals and birds dependent on aquatic insects or other riparian invertebrates, waterfowl dependent on aquatic vegetation or invertebrates for food, and mammals and birds dependent on fish for fool. This effect is especially important if vegetation is damaged at a critical time of the year, such as when deer and elk need it for winter food or waterfowl need it for shelter or nesting.

Second, erosion of islands would decrease habitat used for bird nesting and deer fawning, and also decrease the amount of shoreline used by reptiles for laying eggs. This is most significant on small islands where such areas may be in short supply.

Third, during low water periods, land bridges may be formed to river islands allowing predators easy access to habitat that would otherwise be inaccessible. This is of particular concern a few months out of the year when nesting and fawning is taking place, or when migratory birds use the islands as resting places. However, effects can be long-term if substantial predation occurs during the breeding seasons.

Hydroelectric operations may also have direct adverse effects on wildlife. For example, beaver and muskrat can drown when rapidly rising water inundates their dens; or bird nesting and deer fawning islands may be flooded when young are present; or dormant reptiles (summer or winter) may be affected near the low-water levels. Banksloughing caused by erosion could destroy nests of such species as swallow and king fisher; rapidly dropping water levels could strand and dessicate anphibian egg masses.

In accordance with the Endangered Species Act (16 U.S.C 1531 et. seq.), BPA actions must avoid jeopardizing the existence of any endangered or threatened species. The biological assessment of effects on endangered or threatened species is contained in Appendix L.

H-1b

Background on Fish, Wildlife and Vegetation Impacts Due to Fossil Fuel Fired Plant Operations

Background on Fish, Wildlife and Vegetation Impacts Due to Fossil Fuel Fired Plant Operations

WATER USE AND FISH

As discussed elsewhere in Section 4.3, Intertie decisions may affect the operation and construction of power plants. This section addresses how such changes may affect water use and supply, and fish resources. It discusses, by power generation plant type, how the operation of the power system may affect water resources and fish.

Overview and Summary

Changes in the operation or composition of the power system resulting from changes in power sales contracts, may affect water use, water supply, and fish by several means, including changes in hydroelectric and thermal plant operations.

PLANT OPERATIONS

The operation of a thermal generating plant requires that fuel be acquired, prepared, transported, and consumed, and that any wastes be disposed of. Hydroelectric plants, while requiring none of these steps, can still significantly affect aquatic resources. The discussion below focuses on how the operation of fossil fuel fired power plant types may affect water resources and fish.

Coal

Surface mining may affect both surface water and groundwater. Water bodies can be contaminated by fuels; herbicides; blasting residues (ammonium nitrate); polychlorinated biphenyls (PCBs); and trace elements leached from piles of soil and other materials removed during surface mining, and later used to reclaim the site ("spoil piles"). If water is used in the mining process, the water table may be lowered, indirectly affecting streams, lakes, and other water resources. Where water is scarce (as in the northern Great Plains, and Rocky Mountain regions), livestock, wildlife, and human consumers may be affected. Water use is heaviest for irrigating revegetation projects at mine sites. A typical water requirement for a surface mine is around 360,000 gallons per average megawatt of energy produced by the coal that is mined.

Strip mining removes vegetation and disturbs the ground, leading to increased runoff, erosion, and wind-blown dust. Increased sediment and silt deposition in nearby waters may reduce the kind and number of invertebrate fauna and fish species. Less light penetrates the waters and primary production is reduced. Increased runoff also increases nutrient loading, which at higher levels may reduce fish populations while increasing vegetation (eutrophication).

Runoff from surface disturbances becomes more rapid during storms and may affect the variability of streamflows. Changing flow regimes can change fish habitat, and may shift species abundance (Bovee, 1982; Raleigh et al., 1984; Moyle and Nichols, 1974). Temperature and oxygen content of the water may also change (Garcia et al., 1985).

Most detrimental impacts on water resources can be minimized by suppressing dust, controlling erosion, and treating runoff waters in settling ponds to collect sediment or hazardous material. Many of the impacts discussed above are regulated by Federal, State, and local mining laws. The Surface Mining Control and Reclamation Act of 1977 mandates State permit systems governing environmental standards for maximum recovery of coal; restoration of land to its original contour; use of explosives; waste disposal; construction of access roads; and revegetation. Wastewater discharges from surface mines are also regulated under the Clean Water Act through water quality standards; effluent limitations for new and existing sources; permit programs; and areawide planning (Office of Technology Assessment, 1979). The Clean Water Act requires the best practicable control technology currently available for area runoff from coal mines. All Western surface mines currently operate in compliance with the Surface Mining and Clean Water Acts (M. Shilling, personal communication). Assuming that compliance continues, the power sales contract induced indirect effects related to coal mining upon water use will be negligible.

Coal transportation has minimal impacts on water resources. Dust may enter the water, but only when roads or train tracks are near water. Coal processing and storage has little or no impact on water use. Since Western soils are largely alkaline in the area of coal storage piles, acidic drainage is not likely to be a problem, as the natural alkalinity in the soil quickly neutralizes any acidic runoff.

At many plants, limestone is used in air pollution control processes. Limestone preparation and storage generate dust and runoff, which can carry calcium, carbonates, bicarbonates, and other dissolved and suspended solids to local waters, increasing their hardness and alkalinity (Dvorak et al., 1978; APHA, 1980). Impacts from limestone processing and storage are site-specific, depending on amount of limestone, rainfall, runoff potential, the size of receiving water body, and environmental controls. Runoff and dust controls are required under the Federal Water Pollution Control Act (1972), as amended (Clean Water Act), and under the Resource Conservation and Recovery Act (Office of Technology Assessment, 1979; Hittman, 1974).

The major impacts on water use and fisheries associated with the coal plant fuel cycle are related to coal combustion: the acidification of natural water bodies via airborne pollutants ("acid rain"); and water consumption, heat discharge, and fish entrainment related to plant cooling.

Acid Deposition

Emissions from coal plants have been identified as a factor in acid precipitation in some parts of the country. However, the contributions of individual sources of emissions are relatively small, and because the emissions and their products are often transported great distances by complex meteorological processes, acid precipitation is a regional problem that has proved impossible to link precisely and quantitatively with particular sources (Dvorak et al., 1978; Schindler et al., 1981). With intense rainfall, decreases in rain pH (i.e., greater acidity) have been observed downwind in close proximity (within 5 km) to coal-fired plants. In Western states, the water bodies that are more sensitive to acidification are those at high elevations in mountainous areas (Potter, 1982; EPA, 1982; Logan et al., 1982).

In general there are no long records of acid deposition rates at any site in the West. However, as shown in Appendix E, Table E-8, some areas have recently experienced rainfall with a pH below that generally considered natural (pH 5.6) for pure rain (Gibson, 1981). It is not possible to link the pH of rain at these stations to discharges at individual, or groups of, power plants.

The major impacts of acid deposition on water use and aquatic life can be summarized as follows. Very acidic (low pH) runoff may enter streams and rivers quickly and in large quantities during periods of snowmelt. Different fish species vary greatly in their tolerance of low pH. Among the salmonids present in the high mountain streams, rainbow trout are most sensitive. Some species are more sensitive at certain times of the year; and smaller, younger fish are often more sensitive than larger, older ones. Low pH may alter reproduction rates or may kill eggs, larvae, fingerlings, or adults. Death may be a direct response to low pH or to increased metal concentrations at low pH (e.g., aluminum toxicity). Increased acidity may kill indirectly, through gradual losses due to chronic low-level contamination. Sensitive species may be eliminated from a community, and shifts may occur in predator-prey relationships, competition, or other community-level interactions. Other aquatic biota in the community may be similarly affected.

Aquatic systems with a pH below 5.0 are generally very restricted in fishery resources, but these low pH levels are not now occurring in areas examined in this EIS. The effects can be illustrated by example from other U.S. regions. About 90 percent of high elevation Adirondack (New York) lakes that are acidified and have a pH below 5.0 are not supporting any fish life (Schofield, 1981). In Nova Scotia, nine rivers with a pH of 4.7 no longer support salmon or trout reproduction. In general, most lakes in the Sierra Nevada have a low buffering capacity and pH levels between 6 and 7 (K. Tonnessen, 1981). The acidity of Pardee and Hetch Hetchy reservoirs has been increasing somewhat since at least 1954, but was not lower than 6.8 in the early 1980's (McCall, 1981). At Shaver Lake, also in the Sierras, pH values were between 6.8 and 7.0 in 1986 and in the past 19 years were generally above 6.7 (excluding bottom readings). Readings varied with depth and location within the lake.

At Galena Lake in the Rocky Mountains, acid rain has been recorded (mean pH of 4.2 in the summer of 1980), alkalinity levels were low, and the lake pH was about 6. The sources of the acidity were unknown (Harte, 1981). Often, acidity cannot be linked to specific power plants. Although high altitude regions in the study area are sensitive, they are not now exhibiting significant, negative impacts from the acid deposition they are receiving.

Trace Elements

Coal combustion also releases particulates that can carry trace elements. These particulates may fall immediately in wet or dry form or may be airborne and fall far from the source. Trace elements react in complex ways in aquatic environments. The effects of these elements on biota can include acute mortality, reduced survival and growth, impaired reproduction, structural damage, modified behavior, and reduced crop production (Potter, 1982). Effects on water bodies can also be insignificant, as water temperature, hardness, pH, and dilution volume may modify toxicity. A modeling study by Dvorak et al. (1977) concluded that, for a power plant in a given drainage basin, a stream with a mean annual flow of 1,000 cubic feet per second provides enough dilution to reduce trace element concentrations to below levels toxic to aquatic biota and current water quality thresholds. Many streams near coal plants influenced by power contract decisions fall below this flow level during at least part of the year. Most studies of trace element contamination near specific plants have shown few significant effects (Office of Technology Assessment, 1979). However, it is possible that significant effects due to lower levels of contamination over wider areas may exist.

Thermal Plant Cooling Systems

The use of ground or surface water for cooling in a coal-fired plant can adversely affect both water use and quantity. Further, aquatic biota may be drawn into (entrained in) cooling water intakes. The extent of such impacts depends on the water source (natural surface water, groundwater, or power plant reservoir), the type of cooling system (once-through or closed-recycle), and the organisms present in the water bodies from which cooling water is drawn and to which it is discharged. Because the impacts on water quality and fish due to the cooling cycle in oil/gas plants are essentially the same as the cooling cycle impacts of coal plants, both types of impacts are covered here.

Closed-Cycle Cooling Systems. These systems include cooling ponds and towers. They cool the plant by circulating water through the plant and then into a special pond or tower, where evaporation and exposure to air cool the water. Water is recirculated through the plant and cooling tower or pond, and replenished only to the extent that it evaporates. These systems discharge heat to the atmosphere rather than to water. In general, entrainment of fish is not a significant problem for these systems. However, evaporative losses can make water consumption very high (see Table H-1b-1).

Water consumption can be a significant issue when the amount of the withdrawal due to plant cooling is high relative to the amount of water at the source. For streams and rivers, this may be an issue only at certain low-flow periods, when additional flow reductions might be harmful to fish spawning and migration, and to other wildlife or uses. Cooling water consumption from underground sources can be an issue when the amount of the withdrawal is a significant portion of the total recharge of the aquifer.

Table H-1b-1
WATER REQUIREMENT OF ALTERNATE COOLING SYSTEMS FOR FOSSIL FUEL POWER PLANTS

Acre-Feet/Average Annual MW

TYPE	Evaporation	Blowdown and drift	In Plant Use	Net Consumption
Once-through	8.7	0	1.1	9.8
Mechanical Draft Evaporation Tower	13.6	6.9	1.1	21.6
Natural Draft Evaporation Tower	12.8	6.4	1.1	20.3
Cooling Pond	18.7	7.4	1.1	24.4 */
Spray Pond	13.4	15.5	1.1	30.0
Dry Tower	-	-	1.1	1.1
Wet/Dry Tower	intermediate between dry and wet tower	1.1	4.3 - 21.4	

Adapted from Thomas (1975)

*/ Some contribution due to precipitation on pond.

Because closed-cycle cooling can cause substantial consumption of water through evaporation, consumption of ground and surface water was calculated for the power sales contract alternatives analyzed with SAM. Colstrip, Centralia, and Bridger draw makeup water from rivers, Valmy uses well water, and Boardman uses a cooling lake (Carty Reservoir) replenished by the Columbia River. All these plants use closed-cycle cooling systems.

Water consumption varies among power plants. Withdrawal requirements vary with evaporation losses, cooling system needs, and water quality.

Entrainment. Changes in levels of generation are expected to have little influence on existing entrainment. Cooling water pumps at most plants usually operate at full capacity regardless of generation. Pumps are shut down only if the plant is idle for relatively long periods; for this reason, reductions in entrainment may not occur if the plant is being operated cyclically, as it might under an exchange, even though its average generation is less. If substantial reductions in generation occur, one of several pumps may be turned off (Bernard Rapan, personal communication, February 1986).

Cooling System Wastes. Substances added to condenser cooling waters to minimize corrosion, deposits, and biological growth may be toxic if released to ground or surface waters (Elonka, 1963). Power plant operations may also impair water quality by discharging cooling system water and boiler water containing dissolved solids. The impact depends upon site characteristics. Some generating units recycle these waters until they are evaporated, so no wastewater is released. This effect is considered comparatively minor and is not analyzed in this EIS.

Disposal of combustion wastes can also affect water quality. Water can be consumed if ash and slag wastes are slurried or sluiced to settling basins and storage ponds. Net water consumption is greatest if this water evaporates and least if it is released to surface waters (Table H-1b-2). Water use is higher in facilities that handle each combustion waste separately.

Wastewater may be released through a breach of storage dikes, overflow, or percolation to groundwater (Dvorak et al., 1978). Unintentional discharges should not occur if the facility is designed and operated in conformance with the Effluent Limitations Guidelines, New Source Performance Standards (NSPS), and provisions of the Resource Conservation and Recovery Act (Soholt et al., 1980; Hittman, 1974). Runoff from onsite waste ponds is unlikely if they are lined and if protective dikes are built high enough (Lewis et al., 1978). Most basins are designed to contain runoff from a once-in-10-years storm (Soholt et al., 1981). Excessive rainfall and/or dike failure may cause spills (Dvorak et al., 1978), but the wastewater would likely be contained on-site. Seepage can contaminate soil and groundwater, especially if waste is deposited as a slurry. However, storage ponds are lined in order to minimize such hazards.

Table H-1b-2

WATER REQUIREMENTS FOR WASTE DISPOSAL AT A COAL-FIRED POWER PLANT

TYPE	Water (10^3 Gal/Average MW) No Recycling	Recycling
Bottom Ash	47.3 a/	5.1 c/
Fly Ash	184.2 a/	19.7 c/
Lime Sludge	147.4 b/	26.9 c/
Limestone Sludge	184.2 b/	33.8 c/

a/ Assumes slurry with 30 percent solids by weight.
b/ Assumes sludge with 30 percent solids by weight.
c/ Assume 70 percent solids by weight.

Oil and Natural Gas

The oil and natural gas industries have potential for significant adverse effects on ground and surface waters and aquatic life. Many of these potential effects result from unplanned events such as accidental spills or equipment failure. Although potential water quality and aquatic life impacts resulting from the provision of fuel oil and natural gas for electric power generation are significant, it is difficult to tie projected changes in generation at oil and gas-fired power plants resulting from BPA's power sales contract alternatives to changes in operation of specific oil and gas industry facilities. Therefore, a quantitative analysis of the impacts of contract alternatives on water quality and aquatic life effects of the oil and gas industries within this EIS is precluded.

The environmental effects of oil and gas extraction depend on local site characteristics and the specific drilling method employed. Exploration can significantly affect water quality. Groundwater may supply solvent for drilling muds and for well injection. Aquifers may be contaminated if drilling muds, fluids, brines, and hydrocarbons escape into porous formations. However, casing and other techniques protect aquifers, greatly reducing the risk of contamination. Oil spills may occur at the well-head; however, these are typically confined, low-volume spills which do not seriously contaminate surface waters (Garcia et al., 1983).

Water quality problems resulting directly from operation of oil- and gas-fired power plants are minimal. However, oil and gas generation can lead to substantial consumption of ground and surface water for cooling, or to the entrainment of fish and the discharge of heated waters, as discussed earlier in this section. Impacts from limestone preparation and storage at oil plants, and from condenser cooling at oil and gas-fired plants, are the same as those discussed above for coal plants. The lower sulfur levels involved in burning oil (relative to coal) result in less scrubber sludge and ash waste (Dvorak et al., 1978). Gas combustion produces none of these wastes. Impacts of gas combustion are generically similar to but much less than those described for coal.

VEGETATION AND WILDLIFE EFFECTS OF THERMAL POWER PLANTS

Through their effects on the operation of thermal plants, decisions on power contracts have the potential for impacting vegetation and wildlife. This section considers the effects of changes in the operations of coal, oil, gas, and nuclear generation facilities on these environmental factors.

Coal Mine Effects. Strip-mining involves excavation, backfilling, and grading that removes vegetation from large tracts. This affects wildlife primarily through loss and disturbance of habitat. Displacement of species may cause species to move into adjacent areas, where overcrowding and competition for limited resources may increase mortality, especially in critical habitat areas. (Other sources of information on wildlife impacts include an annotated bibliography by Rolston, Hilbut, and Swift (1977), and a summary of practices to protect fish and wildlife on mined lands in Utah by Procter et al. (1983)).

Uncontrolled runoff and the resulting soil erosion may contaminate surface and groundwaters, altering species composition and soil characteristics. Accidental fires may temporarily affect vegetation and wildlife. Hauling of coal and overburden may result in noise, dust, air emissions, soil compaction, and road-kills.

Exploration and mine development involve the use of drill rigs and test pits which have localized impacts on soil, vegetation, and wildlife due to grading, clearing, noise, dust, runoff, excavation, and related activities, but on a far smaller scale than actual mining operations. By delaying mine development, the Intertie could have a beneficial effect. Mines will operate within standards set by the U.S. Department of the Interior and other governmental standards and therefore will not affect Federally listed threatened and endangered species. Therefore, mine operation's will have no impacts on threatened and endangered species or their habitat.

Reclamation attempts in the Northern Great Plains and Rocky Mountains have typically succeeded in establishing nonnative plant cover. The reclamation of Western coal mines is hampered by a combination of nutrient-poor soil and arid or semiarid climate. All reclamation efforts to date require high inputs of energy, manpower, fertilizer, and water. In effect, these reclamation activities have been short-term in nature and have required high maintenance levels (Curry, 1980; R. Giurgevich and M. Moxley, Wyoming Department of Environmental Quality, personal communication, 1985). To be successful, reclamation requires 15 years or more for long-lasting results. (NAS, 1974; Aldon, 1978).

The Rosebud Mine in Montana, and the Belle-Ayre and Bridger Mines in Wyoming are on Federal lands and are operating under permits granted by the Office of Surface Mining (OSM). Permits require compliance with the National Environmental Policy Act (NEPA), including a requirement dealing with threatened and endangered species. The U.S. Department of the Interior must approve the permit and assure compliance with all Federal laws including the Threatened and Endangered Species Act (Holbrook, 1987, personal communication). These permits apply only to a certain surface area; if expansion is necessary, a new permit must be obtained. All NEPA requirements and other applicable laws such as the Threatened and Endangered Species Act must be reviewed again.

Coal-Fired Plant Effects

For existing coal-fired plants, impacts on vegetation and wildlife can occur from increased water withdrawals for cooling or increased return-water temperature. Tables 1.2.1, 4.1.3, 4.1.5, and 4.3.2 in Chapter 4 of Volume 1 of this EIS show projected maximum changes in water withdrawals for the plants considered in the SAM analyses. Maximum changes in water consumption shown in these tables are small.

Coal-fired power plant emissions may affect wildlife directly and indirectly. The direct effects of these emissions on wildlife involve acute or chronic exposure to gaseous or particulate substances contained in stack gases. Animal response to air pollution varies seasonally and in relation to habitat quality, sex, and age. Indirect effects on wildlife occur through contaminated food sources and habitat. Species that are most susceptible to such indirect effects include eagles, ospreys, kingfishers, and other fish-eating birds; bears; and water-associated mammals such as mink, beaver, and river otters. However, all projected changes in ambient air quality are so small that changes in effects on vegetation and wildlife of air pollution would be negligible (see Appendix H-7).

Dvorak et al. (1978), and Dvorak and Pentacost (1977) cite modeling studies to suggest that trace elements may have relatively little impact on terrestrial organisms and their communities, provided that the power plants meet New Source Performance Standards (NSPS) for particulates, and provided that tall stacks are used.

Of the primary gaseous pollutants, SO_2 is likely to have the greatest impact on terrestrial ecosystems, particularly on vegetation. Gases such as SO_2 and NO_2 can damage plants by destroying all or part of their foliage, reducing vegetation biomass and species diversity, or damaging reproductive ability (Gordon and Tourangeau, 1974). It has been determined that the alternatives analyzed with SAM will produce no significant change in air quality.

Acid deposition may also affect terrestrial environments and wildlife. The impacts of acid deposition are reviewed in Dvorak et al. (1978), Gage (1980), Peterson and Adler(1982), and Newmann (1980). Bark beetle attacks in ponderosa pine forests, for example, are more prevalent and devastating when trees are injured by oxidants (Wood, 1973). Parts of Arizona, New Mexico, Washington, Oregon, and Idaho may also be subject to acid deposition. Steep slopes with thin, rocky soils, and riparian habitats are particularly vulnerable locations (Peterson and Adler, 1982).

Acidification of lakes and streams may change the composition and structure of aquatic vegetation, affecting riparian wildlife, particularly amphibians. Acid deposition has been shown to produce changes in soil pH and water chemistry to such a degree that aquatic and terrestrial producers have drastically declined, resulting in subsequent loss of primary and secondary consumers (Gage, 1980).

Because terrestrial vertebrates are protected by feathers, fur, or scales, the direct effects of acid deposition are minimal. Acute direct effects on animals are restricted to areas very near point sources of the acidifying air pollutants. Such effects as irritation of eyes or respiratory tract (Newmann, 1980) can lead to emigration, abnormal behavior, or reductions in inter- and intra-specific competitiveness (Chilgren, 1978).

Chemicals added to cooling-tower waters to prevent corrosion in the pipes can be released with drifting vapor from cooling towers, and may be deposited on the ground nearby. Trace amounts of heavy metals, including arsenic, cadmium, lead, chromium, and mercury, have also been found in tower drift. Salt drift from plants cooling with ocean water may lead to vegetation shifts where salt-intolerant species are prevalent (BSAI, 1982).

Impacts of diverting water for use in coal plants depends on the source of the water, particularly if diverted from surface drainages. There may be some reduction in the amount of riparian vegetation, a shift in composition to less moisture-dependent species, and a reduction in the habitat value to wildlife. This would be of greatest concern in arid environments.

Where spills or seepage from coal plant waste storage ponds contaminate soil or groundwater, vegetation may accumulate toxins and pass them on to herbivores. Dvorak et al. (1978) discuss the adverse effects of unlined ash and waste-disposal sites on groundwater and terrestrial food chains. Leaching from lined sites is negligible (Soholt et al., 1981). The Resource Conservation and Recovery Act forbids placing waste storage facilities in environmentally sensitive areas (e.g., wetlands), in critical habitat for endangered species, in seismically active areas, or within recharge zones of sole-source aquifers (Soholt et al., 1981). Waste-handling facilities cannot discharge pollutants into surface waters in violation of the requirements of the National Pollution Discharge Elimination System established through the Clean Water Act. Therefore, only accidental spills or poorly operated facilities are likely to affect vegetarion and wildlife.

Disposal ponds may attract waterbirds, especially if there are nearby sources of food. Birds using these ponds for resting and feeding can ingest potentially toxic particles or slag. Surface-feeding waterfowl are most vulnerable to ingesting slag, which may contain beneficial as well as detrimental trace metals. Birds may also collide with transmission towers and lines situated close to the ponds. There would be a slight change in the amount of ash deposited into disposal ponds as a result of the power sales contract alternatives.

Gas and Oil-Fired Power Plant Effects. Air pollutants emitted by oil or gas plants affect wildlife and their habitat much as those emitted by coal plants, but the magnitude of these impacts are much smaller in most cases, because of the lower level of emissions from oil/gas plants. Effects on vegetation and wildlife related to air quality from changes in operation of oil/gas plants are negligible since the projected ambient air quality differences (see 4.3.3) are so small.

Nuclear Plant Operations. Effects from nuclear power plants depend on the plant's location and cooling system used. Nuclear plants produce radioactive waste, radioactive emissions, waste heat, and chemical residuals from the cooling water system. The impact of nuclear power plants on terrestrial vegetation is most likely to occur through the deposition of drifting steam that is released from cooling towers. This drifting steam can damage nearby vegetation, especially if salt water is used for cooling. Improved engineering design can control the problem through the use of baffles or drift eliminators, which reduce the amount of water droplets in the air stream.

Thermal discharges from once-through cooling systems near estuaries could affect terrestrial wildlife and vegetation through a change in distribution of some marine fish. Waste heat released in other areas does not appear to affect wildlife or vegetation. Operation of existing nuclear plants are not projected to change with power sales contract alternatives. However, some alternatives do affect the liklihood of and timing of additional nuclear plant capacity being developed.

H-1c

Overview of Columbia Basin Anadromous Fish Stocks and Significance Analysis

SPECIAL NOTE

Effect on Fish Stock Analysis of Proposed Listings under the Endangered Species Act

PLEASE NOTE: The fish stocks discussed in this appendix are those which were considered at the time of analysis to be potentially impacted by alternatives in the power sales contracts EIS. The analysis focused on Columbia River stocks and passage measures at projects through which those stocks must travel during migration. Since this analysis was completed, the National Marine Fisheries Service (NMFS), in response to petitions from fisheries groups, has proposed listing three species of Snake River salmon as threatened or endangered species under the Endangered Species Act. The species proposed for listing are Snake River sockeye salmon, Snake River spring and summer chinook (as a single species), and Snake River fall chinook.

Regional organizations with authority and activities affected by the proposed listings are working to develop plans to enhance the survival of these species through a variety of activities. Several short-term measures were implemented at federal hydro projects immediately following the proposed listings to improve migration conditions for the candidate species. The Northwest Power Planning Council is considering amendments to its Fish and Wildlife Program. The U.S. Army Corps of Engineers, in cooperation with the Bureau of Reclamation and BPA, is considering alternative water management actions at lower Snake and Columbia River projects to help juvenile and adult migration in 1992 and beyond. Alternative actions are analyzed in the "1992 Columbia River Salmon Flow Measures Options Analysis/EIS." Similarly, longer term options for system operation to enhance the survival of runs proposed for listing will be considered in the System Operation Review EIS, also under preparation by the Corps, the Bureau, and BPA.

Impacts discussed in this appendix are those of alternatives other than the proposed action. The proposed action continues current operations of the hydro system. The EIS analysis of the proposed action did not identify any additional impacts beyond those of current hydro operations. Actions adopted through the above planning efforts and changes in the survival of species proposed for listing as a result of those actions will supersede the analysis in this appendix of fishery impacts of EIS alternatives.

Initiatives taken in response to proposed listings will benefit system operations to enhance fish survival. Operations of the existing system will be subject to any new limitations adopted by project operators or imposed as part of a recovery plan if species are listed. Improved operations to protect fish runs would tend to diminish the fishery impacts of the EIS alternatives as described in this appendix. Measures to enhance the survival of species proposed for listing will also benefit other stocks discussed in this appendix.

In short, responses to proposed listings will reduce adverse impacts of EIS alternatives on fish. As a result, adverse effects of EIS alternatives on fish runs will probably be smaller than the EIS discussion states.

Overview of Columbia Basin Anadromous Fish Stocks

A large number of anadromous fish stocks are produced in the Columbia River Basin. These include upper river spring and summer chinook, fall chinook, coho and sockeye salmon and steelhead trout.

Upper River Spring Chinook. Upper River spring chinook spawn throughout the Columbia and Snake River Basins. The adults enter the Columbia River on their spawning migration in the spring with the run peaking at Bonneville Dam in April and May. The adults spawn in the fall. Juveniles migrate to the ocean a year from the following spring as "yearlings." The upriver spring chinook run averaged at 168,000 between 1939 and 1974. This average declined in recent years to a 1975-1985 average of 85,000 fish, with a record low upriver run in 1979 of 51,500 fish. This compares to the management goal of 115,000 spring chinook over Bonneville Dam with 25,000 natural/wild and 10,000 hatchery fish over Lower Granite Dam. This was met in 1986 when 125,600 spring chinook passed over Bonneville Dam. The 1987 and 1988 run sizes were 103,200 and 92,700 respectively.

Spring chinook are not harvested in significant numbers by the ocean fishery. Prior to 1970, in-river fisheries harvested substantial numbers of fish, but due to declines in the run since that time, significant catches occurred only in 1977 and 1986. In 1988 the Columbia River Fish Management Plan (CRFMP) resulted from the settlement of the U.S. District Court case of U.S. v. Oregon (Case No. 68-513), through an agreement between the Federal agencies, Indian Tribes, and State agencies. This agreement entitles the Treaty fisheries to a minimum of 10,000 spring and summer chinook with the majority being spring chinook. Treaty fishery harvest rates when runs are below the passage goal will not exceed 7 percent of the run. In 1988 the Treaty commercial and ceremonial/subsistence fisheries harvested 6,429 spring chinook.

Upper River Summer Chinook. The Upper River summer chinook run contains two distinct runs divided between the Snake and the Upper Columbia rivers. Both groups return as adults to Bonneville dam in June and July. However, the Snake River summer chinook have a life-cycle similar to spring chinook in that the juveniles migrate from the system as yearlings. In contrast, Upper Columbia River summer chinook have a life-cycle like fall chinook--their progeny migrate downstream during the summer (June-August) as subyearlings.

Both the Snake and Upper Columbia River summer chinook runs have decreased dramatically in recent years. The 1938-1969 average run at Bonneville Dam was 111,000 fish, while the 1978-1987 average was 26,000 fish. Since 1986 the average has been exceeded but the run is well below the management goal of 80,000 to 90,000 fish over Bonneville Dam.

Summer chinook continue to be harvested in substantial numbers. The ocean fisheries occur primarily in Alaska and British Columbia. A 1984 estimate placed ocean harvest at 62.9 percent of the stock. In river incidental harvest of summer chinook does occur and is limited to jacks during the steelhead sport fishery and the lower river gill-net sockeye fishery; adults and jacks in the Treaty set-net sockeye fishery; and handling only in the lower river shad gill-net fishery. In 1988, an estimated 1,100 summer chinook were harvested.

Fall Chinook. While a limited number of some fall chinook migrate as yearlings, the majority of juveniles move down river in their first summer as subyearlings. Adults enter the river to spawn from August through November, with counts peaking at Bonneville Dam during September. Fall chinook may be divided into two groups Tule and Upriver Bright. The Tule chinook are a lower river, predominantly Bonneville Pool Hatchery (BPH) stock which is produced primarily at Spring Creek Hatchery. BPH fall chinook maintained their numbers well until 1982. Since then, the run has been depressed primarily due to hatchery disease problems.

Upriver Bright fall chinook are divided into two major segments, one which spawns in the Mid-Columbia River and the other in the Snake River. The Mid-Columbia fish are for the most part, either naturally produced in the free flowing Hanford Reach of the Columbia, are hatchery production from Priest Rapids, and Ringold hatcheries or recent releases into the Yakima River. The Snake River population, until recently, was an entirely naturally produced run. The Lyon's Ferry Hatchery is now producing a substantial number of Snake River fall chinook.

Recently another group of fall chinook has been developed, this is the Mid-Columbia Bright (MCB). The MCB is comprised of brights reared and released at Bonneville Hatchery and brights from Bonneville, Little White Salmon, Spring Creek, and Klickitat hatcheries released in areas between Bonneville and McNary dams.

The Upriver Bright fall chinook count at McNary Dam has, since 1960, often fallen below the 40,000 adult escapement goal. For example, from 1974 to 1982, the escapement goal was not reached. It appears the decline is attributable to a virtual loss of the Snake River segment of the run. The 1962-1977 annual average total Snake River fall chinook count was 16,400, compared to a 1975-1984 average of 2,000 fish. The Mid-Columbia segment, on the other hand, has grown in strength, with 1984-1986 counts vastly exceeding desired escapement levels. Both Tule and Upriver Bright fall chinook are heavily harvested in the ocean fisheries, Tules at 65.9 percent and Brights at 67.4 percent. Tules are harvested most heavily in the U.S. Coastal Fishery (39.9 percent), while Upriver Brights are harvested predominantly in the British Columbia Fishery (40.6 percent). Both stocks are harvested in-river as well, Tules at 10.7 percent and Brights at 7.9 percent. Since 1983, the Pacific Fisheries Management Council has attempted to decrease the harvest of BPH Tules to allow the stock to recover.

Coho Salmon. Coho salmon runs above Bonneville Dam are small and are largely limited to the Bonneville Pool. Nearly 90 percent of the 1980-1984 average Bonneville Dam count of 22,468 adult coho remained in the Bonneville Pool. Since the 1970's coho releases have occurred at the Rocky Reach-Turtle Rock complex, and recently releases of coho have begun in the Yakima and Umatilla Rivers, as outlined in the CRFMP. Efforts to obtain Snake River Brood Stock in 1983-1984 failed when no coho were trapped, even through dam counts indicated that a small number of coho were counted at the Snake River dams.

Upriver coho are harvested by ocean and in river fisheries. Harvest of stocks above Bonneville Dam in the Treaty Indian fisheries was 2,300 in 1988. Harvest have been minor due to restrictions to protect steelhead and because the run migrates only through the lowermost portion of the treaty fishing area enroute to Bonneville pool area hatcheries.

Sockeye Salmon. Columbia River sockeye originate from both the Snake and Mid-Columbia Rivers. By far the majority of the run, Mid-Columbia sockeye, comes from the Wenatchee and Okanogan Rivers. Over the period 1970 to 1984, the Okanogan system annually produced 58.5 percent of the 77,895 fish total. Total sockeye numbers from the Mid-Columbia have been stable since 1970, except for recent fluctuation: 1985 = 166,500; 1986 = 58,100; 1987 = 117,000 fish.

Sockeye are not harvested to any appreciable extent in the ocean commercial or sport fisheries. In-river fisheries have been sporadic, harvesting the larger runs when fish numbers exceeded escapement goals (65,000 at Preist Rapids Dam). The CRFMP has set up harvest levels based on Bonneville Dam passage with harvest, by ceremonial/subsistence fisheries for runs under 75,000, not to exceed 7 percent of the run. The harvest is divided between Treaty and non-Treaty fisheries for runs above 75,000 sockeye salmon.

Steelhead Trout. Steelhead trout are widely distributed throughout the Columbia and Snake River Basins. Their broad geographic distribution is matched by the great span of their run timing. Steelhead cross Bonneville Dam every day of the counting season (March-November) and beyond. The summer steelhead migration is generally divided into an "A" run, distribution throughout much of the system, and a "B" run, which consists of larger fish destined for the Snake River. The "B" run crosses Bonneville Dam after August 25. The timing of the peak of the "B" run depends on the contribution of its sub-populations and has varied from mid-July to early September. In addition to the summer steelhead discussed above, winter steelhead return to several streams within the Bonneville Pool.

Juvenile steelhead migrate to the ocean in the spring, with timing similar to that of yearling chinook. Their age at migration is variable (1-4 years), with 2 years as an average. Steelhead runs have increased substantially in recent years after reaching a low point in 1975. The 1986 Bonneville Dam total upriver run of 384,400 steelhead was exceeded only by the 1940 return of 422,800. The 1983-1987 "A" run sizes have all exceeded the 1969-1987 average of 121,000, with the 1988 minimum run size of 194,700 showing a decrease from the 1985-1987 highs. The "B" run from 1969-1985 averaged 58,000 fish. This figure has been exceeded each year since 1983, with the 1988 run reaching 90,200 steelhead.

Steelhead are not harvested in ocean fisheries and in-river commercial harvest by non-Treaty fishermen has been prohibited since 1975. Commercial harvest by the Treaty Indian fishery has averaged 78,400 steelhead during the period 1984-1988, a vast improvement over the 1979-1988 average of 43,800 steelhead. Lower river sport harvest also occurs with the 1988 harvest of upriver steelhead estimated to be 4,900 fish. Small numbers of steelhead are also harvested by the ceremonial and subsistence fisheries. No escapement goal has been set through the CRFMP for steelhead, but fisheries managers desire to continue to increase the run size.

Significance Analysis

Stocks Potentially Impacted by Power Sales Contract Alternatives
Critical and Noncritical Stocks

Wells Pool

Yearlings: Methow River Spring Chinook*
Winthrop National Fish Hatchery Spring Chinook

Subyearlings: Methow River Summer/fall Chinook*
Okanogan - Similkameen River Summer/Fall Chinook*

Rocky Reach Pool

Subyearlings: Wells Hatchery Summer/Fall Chinook*

Rock Island Pool

Yearlings: Wenatchee River Spring Chinook
Rocky Reach - Turtle Rock Complex Coho

Subyearlings: Wenatchee River Summer Chinook
Rocky Reach - Turtle Rock Complex Fall Chinook

Lower Monumental Pool

Yearlings: Tucannon River Spring Chinook*

Steelhead: Tucannon River Summer Steelhead

McNary Pool

Yearlings: Yakima River Spring Chinook
Yakima River Coho

John Day Pool

Yearlings: John Day River Spring Chinook
Umatilla River Spring Chinook
Umatilla River Coho

Subyearlings: John Day River Fall Chinook
Umatilla River URB

* Indicate a critical stock.

The Dalles Pool

Yearlings: Deschutes River Spring Chinook
WSNFH, RBH Spring Chinook

Steelhead: Deschutes River Summer Steelhead

Based on a relative decrease in survival of one percent in any year (FISHPASS)

WELLS POOL

Yearling Stocks

The Fishpass model identified decreased system survival of greater than 1 percent for all yearling stocks originating from the Wells Pool, for the alternative 4.10 (Increase First Quartile-Type Interruptability - 100 percent). There are two stocks identified in the Wells Pool: the Methow River spring chinook, and the Winthrop National Fish Hatchery spring chinook.

There is at present no sport or Indian terminal fisheries in the subbasin. Upriver spring chinook are harvested incidental to the Lower Columbia River winter gill-net, sport and Zone 6 (above Bonneville Dam) Treaty Indian fisheries. Seasons are regulated to minimize the number of upriver spring chinook harvested. As part of the U.S. vs Oregon agreement, Treaty Indian Commercial and Ceremonial and Subsistence fisheries are allowed to harvest 7 percent of the upriver spring chinook run up to 10,000 fish. The 1987 Treaty Indian Zone 6 harvest was 6,429 adults. It is assumed that even with this harvest that no significant numbers of Methow River or Winthrop NFH spring chinook are taken in any fishery.

Under alternative 4.10 the average system survival decreased 1.0 percent in 1 year and increased by 1.6 percent in another for yearling stocks originating in the Wells Pool.

Methow River Spring Chinook: This run is a mixture of natural returning fish and fish from the Winthrop NFH. This stock has shown improvement with an estimated return in 1985 of 3,433 fish, an increase from a low of 838 in 1979. The estimated return can include hatchery strays, and is still at a depressed level. Supplementation with Winthrop NFH stock in 1985 was 1,167,600, and in 1986 was 1,098,700 smolts, and will increase by 675,000 smolts as part of the Wells Settlement Agreement with Douglas County PUD.

The stock is considered to be managed as a critical hatchery - supplemented stock.

Winthrop National Fish Hatchery: This hatchery stock relies on returns to the Methow River and has used in the past stocks from Leavenworth NFH, Carson NFH, Little White Salmon NFH, and Cowlitz Hatchery. The present run is depressed with returns reaching a peak 1,200 in 1985 with an average return of 887 adults (1982-86), which is an increase over the returns of less than 100 in the late 1970s. Spring chinook are managed as a hatchery stock with current production at 1.1 million smolts. In the U.S. vs Oregon agreement, a provision calls for the production to increase to 1.4 million smolts, and a future developement plan will increase production to 2.0 million smolts.

It is assumed that this run is a viable hatchery stock.

Subyearling Stocks

The Fishpass model has identified a decrease in system survival for subyearling stocks originating in the Wells Pool. The two stocks that are identified are the Methow River summer/fall chinook, and the Okanogan -

Similkameen River summer/fall chinook. Due to confusion which exists regarding the identification of discrete races of summer and fall chinook for these subbasins, the subspecies will be treated as one race (i.e., summer/fall chinook).

There is presently no terminal sport or Treaty Indian fisheries targeting the summer/fall chinook in these subbasins. There are no lower river fisheries that target summer/fall chinook but incidental harvest of summer chinook does occur and is limited to jacks during the steelhead sport fishery and the lower river gill-net sockeye fishery; adults and jacks in the treaty set-net sockeye fishery; and handling only in the lower river shad gill-net fishery. In 1987, out of a run of 33,000, a harvest of 1,200 adults occurred in the Zone 6 commercial and ceremonial and subsistence fisheries. It is assumed that insignificant numbers of summer/fall chinook from the Wells Pool are taken in any fishery.

System survival for subyearlings under alternative 4.10 showed a decrease as great as 1.8 percent with other years, except one, showing decreases greater than 1.5 percent.

Methow River Summer/Fall Chinook: Spawning ground surveys show a decreasing trend for Methow River summer/fall chinook from a high in 1979 of 2,433 adults to 630 in 1985. This trend should show a turn around with the implementation of the Rock Island Dam Agreement which will increase the present release of 400,000 smolts by an additional 400,000 smolts. It is possible an additional production of 410,000 smolts will come from the Wells Settlement agreement depending on the success of the sockeye net pen rearing project. The stock is managed as a potentially critical supplemented stock.

Okanogan - Similkameen River Summer/Fall Chinook: The natural escapement has shown a slight rebound to a high of 2,244 adults in 1984 from a low of 526 in 1982. The 1977-85 average is 1,149 adults, with 1984 and 1985 showing a increase over the average. This stock has had no direct supplementation, but returns to Wells Hatchery may have entered the subbasin. As part of the Rock Island Settlement, 560,000 smolts will be released into the subbasin. The stock has been managed for natural production but will be enhanced with the above supplementation. The stock is managed as a critical natural supplemented stock.

ROCKY REACH POOL

Subyearling Stocks

The fishpass model has identified a decrease in survival under alternative 4.10 for subyearlings originating in the Rocky Reach pool. There is one subyearling stock that has been identified in the Rocky Reach Pool: Wells Hatchery summer/fall chinook. Due to confusion which exists regarding the identification of discrete races of summer and fall chinook for this hatchery, the sub-species will be treated as one race (i.e., summer/fall chinook).

There is presently no terminal sport or Treaty Indian fisheries targeting the returns to the hatchery. There are no lower river fisheries that target summer/fall chinook but incidental harvest of summer chinook does occur and is limited to jacks during the steelhead sport fishery and the lower river gill-net sockeye fishery; adults and jacks in the treaty set-net sockeye fishery; and handling only in the lower river shad gill-net fishery. In 1987, out of a run of 33,000, a harvest of 1,200 adults occurred in the Zone 6 commercial, and ceremonial and subsistence fisheries. It is assumed that insignificant numbers of summer/fall chinook from the Wells Hatchery are taken in any fishery.

Under alternative 4.10 the average system survival for subyearlings originating in the Rocky Reach Pool decreased by as much as 2.1 percent, with decreases occurring for all years.

Wells Hatchery Summer/Fall Chinook: The hatchery traps brood stock for its rearing program from the fish ladder at Wells Dam. The only information available for stock returns are dam counts at Wells Dam. A high count of 6,696 adults occurred in 1979, the recent low of 1,975 adults was in 1983, and a slight decreasing trend is seen with returns of 2,772 adults in 1987. The dam counts include brood stock trapped and summer/fall chinook bound for subbasins above Wells Dam. Wells Hatchery plans include production of 1,440,000 fingerlings and 250,000 yearlings for on station release. The hatchery also will produce 400,000 fingerlings for release into the Methow River, and possible additional production of 400,000 fingerlings for release into the Methow and Okanogan Rivers. The 1988 releases on station were 390,000 yearlings, and 1,963,000 fingerlings. This stock is managed as a potentially critical hatchery stock.

ROCK ISLAND POOL

Yearling Stocks

The fishpass model has identified an impact on the survival of yearling stocks originating from the Rock Island pool. There are two yearling stocks that originate in the pool, these are the Wenatchee River spring chinook, and the Rocky Reach - Turtle Rock Complex coho. The later of the two was not identified as a stock in the IDU EIS, but was identified as one in the NPPC's draft System Subbasin Planning report.

There presently is a terminal sport fishery that targets surplus hatchery returns to Icicle Creek and the Leavenworth Hatchery, some incidental harvest of wild fish does occur. Tribal harvest in recent years has concentrated on the hatchery stock. In 1985 the sport harvest was 4,280 adults, in 1986, the sport harvest was 4,717 adults.

Upriver spring chinook are harvested incidental to the Lower Columbia River winter gill-net, sport and Zone 6 (above Bonneville Dam) Treaty Indian fisheries. Seasons are regulated to minimize the number of upriver spring chinook harvested. As part of the U.S. vs Oregon agreement, Treaty Indian Commercial and Ceremonial and Subsistence fisheries are allowed to harvest 7 percent of the upriver spring chinook run up to 10,000 fish. The 1987 Treaty Indian Zone 6 harvest was 6,429 adults.

In the 1970s a sport fishery targeting the coho returns produced by a new coho program at Rock Island Dam had several annual harvests exceeding 3,000 fish.

Presently, pressure is very light, and the sport harvest of coho in the mid-Columbia is not available, but is assumed to be less than 50 fish. The coho returning to the Rock Island Pool are the early race of coho which use to predominate the areas above Priest Rapids. There is a major lower Columbia river fishery in the fall on returning coho salmon, mainly concentrating on stocks originating in the lower river below Bonneville Dam. There is a Treaty Indian fishery in Zone 6 above Bonneville Dam, but this is minor and limited by season and gear restrictions to protect upriver steelhead, and by the fact that most of the run is limited to returns to Bonneville Pool hatcheries. In 1987, the Zone 6 Treaty harvest was 2,300 adults, and in 1988 the harvest was 7,000 adults. This is the second highest harvest since 1973, the record harvest was 16,800 adults in 1986. Under U.S. vs Oregon, the management goal is to increase harvests in tributary fisheries.

The alternative 4.10 when compared to the Base Case shows a decrease in system survival for yearling stocks by as much as 1.5 percent for 1 year, but also showed increases of 1.7 percent and 1.3 percent in other years.

Wenatchee River Spring Chinook: This run consists of wild and Leavenworth National Fish hatchery returns, some straying of hatchery fish does occur. The Leavenworth NFH production goal to release 2,300,000 smolts into Icicle Creek. The 1988 release was 2,337,500 smolts and 348,500 presmolts (greater than 30 to the pound). A possible future release sight in the subbasin would release 670,000 smolts as part of the Rock Island Settlement agreement. Total returns (hatchery, wild and sport harvest), increased in 1985 and 1986 to 18,998 and 20,345 adults from a low of 4,097 in 1981. The greatest increase coming in the wild portion of the run. This stock is managed as a viable natural population and is not in critical condition, but consistent high returns are needed to allow a terminal fishery on the natural portion of the run. The hatchery portion of the run is managed for hatchery production, and in recent years the hatchery returns have shown an increasing trend, which is illustrated by the increased harvest opportunities below the hatchery.

Rocky Reach - Turtle Rock Complex Coho: The hatchery program at Rocky Reach was started in the 1970s after coho stocking programs for the Wenatchee, Entiat, and Methow rivers were discontinued in the 1960s. Lower river stocks are used to supplement hatchery returns which have been highly variable in the past. Returns have ranged from 260 in 1983 to 2,179 in 1984, and show a decreasing trend to 503 in 1986. The hatchery has used eggs from a number of sources: Lower Kalama, Elokomin, Washougal and Cowlitz hatcheries. Current production goal is 500,000 yearlings, the 1988 release was 417,000. This stock is managed for hatchery production, and is in depressed, but not critical condition.

Subyearling Stocks

The fishpass model has identified a impact to subyearling salmon originating in Rock Island Pool. There are two subyearling stocks that originate in the Rock Island Pool: Wenatchee River summer chinook, and Rocky Reach - Turtle Rock Complex fall chinook, the latter was not listed as a stock in the IDU EIS, but was identified as one in the NPPC's draft System Subbasin Planning report.

There are presently no terminal sport or Treaty Indian fisheries targeting the summer chinook returns to the subbasin. There are no lower river fisheries that target summer chinook but incidental harvest of summer chinook does occur and is limited to jacks during the steelhead sport fishery and the lower river gill-net sockeye fishery; adults and jacks in the treaty set-net sockeye fishery; and handling only, in the lower river shad gill-net fishery. In 1987, out of a run of 33,000, a harvest of 1,200 adults occurred in the Zone 6 commercial, and ceremonial and subsistence fisheries.

Columbia River fall chinook salmon stocks consist of five groups: Lower River Hatchery, Lower River Wild, Bonneville Pool Hatchery (BPH), Upriver Brights (URB), and Mid-Columbia Brights (MCB). All five groups are targeted in the mainstem Columbia River by sport, commercial and Treaty Indian fisheries and by ocean commercial fisheries. The MCB portion of the run is comprised of brights reared and released at Bonneville Hatchery and brights from Bonneville, Little White Salmon, Spring Creek, and Klickitat Hatcheries released in areas between Bonneville and McNary dams. The URB portion of the run has set record returns with an estimated 400,000 in 1988, and a record high of 419,000 in 1987. Harvests of URB have also set records with 254,800 taken in the Commercial fishery and 14,500 taken in the sport fishery in 1987. Annual passage goals of 40,000 URB at McNary Dam have been exceeded since 1983. Commercial gill-net harvests occurred in 1986 and 1987 in the area between Priest Rapids and Wanapum Dams, with the 1987 harvest totaling 2,215 chinook, and in 1988, 2,300 chinook were harvested. URB runs also have benefited from ocean and in river harvest regulations set to protect depressed returns of BPH stocks.

Under alternative 4.10 the average system survival for subyearlings originating in the Rock Island pool decreased by a maximum of 1.7 percent, ranging down to .5 percent.

Wenatchee River Summer Chinook: Presently the stock is a wild run of fish with no hatchery supplementation. Returns to the subbasin have shown an increasing trend from a low in 1983 of 4,169 chinook to 10,609 in 1986. A possible facility as part of the Rock Island Settlement would produce 864,000 smolts from adults collected at Dryden Dam. This stock has been managed as natural stock but this will change if the facility is built. Presently it is an improving and viable stock.

Rocky Reach - Turtle Rock Fall Chinook: This is an URB hatchery stock, with production goals of 200,000 yearling fall chinook, with the 1988 release of 230,000 yearling fall chinook. URB fall chinook mainly spawn in the Hanford Reach area below Priest Rapids Dam, but spawning has been observed below Wells and Wanapum Dam. This is assumed to be a viable hatchery stock, managed for harvest in the mainstem Columbia river

LOWER MONUMENTAL POOL

Yearling Stocks

The fishpass model has identified a decrease in survival under alternative 4.10 for yearling stocks originating in the Lower Monumental Pool. There is only one yearling stock identified in the Lower Monumental Pool: Tucannon River spring chinook.

There is presently no terminal harvest in the subbasin. Upriver spring chinook are harvested incidental to the Lower Columbia River winter gill-net, sport and Zone 6 (above Bonneville Dam) Treaty Indian fisheries. Seasons are regulated to minimize the number of upriver spring chinook harvested. As part of the U.S. vs Oregon agreement, Treaty Indian Commercial and Ceremonial and Subsistence fisheries are allowed to harvest 7 percent of the upriver spring chinook run up to 10,000 fish. The 1987 Treaty Indian Zone 6 harvest was 6,429 adults.

The system survival for yearling stocks under alternative 4.10 decreased in 1 year by 1.5 percent, but showed increases of 1.8 percent and 1.1 percent in other years.

Tucannon River Spring chinook: The historic returns were estimated to average about 2,400 adults, with some returns exceeding 5,000 adults. The Lower Snake River Plan sets the mitigation level at 1,152 adult escapement. Since 1971, the annual escapement has averaged about 200 adult spring chinook. In 1987, the return to the WDF trap for the Tucannon Fish Hatchery was 203 adults. Stocking started in 1962 with a release of 16,000 Klickitat stock; and in 1964, 10,500 Willamette River spring chinook stock smolts. In 1987, the first spring chinook release of Tucannon stock reared at Lyon's Ferry Hatchery occurred. In 1988, 150,000 spring chinook smolts were released from the Tucannon Hatchery. The management goal is to build the stock to allow increased Treaty Indian harvest. The stock is now managed as a critical hatchery-supplemented stock.

Steelhead

The fishpass model identified decreased survival for steelhead stocks originating in the Lower Monumental Pool when comparing alternative 4.10 to the Base Case. The only Steelhead stock originating from Lower Monumental Pool is the Tucannon River summer steelhead.

No harvest occurred in the Basin from mid 1977 to 1985. Harvest still occurs in the Zone 6 Treaty Indian fisheries, and the mainstem sport fishery. In 1987, the Zone 6 harvest of summer steelhead was 71,800, and in 1986, the harvest was 64,100. The Basin sport harvest is limited to hatchery fish only, with the release of all wild fish. The sport harvest in 1987 was 209 with an estimated escapement of 611, and in 1988, the sport harvest was 189 within estimated escapement of 905 summer steelhead.

The system survival for steelhead originating in the Lower Monumental Pool decreased by 1.1 percent in 1 year, under alternative 4.10.

Tucannon River Summer Steelhead

Supplementation of the Tucannon river summer steelhead has occurred since 1936 with stocks from Tucannon/Touchet river, Priest Rapids, Wells, Skamania, Wallowa, and Lyon's Ferry being used. The Lower Snake River Plan has a goal of returning 3,400 adults to the Basin. Tucannon hatchery now being remodeled by LSRP. In 1988, 161,500 smolts from the Lyon's Ferry hatchery were released in the Tucannon River. Returns to the Basin are below goals set by LSRP but show signs of improvement. The stock is managed as a hatchery supplemented natural stock.

MCNARY POOL

Yearling Stocks

The fishpass model has identified an impact on yearling stocks originating from the McNary Pool. There are two yearling stocks that have been identified in the McNary Pool: Yakima River spring chinook, and Yakima River coho.

Presently there is a Tribal subsistence fishery with in the Basin, with a future goal of increasing the Tribal exploitation rate to 25 percent of the run. Upriver spring chinook are harvested incidental to the Lower Columbia River winter gill-net, sport and Zone 6 (above Bonneville Dam) Treaty Indian fisheries. Seasons are regulated to minimize the number of upriver spring chinook harvested. As part of the U.S. vs Oregon agreement, Treaty Indian Commercial and Ceremonial and Subsistence fisheries are allowed to harvest 7 percent of the upriver spring chinook run up to 10,000 fish. The 1987 Treaty Indian Zone 6 harvest was 6,429 adults.

There is a major lower Columbia river fishery in the fall on returning coho salmon, mainly concentrating on stock originating in the lower river below Bonneville Dam. There is a Treaty Indian fishery in Zone 6 above Bonneville Dam, but this is minor and limited by season and gear restrictions to protect upriver steelhead, and by the fact that most of the run is limited to returns to Bonneville Pool hatcheries. In 1987, the Zone 6 Treaty harvest was 2,300 adults, and in 1988 the harvest was 7,000 adults, this is the second highest harvest since 1973, the record harvest was 16,800 adults in 1986. Under U.S. vs Oregon, the management goal is to increase harvests in tributary fisheries.

The alternative 4.10 when compared to the Base Case showed a 1 year decrease in system survival for yearling stocks of 2.1 percent. In another year, system survival increased by 1.3 percent, and the remaining years shows a slight improvement in system survival.

Yakima River Spring Chinook: Returns have varied in the past few years from a low of 1,324 in 1983 to a high of 9,452 in 1986, dropping to 4,390 adults in 1987. An estimated return of 6,000 adults is needed to meet hatchery and harvest goals. Supplementation has occurred since 1958 using Leavenworth, Carson and Yakima River stocks. Supplementation will increase with the completion of the Yakima/Klickitat Production Facility, where production will be 1.6 million smolts annually. Two stock will be used, Naches River and Upper Yakima, and management will try to insulate the American River stock from supplementation. This stock is managed as a hatchery supplemented stock.

Yakima River Coho: This stock was not listed in the IDU EIS because it is a recent re-introduction to the Basin. No harvest of coho has occurred since the 1930s, and there are presently no estimates on returns. Under U.S. vs Oregon, 700,000 coho smolts will be released into the Yakima annually for 5 years (1988-1992) to diversify fishing opportunities. Future studies will determine if natural production is warranted. The Yakima/Klickitat facility will release 2,009,250 smolts using 2,350 spawners, with the goal of producing a total return of 40,000 natural and hatchery adults. This stock is presently managed as a building hatchery stock.

JOHN DAY POOL

Yearling Stocks

The fishpass model has identified an impact on yearling stocks that originate in the John Day Pool. There are three yearling stocks that originate in the John Day Pool: John Day River spring chinook; Umatilla River spring chinook, and Umatilla River coho.

Upriver spring chinook are harvested incidental to the Lower Columbia River winter gill-net, sport and Zone 6 (above Bonneville Dam) Treaty Indian fisheries. Seasons are regulated to minimize the number of upriver spring chinook harvested. As part of the U.S. vs Oregon agreement, Treaty Indian Commercial and Ceremonial and Subsistence fisheries are allowed to harvest 7 percent of the upriver spring chinook run up to 10,000 fish. The 1987 Treaty Indian Zone 6 harvest was 6,429 adults.

There is a major lower Columbia river fishery in the fall on returning coho salmon, mainly concentrating on stock originating in the lower river below Bonneville Dam. There is a Treaty Indian fishery in Zone 6 above Bonneville Dam but this is minor and limited by season and gear restrictions to protect upriver steelhead, and by the fact that most of the run is limited to returns to Bonneville Pool hatcheries. In 1987, the Zone 6 Treaty harvest was 2,300 adults, and in 1988 the harvest was 7,000 adults, this is the second highest harvest since 1973, the record harvest was 16,800 adults in 1986. Under U.S. vs Oregon, the management goal is to increase harvests in tributary fisheries.

The alternative 4.10 when compared to the Base Case showed a decrease in system survival for yearlings as high as 1.7 percent with decreases in other years ranging from 0.2 percent to 1.4 percent.

John Day River Spring Chinook: Returns have increased from a recent low of 918 in 1980 to a high of 4,637 in 1987. The sport fishery has been closed since 1978, but there is a small harvest by Umatilla and Warm Springs Tribal members. The Tribal harvest in 1986 was 31, and, in 1987, was 41 adults. The goal for the Basin is to harvest 15 percent of the run in sport and Tribal fisheries, when the run at the mouth is over 5,000 adults, a smaller percentage when the run size is lower. There has been no supplementation of the John Day River spring chinook stock, and no future supplementation is planned. The stock will be managed as a wild stock, and is not in critical condition.

Umatilla River Spring Chinook: There are no run size records at present for this stock that is being re-introduced to the Basin. No harvest has occurred in recent years. There is planned a Umatilla Hatchery that will produce 1.29 million smolts annually, plus an additional 939,000 smolts will come from other sources (Carson stock, Lookingglass, Yakima, Rapid River, and

Bonneville). In 1988, Bonneville Hatchery released 540,00 smolts into the Umatilla Basin. The planning goal is to get a return of 11,000 adults to the Basin. This stock is managed as a building hatchery stock.

Umatilla River Coho: Smolt releases first occurred in 1966-69 with no results, supplementation resumed in 1987 as part of U.S. vs Oregon with an annual release of 1.0 million smolts. Coho are stocked to support terminal and mainstem fisheries. In 1987, 29 jacks returned, and in 1988 Tribal dip netting occurred with very few coho harvested. This stock is managed as a hatchery supplemented stock to enhance Tribal and mainstem fisheries.

Subyearling Stocks

The fishpass model identified an impact to subyearling stocks originating from the John Day Pool. There are two subyearling stocks that have been identified as originating from the John Day Pool: John Day River fall chinook, and Umatilla River upriver bright (URB). The John Day River fall chinook was identified as a critical stock in the IDU EIS, but was not listed as a stock in the NPPC's System Subbasin Planning draft report, so it will not be included here.

Columbia River fall chinook salmon stocks consist of five groups: Lower River Hatchery, Lower River Wild, Bonneville Pool Hatchery (BPH), Upriver Brights (URB), and Mid-Columbia Brights (MCB). All five groups are the targeted in the mainstem Columbia River by sport, commercial and Treaty Indian fisheries and by ocean commercial fisheries. The MCB portion of the run is comprised of brights reared and released at Bonneville Hatchery and brights from Bonneville, Little White Salmon, Spring Creek, and Klickitat Hatcheries released in areas between Bonneville and McNary dams. The URB portion of the run has set record returns with an estimated 400,000 in 1988, and a record high of 419,000 in 1987. Harvests of URB have also set records with 254,800 taken in the Commercial fishery and 14,500 taken in the sport fishery. Annual passage goals of 40,000 URB at McNary Dam have been exceeded since 1983. Commercial gill-net harvests occurred in 1986 and 1987 in the area between Priest Rapids and Wanapum Dams, with the 1987 harvest totaling 2,215 chinook, and, in 1988, 2,300 chinook were harvested. URB runs also have benefited from ocean and in river harvest regulations set to protect depressed returns of BPH stocks.

Umatilla River URB Fall Chinook: Returns have been improving since releases started in 1982. The 1985 Three Mile Dam and carcass counts were 85 adults, in 1986, 435, and in 1987, 461, showing an improving trend. Umatilla/Irrigon facility will produce 5.94 million subyearlings and an additional 1.06 million subyearlings will come from the Bonneville Hatchery. Presently URB are being released from the Irrigon hatchery, in 1988 3,350,000 subyearlings were released. The goal of the master plan is to achieve a return of 21,000 adults of which 10,000 will be hatchery fish and 11,000 will be naturally spawning fish. This stock is managed as a building hatchery/natural stock.

THE DALLES POOL

Yearling Stocks

The fishpass model identified an impact on yearling fish originating from The Dalles Pool, under alternative 4.10. There are two yearling stocks that have been identified as originating from The Dalles Pool: Deschutes River spring chinook, and Warm Springs National Fish Hatchery (WSNFH), Round Butte Hatchery (RBH) spring chinook.

Upriver spring chinook are harvested incidental to the Lower Columbia River winter gill-net, sport and Zone 6 (above Bonneville Dam) Treaty Indian fisheries. Seasons are regulated to minimize the number of upriver spring chinook harvested. As part of the U.S. vs Oregon agreement, Treaty Indian Commercial and Ceremonial and Subsistence fisheries are allowed to harvest 7 percent of the upriver spring chinook run up to 10,000 fish. The 1987 Treaty Indian Zone 6 harvest was 6,429 adults. Sport and Tribal harvest of both stocks occur at Sherars falls.

The system survival for yearling stocks under alternative 4.10 decreases in all years. The range of decreases when compared to the Base Case was 0.3 percent to 1.6 percent.

Deschutes River Spring Chinook: This is a natural/wild stock that spawns naturally only in the Warm Springs River and in Shitike Creek. Warms Springs Hatchery passes fish to spawn naturally above the hatchery. Estimated escapement of natural/wild fish consistently above 1,000 since 1980, with 1987 escapement estimated to be 1,783 adults and jacks. Planning goals for the Basin is to have a natural run escapement of 1,300 adults. Some hatchery spawners may have been allowed to pass upstream from 1982 to 1986 diluting the wild stock. In 1985, the sport and Tribal harvest was 648 jacks and adults, in 1987, it was estimated that 911 were harvested. This stock is assumed to be a viable natural/ wild stock, subject to a terminal fishery.

WSNFH, RBH Spring Chinook: Round Butte Hatchery is part of the PGE mitigation for Round Butte and Pelton Dams. Returns to WSNFH have fluctuated from a high of 1,079 in 1985 to a low of 346 in 1986, but showed an increase to 725 in 1987. RBH hatchery returns have shown better improvements increasing from a low of 453 in 1981 to high of 1,820 in 1986, with 1987 returns being 1,348 jacks and adults. Excess adult returns to the Pelton Trap are given to the Warm Springs Tribes or recycled to the Sherars falls fishery. In 1985, an estimated 1,656 hatchery jacks and adults were harvested by the sport and Tribal fishery at Sherars Falls, in 1987, the harvest was 1,135. RBH releases 60,000 smolts and 210,000 subyearlings are stocked into the Pelton Fish Ladder for additional rearing capacity. WSNFH currently produces 700,000 smolts with a design capacity of 1.3 million smolts. In 1988 the WSNFH released 950,000 smolts and RBH released 54,000 smolts directly and 210,000 reared in the Pelton Fish Ladder. The stock is assumed to be a viable hatchery stock.

Steelhead

The fishpass model identified an impact to steelhead originating from the Dalles Pool. There is one stock of steelhead that comes from this pool: Deschutes River summer steelhead.

Terminal sport harvest starts in July and continues to December. A Tribal fishery occurs below Sherars Falls, the recent harvest high of 3,800 in 1986 was above the 1980-87 average of 2,198 steelhead. The sport harvest reached a high in 1985 of 9,287 and for the same period 1980-87, averaged 4,731 steelhead. Harvest of wild steelhead was restricted in 1979 and has been prohibited since 1987.

Harvest still occurs in the Zone 6 Treaty Indian fisheries, and the mainstem sport fishery. In 1987, the Zone 6 harvest of summer steelhead was 71,800, and in 1986 the harvest was 64,100.

Deschutes River Summer Steelhead: This is a natural/hatchery stock with supplementation occurring only in the upper river. Hatchery releases from Warm Springs NFH occurred from 1973-84 and are presently from Round Butte hatchery. The present RBH mitigation goal is to get a return of 1,300 steelhead and releases 162,000 smolts. In 1988, 162,500 smolts were released into the Deschutes River. Subbasin goals call for escapements of 10,000 steelhead above Sherars Falls out of a total return of 16,000 to 22,000 steelhead. This is managed as a natural/ hatchery stock supporting a sport and Tribal fishery.

H-1d

OVERGENERATION SPILL

(incremental monthly)

KEY TO LABELS FOR ALTERNATIVES

H-1d through H-1k

BA000MED	Base Case (No Action Alternative), Medium Loads
BD120MED	Alternative 1.2, Medium Loads
BE410MED	Alternative 4.1, Case B (100%), Medium Loads
BB415MED	Alternative 4.1, Case A (50%), Medium Loads
BA430MED	Alternative 4.3, Medium Loads
BC440MED	Alternative 4.4, Medium Loads

Table H-1d-1

INCREMENTAL MONTHLY OVERGEN SPILL (MW)
PSCEIS : MED LOADS : 1/24/89
BASE CASE

OP-YR	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	ANNUAL
1989	0.0	0.0	0.0	0.0	21.4	77.8	52.7	128.1	663.2	1385.6	243.9	0.0	214.4
1990	0.0	0.0	0.0	0.0	11.8	59.8	86.7	139.9	736.6	1124.9	333.7	0.0	207.8
1991	0.0	0.0	0.0	0.0	0.0	69.5	75.7	98.5	467.5	1354.9	145.8	0.0	184.3
1992	0.0	0.0	0.0	0.0	2.9	24.8	27.9	75.4	505.5	1355.0	237.7	0.0	185.8
1993	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	221.3	1030.8	6.5	0.0	105.0
1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	142.9	429.4	19.8	0.0	49.4
1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.8	129.6	474.4	58.1	0.0	56.4
1996	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	257.1	587.0	33.8	0.0	73.4
1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	112.0	423.3	44.4	0.0	48.4
1998	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	206.2	712.7	107.8	0.0	85.7
1999	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	88.5	378.0	71.5	0.0	45.2
2000	0.0	0.0	0.0	0.0	0.0	1.2	0.0	27.7	99.9	412.6	104.8	0.0	53.9
2001	0.0	0.0	0.0	0.0	0.0	0.8	0.0	33.1	93.4	372.2	194.7	0.0	57.9
2002	0.0	0.0	0.0	0.0	0.0	9.2	0.0	6.0	88.7	345.8	186.8	0.0	53.0
2003	0.0	0.0	0.0	0.0	0.0	4.5	0.9	11.9	56.1	263.7	213.5	0.0	45.9
2004	0.0	0.0	0.0	0.0	2.7	4.4	0.0	21.6	160.4	390.5	129.6	0.0	59.1
2005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.5	138.5	293.7	111.1	0.0	46.6
2006	0.0	0.0	0.0	0.0	0.0	4.1	0.0	16.8	133.4	261.9	110.6	0.0	43.9
2007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	106.6	208.2	65.7	0.0	32.2
2008	0.0	0.0	0.0	0.0	0.0	0.6	0.0	2.6	58.7	128.0	187.4	0.0	31.4

Table H-1d-1

INCREMENTAL MONTHLY OVERGEN SPILL (MW)
PSCEIS : MEDIUM LOAD : 1/25/89
ALT 1.2 - BASE

OP-YR	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	ANNUAL
1989	0.0	0.0	0.0	0.0	0.5	7.0	2.1	18.4	-5.9	83.9	10.7	0.0	9.7
1990	0.0	0.0	0.0	0.0	-0.3	-5.2	-14.0	13.5	-31.2	57.7	15.0	0.0	3.0
1991	0.0	0.0	0.0	0.0	0.4	40.0	26.5	47.0	99.3	168.3	80.7	0.0	38.5
1992	0.0	0.0	0.0	0.0	15.5	25.7	24.5	38.3	139.7	33.9	106.0	0.0	32.0
1993	0.0	0.0	0.0	0.0	0.0	0.0	5.2	8.5	57.4	-124.2	42.8	0.0	-0.9
1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	41.6	114.8	91.2	0.0	20.7
1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.8	31.7	169.8	41.6	0.0	19.9
1996	0.0	0.0	0.0	0.0	0.0	0.0	2.2	3.7	56.1	156.4	64.5	0.0	23.6
1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7	35.5	190.2	71.0	0.0	25.2
1998	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.1	61.0	234.4	130.6	0.0	36.4
1999	0.0	0.0	0.0	0.0	0.0	0.5	3.3	36.3	16.7	89.5	141.9	0.0	24.0
2000	0.0	0.0	0.0	0.0	0.0	-1.2	3.0	16.7	10.7	159.6	108.0	0.0	24.7
2001	0.0	0.0	0.0	0.0	0.0	-0.8	0.0	-2.0	26.7	112.9	62.4	0.0	16.6
2002	0.0	0.0	0.0	0.0	0.0	-7.5	4.3	11.8	54.3	112.9	128.5	0.0	25.4
2003	0.0	0.0	0.0	0.0	4.1	8.2	25.6	42.9	149.8	33.6	15.3	0.0	23.3
2004	0.0	0.0	0.0	0.0	2.5	-2.9	2.2	11.1	42.1	100.2	74.5	0.0	19.1
2005	0.0	0.0	0.0	0.0	0.0	0.2	1.2	5.2	44.1	45.7	67.9	0.0	13.7
2006	0.0	0.0	0.0	0.0	0.0	0.0	5.7	14.5	38.3	91.1	61.8	0.0	17.6
2007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.5	44.8	69.4	68.4	0.0	16.7
2008	0.0	0.0	0.0	0.0	0.0	-0.6	0.0	9.5	34.3	86.7	92.6	0.0	18.5

Table H-1d-1

INCREMENTAL MONTHLY OVERGEN SPILL (MW)
PSCEIS : ALT415-MED : 2-21-89
ALT 415 - BASE

OP-YR	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	ANNUAL
1989	0.0	0.0	0.0	0.0	-0.2	-19.0	-2.8	-11.5	2.8	-7.2	12.4	0.0	-2.1
1990	0.0	0.0	0.0	0.0	4.7	-8.9	5.6	-1.1	12.5	28.1	-15.6	0.0	2.1
1991	0.0	0.0	0.0	0.0	3.6	-0.8	9.7	7.6	-50.3	37.7	15.7	0.0	1.9
1992	0.0	0.0	0.0	0.0	5.8	11.9	-1.9	-12.2	8.8	-1.0	-10.0	0.0	0.1
1993	0.0	0.0	0.0	0.0	0.0	0.0	1.3	-1.0	-2.9	28.2	5.5	0.0	2.6
1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-13.1	-8.6	4.4	0.0	-1.4
1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-4.1	-17.5	-0.5	-19.0	0.0	-3.4
1996	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.4	-46.8	-27.1	9.2	0.0	-5.4
1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.5	-18.7	-48.9	-8.2	0.0	-6.4
1998	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.8	-75.0	-128.7	-58.6	0.0	-21.9
1999	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.2	-35.4	-103.8	-57.7	0.0	-16.7
2000	0.0	0.0	0.0	0.0	0.0	-1.2	0.0	-26.7	-11.4	0.2	-78.8	0.0	-9.8
2001	0.0	0.0	0.0	0.0	0.0	-0.8	0.0	-25.9	0.8	-1.1	-139.4	0.0	-13.9
2002	0.0	0.0	0.0	0.0	0.0	-7.9	0.0	-6.0	27.5	20.1	-79.2	0.0	-3.8
2003	0.0	0.0	0.0	0.0	0.0	1.0	-0.9	-3.2	-16.2	-38.0	-93.4	0.0	-12.6
2004	0.0	0.0	0.0	0.0	-2.0	-4.4	0.0	-15.0	-114.7	-13.8	7.7	0.0	-11.9
2005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-12.5	-80.7	-33.6	-9.7	0.0	-11.4
2006	0.0	0.0	0.0	0.0	0.0	-2.0	0.0	-16.1	-91.4	18.5	-11.1	0.0	-8.5
2007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-5.4	-63.4	31.7	14.0	0.0	-1.9
2008	0.0	0.0	0.0	0.0	0.0	-0.6	0.0	-2.6	-36.1	49.0	21.2	0.0	2.6

Table H-1d-1

INCREMENTAL MONTHLY OVERGEN SPILL (MW)
PSCEIS : MEDIUM LDS : 2/2/89
ALT 4.1.0 - BASE

OP-YR	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	ANNUAL
1989	0.0	0.0	0.0	0.0	-0.3	-43.0	-4.6	-14.0	-0.3	-16.1	2.7	0.0	-6.3
1990	0.0	0.0	0.0	0.0	-2.8	-4.9	-4.7	4.4	33.4	31.7	-29.3	0.0	2.3
1991	0.0	0.0	0.0	0.0	3.4	-20.5	8.6	-7.0	-39.2	35.6	30.2	0.0	0.9
1992	0.0	0.0	0.0	0.0	0.7	-2.1	4.9	-8.4	8.9	-44.4	37.0	0.0	-0.3
1993	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.8	-10.9	33.1	1.4	0.0	1.9
1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	-27.9	-24.4	-0.8	0.0	-4.0
1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-7.6	-39.2	-32.4	-31.8	0.0	-9.3
1996	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0	-63.0	-72.0	-10.4	0.0	-12.4
1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.1	-43.3	-52.7	-19.3	0.0	-9.7
1998	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.9	-110.8	-153.8	-83.4	0.0	-29.2
1999	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.3	-53.6	-93.3	-66.5	0.0	-18.1
2000	0.0	0.0	0.0	0.0	0.0	-1.2	0.0	-27.5	-41.6	-87.3	-92.0	0.0	-20.8
2001	0.0	0.0	0.0	0.0	0.0	-0.8	0.0	-28.5	-40.0	-75.0	-155.0	0.0	-24.9
2002	0.0	0.0	0.0	0.0	0.0	-9.2	0.0	-6.0	-35.9	-91.3	-158.9	0.0	-25.1
2003	0.0	0.0	0.0	0.0	0.0	-4.5	-0.9	-11.1	-38.3	-69.7	-199.6	0.0	-27.0
2004	0.0	0.0	0.0	0.0	-2.7	-4.4	0.0	-21.6	-125.1	-115.7	-107.9	0.0	-31.5
2005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-15.5	-91.8	-97.4	-110.2	0.0	-26.2
2006	0.0	0.0	0.0	0.0	0.0	-4.1	0.0	-16.8	-114.9	-83.8	-105.8	0.0	-27.1
2007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-5.4	-85.9	-62.1	-60.3	0.0	-17.8
2008	0.0	0.0	0.0	0.0	0.0	-0.6	0.0	-2.6	-43.7	-37.0	-146.6	0.0	-19.2

Table H-1d-1

INCREMENTAL MONTHLY OVERGEN SPILL (MW)
PSCEIS : MED LOADS : 2-24-89
ALT 4.3 - BASE

OP-YR	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	ANNUAL
1989	0.0	0.0	0.0	0.0	0.5	7.0	2.1	18.4	-5.9	83.9	10.7	0.0	9.7
1990	0.0	0.0	0.0	0.0	-0.3	-5.2	-14.0	13.5	-31.2	57.7	15.0	0.0	3.0
1991	0.0	0.0	0.0	0.0	0.4	40.0	26.5	47.0	99.3	168.3	80.7	0.0	38.5
1992	0.0	0.0	0.0	0.0	15.5	25.7	24.5	38.3	139.7	33.9	106.0	0.0	32.0
1993	0.0	0.0	0.0	0.0	0.0	0.0	5.2	8.5	57.4	-124.2	42.8	0.0	-0.9
1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	41.6	114.8	91.2	0.0	20.7
1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.8	31.7	169.8	41.6	0.0	19.9
1996	0.0	0.0	0.0	0.0	0.0	0.0	2.2	3.7	56.1	156.4	64.5	0.0	23.6
1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7	35.5	190.2	71.0	0.0	25.2
1998	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.1	61.0	234.4	130.6	0.0	36.4
1999	0.0	0.0	0.0	0.0	0.0	0.5	3.3	36.3	16.7	89.5	141.9	0.0	24.0
2000	0.0	0.0	0.0	0.0	0.0	-1.2	3.0	16.7	10.7	159.6	108.0	0.0	24.7
2001	0.0	0.0	0.0	0.0	0.0	-0.8	0.0	-2.0	26.7	112.9	62.4	0.0	16.6
2002	0.0	0.0	0.0	0.0	0.0	-7.5	4.3	11.8	54.3	112.9	128.5	0.0	25.4
2003	0.0	0.0	0.0	0.0	4.1	8.2	25.6	42.9	149.8	33.6	15.3	0.0	23.3
2004	0.0	0.0	0.0	0.0	2.5	-2.9	2.2	11.1	42.1	100.2	74.5	0.0	19.1
2005	0.0	0.0	0.0	0.0	0.0	0.2	1.2	5.2	44.1	45.7	67.9	0.0	13.7
2006	0.0	0.0	0.0	0.0	0.0	0.0	5.7	14.5	38.3	91.1	61.8	0.0	17.6
2007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.5	44.8	69.4	68.4	0.0	16.7
2008	0.0	0.0	0.0	0.0	0.0	-0.6	0.0	9.5	34.3	86.7	92.6	0.0	18.5

Table H-1d-1

INCREMENTAL MONTHLY OVERGEN SPILL (MW)
PSCEIS : ALT 44 MED : 2/13/89
ALT 44 - BASE

OP-YR	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	ANNUAL
1989	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

H-1e

FISHPASS MODEL OUTPUT

Relative Changes in System Stock Survival
Frequency of Relative Survival Changes Exceeding 1% and 5%

Table H-1e-1

RELATIVE CHANGES IN SYSTEM STOCK SURVIVAL
BE410MED VS BA000MED (BASE CASE)

PROGRAM = DSN=PJI.PF400.RNR.FISHPASS.SAS.REPORTS(FSUM56)
FILES: PJI.PF400.RNR.FISH.PASS.DATA.MIDCOLFG RUN DATE: JUN/29/89
PJI.PF400.RNR.FISH.PASS.DATA.MIDCOLFG RUN DATE: JUN/28/89

		YEARLING			SUBYEARLING			STEELHEAD			SOCKEYE		
POOL	YEAR	MB	MA	RM	MB	MA	RM	MB	MA	RM	MB	MA	RM
ELLS	1991	29.6	29.7	0.1	19.0	18.6	-1.6	34.2	34.1	-0.2	24.2	24.0	-0.7
	1993	33.0	33.0	0.0	20.8	20.4	-1.8	37.9	37.8	-0.1	26.5	26.3	-0.8
	1995	40.9	41.5	1.6	29.5	29.0	-1.5	47.2	47.3	0.2	34.1	34.0	-0.2
	1997	41.9	42.1	0.6	29.5	29.0	-1.7	47.8	47.8	0.1	34.0	33.9	-0.4
	2001	41.0	41.0	0.0	29.1	28.7	-1.5	47.2	47.2	0.1	33.8	33.7	-0.3
	2005	41.4	41.0	-1.0	28.2	28.1	-0.7	47.6	47.3	-0.5	34.2	34.0	-0.6
RRECH	1991	32.9	33.2	0.8	24.2	23.9	-1.2	35.9	35.8	-0.3	0.0	0.0	0.0
	1993	36.7	37.0	0.9	26.2	25.6	-2.1	39.7	39.6	-0.2	0.0	0.0	0.0
	1995	46.5	47.3	1.8	34.6	34.4	-0.4	49.6	49.7	0.2	0.0	0.0	0.0
	1997	47.6	48.3	1.4	33.9	33.5	-1.3	50.0	50.0	0.0	0.0	0.0	0.0
	2001	46.4	46.7	0.6	34.0	33.5	-1.4	49.5	49.5	0.0	0.0	0.0	0.0
	2005	46.7	46.3	-0.9	34.3	34.0	-0.9	49.9	49.7	-0.4	0.0	0.0	0.0
RISL	1991	39.8	40.0	0.3	26.6	26.2	-1.4	42.7	42.5	-0.5	33.3	33.1	-0.6
	1993	40.1	40.4	0.9	27.0	26.6	-1.7	43.0	42.7	-0.7	33.0	32.9	-0.4
	1995	50.9	51.8	1.7	37.4	37.0	-0.9	54.5	54.5	-0.0	42.6	42.5	-0.1
	1997	52.1	52.7	1.3	37.3	36.8	-1.3	54.8	54.6	-0.2	42.6	42.6	-0.1
	2001	50.4	50.5	0.2	37.1	36.6	-1.2	53.9	53.9	0.0	42.2	42.2	-0.0
	2005	51.1	50.3	-1.5	36.4	36.2	-0.5	54.6	54.3	-0.5	42.8	42.6	-0.4
WG	1991	82.9	82.9	0.0	59.8	59.8	-0.0	85.6	85.6	-0.0	65.4	65.4	-0.1
	1993	82.2	82.2	0.1	60.1	60.0	-0.1	85.6	85.5	-0.0	65.3	65.2	-0.0
	1995	88.1	88.1	0.1	70.1	70.1	-0.0	89.4	89.5	0.0	74.5	74.5	0.0
	1997	88.5	88.6	0.1	70.4	70.3	-0.0	89.5	89.5	0.0	74.4	74.4	0.0
	2001	88.3	88.3	0.1	70.8	70.7	-0.1	89.7	89.7	0.0	74.8	74.8	-0.0
	2005	87.8	87.7	-0.0	70.1	70.1	-0.1	89.3	89.3	-0.0	74.3	74.3	-0.1
HM	1991	33.2	33.2	0.1	27.4	27.3	-0.3	39.8	39.6	-0.3	0.0	0.0	0.0
	1993	35.9	36.1	0.4	28.1	27.9	-0.7	43.6	43.7	0.1	0.0	0.0	0.0
	1995	38.6	39.3	1.8	33.5	33.3	-0.5	46.5	46.8	0.8	0.0	0.0	0.0
	1997	38.9	39.3	1.1	34.6	34.3	-0.7	46.7	46.9	0.5	0.0	0.0	0.0
	2001	38.7	38.8	0.2	34.7	34.4	-0.8	46.9	46.9	0.1	0.0	0.0	0.0
	2005	39.5	38.9	-1.5	32.7	32.4	-0.8	48.0	47.5	-1.1	0.0	0.0	0.0
ICN	1991	59.2	59.2	0.1	42.8	42.5	-0.7	67.6	67.5	-0.2	0.0	0.0	0.0
	1993	59.1	59.3	0.3	42.7	42.4	-0.7	66.6	66.5	-0.2	0.0	0.0	0.0
	1995	66.0	66.8	1.3	53.2	53.1	-0.1	73.5	74.2	0.9	0.0	0.0	0.0
	1997	67.3	67.5	0.4	53.3	53.1	-0.4	74.6	74.8	0.2	0.0	0.0	0.0
	2001	65.0	64.9	-0.1	53.3	53.0	-0.6	73.2	73.3	0.1	0.0	0.0	0.0
	2005	66.0	64.7	-2.1	52.5	52.3	-0.4	73.9	73.3	-0.8	0.0	0.0	0.0
DAY	1991	55.2	54.5	-1.3	45.2	44.7	-1.1	59.5	59.0	-0.8	0.0	0.0	0.0
	1993	54.5	53.6	-1.7	44.7	44.0	-1.6	58.5	58.2	-0.6	0.0	0.0	0.0
	1995	53.8	53.1	-1.3	45.1	44.7	-0.8	58.3	58.0	-0.5	0.0	0.0	0.0
	1997	56.1	55.3	-1.4	44.5	44.0	-1.0	61.0	60.7	-0.5	0.0	0.0	0.0
	2001	55.9	55.7	-0.2	45.4	44.9	-1.1	60.9	60.6	-0.5	0.0	0.0	0.0
	2005	56.7	56.1	-0.9	44.8	44.4	-1.0	61.3	60.9	-0.6	0.0	0.0	0.0
ALS	1991	65.8	65.1	-1.1	55.2	54.8	-0.7	65.9	65.4	-0.7	0.0	0.0	0.0
	1993	65.5	64.4	-1.6	55.2	54.7	-0.8	65.5	64.8	-1.1	0.0	0.0	0.0
	1995	65.3	64.8	-0.8	54.9	54.5	-0.6	65.4	64.9	-0.9	0.0	0.0	0.0
	1997	68.7	67.8	-1.2	56.5	56.1	-0.7	68.5	67.9	-0.8	0.0	0.0	0.0
	2001	68.0	67.7	-0.3	56.4	56.0	-0.6	68.6	68.4	-0.3	0.0	0.0	0.0
	2005	68.6	67.8	-1.2	55.2	55.0	-0.3	68.6	68.2	-0.6	0.0	0.0	0.0
ONN	1991	87.2	86.9	-0.3	79.4	79.1	-0.4	83.9	83.6	-0.3	0.0	0.0	0.0
	1993	87.0	86.8	-0.3	79.2	78.8	-0.5	83.6	83.2	-0.4	0.0	0.0	0.0
	1995	86.2	86.0	-0.2	78.7	78.4	-0.4	82.6	82.4	-0.3	0.0	0.0	0.0
	1997	86.8	86.6	-0.2	78.1	77.8	-0.4	82.5	82.3	-0.3	0.0	0.0	0.0
	2001	86.5	86.4	-0.0	77.7	77.7	-0.1	82.3	82.3	0.0	0.0	0.0	0.0
	2005	86.9	86.6	-0.3	78.1	77.7	-0.4	82.8	82.6	-0.2	0.0	0.0	0.0
YS	1991	69.4	69.3	-0.1	52.3	52.0	-0.6	72.6	72.5	-0.2	50.2	50.0	-0.2
	1993	69.6	69.5	-0.1	52.4	52.0	-0.7	72.7	72.6	-0.2	50.4	50.3	-0.2
	1995	73.6	73.9	0.3	58.1	58.0	-0.3	76.6	76.7	0.1	59.3	59.2	-0.0
	1997	74.5	74.6	0.1	58.0	57.7	-0.5	77.2	77.2	-0.0	59.2	59.2	-0.1
	2001	73.8	73.8	0.0	57.9	57.6	-0.5	77.1	77.1	-0.0	59.3	59.3	-0.1
	2005	74.1	73.7	-0.5	57.5	57.2	-0.5	77.2	77.0	-0.2	59.2	59.1	-0.2

EGEND MB = MEAN SURVIVAL WITH BASE CASE CONDITIONS (%) (BASE CASE)
MA = MEAN SURVIVAL WITH ALTERNATIVE CONDITIONS (%) (ALTERNATIVE)
RM = RELATIVE CHANGE IN MEAN SURVIVAL (%)
(ALTERNATIVE SURVIVAL - BASE CASE SURVIVAL) / (BASE CASE SURVIVAL)

ATE RUN= 29AUG89:07:25:03

FREQUENCY OF RELATIVE SURVIVAL CHANGES EXCEEDING
ONE AND FIVE PERCENT

PROGRAM = DSN=PJI.PF400.RNR.SAS.REPORTS(FSUM)
FILE: PJI.PF400.RNR.FISH.PASS.DATA.MIDCOLFG
FILE: PJI.PF400.RNR.FISH.PASS.DATA.MIDCOLFG

YEARLING		SUBYEARLING		STEELHEAD		SOCKEYE	
FI1/FI5	FD1/FD5	FI1/FI5	FD1/FD5	FI1/FI5	FD1/FD5	FI1/FI5	FD1/FD
33/ 0	18/ 0	20/ 5	43/ 18	13/ 0	25/ 3	13/ 0	28/ [illegible]
28/ 0	20/ 0	8/ 0	53/ 15	8/ 0	15/ 0	8/ 0	30/ [illegible]
43/ 13	5/ 0	3/ 3	50/ 15	18/ 0	3/ 0	10/ 3	15/ [illegible]
28/ 5	13/ 0	5/ 0	53/ 15	10/ 0	5/ 0	8/ 0	20/ [illegible]
23/ 0	18/ 3	3/ 0	55/ 8	8/ 0	5/ 0	5/ 0	23/ [illegible]
10/ 0	30/ 10	18/ 0	28/ 8	0/ 0	13/ 5	0/ 0	23/ [illegible]
30/ 8	10/ 0	13/ 3	33/ 15	8/ 0	18/ 3	0/ 0	0/ [illegible]
33/ 10	13/ 0	5/ 0	40/ 15	3/ 0	20/ 0	0/ 0	0/ [illegible]
40/ 15	3/ 3	8/ 3	23/ 5	18/ 0	3/ 0	0/ 0	0/ [illegible]
35/ 10	5/ 0	8/ 0	33/ 10	10/ 0	10/ 0	0/ 0	0/ [illegible]
20/ 3	5/ 0	0/ 0	23/ 18	8/ 0	5/ 0	0/ 0	0/ [illegible]
13/ 5	18/ 13	10/ 0	23/ 13	0/ 0	5/ 0	0/ 0	0/ [illegible]
18/ 5	13/ 0	15/ 0	35/ 15	5/ 0	25/ 0	5/ 0	30/ [illegible]
23/ 10	8/ 0	5/ 0	50/ 13	3/ 0	28/ 0	5/ 0	25/ [illegible]
38/ 15	5/ 0	3/ 0	40/ 5	13/ 0	8/ 0	18/ 0	18/ [illegible]
30/ 10	0/ 0	3/ 0	33/ 10	3/ 0	10/ 0	10/ 0	18/ [illegible]
18/ 0	8/ 0	3/ 0	45/ 10	3/ 3	8/ 0	8/ 0	10/ [illegible]
5/ 3	20/ 13	10/ 0	23/ 3	3/ 0	15/ 3	0/ 0	18/ [illegible]
0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0
0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0
0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0
3/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	3/ 0	0/ 0
3/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0
0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0
28/ 0	23/ 0	10/ 5	40/ 8	13/ 0	25/ 0	0/ 0	0/ 0
30/ 0	20/ 0	5/ 0	33/ 8	10/ 0	15/ 0	0/ 0	0/ 0
50/ 13	5/ 0	10/ 3	20/ 3	13/ 3	8/ 0	0/ 0	0/ 0
33/ 10	8/ 0	3/ 0	25/ 8	16/ 3	5/ 0	0/ 0	0/ 0
13/ 3	15/ 0	3/ 0	25/ 5	8/ 0	8/ 0	0/ 0	0/ 0
3/ 3	35/ 5	10/ 0	33/ 5	3/ 0	13/ 5	0/ 0	0/ 0
15/ 5	28/ 5	3/ 0	30/ 5	8/ 0	10/ 0	0/ 0	0/ [illegible]
23/ 18	25/ 8	3/ 0	33/ 3	8/ 0	10/ 0	0/ 0	0/ [illegible]
30/ 15	8/ 0	13/ 0	23/ 0	33/ 0	3/ 0	0/ 0	0/ [illegible]
18/ 10	13/ 3	8/ 0	15/ 0	18/ 3	5/ 0	0/ 0	0/ 0
8/ 3	8/ 5	0/ 0	25/ 0	3/ 3	3/ 0	0/ 0	0/ 0
3/ 0	23/ 18	0/ 0	20/ 0	0/ 0	20/ 5	0/ 0	0/ 0
8/ 3	45/ 10	8/ 3	35/ 20	5/ 0	25/ 10	0/ 0	0/ 0
10/ 3	35/ 18	10/ 0	28/ 18	10/ 0	20/ 10	0/ 0	0/ 0
5/ 0	38/ 5	8/ 3	30/ 13	5/ 3	28/ 3	0/ 0	0/ 0
10/ 0	40/ 5	5/ 0	30/ 8	10/ 0	25/ 5	0/ 0	0/ 0
8/ 3	18/ 3	0/ 0	28/ 18	10/ 0	20/ 5	0/ 0	0/ 0
8/ 0	20/ 13	13/ 3	28/ 13	13/ 0	18/ 3	0/ 0	0/ 0
8/ 3	40/ 8	0/ 0	35/ 3	10/ 0	40/ 0	0/ 0	0/ 0
3/ 3	38/ 13	0/ 0	35/ 0	3/ 0	43/ 0	0/ 0	0/ 0
5/ 0	30/ 3	3/ 0	33/ 0	5/ 0	48/ 0	0/ 0	0/ 0
3/ 0	43/ 5	0/ 0	28/ 3	0/ 0	43/ 0	0/ 0	0/ 0
5/ 3	23/ 0	0/ 0	33/ 0	3/ 3	25/ 0	0/ 0	0/ 0
3/ 0	25/ 10	5/ 0	20/ 0	3/ 0	28/ 0	0/ 0	0/ 0
3/ 0	8/ 0	3/ 0	23/ 0	3/ 0	13/ 0	0/ 0	0/ 0
3/ 0	13/ 0	3/ 0	23/ 0	0/ 0	23/ 0	0/ 0	0/ 0
3/ 0	5/ 0	3/ 0	15/ 0	0/ 0	8/ 0	0/ 0	0/ 0
0/ 0	5/ 0	0/ 0	8/ 0	3/ 0	13/ 0	0/ 0	0/ 0
3/ 0	0/ 0	3/ 3	5/ 0	3/ 0	0/ 0	0/ 0	0/ 0
0/ 0	13/ 0	0/ 0	15/ 0	0/ 0	15/ 0	0/ 0	0/ 0
3/ 0	5/ 0	3/ 0	28/ 0	0/ 0	5/ 0	0/ 0	13/ 0
10/ 0	10/ 0	0/ 0	35/ 0	0/ 0	0/ 0	0/ 0	15/ 0
18/ 0	3/ 0	3/ 0	18/ 0	3/ 0	0/ 0	5/ 0	0/ 0
10/ 0	3/ 0	0/ 0	18/ 0	5/ 0	0/ 0	3/ 0	3/ 0
3/ 0	0/ 0	3/ 0	23/ 0	3/ 0	0/ 0	3/ 0	0/ 0
3/ 0	18/ 3	0/ 0	23/ 0	0/ 0	5/ 0	0/ 0	5/ 0

LEGEND FI1 = PERCENT OF RELATIVE SURVIVAL INCREASES EXCEEDING ONE PERCENT
FI5 = PERCENT OF RELATIVE SURVIVAL INCREASES EXCEEDING FIVE PERCENT
FD1 = PERCENT OF RELATIVE SURVIVAL DECREASES EXCEEDING ONE PERCENT
FD5 = PERCENT OF RELATIVE SURVIVAL DECREASES EXCEEDING FIVE PERCENT

DATE RUN= 29AUG89:07:30:37

Table H-1e-1

RELATIVE CHANGES IN SYSTEM STOCK SURVIVAL
B8415MED VS BA000MED (BASE CASE)

PROGRAM = DSN=PJI.PF400.RNR.FISHPASS.SAS.REPORTS(FSUM56)
FILES; PJI.PF400.RNR.FISH.PASS.DATA.MIDCOLFG RUN DATE: JUN/29/89
PJI.PF400.RNR.FISH.PASS.DATA.MIDCOLFG RUN DATE: JUN/28/89

		YEARLING			SUBYEARLING			STEELHEAD			SOCKEYE		
OOL	YEAR	MB	MA	RM	MB	MA	RM	MB	MA	RM	MB	MA	RM
ELLS	1991	29.6	29.7	0.3	19.0	18.8	-0.8	34.2	34.1	-0.3	24.9	24.9	-0.4
	1993	33.0	33.2	0.5	20.8	20.6	-0.6	37.9	37.9	0.1	26.5	26.4	-0.2
	1995	40.9	41.0	0.3	29.5	29.4	-0.2	47.2	47.2	0.1	34.1	34.1	-0.0
	1997	41.9	41.9	0.1	29.5	29.4	-0.4	47.8	47.8	0.0	34.0	34.0	-0.1
	2001	41.0	40.9	-0.2	29.1	29.2	0.1	47.2	47.1	-0.1	33.8	33.7	-0.2
	2005	41.4	41.3	-0.4	28.2	28.3	0.0	47.6	47.4	-0.3	34.2	34.0	-0.4
RECH	1991	32.9	33.0	0.4	24.2	24.2	0.1	35.9	35.8	-0.2	0.0	0.0	0.0
	1993	36.7	36.9	0.6	26.2	26.0	-0.6	39.7	39.7	0.0	0.0	0.0	0.0
	1995	46.5	46.7	0.3	34.6	34.4	-0.6	49.6	49.6	0.1	0.0	0.0	0.0
	1997	47.6	47.7	0.1	33.9	33.8	-0.3	50.0	50.0	0.0	0.0	0.0	0.0
	2001	46.4	46.5	0.2	34.0	33.9	-0.5	49.5	49.5	-0.1	0.0	0.0	0.0
	2005	46.7	46.9	0.3	34.3	34.1	-0.5	49.9	49.8	-0.2	0.0	0.0	0.0
ISL	1991	39.8	40.0	0.3	26.6	26.5	-0.3	42.7	42.5	-0.4	33.3	33.1	-0.6
	1993	40.1	40.3	0.5	27.0	26.9	-0.5	43.0	42.9	-0.1	33.0	32.9	-0.1
	1995	50.9	51.0	0.3	37.4	37.3	-0.2	54.5	54.5	0.0	42.6	42.6	-0.0
	1997	52.1	52.2	0.3	37.3	37.2	-0.2	54.8	54.8	0.0	42.6	42.6	0.0
	2001	50.4	50.2	-0.3	37.1	37.1	0.1	53.9	54.0	0.2	42.2	42.2	-0.0
	2005	51.1	50.8	-0.4	36.4	36.3	-0.1	54.6	54.7	0.1	42.8	42.6	-0.3
NG	1991	82.9	82.9	0.0	59.8	59.8	-0.0	85.6	85.6	0.0	65.4	65.4	-0.0
	1993	82.2	82.2	0.1	60.1	60.1	-0.0	85.6	85.6	0.0	65.3	65.3	0.0
	1995	88.1	88.1	0.1	70.1	70.1	-0.0	89.4	89.4	0.0	74.5	74.5	0.0
	1997	88.5	88.6	0.0	70.4	70.4	-0.0	89.5	89.5	0.0	74.4	74.4	0.0
	2001	88.3	88.3	-0.0	70.8	70.8	-0.0	89.7	89.7	-0.0	74.8	74.8	-0.0
	2005	87.8	87.7	-0.0	70.1	70.1	-0.0	89.3	89.3	-0.0	74.3	74.3	-0.1
NM	1991	33.2	33.3	0.2	27.4	27.4	0.1	39.8	39.7	-0.2	0.0	0.0	0.0
	1993	35.9	36.2	0.7	28.1	28.0	-0.3	43.6	43.7	0.3	0.0	0.0	0.0
	1995	38.6	38.8	0.5	33.5	33.4	-0.4	46.5	46.6	0.3	0.0	0.0	0.0
	1997	38.9	39.1	0.5	34.6	34.5	-0.3	46.7	46.9	0.3	0.0	0.0	0.0
	2001	38.7	38.6	-0.3	34.7	34.6	-0.2	46.9	46.8	-0.2	0.0	0.0	0.0
	2005	39.5	39.3	-0.6	32.7	32.6	-0.3	48.0	47.7	-0.5	0.0	0.0	0.0
CN	1991	59.2	59.1	-0.0	42.8	42.7	-0.1	67.6	67.5	-0.2	0.0	0.0	0.0
	1993	59.1	59.4	0.5	42.7	42.6	-0.2	66.6	66.8	0.2	0.0	0.0	0.0
	1995	66.0	66.1	0.2	53.2	53.1	-0.2	73.5	73.8	0.3	0.0	0.0	0.0
	1997	67.3	67.2	-0.1	53.3	53.2	-0.1	74.6	74.8	0.2	0.0	0.0	0.0
	2001	65.0	64.8	-0.3	53.3	53.2	-0.2	73.2	73.2	-0.1	0.0	0.0	0.0
	2005	66.0	65.7	-0.5	52.5	52.4	-0.2	73.9	73.7	-0.2	0.0	0.0	0.0
DAY	1991	55.2	54.8	-0.7	45.2	45.3	0.2	59.5	59.4	-0.2	0.0	0.0	0.0
	1993	54.5	54.3	-0.5	44.7	44.5	-0.4	58.5	58.5	-0.0	0.0	0.0	0.0
	1995	53.8	53.7	-0.2	45.1	44.8	-0.6	58.3	58.2	-0.2	0.0	0.0	0.0
	1997	56.1	56.2	0.1	44.5	44.4	-0.3	61.0	61.0	-0.0	0.0	0.0	0.0
	2001	55.9	56.2	0.5	45.4	45.2	-0.4	60.9	60.8	-0.2	0.0	0.0	0.0
	2005	56.7	56.8	0.3	44.8	44.5	-0.7	61.3	61.1	-0.4	0.0	0.0	0.0
ALS	1991	65.8	65.5	-0.5	55.2	55.1	-0.3	65.9	65.7	-0.2	0.0	0.0	0.0
	1993	65.5	65.3	-0.3	55.2	55.0	-0.3	65.5	65.2	-0.3	0.0	0.0	0.0
	1995	65.3	65.2	-0.2	54.9	54.8	-0.2	65.4	65.3	-0.2	0.0	0.0	0.0
	1997	68.7	68.7	-0.0	56.5	56.4	-0.1	68.5	68.4	-0.0	0.0	0.0	0.0
	2001	68.0	68.3	0.5	56.4	56.4	0.0	68.6	68.8	0.3	0.0	0.0	0.0
	2005	68.6	68.9	0.4	55.2	55.2	-0.0	68.6	68.7	0.1	0.0	0.0	0.0
ONN	1991	87.2	87.1	-0.1	79.4	79.3	-0.2	83.9	83.7	-0.2	0.0	0.0	0.0
	1993	87.0	87.0	-0.0	79.2	79.1	-0.1	83.6	83.5	-0.1	0.0	0.0	0.0
	1995	86.2	86.2	-0.0	78.7	78.6	-0.0	82.6	82.6	-0.1	0.0	0.0	0.0
	1997	86.8	86.8	0.0	78.1	78.1	0.0	82.5	82.6	0.1	0.0	0.0	0.0
	2001	86.5	86.6	0.1	77.7	77.9	0.2	82.3	82.4	0.2	0.0	0.0	0.0
	2005	86.9	86.9	0.1	78.1	78.2	0.1	82.8	82.9	0.1	0.0	0.0	0.0
SYS	1991	69.4	69.3	-0.0	52.3	52.3	-0.2	72.6	72.5	-0.1	50.2	50.1	-0.1
	1993	69.6	69.6	0.1	52.4	52.3	-0.2	72.7	72.7	0.0	50.4	50.4	-0.0
	1995	73.6	73.7	0.1	58.1	58.1	-0.1	76.6	76.7	0.0	59.3	59.3	0.0
	1997	74.5	74.5	0.0	58.0	57.9	-0.1	77.2	77.5	0.0	59.2	59.2	-0.0
	2001	73.8	73.8	0.0	57.9	57.9	-0.0	77.1	77.1	-0.0	59.3	59.3	-0.0
	2005	74.1	74.1	-0.0	57.5	57.5	-0.1	77.2	77.1	-0.1	59.2	59.2	-0.1

LEGEND MB = MEAN SURVIVAL WITH BASE CASE CONDITIONS (%) (BASE CASE)
MA = MEAN SURVIVAL WITH ALTERNATIVE CONDITIONS (%) (ALTERNATIVE)
RM = RELATIVE CHANGE IN MEAN SURVIVAL (%)
(ALTERNATIVE SURVIVAL - BASE CASE SURVIVAL) / (BASE CASE SURVIVAL)

DATE RUN= 29AUG89:07:26:41

FREQUENCY OF RELATIVE SURVIVAL CHANGES EXCEEEDING
ONE AND FIVE PERCENT

PROGRAM = DSN=PJI.PF400.RNR.SAS.REPORTS(FSUM)
FILE: PJI.PF400.RNR.FISH.PASS.DATA.MIDCOLFG
FILE: PJI.PF400.RNR.FISH.PASS.DATA.MIDCOLFG

YEARLING				SUBYEARLING				STEELHEAD				SOCKEYE			
FI1/	FI5	FD1/	FD5	FI1/	FI5	FD1/	FD5	FI1/	FI5	FD1/	FD5	FI1/	FI5	FD1/	FD5
25/	0	8/	0	23/	3	40/	10	5/	0	13/	3	10/	0	20/	[illegible]
23/	0	8/	0	10/	0	43/	3	8/	0	5/	0	0/	0	13/	[illegible]
20/	0	8/	3	5/	3	15/	3	10/	0	3/	0	8/	0	5/	[illegible]
10/	0	5/	0	5/	0	15/	5	3/	0	0/	0	3/	0	8/	[illegible]
13/	0	18/	3	30/	5	20/	0	3/	0	8/	0	3/	0	13/	[illegible]
10/	3	15/	10	15/	0	15/	3	0/	0	5/	3	0/	0	20/	[illegible]
23/	3	13/	0	20/	5	18/	5	8/	0	15/	3	0/	0	0/	0
33/	0	10/	3	15/	0	28/	5	8/	0	3/	0	0/	0	0/	0
18/	5	5/	3	0/	0	23/	3	10/	0	0/	0	0/	0	0/	0
8/	3	13/	0	5/	0	15/	3	5/	0	3/	0	0/	0	0/	0
8/	3	8/	0	0/	0	18/	5	3/	0	8/	0	0/	0	0/	0
18/	5	15/	0	8/	0	20/	10	0/	0	5/	0	0/	0	0/	0
18/	0	5/	0	15/	3	23/	3	3/	0	23/	0	3/	0	28/	[illegible]
20/	0	8/	0	10/	0	35/	0	8/	0	10/	3	3/	0	8/	[illegible]
15/	3	5/	3	3/	0	10/	0	8/	0	3/	0	13/	0	8/	[illegible]
13/	3	5/	0	8/	0	5/	3	3/	0	0/	0	5/	0	3/	[illegible]
5/	0	13/	3	18/	0	13/	0	5/	3	0/	0	3/	0	3/	[illegible]
5/	3	13/	8	13/	0	15/	0	10/	0	3/	0	3/	0	8/	[illegible]
0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0
0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0
0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0
3/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0
0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0
0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0
25/	0	10/	0	13/	3	25/	0	10/	0	15/	0	0/	0	0/	0
25/	0	3/	0	8/	0	23/	0	15/	0	3/	0	0/	0	0/	0
23/	5	8/	0	0/	0	18/	0	20/	0	5/	0	0/	0	0/	0
18/	5	3/	0	5/	0	18/	0	13/	3	3/	0	0/	0	0/	0
8/	0	15/	0	3/	0	15/	0	3/	0	8/	0	0/	0	0/	0
5/	3	25/	3	8/	0	23/	0	5/	0	13/	3	0/	0	0/	0
13/	5	13/	5	5/	0	15/	0	5/	0	10/	0	0/	0	0/	0
25/	8	13/	8	5/	0	18/	0	20/	0	3/	0	0/	0	0/	0
18/	0	5/	3	0/	0	5/	0	15/	3	5/	0	0/	0	0/	0
8/	0	5/	3	0/	0	3/	0	10/	3	5/	0	0/	0	0/	0
8/	5	13/	8	0/	0	5/	0	3/	0	5/	0	0/	0	0/	0
8/	0	15/	8	3/	0	15/	0	8/	0	13/	3	0/	0	0/	0
10/	0	28/	0	20/	8	20/	8	5/	0	13/	0	0/	0	0/	0
10/	3	23/	3	18/	0	20/	5	8/	0	5/	0	0/	0	0/	0
5/	0	10/	3	3/	0	18/	5	5/	0	10/	0	0/	0	0/	0
8/	0	3/	0	5/	0	13/	0	3/	0	5/	0	0/	0	0/	0
20/	3	3/	0	5/	0	18/	10	6/	0	18/	0	0/	0	0/	0
20/	5	5/	3	8/	0	30/	5	8/	0	20/	0	0/	0	0/	0
10/	3	20/	5	0/	0	15/	0	10/	0	23/	0	0/	0	0/	0
8/	5	28/	5	5/	0	8/	0	8/	0	20/	0	0/	0	0/	0
3/	0	5/	0	0/	0	8/	0	5/	0	8/	0	0/	0	0/	0
5/	0	5/	0	0/	0	5/	0	3/	0	5/	0	0/	0	0/	0
15/	3	3/	0	5/	0	8/	0	13/	3	8/	0	0/	0	0/	0
15/	5	3/	3	8/	0	8/	0	5/	3	5/	0	0/	0	0/	0
3/	0	5/	0	5/	0	10/	0	3/	0	10/	0	0/	0	0/	0
5/	0	5/	0	8/	0	8/	0	5/	0	5/	0	0/	0	0/	0
3/	0	0/	0	3/	0	3/	0	3/	0	3/	0	0/	0	0/	0
0/	0	0/	0	0/	0	0/	0	3/	0	3/	0	0/	0	0/	0
3/	0	0/	0	5/	3	0/	0	5/	0	0/	0	0/	0	0/	0
5/	0	3/	0	5/	0	3/	0	5/	0	3/	0	0/	0	0/	0
5/	0	5/	0	3/	0	13/	0	0/	0	3/	0	0/	0	3/	0
13/	0	3/	0	3/	0	10/	0	0/	0	0/	0	0/	0	0/	0
5/	0	3/	0	0/	0	3/	0	3/	0	0/	0	0/	0	0/	0
3/	0	3/	0	0/	0	3/	0	3/	0	0/	0	0/	0	0/	0
3/	0	5/	0	3/	0	0/	0	0/	0	0/	0	0/	0	0/	0
5/	0	8/	0	5/	0	8/	0	0/	0	5/	0	0/	0	5/	0

LEGEND FI1 = PERCENT OF RELATIVE SURVIVAL INCREASES EXCEEDING ONE PERCENT
FI5 = PERCENT OF RELATIVE SURVIVAL INCREASES EXCEEDING FIVE PERCENT
FD1 = PERCENT OF RELATIVE SURVIVAL DECREASES EXCEEDING ONE PERCENT
FD5 = PERCENT OF RELATIVE SURVIVAL DECREASES EXCEEDING FIVE PERCENT

DATE RUN= 29AUG89:07:38:55

Table H-1e-1

RELATIVE CHANGES IN SYSTEM STOCK SURVIVAL
BA430MED VS BA000MED (BASE CASE)

PROGRAM = DSN=PJI.PF400.RNR.FISHPASS.SAS.REPORTS(FSUM56)
FILES: PJI.PF400.RNR.FISH.PASS.DATA.MIDCOLFG RUN DATE: JUN/29/89
PJI.PF400.RNR.FISH.PASS.DATA.MIDCOLFG RUN DATE: JUN/30/89

		YEARLING			SUBYEARLING			STEELHEAD			SOCKEYE		
POOL	YEAR	MB	MA	RM	MB	MA	RM	MB	MA	RM	MB	MA	RM
ELLS	1991	29.6	29.9	1.1	19.0	19.1	1.0	34.2	34.5	0.9	24.9	25.3	1.5
	1993	33.0	33.2	0.6	20.8	20.8	0.1	37.9	38.1	0.5	26.5	26.6	0.5
	1995	40.9	41.2	0.7	29.5	29.7	0.7	47.2	47.3	0.3	34.1	34.2	0.2
	1997	41.9	42.1	0.5	29.5	29.6	0.5	47.8	47.9	0.3	34.0	34.2	0.4
	2001	41.0	40.9	-0.3	29.1	29.3	0.7	47.2	47.1	-0.2	33.8	33.8	-0.0
	2005	41.4	41.5	0.1	28.2	28.4	0.5	47.6	47.6	0.1	34.2	34.3	0.4
RECH	1991	32.9	33.1	0.7	24.2	24.4	1.2	35.9	36.3	1.0	0.0	0.0	0.0
	1993	36.7	36.8	0.4	26.2	26.1	-0.2	39.7	39.9	0.5	0.0	0.0	0.0
	1995	46.5	46.8	0.5	34.6	34.6	0.2	49.6	49.7	0.3	0.0	0.0	0.0
	1997	47.6	47.7	0.1	33.9	34.2	0.8	50.0	50.1	0.2	0.0	0.0	0.0
	2001	46.4	46.3	-0.3	34.0	34.2	0.6	49.5	49.5	-0.1	0.0	0.0	0.0
	2005	46.7	46.8	0.1	34.3	34.5	0.6	49.9	50.0	0.2	0.0	0.0	0.0
RISL	1991	39.8	40.1	0.6	26.6	26.7	0.7	42.7	42.7	0.1	33.3	33.5	0.7
	1993	40.1	40.3	0.4	27.0	27.0	-0.1	43.0	43.0	0.2	33.0	33.1	0.5
	1995	50.9	51.3	0.8	37.4	37.5	0.3	54.5	54.5	0.0	42.6	42.6	0.1
	1997	52.1	52.2	0.3	37.3	37.5	0.5	54.8	54.9	0.2	42.6	42.7	0.3
	2001	50.4	50.3	-0.2	37.1	37.3	0.5	53.9	53.9	0.2	42.2	42.2	0.0
	2005	51.1	51.0	-0.0	36.4	36.5	0.4	54.6	54.7	0.2	42.8	42.8	0.2
NG	1991	82.9	82.9	0.0	59.8	59.8	0.1	85.6	85.6	-0.0	65.4	65.5	0.1
	1993	82.2	82.2	0.0	60.1	60.1	-0.0	85.6	85.6	0.0	65.3	65.3	0.0
	1995	88.1	88.1	0.0	70.1	70.1	0.0	89.4	89.4	0.0	74.5	74.5	0.0
	1997	88.5	88.5	-0.0	70.4	70.3	-0.0	89.5	89.5	0.0	74.4	74.4	0.0
	2001	89.3	89.3	0.0	70.8	70.8	0.0	89.7	89.7	0.0	74.8	74.8	0.0
	2005	87.8	87.8	0.0	70.1	70.1	0.0	89.3	89.3	0.0	74.3	74.4	0.0
[illegible]H	1991	33.2	33.6	1.1	27.4	27.6	0.9	39.8	40.1	0.9	0.0	0.0	0.0
	1993	35.9	36.1	0.3	28.1	27.9	-0.7	43.6	43.8	0.4	0.0	0.0	0.0
	1995	38.6	38.9	0.7	33.5	33.7	0.7	46.5	46.7	0.5	0.0	0.0	0.0
	1997	38.9	39.0	0.4	34.6	35.1	1.4	46.7	46.9	0.3	0.0	0.0	0.0
	2001	38.7	38.8	0.1	34.7	34.9	0.6	46.9	46.9	-0.0	0.0	0.0	0.0
	2005	39.5	39.5	-0.1	32.7	32.8	0.3	48.0	48.0	0.1	0.0	0.0	0.0
CN	1991	59.2	59.4	0.4	42.8	43.0	0.4	67.6	67.6	0.1	0.0	0.0	0.0
	1993	59.1	59.3	0.3	42.7	42.7	0.1	66.6	66.8	0.2	0.0	0.0	0.0
	1995	66.0	66.4	0.7	53.2	53.3	0.2	73.5	73.9	0.5	0.0	0.0	0.0
	1997	67.3	67.3	0.0	53.3	53.4	0.3	74.6	74.7	0.2	0.0	0.0	0.0
	2001	65.0	65.0	-0.0	53.3	53.5	0.3	73.2	73.3	0.1	0.0	0.0	0.0
	2005	66.0	66.2	0.2	52.5	52.7	0.3	73.9	73.9	0.1	0.0	0.0	0.0
DAY	1991	55.2	55.4	0.2	45.2	45.3	0.3	59.5	59.6	0.3	0.0	0.0	0.0
	1993	54.5	54.7	0.2	44.7	44.5	-0.4	58.5	58.8	0.4	0.0	0.0	0.0
	1995	53.8	53.7	-0.2	45.1	45.2	0.3	58.3	58.4	0.1	0.0	0.0	0.0
	1997	56.1	56.2	0.1	44.5	45.0	1.1	61.0	61.1	0.2	0.0	0.0	0.0
	2001	55.9	56.1	0.5	45.4	45.6	0.5	60.9	60.9	0.1	0.0	0.0	0.0
	2005	56.7	56.9	0.4	44.8	45.0	0.5	61.3	61.5	0.3	0.0	0.0	0.0
ALS	1991	65.8	65.9	0.1	55.2	55.4	0.4	65.9	66.1	0.3	0.0	0.0	0.0
	1993	65.5	65.5	0.0	55.2	55.1	-0.0	65.5	65.5	0.1	0.0	0.0	0.0
	1995	65.3	65.3	-0.1	54.9	55.0	0.3	65.4	65.4	-0.0	0.0	0.0	0.0
	1997	68.7	68.8	0.2	56.5	56.6	0.3	68.5	68.6	0.2	0.0	0.0	0.0
	2001	68.0	68.3	0.5	56.4	56.6	0.4	68.6	68.8	0.3	0.0	0.0	0.0
	2005	68.6	68.9	0.5	55.2	55.3	0.2	68.6	68.8	0.3	0.0	0.0	0.0
ONN	1991	87.2	87.2	-0.0	79.4	79.4	-0.0	83.9	83.9	-0.0	0.0	0.0	0.0
	1993	87.0	87.1	0.1	79.2	79.2	0.1	83.6	83.6	0.0	0.0	0.0	0.0
	1995	86.2	86.2	-0.0	78.7	78.6	-0.0	82.6	82.6	-0.0	0.0	0.0	0.0
	1997	86.8	86.8	0.1	78.1	78.2	0.1	82.5	82.6	0.1	0.0	0.0	0.0
	2001	86.5	86.5	0.1	77.7	77.8	0.2	82.3	82.4	0.1	0.0	0.0	0.0
	2005	86.9	86.9	0.1	78.1	78.2	0.2	82.8	82.9	0.1	0.0	0.0	0.0
YS	1991	69.4	69.5	0.1	52.3	52.5	0.2	72.6	72.6	0.1	50.2	50.3	0.3
	1993	69.6	69.6	0.1	52.4	52.4	0.0	72.7	72.8	0.1	50.4	50.5	0.1
	1995	73.6	73.8	0.2	58.1	58.2	0.1	76.6	76.7	0.1	59.3	59.3	0.1
	1997	74.5	74.6	0.1	58.0	58.1	0.3	77.2	77.3	0.1	59.2	59.3	0.1
	2001	73.8	73.8	0.0	57.9	58.1	0.3	77.1	77.1	0.0	59.3	59.3	0.0
	2005	74.1	74.2	0.1	57.5	57.6	0.3	77.2	77.2	0.1	59.2	59.3	0.1

LEGEND MB = MEAN SURVIVAL WITH BASE CASE CONDITIONS (%) (BASE CASE)
MA = MEAN SURVIVAL WITH ALTERNATIVE CONDITIONS (%) (ALTERNATIVE)
RM = RELATIVE CHANGE IN MEAN SURVIVAL (%)
(ALTERNATIVE SURVIVAL - BASE CASE SURVIVAL) / (BASE CASE SURVIVAL)

DATE RUN= 29AUG89:07:28:27

FREQUENCY OF RELATIVE SURVIVAL CHANGES EXCEEDING
ONE AND FIVE PERCENT

PROGRAM = DSN=PJI.PF400.RNR.SAS.REPORTS(FSUM)
FILE: PJI.PF400.RNR.FISH.PASS.DATA.MIDCOLFG
FILE: PJI.PF400.RNR.FISH.PASS.DATA.MIDCOLFG

YEARLING		SUBYEARLING		STEELHEAD		SOCKEYE	
FI1/FI5	FD1/FD5	FI1/FI5	FD1/FD5	FI1/FI5	FD1/FD5	FI1/FI5	FD1/FC
35/ 5	15/ 0	35/ 8	20/ 5	35/ 3	5/ 0	33/ 10	10/
18/ 3	0/ 0	20/ 5	25/ 5	13/ 3	0/ 0	23/ 0	5/
23/ 10	13/ 0	28/ 3	8/ 0	15/ 0	3/ 0	13/ 0	5/
18/ 3	3/ 0	35/ 0	18/ 3	10/ 0	3/ 0	20/ 0	5/
3/ 0	20/ 0	35/ 0	15/ 0	3/ 0	13/ 0	3/ 0	10/
8/ 0	10/ 0	25/ 0	5/ 0	10/ 0	5/ 0	10/ 0	3/
33/ 8	13/ 3	55/ 3	18/ 3	30/ 5	3/ 0	0/ 0	0/
13/ 3	5/ 0	25/ 3	20/ 5	13/ 0	0/ 0	0/ 0	0/
20/ 5	15/ 3	20/ 0	8/ 0	15/ 0	3/ 0	0/ 0	0/
18/ 3	13/ 5	43/ 5	10/ 3	10/ 0	3/ 0	0/ 0	0/
3/ 3	20/ 0	28/ 0	3/ 0	3/ 0	13/ 0	0/ 0	0/
3/ 3	10/ 0	25/ 3	5/ 0.	8/ 0	5/ 0	0/ 0	0/
28/ 5	8/ 3	33/ 3	15/ 3	10/ 0	10/ 0	28/ 0	10/
13/ 3	5/ 0	23/ 3	23/ 5	15/ 0	10/ 0	18/ 0	3/
20/ 10	10/ 0	18/ 0	0/ 0	5/ 0	8/ 0	10/ 0	3/
18/ 3	8/ C	23/ 0	3/ 0	13/ 0	5/ 0	13/ 0	5/
3/ 0	15/ 0	33/ 0	5/ 0	8/ 3	0/ 0	3/ 0	10/
5/ 0	10/ 0	20/ 3	3/ 0	8/ 0	3/ 0	10/ 0	3/
0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/
0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/
0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/
0/ 0	0/ 0	0/ 0	3/ 0	0/ 0	0/ 0	0/ 0	0/
3/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/
0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/
43/ 3	8/ 3	33/ 8	20/ 0	45/ 0	3/ 0	0/ 0	0/
18/ 0	5/ 0	18/ 0	28/ 5	15/ 0	3/ 0	0/ 0	0/
33/ 8	13/ 0	15/ 5	10/ 0	30/ 0	3/ 0	0/ 0	0/
18/ 3	8/ 3	38/ 3	8/ 0	13/ 0	5/ 0	0/ 0	0/
5/ 3	10/ 0	23/ 0	5/ 0	3/ 3	13/ 0	0/ 0	0/
3/ 3	8/ 3	18/ 0	5/ 0	10/ 0	10/ 0	0/ 0	0/
13/ 8	13/ 3	20/ 3	8/ 0	15/ 0	10/ 0	0/ 0	0/
15/ 0	3/ 0	8/ 0	15/ 0	15/ 0	0/ 0	0/ 0	0/
23/ 8	5/ 0	3/ 0	3/ 0	28/ 3	3/ 0	0/ 0	0/
20/ 3	13/ 5	3/ 0	0/ 0	15/ 0	8/ 0	0/ 0	0/
8/ 5	5/ 5	10/ 0	0/ 0	5/ 3	3/ 0	0/ 0	0/
8/ 3	5/ 0	13/ 0	3/ 0	3/ 3	8/ 0	0/ 0	0/
20/ 3	25/ 0	30/ 5	18/ 8	23/ 0	18/ 0	0/ 0	0/
18/ 3	13/ 0	18/ 5	23/ 5	25/ 3	5/ 0	0/ 0	0/
5/ 3	20/ 0	20/ 0	8/ 3	13/ 0	18/ 0	0/ 0	0/
18/ 5	13/ 3	50/ 3	10/ 3	15/ 0	8/ 0	0/ 0	0/
10/ 3	5/ 0	30/ 3	8/ 0	8/ 0	10/ 0	0/ 0	0/
13/ 3	8/ 0	38/ 3	8/ 0	10/ 0	3/ 0	0/ 0	0/
25/ 5	20/ 0	20/ 0	8/ 0	20/ 0	15/ 0	0/ 0	0/
20/ 5	15/ 3	13/ 0	10/ 0	18/ 0	8/ 0	0/ 0	0/
3/ 0	10/ 0	10/ 0	0/ 0	5/ 0	8/ 0	0/ 0	0/
15/ 5	8/ 5	10/ 0	0/ 0	15/ 0	10/ 3	0/ 0	0/
15/ 3	3/ 0	15/ 0	0/ 0	8/ 3	0/ 0	0/ 0	0/
18/ 3	8/ 0	8/ 0	8/ 0	13/ 0	3/ 0	0/ 0	0/
5/ 0	3/ 0	10/ 0	13/ 0	3/ 0	0/ 0	0/ 0	0/
8/ 0	3/ 0	10/ 0	8/ 0	5/ 0	3/ 0	0/ 0	0/
3/ 0	0/ 0	3/ 0	3/ 0	3/ 0	0/ 0	0/ 0	0/
5/ 0	5/ 0	8/ 0	5/ 0	5/ 0	3/ 0	0/ 0	0/
3/ 0	0/ 0	3/ 3	0/ 0	3/ 0	0/ 0	0/ 0	0/
3/ 0	0/ 0	8/ 0	3/ 0	3/ 0	0/ 0	0/ 0	0/
8/ 0	0/ 0	18/ 0	5/ 0	0/ 0	0/ 0	10/ 0	0/
8/ 0	0/ 0	8/ 0	3/ 0	0/ 0	0/ 0	5/ 0	0/
13/ 0	0/ 0	3/ 0	0/ 0	3/ 0	0/ 0	3/ 0	0/
8/ 0	3/ 0	10/ 0	5/ 0	0/ 0	0/ 0	3/ 0	0/
3/ 0	3/ 0	8/ 0	0/ 0	3/ 0	0/ 0	3/ 0	0/
3/ 0	0/ 0	5/ 0	0/ 0	3/ 0	0/ 0	0/ 0	0/

LEGEND FI1 = PERCENT OF RELATIVE SURVIVAL INCREASES EXCEEDING ONE PERCENT
FI5 = PERCENT OF RELATIVE SURVIVAL INCREASES EXCEEDING FIVE PERCENT
FD1 = PERCENT OF RELATIVE SURVIVAL DECREASES EXCEEDING ONE PERCENT
FD5 = PERCENT OF RELATIVE SURVIVAL DECREASES EXCEEDING FIVE PERCENT

DATE RUN= 29AUG89:07:47:53

Table H-1e-1

RELATIVE CHANGES IN SYSTEM STOCK SURVIVAL
BD120MED VS BA000MED (BASE CASE)

PROGRAM = DSN=PJI.PF400.RNR.FISHPASS.SAS.REPORTS(FSUM56)
FILES; PJI.PF400.RNR.FISH.PASS.DATA.MIDCOLFG RUN DATE; JUN/29/89
PJI.PF400.RNR.FISH.PASS.DATA.MIDCOLFG RUN DATE; JUN/30/89

		YEARLING			SUBYEARLING			STEELHEAD			SOCKEYE		
POOL	YEAR	MB	MA	RM	MB	MA	RM	MB	MA	RM	MB	MA	RM
IELLS	1991	29.6	29.6	0.1	19.0	18.9	-0.0	34.2	34.2	0.0	24.9	25.0	0.1
	1993	33.0	33.0	0.1	20.8	20.8	0.4	37.9	37.9	0.1	26.5	26.5	0.2
	1995	40.9	40.9	-0.0	29.5	29.6	0.2	47.2	47.1	-0.0	34.1	34.1	-0.1
	1997	41.9	41.9	0.1	29.5	29.5	-0.0	47.8	47.8	0.0	34.0	34.1	0.1
	2001	41.0	40.9	-0.2	29.1	29.1	-0.1	47.2	47.1	-0.1	33.8	33.8	-0.1
	2005	41.4	41.4	-0.1	28.2	28.3	0.0	47.6	47.6	-0.0	34.2	34.2	0.0
RECH	1991	32.9	33.0	0.2	24.2	24.3	0.8	35.9	35.9	0.0	0.0	0.0	0.0
	1993	36.7	36.7	0.1	26.2	26.2	0.3	39.7	39.8	0.1	0.0	0.0	0.0
	1995	46.5	46.6	0.1	34.6	34.5	-0.2	49.6	49.6	-0.1	0.0	0.0	0.0
	1997	47.6	47.5	-0.2	33.9	34.1	0.3	50.0	50.1	0.1	0.0	0.0	0.0
	2001	46.4	46.3	-0.2	34.0	34.1	0.2	49.5	49.4	-0.1	0.0	0.0	0.0
	2005	46.7	46.7	-0.1	34.3	34.3	0.1	49.9	49.9	-0.0	0.0	0.0	0.0
RISL	1991	39.8	39.9	0.0	26.6	26.6	0.1	42.7	42.7	0.0	33.3	33.3	-0.1
	1993	40.1	40.1	0.1	27.0	27.1	0.3	43.0	43.0	0.1	33.0	33.0	0.2
	1995	50.9	50.9	-0.0	37.4	37.4	0.1	54.5	54.5	0.0	42.6	42.5	-0.1
	1997	52.1	52.1	0.0	37.3	37.3	0.1	54.8	54.9	0.2	42.6	42.7	0.1
	2001	50.4	50.3	-0.1	37.1	37.1	0.0	53.9	53.9	-0.0	42.2	42.1	-0.1
	2005	51.1	51.0	-0.1	36.4	36.4	0.1	54.6	54.6	-0.0	42.8	42.7	-0.0
LWG	1991	82.9	82.9	0.0	59.8	59.8	0.0	85.6	85.6	0.0	65.4	65.4	0.0
	1993	82.2	82.1	-0.0	60.1	60.1	-0.0	85.6	85.5	-0.0	65.3	65.3	0.0
	1995	88.1	88.1	-0.0	70.1	70.1	-0.0	89.4	89.4	-0.0	74.5	74.5	-0.0
	1997	88.5	88.5	-0.0	70.4	70.4	-0.0	89.5	89.5	0.0	74.4	74.4	0.0
	2001	88.3	88.3	-0.0	70.8	70.8	0.0	89.7	89.7	0.0	74.8	74.8	-0.0
	2005	87.8	87.7	-0.0	70.1	70.1	-0.0	89.3	89.3	-0.0	74.3	74.3	-0.0
LMM	1991	33.2	33.2	0.0	27.4	27.5	0.4	39.8	39.8	0.1	0.0	0.0	0.0
	1993	35.9	35.9	-0.1	28.1	28.2	0.3	43.6	43.6	-0.1	0.0	0.0	0.0
	1995	38.6	38.6	-0.2	33.5	33.5	-0.0	46.5	46.4	-0.1	0.0	0.0	0.0
	1997	38.9	38.9	0.1	34.6	34.7	0.4	46.7	46.8	0.1	0.0	0.0	0.0
	2001	38.7	38.7	-0.2	34.7	34.7	0.1	46.9	46.8	-0.1	0.0	0.0	0.0
	2005	39.5	39.4	-0.1	32.7	32.7	0.1	48.0	47.9	-0.1	0.0	0.0	0.0
MCN	1991	59.2	59.2	0.1	42.8	42.9	0.1	67.4	67.4	-0.0	0.0	0.0	0.0
	1993	59.1	59.1	0.1	42.7	42.8	0.2	66.6	66.5	-0.1	0.0	0.0	0.0
	1995	66.0	65.9	-0.2	53.2	53.2	-0.0	73.5	73.5	-0.1	0.0	0.0	0.0
	1997	67.3	67.2	-0.1	53.3	53.3	0.0	74.6	74.7	0.1	0.0	0.0	0.0
	2001	65.0	65.0	0.0	53.3	53.3	0.0	73.2	73.2	-0.1	0.0	0.0	0.0
	2005	66.0	66.0	-0.0	52.5	52.5	0.0	73.9	73.8	-0.1	0.0	0.0	0.0
ODAY	1991	55.2	55.2	-0.1	45.2	45.5	0.8	59.5	59.5	0.0	0.0	0.0	0.0
	1993	54.5	54.6	0.1	44.7	44.7	0.1	58.5	58.7	0.2	0.0	0.0	0.0
	1995	53.8	53.9	0.1	45.1	44.9	-0.2	58.3	58.2	-0.1	0.0	0.0	0.0
	1997	56.1	56.3	0.4	44.5	44.7	0.4	61.0	61.1	0.1	0.0	0.0	0.0
	2001	55.9	55.9	0.1	45.4	45.4	0.0	60.9	60.9	-0.0	0.0	0.0	0.0
	2005	56.7	56.6	-0.0	44.8	44.9	0.1	61.3	61.3	0.0	0.0	0.0	0.0
DALS	1991	65.8	65.9	0.1	55.2	55.3	0.1	65.9	66.0	0.2	0.0	0.0	0.0
	1993	65.5	65.6	0.2	55.2	55.2	0.1	65.5	65.6	0.2	0.0	0.0	0.0
	1995	65.3	65.4	0.1	54.9	54.9	0.0	65.4	65.4	-0.0	0.0	0.0	0.0
	1997	68.7	68.9	0.4	56.5	56.5	0.1	68.5	68.6	0.2	0.0	0.0	0.0
	2001	68.0	68.1	0.2	56.4	56.4	0.0	68.6	68.7	0.1	0.0	0.0	0.0
	2005	68.6	68.6	-0.0	55.2	55.2	0.0	68.6	68.6	0.0	0.0	0.0	0.0
JONN	1991	87.2	87.2	-0.0	79.4	79.4	-0.1	83.9	83.9	-0.0	0.0	0.0	0.0
	1993	87.0	87.0	0.0	79.2	79.2	0.1	83.6	83.6	0.0	0.0	0.0	0.0
	1995	86.2	86.2	0.0	78.7	78.7	0.1	82.6	82.7	0.0	0.0	0.0	0.0
	1997	86.8	86.8	0.1	78.1	78.2	0.1	82.5	82.6	0.1	0.0	0.0	0.0
	2001	86.5	86.5	-0.0	77.7	77.7	0.0	82.3	82.3	0.0	0.0	0.0	0.0
	2005	86.9	86.9	0.0	78.1	78.0	-0.0	82.8	82.8	-0.0	0.0	0.0	0.0
SYS	1991	69.4	69.4	0.0	52.3	52.4	0.1	72.6	72.6	0.0	50.2	50.2	0.0
	1993	69.6	69.6	0.0	52.4	52.5	0.2	72.7	72.7	0.0	50.4	50.5	0.1
	1995	73.6	73.7	0.0	58.1	58.1	0.0	76.6	76.6	-0.0	59.3	59.2	-0.0
	1997	74.5	74.5	0.0	58.0	58.1	0.1	77.2	77.3	0.0	59.3	59.3	0.0
	2001	73.8	73.8	-0.0	57.9	57.9	0.0	77.1	77.1	-0.0	59.3	59.3	-0.0
	2005	74.1	74.1	-0.0	57.5	57.5	0.0	77.2	77.2	-0.0	59.2	59.2	-0.0

LEGEND MB = MEAN SURVIVAL WITH BASE CASE CONDITIONS (%) (BASE CASE)
MA = MEAN SURVIVAL WITH ALTERNATIVE CONDITIONS (%) (ALTERNATIVE)
RM = RELATIVE CHANGE IN MEAN SURVIVAL (%) A
(ALTERNATIVE SURVIVAL - BASE CASE SURVIVAL) / (BASE CASE SURVIVAL)

DATE RUN= 29AUG89:07:15:57

FREQUENCY OF RELATIVE SURVIVAL CHANGES EXCEEDING
ONE AND FIVE PERCENT

PROGRAM = DSN=PJI.PF400.RNR.SAS.REPORTS(FSUM)
FILE; PJI.PF400.RNR.FISH.PASS.DATA.MIDCOLFG
FILE; PJI.PF400.RNR.FISH.PASS.DATA.MIDCOLFG

		YEARLING				SUBYEARLING				STEELHEAD				SOCKEYE			
POOL	YEAR	FI1/	FI5	FD1/	FD5	FI1/	FI5	FD1/	FD5	FI1/	FI5	FD1/	FD5	FI1/	FI5	D1/	FD5
IELLS	1991	8/	0	5/	0	13/	0	18/	0	5/	0	5/	0	8/	0	8/	0
	1993	8/	0	5/	0	15/	3	10/	0	5/	0	0/	0	18/	0	0/	0
	1995	8/	0	0/	0	10/	3	5/	0	3/	0	8/	0	3/	0	5/	0
	1997	3/	0	5/	0	8/	0	8/	3	5/	0	0/	0	5/	0	0/	0
	2001	0/	0	10/	0	8/	0	15/	0	0/	0	5/	0	3/	0	8/	0
	2005	5/	0	5/	0	13/	0	13/	0	3/	0	0/	0	3/	0	3/	0
RECH	1991	8/	0	3/	0	20/	5	8/	0	5/	0	5/	0	0/	0	0/	0
	1993	8/	0	3/	0	20/	5	10/	0	5/	0	0/	0	0/	0	0/	0
	1995	13/	3	10/	0	0/	0	8/	3	0/	0	3/	0	0/	0	0/	0
	1997	5/	0	18/	0	8/	3	3/	0	3/	0	0/	0	0/	0	0/	0
	2001	0/	0	10/	0	5/	0	0/	0	0/	0	5/	0	0/	0	0/	0
	2005	0/	0	3/	0	10/	0	5/	0	0/	0	0/	0	0/	0	0/	0
RISL	1991	8/	0	5/	0	10/	0	13/	0	0/	0	0/	0	5/	0	8/	0
	1993	3/	0	0/	0	20/	0	3/	0	5/	0	3/	0	8/	0	0/	0
	1995	8/	0	8/	0	8/	0	0/	0	5/	0	5/	0	3/	0	3/	0
	1997	8/	0	5/	0	13/	0	0/	0	5/	0	0/	0	5/	0	0/	0
	2001	0/	0	5/	0	8/	0	0/	0	3/	0	0/	0	0/	0	5/	0
	2005	0/	0	3/	0	8/	0	5/	0	0/	0	0/	0	0/	0	0/	0
LWG	1991	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0
	1993	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0
	1995	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0
	1997	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0
	2001	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0
	2005	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0
LMM	1991	5/	0	5/	0	15/	3	5/	0	5/	0	10/	0	0/	0	0/	0
	1993	3/	0	8/	0	20/	3	8/	0	3/	0	5/	0	0/	0	0/	0
	1995	5/	0	13/	0	0/	0	3/	0	3/	0	8/	0	0/	0	0/	0
	1997	5/	0	5/	0	10/	3	3/	0	8/	0	0/	0	0/	0	0/	0
	2001	0/	0	10/	0	3/	0	0/	0	0/	0	8/	0	0/	0	0/	0
	2005	0/	0	5/	0	10/	0	5/	0	0/	0	3/	0	0/	0	0/	0
MCN	1991	5/	3	3/	0	8/	0	0/	0	3/	0	3/	0	0/	0	0/	0
	1993	8/	0	5/	0	13/	0	0/	0	0/	0	3/	0	0/	0	0/	0
	1995	3/	0	5/	3	0/	0	0/	0	0/	0	3/	0	0/	0	0/	0
	1997	5/	0	5/	0	3/	0	0/	0	3/	0	0/	0	0/	0	0/	0
	2001	3/	3	3/	3	3/	0	0/	0	0/	0	0/	0	0/	0	0/	0
	2005	0/	0	5/	0	3/	0	5/	0	0/	0	3/	0	0/	0	0/	0
ODAY	1991	5/	0	8/	0	15/	5	5/	0	5/	0	8/	0	0/	0	0/	0
	1993	13/	0	3/	0	15/	5	8/	3	13/	0	3/	0	0/	0	0/	0
	1995	13/	0	5/	0	3/	0	8/	3	0/	0	10/	0	0/	0	0/	0
	1997	13/	3	0/	0	15/	3	3/	0	5/	0	0/	0	0/	0	0/	0
	2001	5/	0	5/	0	5/	3	0/	0	3/	0	5/	0	0/	0	0/	0
	2005	3/	0	8/	0	10/	0	8/	0	3/	0	3/	0	0/	0	0/	0
DALS	1991	5/	3	5/	0	5/	0	0/	0	8/	0	0/	0	0/	0	0/	0
	1993	13/	3	3/	3	8/	0	3/	0	13/	0	5/	0	0/	0	0/	0
	1995	5/	0	3/	0	3/	0	0/	0	3/	0	3/	0	0/	0	0/	0
	1997	10/	0	0/	0	0/	0	0/	0	10/	0	0/	0	0/	0	0/	0
	2001	8/	0	3/	0	0/	0	0/	0	3/	0	0/	0	0/	0	0/	0
	2005	3/	0	8/	0	0/	0	3/	0	3/	0	0/	0	0/	0	0/	0
JONN	1991	0/	0	0/	0	3/	0	3/	0	0/	0	0/	0	0/	0	0/	0
	1993	3/	0	3/	0	3/	0	3/	0	3/	0	3/	0	0/	0	0/	0
	1995	0/	0	0/	0	5/	0	0/	0	0/	0	0/	0	0/	0	0/	0
	1997	0/	0	0/	0	5/	0	0/	0	3/	0	0/	0	0/	0	0/	0
	2001	0/	0	0/	0	3/	0	0/	0	0/	0	0/	0	0/	0	0/	0
	2005	0/	0	0/	0	0/	0	3/	0	0/	0	0/	0	0/	0	0/	0
SYS	1991	0/	0	0/	0	3/	0	0/	0	0/	0	0/	0	0/	0	0/	0
	1993	3/	0	0/	0	8/	0	3/	0	0/	0	0/	0	0/	0	0/	0
	1995	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0
	1997	0/	0	0/	0	3/	0	0/	0	0/	0	0/	0	0/	0	0/	0
	2001	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0
	2005	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0	0/	0

LEGEND FI1 = PERCENT OF RELATIVE SURVIVAL INCREASES EXCEEDING ONE PERCENT
FI5 = PERCENT OF RELATIVE SURVIVAL INCREASES EXCEEDING FIVE PERCENT
FD1 = PERCENT OF RELATIVE SURVIVAL DECREASES EXCEEDING ONE PERCENT
FD5 = PERCENT OF RELATIVE SURVIVAL DECREASES EXCEEDING FIVE PERCENT

DATE RUN= 29AUG89:07:21:14

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Table H-1e-1

RELATIVE CHANGES IN SYSTEM STOCK SURVIVAL
BC440MED VS BA000MED (BASE CASE)

PROGRAM = DSN=PJI.PF400.RNR.FISHPASS.SAS.REPORTS(FSUM56)
FILES: PJI.PF400.RNR.FISH.PASS.DATA.MIDCOLFG RUN DATE: JUN/29/89
PJI.PF400.RNR.FISH.PASS.DATA.MIDCOLFG RUN DATE: JUN/30/89

		YEARLING			SUBYEARLING			STEELHEAD			SOCKEYE		
POOL	YEAR	MB	MA	RM	MB	MA	RM	MB	MA	RM	MB	MA	RM
WELLS	1991	29.6	29.6	0.0	19.0	19.0	0.0	34.2	34.2	0.0	24.9	24.9	0.0
	1993	33.0	33.0	0.0	20.8	20.8	0.0	37.9	37.9	0.0	26.5	26.5	0.0
	1995	40.9	40.9	0.0	29.5	29.5	0.0	47.2	47.2	0.0	34.1	34.1	0.0
	1997	41.9	41.9	0.0	29.5	29.5	0.0	47.8	47.8	0.0	34.0	34.0	0.0
	2001	41.0	41.0	0.0	29.1	29.1	0.0	47.2	47.2	0.0	33.0	33.0	0.0
	2005	41.4	41.4	0.0	28.2	28.2	0.0	47.6	47.6	0.0	34.2	34.2	0.0
RRECH	1991	32.9	32.9	0.0	24.2	24.2	0.0	35.9	35.9	0.0	0.0	0.0	0.0
	1993	36.7	36.7	0.0	26.2	26.2	0.0	39.7	39.7	0.0	0.0	0.0	0.0
	1995	46.5	46.5	0.0	34.6	34.6	0.0	49.6	49.6	0.0	0.0	0.0	0.0
	1997	47.6	47.6	0.0	33.9	33.9	0.0	50.0	50.0	0.0	0.0	0.0	0.0
	2001	46.4	46.4	0.0	34.0	34.0	0.0	49.5	49.5	0.0	0.0	0.0	0.0
	2005	46.7	46.7	0.0	34.3	34.3	0.0	49.9	49.9	0.0	0.0	0.0	0.0
RISL	1991	39.8	39.8	0.0	26.6	26.6	0.0	42.7	42.7	0.0	33.3	33.3	0.0
	1993	40.1	40.1	0.0	27.0	27.0	0.0	43.0	43.0	0.0	33.0	33.0	0.0
	1995	50.9	50.9	0.0	37.4	37.4	0.0	54.5	54.5	0.0	42.6	42.6	0.0
	1997	52.1	52.1	0.0	37.3	37.3	0.0	54.8	54.8	0.0	42.6	42.6	0.0
	2001	50.4	50.4	0.0	37.1	37.1	0.0	53.9	53.9	0.0	42.2	42.2	0.0
	2005	51.1	51.1	0.0	36.4	36.4	0.0	54.6	54.6	0.0	42.8	42.8	0.0
LWG	1991	82.9	82.9	0.0	59.8	59.8	0.0	85.6	85.6	0.0	65.4	65.4	0.0
	1993	82.2	82.2	0.0	60.1	60.1	0.0	85.6	85.6	0.0	65.3	65.3	0.0
	1995	88.1	88.1	0.0	70.1	70.1	0.0	89.4	89.4	0.0	74.5	74.5	0.0
	1997	88.5	88.5	0.0	70.4	70.4	0.0	89.5	89.5	0.0	74.4	74.4	0.0
	2001	88.3	88.3	0.0	70.8	70.8	0.0	89.7	89.7	0.0	74.8	74.8	0.0
	2005	87.8	87.8	0.0	70.1	70.1	0.0	89.3	89.3	0.0	74.3	74.3	0.0
LMN	1991	33.2	33.2	0.0	27.4	27.4	0.0	39.8	39.8	0.0	0.0	0.0	0.0
	1993	35.9	35.9	0.0	28.1	28.1	0.0	43.6	43.6	0.0	0.0	0.0	0.0
	1995	38.6	38.6	0.0	33.5	33.5	0.0	46.5	46.5	0.0	0.0	0.0	0.0
	1997	38.9	38.9	0.0	34.6	34.6	0.0	46.7	46.7	0.0	0.0	0.0	0.0
	2001	38.7	38.7	0.0	34.7	34.7	0.0	46.9	46.9	0.0	0.0	0.0	0.0
	2005	39.5	39.5	0.0	32.7	32.7	0.0	48.0	48.0	0.0	0.0	0.0	0.0
ICN	1991	59.2	59.2	0.0	42.0	42.0	0.0	67.4	67.4	0.0	0.0	0.0	0.0
	1993	59.1	59.1	0.0	42.7	42.7	0.0	69.6	69.6	0.0	0.0	0.0	0.0
	1995	66.0	66.0	0.0	53.2	53.2	0.0	73.5	73.5	0.0	0.0	0.0	0.0
	1997	67.5	67.5	0.0	53.3	53.3	0.0	73.9	73.9	0.0	0.0	0.0	0.0
	2001	65.0	65.0	0.0	53.3	53.3	0.0	73.2	73.2	0.0	0.0	0.0	0.0
	2005	66.0	66.0	0.0	52.5	52.5	0.0	73.9	73.9	0.0	0.0	0.0	0.0
JDAY	1991	55.2	55.2	0.0	45.2	45.2	0.0	59.5	59.5	0.0	0.0	0.0	0.0
	1993	54.5	54.5	0.0	44.7	44.7	0.0	58.5	58.5	0.0	0.0	0.0	0.0
	1995	53.8	53.8	0.0	45.1	45.1	0.0	58.3	58.3	0.0	0.0	0.0	0.0
	1997	56.1	56.1	0.0	44.5	44.5	0.0	61.0	61.0	0.0	0.0	0.0	0.0
	2001	55.9	55.9	0.0	45.4	45.4	0.0	60.9	60.9	0.0	0.0	0.0	0.0
	2005	56.7	56.7	0.0	44.8	44.8	0.0	61.3	61.3	0.0	0.0	0.0	0.0
DALS	1991	65.8	65.8	0.0	55.2	55.2	0.0	65.9	65.9	0.0	0.0	0.0	0.0
	1993	65.5	65.5	0.0	55.2	55.2	0.0	65.5	65.5	0.0	0.0	0.0	0.0
	1995	65.3	65.3	0.0	54.9	54.9	0.0	65.4	65.4	0.0	0.0	0.0	0.0
	1997	68.7	68.7	0.0	56.5	56.5	0.0	68.5	68.5	0.0	0.0	0.0	0.0
	2001	68.0	68.0	0.0	56.4	56.4	0.0	68.6	68.6	0.0	0.0	0.0	0.0
	2005	68.6	68.6	0.0	55.2	55.2	0.0	68.6	68.6	0.0	0.0	0.0	0.0
CONN	1991	87.2	87.2	0.0	79.4	79.4	0.0	83.9	83.9	0.0	0.0	0.0	0.0
	1993	87.0	87.0	0.0	79.2	79.2	0.0	83.6	83.6	0.0	0.0	0.0	0.0
	1995	86.2	86.2	0.0	78.7	78.7	0.0	82.6	82.6	0.0	0.0	0.0	0.0
	1997	86.8	86.8	0.0	78.1	78.1	0.0	82.5	82.5	0.0	0.0	0.0	0.0
	2001	86.5	86.5	0.0	77.7	77.7	0.0	82.3	82.3	0.0	0.0	0.0	0.0
	2005	86.9	86.9	0.0	78.1	78.1	0.0	82.8	82.8	0.0	0.0	0.0	0.0
SYS	1991	69.4	69.4	0.0	52.3	52.3	0.0	72.6	72.6	0.0	50.2	50.2	0.0
	1993	69.6	69.6	0.0	52.4	52.4	0.0	72.7	72.7	0.0	50.5	50.5	0.0
	1995	73.6	73.6	0.0	58.1	58.1	0.0	76.6	76.6	0.0	59.3	59.3	0.0
	1997	74.5	74.5	0.0	58.0	58.0	0.0	77.2	77.2	0.0	59.2	59.2	0.0
	2001	73.8	73.8	0.0	57.9	57.9	0.0	77.1	77.1	0.0	59.5	59.5	0.0
	2005	74.1	74.1	0.0	57.5	57.5	0.0	77.2	77.2	0.0	59.2	59.2	0.0

LEGEND MB = MEAN SURVIVAL WITH BASE CASE CONDITIONS (%) (BASE CASE)
MA = MEAN SURVIVAL WITH ALTERNATIVE CONDITIONS (%) (ALTERNATIVE)
RM = RELATIVE CHANGE IN MEAN SURVIVAL (%)
(ALTERNATIVE SURVIVAL - BASE CASE SURVIVAL) / (BASE CASE SURVIVAL)

DATE RUN= 29AUG89:07:30:06

FREQUENCY OF RELATIVE SURVIVAL CHANGES EXCEEDING
ONE AND FIVE PERCENT

PROGRAM = DSN=PJI.PF400.RNR.SAS.REPORTS(FSUM)
FILE: PJI.PF400.RNR.FISH.PASS.DATA.MIDCOLFG
FILE: PJI.PF400.RNR.FISH.PASS.DATA.MIDCOLFG

YEARLING		SUBYEARLING		STEELHEAD		SOCKEYE	
FI1/FI5	FD1/FD5	FI1/FI5	FD1/FD5	FI1/FI5	FD1/FD5	FI1/FI5	FD1/FD5
0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0
0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0
0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0
0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0
0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0
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0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0
0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0
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0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0
0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0
0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0
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0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0
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0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0
0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0	0/ 0

LEGEND FI1 = PERCENT OF RELATIVE SURVIVAL INCREASES EXCEEDING ONE PERCENT
FI5 = PERCENT OF RELATIVE SURVIVAL INCREASES EXCEEDING FIVE PERCENT
FD1 = PERCENT OF RELATIVE SURVIVAL DECREASES EXCEEDING ONE PERCENT
FD5 = PERCENT OF RELATIVE SURVIVAL DECREASES EXCEEDING FIVE PERCENT

DATE RUN= 29AUG89:07:57:06

H-1f

FLOW CHANGES

Discharges and Differences for
Lower Granite, Priest Rapids and The Dalles

Table H-1f-1

****

BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

****

LWG Discharge (QTDA - QPRD)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	31	35	40	41	37	43	43	48	52	77	60	38	28	23	43
1990	27	29	34	41	43	41	45	45	48	50	77	67	38	28	24	45
1991	26	30	32	37	39	35	42	43	48	52	75	60	37	26	22	42
1992	18	31	33	39	41	37	41	42	51	52	76	59	38	29	23	43
1993	21	31	34	41	42	39	44	44	47	50	77	65	40	30	25	44
1994	30	31	33	38	40	37	42	43	45	54	79	60	39	29	24	43
1995	31	32	32	38	42	37	44	43	46	52	76	60	38	29	23	43
1996	29	30	33	40	42	40	43	44	50	51	78	61	38	30	24	44
1997	29	31	34	41	44	41	46	45	47	51	79	64	40	31	26	45
1998	23	32	32	38	40	34	42	42	48	52	74	58	38	26	22	42
1999	33	32	33	40	43	39	45	45	47	52	77	62	39	30	24	44
2000	27	31	34	41	43	39	43	43	50	49	76	63	38	29	23	44
2001	31	31	33	38	42	37	43	42	47	52	75	59	38	28	23	43
2002	25	32	34	40	44	41	43	44	48	52	80	64	40	32	26	45
2003	23	31	33	38	42	37	44	43	47	52	77	60	39	28	23	43
2004	24	32	33	40	41	38	43	43	46	51	78	65	41	27	23	44
2005	30	31	33	40	43	39	44	44	47	51	77	64	40	27	23	44
2006	32	29	33	39	42	39	45	45	47	51	79	63	39	27	23	44
2007	23	31	34	41	42	40	42	43	50	50	77	63	40	28	23	44
2008	26	29	32	38	40	37	42	44	45	53	78	63	40	28	23	43
AVERAGE		31	33	39	42	38	43	44	48	51	77	62	39	28	24	44

Table H-1f-1

```
*****************************************************************************************************************
                                              BPAHYSUM Summary
Base Study:    BA000MED : PSCEIS : BASE CASE                                Date:    3-JAN-89 06:55:28
Incr Study:    BD120MED : PSCEIS : BASE CASE   : ALT 1.2                    Date:    6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)
*****************************************************************************************************************
```

Difference Of
LWG Discharge (QTDA - QPRD)

YEAR / NUM		SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	26	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0
1992	18	0	0	0	-1	0	0	1	0	0	0	0	0	0	0	0
1993	21	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	30	0	0	0	-1	0	0	0	0	1	0	0	0	0	1	0
1995	31	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
1996	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	29	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
1998	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	33	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2000	27	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2001	31	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0
2002	25	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0
2003	23	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0
2004	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	30	-1	0	0	-1	0	0	0	0	0	0	1	0	0	0	0
2006	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	23	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	26	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AVERAGE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table H-1f-1

```
*****************************************************************************************************
                                        BPAHYSUM Summary
Base Study:    BA000MED : PSCEIS : BASE CASE                          Date:   3-JAN-89 06:55:28
Incr Study:    BE410MED : PSCEIS : ALT410                             Date:   1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)
*****************************************************************************************************
```

Difference Of
LWG Discharge (QTDA - QPRD)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	2	1	0	3	1	0	0	-1	-1	-1	-1	-2	-3	-2	0
1990	27	1	1	0	3	-1	1	0	0	0	-1	-2	-1	-2	-1	0
1991	26	2	0	1	3	2	0	-1	-1	-1	0	-2	-1	-1	-1	0
1992	18	2	0	1	1	2	0	0	-1	-1	-1	-1	-1	-1	-1	0
1993	21	2	1	1	1	0	0	0	0	0	-1	-1	-2	-3	-2	0
1994	30	2	1	1	2	1	0	-1	-1	0	-1	-1	-1	-1	-1	0
1995	31	1	0	1	2	1	0	-1	0	0	-1	-1	-2	-1	-1	0
1996	29	1	1	1	1	0	0	0	-1	0	-1	-1	-1	-2	-2	0
1997	29	1	1	0	1	0	0	-1	0	-1	-1	-2	-2	-2	-3	0
1998	23	2	1	1	2	2	-1	-1	0	0	0	-1	-2	-1	-1	0
1999	33	1	1	1	0	0	-1	0	0	-1	-1	-1	-1	0	0	0
2000	27	1	1	1	1	0	0	-1	0	0	0	-2	0	0	0	0
2001	31	0	0	0	1	0	0	0	1	0	-1	-1	0	0	0	0
2002	25	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0
2003	23	0	0	0	0	0	-1	0	1	1	0	-1	0	2	2	0
2004	24	0	0	1	0	0	1	0	-1	0	0	-2	-1	2	1	0
2005	30	0	0	0	0	-1	1	0	0	0	0	-2	-1	2	1	0
2006	32	0	0	0	0	0	0	0	0	0	0	-1	-1	2	2	0
2007	23	0	0	0	1	0	0	0	0	0	0	-2	-1	2	1	0
2008	26	0	0	0	1	0	1	0	0	0	0	-2	-1	1	1	0
AVERAGE		1	0	0	1	0	0	0	0	0	-1	-1	-1	0	0	0

Table H-1f-1

****

BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415 Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

****

Difference Of
LWG Discharge (QTDA - QPRD)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	2	1	0	3	1	-1	0	-1	-1	-1	-1	-1	-2	-2	0
1990	27	1	1	0	2	-1	0	0	0	0	-1	-1	-1	0	0	0
1991	26	2	0	1	2	1	0	-1	-1	0	0	-1	0	0	0	0
1992	18	1	0	0	1	1	-1	0	0	0	-1	-1	0	0	1	0
1993	21	0	0	1	0	-1	-1	0	0	0	0	-1	-1	0	0	0
1994	30	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0
1995	31	0	0	0	0	0	-1	-1	0	0	0	0	0	0	0	0
1996	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	29	0	0	0	0	0	0	0	0	0	0	-1	0	0	1	0
1998	23	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0
1999	33	0	0	0	0	0	0	0	0	0	0	-1	0	1	2	0
2000	27	0	0	0	0	0	1	0	0	0	0	-1	1	0	1	0
2001	31	0	0	0	0	1	0	0	1	-1	0	-1	1	0	1	0
2002	25	0	0	0	0	0	0	0	0	0	0	0	1	-1	-1	0
2003	23	0	0	0	-1	0	-1	0	0	1	0	0	0	2	2	0
2004	24	-1	0	0	0	0	1	1	0	0	0	-1	-1	3	2	0
2005	30	0	0	0	0	0	0	0	0	0	0	-1	-1	2	1	0
2006	32	0	0	0	0	0	0	0	0	0	0	-1	-1	2	1	0
2007	23	0	0	0	0	-1	1	0	1	0	0	-1	-1	2	1	0
2008	26	0	0	0	0	0	1	0	1	0	-1	-1	-1	1	1	0
AVERAGE		0	0	0	0	0	0	0	0	0	0	-1	0	1	1	0

Table H-1f-1

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*********************************************************************************************************
                                        BPAHYSUM Summary
Base Study:     BA000MED : PSCEIS : BASE CASE                     Date:   3-JAN-89 06:55:28
Incr Study:     BA430MED : PSCEIS : ALT43                         Date:  21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)
*********************************************************************************************************
```

Difference Of
LWG Discharge (QTDA - QPRD)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	-1	-1	0	-2	1	0	0	1	0	0	0	0	-3	-2	0
1990	27	0	0	0	0	1	0	1	1	0	1	-1	-1	-1	-1	0
1991	26	0	0	0	-1	1	0	0	1	0	0	-1	0	-1	0	0
1992	18	-1	0	-1	-1	0	-1	1	-1	0	0	0	-1	-2	0	0
1993	21	-1	0	0	-1	1	-1	0	0	0	1	-1	-1	-1	0	0
1994	30	0	0	0	-1	0	0	0	0	0	1	-1	0	0	0	0
1995	31	-1	0	0	-1	0	0	0	1	1	0	-1	0	-1	0	0
1996	29	-1	0	0	-1	0	0	0	0	0	0	0	0	0	0	0
1997	29	-1	0	0	-1	0	0	0	1	0	0	-1	-1	-1	-1	0
1998	23	0	0	0	-1	0	-1	0	0	0	0	0	-1	0	0	0
1999	33	-1	0	0	-1	1	-1	-1	0	0	1	0	-1	0	1	0
2000	27	-1	0	0	-1	0	0	0	0	0	0	-1	-1	-1	0	0
2001	31	0	0	0	-1	0	0	0	1	0	0	0	0	0	0	0
2002	25	-1	0	0	-1	0	0	0	0	0	0	0	0	-1	-1	0
2003	23	0	0	0	-2	0	-2	-1	1	1	1	0	1	0	1	0
2004	24	-1	0	0	0	0	0	0	0	0	0	-1	-1	1	0	0
2005	30	-1	0	0	-1	0	0	0	0	0	0	0	0	1	0	0
2006	32	0	0	0	0	0	0	0	0	0	0	-1	-1	2	1	0
2007	23	-1	0	0	0	0	0	0	0	0	0	-1	0	1	1	0
2008	26	-1	0	0	-1	0	0	0	0	0	0	0	-1	0	0	0
AVERAGE		-1	0	0	-1	0	0	0	0	0	0	0	0	0	0	0

Table H-1f-1

****

BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BC440MED : PSCEIS : ALT44 — Date: 28-JAN-89 06:06:31
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

****

Difference Of
LWG Discharge (QTDA - QPRD)

YEAR / NUM		SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AVERAGE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table H-1f-2

****

BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

****

LWG Discharge (QTDA - QPRD)

YEAR / NUM		SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP 1	AP 2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	34	38	44	52	53	71	73	91	103	106	105	49	32	26	63
1990	154	32	38	43	51	53	71	72	95	111	109	104	50	33	27	63
1991	154	33	38	44	53	54	70	72	91	100	103	104	49	33	27	62
1992	160	33	37	44	55	57	74	73	94	108	106	106	51	33	28	64
1993	155	33	37	43	50	51	69	72	93	106	107	103	49	33	27	62
1994	155	33	37	43	52	53	68	72	92	104	107	99	48	33	28	62
1995	154	32	38	43	51	51	68	71	92	107	112	103	48	33	27	62
1996	148	32	37	43	52	55	72	72	91	105	107	100	48	33	28	62
1997	155	32	38	44	51	53	69	70	93	100	103	102	48	33	27	61
1998	155	32	38	43	52	53	68	73	96	107	105	100	49	33	27	62
1999	149	33	37	43	53	56	73	72	95	108	108	104	50	33	28	63
2000	151	32	38	44	55	57	72	73	94	103	107	101	47	32	27	63
2001	152	33	38	44	53	55	74	74	95	107	108	105	49	33	27	64
2002	157	32	38	43	50	51	66	71	91	100	105	98	48	33	27	61
2003	163	32	37	44	53	54	72	72	97	109	109	100	49	33	27	63
2004	146	33	37	43	53	54	72	73	93	108	109	107	50	33	27	64
2005	151	32	38	43	53	55	73	75	95	111	111	108	51	33	28	64
2006	145	32	37	43	52	55	71	75	100	112	108	98	50	33	27	63
2007	155	32	38	43	50	51	67	70	89	100	104	97	48	32	27	60
2008	159	32	37	43	51	54	65	70	92	99	101	102	49	33	27	61
AVERAGE		33	38	43	52	54	70	72	93	105	107	102	49	33	27	62

Table H-1f-2

BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2 Date: 6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

Difference Of
LWG Discharge (QTDA - QPRD)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	149	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	163	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	159	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AVERAGE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table H-1f-2

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410 Date: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
LWG Discharge (QTDA - QPRD)

YEAR / NUM		SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	2	1	0	1	0	-1	0	0	-1	0	0	0	0	0	0
1990	154	1	0	0	1	-1	-1	0	-1	0	0	0	0	0	0	0
1991	154	2	0	0	0	-1	-1	-1	-1	0	0	0	0	-1	0	0
1992	160	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	155	2	1	1	0	-1	0	0	0	0	0	0	0	-1	0	0
1994	155	2	1	1	0	-1	0	0	-1	-1	0	0	0	-1	-1	0
1995	154	2	1	1	0	-1	-1	0	0	-1	0	0	0	-1	-1	0
1996	148	2	1	1	0	-1	0	0	0	-1	0	0	0	0	0	0
1997	155	2	1	1	0	-1	0	0	0	-1	-1	0	0	0	0	0
1998	155	2	1	1	0	-1	0	0	0	-1	0	0	0	0	0	0
1999	149	1	1	1	-1	0	0	0	0	0	0	0	0	0	0	0
2000	151	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
2001	152	1	0	0	0	0	0	0	0	-1	0	0	0	0	0	0
2002	157	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0
2003	163	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	146	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0
2005	151	0	0	0	0	0	0	0	-1	1	1	0	0	0	0	0
2006	145	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0
2007	155	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0
2008	159	0	0	0	0	-1	0	0	-1	0	0	0	0	0	0	0
AVERAGE		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table H-1f-2

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****************************************************************************************************
                                        BPAHYSUM Summary
Base Study:     BA000MED : PSCEIS : BASE CASE                          Date:    3-JAN-89 06:55:28
Incr Study:     BB415MED : PSCEIS : ALT415                             Date:   14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)
****************************************************************************************************
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Difference Of
LWG Discharge (QTDA - QPRD)

YEAR / NUM		SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	2	1	0	0	0	-1	0	0	-1	0	0	0	0	0	0
1990	154	1	0	0	1	-1	-1	0	-1	0	0	0	0	0	0	0
1991	154	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	160	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	155	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	154	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0
1996	148	0	0	0	0	-1	0	0	0	-1	0	0	0	0	0	0
1997	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	149	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	163	0	0	0	-1	1	0	0	0	0	0	0	0	0	0	0
2004	146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	159	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AVERAGE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table H-1f-2

BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BA430MED : PSCEIS : ALT43 — Date: 21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

Difference Of
LWG Discharge (QTDA - QPRD)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	-1	-1	0	-1	1	1	0	1	0	0	0	0	0	0	0
1990	154	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
1991	154	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
1992	160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	155	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
1994	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	154	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
1996	148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	149	-1	0	0	0	0	1	0	0	1	0	0	0	0	0	0
2000	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	163	-1	0	0	-1	1	1	0	0	0	0	0	0	0	0	0
2004	146	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	151	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2006	145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	159	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AVERAGE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table H-1f-2

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BC440MED : PSCEIS : ALT44 Date: 28-JAN-89 06:06:31
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
LWG Discharge (QTDA - QPRD)

YEAR / NUM		SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	149	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	163	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	159	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AVERAGE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table H-1f-3

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28

Number of Games: 200

Average Over High Water Years (Top 10 Percent)

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LWG Discharge (QTDA - QPRD)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	32	38	53	69	75	80	79	97	141	164	188	59	35	26	82
1990	19	31	36	52	73	78	81	83	100	151	167	180	57	36	26	83
1991	20	31	36	52	66	75	79	75	94	136	164	191	59	35	26	81
1992	22	32	35	52	64	72	79	71	92	129	162	197	60	35	26	80
1993	24	32	35	51	74	79	82	84	100	155	168	177	56	36	26	83
1994	15	31	36	52	71	78	81	80	98	148	166	183	57	36	26	82
1995	15	31	35	52	65	73	79	72	92	130	163	195	60	35	26	81
1996	23	31	34	51	75	80	83	85	102	155	169	175	55	36	26	83
1997	16	32	35	52	68	75	80	77	96	137	165	189	58	35	26	82
1998	22	31	35	52	69	76	80	77	96	139	165	188	58	35	26	82
1999	18	31	35	52	61	71	76	68	89	120	160	203	61	35	27	79
2000	22	31	35	51	72	78	82	81	98	147	167	182	57	36	26	82
2001	17	31	35	52	70	78	81	80	98	145	166	183	57	36	26	82
2002	18	31	35	51	70	77	81	79	97	143	166	185	57	36	26	82
2003	14	30	35	52	65	73	79	73	93	132	164	193	59	35	26	80
2004	30	31	35	52	68	76	80	78	97	141	165	186	58	35	26	81
2005	19	30	35	52	70	77	81	80	97	146	166	183	57	36	26	82
2006	23	31	35	52	69	76	81	78	97	142	165	186	58	35	26	82
2007	22	31	35	51	72	78	82	80	97	148	167	182	57	36	26	82
2008	15	31	35	52	71	78	82	80	98	146	166	183	57	36	26	82
AVERAGE		31	35	52	69	76	80	78	97	142	165	186	58	35	26	82

Table H-1f-3

BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2 Date: 6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

Difference Of
LWG Discharge (QTDA - QPRD)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	24	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0
1994	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	18	0	0	0	0	0	1	-1	0	0	0	0	0	0	0	0
2000	22	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	14	-1	0	0	0	0	0	0	0	0	-1	1	0	0	0	0
2004	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	23	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AVERAGE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table H-1f-3

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410 Date: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

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Difference Of
LWG Discharge (QTDA - QPRD)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	2	2	0	0	-1	0	1	-1	-1	0	-1	0	0	0	0
1990	19	2	0	0	-1	0	0	0	0	-1	0	0	0	0	0	0
1991	20	3	0	0	0	-1	0	1	0	0	0	-1	0	0	0	0
1992	22	1	0	0	-1	0	-1	1	0	0	0	0	0	0	0	0
1993	24	2	1	0	0	-1	-1	2	0	-2	0	0	0	0	0	0
1994	15	2	2	1	0	-2	-1	3	0	-1	-1	-1	0	0	0	0
1995	15	1	2	0	-1	-2	-1	4	1	0	-1	-2	0	0	0	0
1996	23	2	1	1	0	-2	-2	4	0	-1	0	-1	0	0	0	0
1997	16	2	2	0	0	-2	-1	3	1	1	-1	-2	0	0	0	0
1998	22	1	1	0	-1	-2	-1	4	1	-1	-1	-3	0	0	0	0
1999	18	1	1	0	0	-2	0	3	1	0	1	-5	0	0	0	0
2000	22	0	1	1	0	-2	-2	3	2	-2	0	-2	0	0	0	0
2001	17	1	1	0	-1	-2	-2	2	2	-1	1	-2	0	0	0	0
2002	18	1	1	0	-1	-2	-1	2	2	0	0	-1	0	0	0	0
2003	14	0	1	0	0	0	-1	1	1	-1	-1	0	0	0	0	0
2004	30	0	0	0	0	0	0	0	1	-1	1	0	0	0	0	0
2005	19	0	0	-1	0	0	0	1	2	-2	0	0	0	0	0	0
2006	23	0	0	0	0	0	0	1	0	-2	0	0	0	0	0	0
2007	22	0	0	0	0	0	0	1	3	-2	0	0	0	0	0	0
2008	15	0	0	0	0	0	0	0	2	-2	0	0	0	0	0	0
AVERAGE		1	1	0	0	-1	-1	2	1	-1	0	-1	0	0	0	0

Table H-1f-3

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415 — Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

****

Difference Of
LWG Discharge (QTDA - QPRD)

YEAR	/ NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	2	1	0	0	-1	0	0	0	-1	0	-1	0	0	0	0
1990	19	1	0	0	-1	0	0	0	-1	-1	0	0	0	0	0	0
1991	20	2	0	0	0	0	0	0	0	-1	0	0	0	0	0	0
1992	22	0	0	0	-1	1	-1	0	0	0	0	0	0	0	0	0
1993	24	1	1	0	0	0	0	1	1	-1	0	0	0	0	0	0
1994	15	0	1	0	0	-1	0	0	1	0	-1	0	0	0	0	0
1995	15	0	1	1	-1	-1	0	0	1	0	-1	0	0	0	0	0
1996	23	0	1	0	0	0	-1	1	0	0	0	0	0	0	0	0
1997	16	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
1998	22	0	0	0	-1	0	0	0	0	-1	1	0	0	0	0	0
1999	18	0	0	-1	0	1	0	0	-1	-1	1	0	0	0	0	0
2000	22	0	0	0	0	0	0	0	1	-2	1	0	0	0	0	0
2001	17	0	0	-1	0	1	0	0	0	-2	1	0	0	0	0	0
2002	18	0	1	-1	-1	0	0	0	1	-1	0	0	0	0	0	0
2003	14	0	0	-1	0	1	0	0	-1	-1	0	1	0	0	0	0
2004	30	0	-1	-1	0	1	0	0	-1	-2	1	0	0	0	0	0
2005	19	0	0	-1	0	1	0	0	0	-2	1	0	0	0	0	0
2006	23	0	0	-1	0	0	0	0	-1	-2	1	0	0	0	0	0
2007	22	0	0	0	0	0	0	0	1	-2	0	0	0	0	0	0
2008	15	0	0	0	0	0	0	0	0	-2	0	0	0	0	0	0
AVERAGE		0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0

Table H-1f-3

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BA430MED : PSCEIS : ALT43   Date: 21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

****

Difference Of
LWG Discharge (QTDA - QPRD)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	-1	0	0	0	1	0	0	0	0	1	0	0	0	0	0
1990	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	20	-1	0	0	0	0	0	0	-1	1	0	0	0	0	0	0
1992	22	-1	1	0	0	0	-1	1	0	0	0	0	0	0	0	0
1993	24	-1	0	0	0	0	1	-1	1	-1	0	0	0	0	0	0
1994	15	0	1	0	0	0	0	0	1	0	-1	0	0	0	0	0
1995	15	0	1	0	0	0	0	0	1	1	-1	0	0	0	0	0
1996	23	0	1	1	0	0	0	0	0	2	0	0	0	0	0	0
1997	16	0	1	0	0	0	0	0	0	2	-1	0	0	0	0	0
1998	22	0	1	1	0	-1	-1	1	0	2	-1	0	0	0	0	0
1999	18	0	1	1	0	0	1	-1	0	2	-1	0	0	0	0	0
2000	22	-1	1	1	0	0	0	0	1	1	-1	0	0	0	0	0
2001	17	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0
2002	18	0	1	1	0	-1	0	1	1	1	-1	0	0	0	0	0
2003	14	-1	0	0	0	0	-1	1	0	1	-1	1	0	0	0	0
2004	30	-1	0	0	1	1	0	-1	0	1	0	0	0	0	0	0
2005	19	-1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2006	23	-1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	22	0	0	0	0	0	0	0	1	1	-1	0	0	0	0	0
2008	15	-1	0	1	0	0	0	0	1	1	-1	0	0	0	0	0
AVERAGE		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0

Table H-1f-3

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BC440MED : PSCEIS : ALT44 Date: 28-JAN-89 06:06:31
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

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Difference Of
LWG Discharge (QTDA - QPRD)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AVERAGE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table H-1f-4

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE　　Date: 3-JAN-89 06:55:28

Number of Games: 200

Average Over Low Water Years (Bottom 10 Percent)

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Priest Rapids Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	68	81	79	97	98	82	84	73	115	115	74	65	64	72	84
1990	27	71	81	78	98	100	83	89	80	115	115	79	60	60	73	85
1991	26	71	78	75	94	100	84	84	70	116	115	75	65	72	76	84
1992	18	73	80	80	99	100	87	85	73	113	115	77	60	66	76	85
1993	21	72	78	77	102	101	88	90	80	115	115	74	58	71	79	86
1994	30	69	76	77	97	104	89	86	72	114	115	74	62	77	77	85
1995	31	72	79	78	98	105	86	87	74	115	115	75	63	79	80	86
1996	29	73	80	78	99	101	87	88	77	116	115	78	61	74	78	86
1997	29	72	79	76	100	105	85	90	82	116	115	70	63	76	80	86
1998	23	72	75	76	98	102	87	88	73	116	115	73	62	83	79	85
1999	33	74	79	78	101	104	87	86	79	112	115	72	63	75	80	86
2000	27	72	78	76	102	101	85	87	77	115	115	85	57	72	79	86
2001	31	73	75	78	99	102	84	84	72	115	115	79	61	80	78	85
2002	25	73	81	79	102	101	87	86	80	114	115	84	59	76	81	87
2003	23	72	80	80	99	103	86	87	79	116	115	77	61	74	74	86
2004	24	73	76	76	99	101	84	86	75	116	115	81	63	72	74	85
2005	30	71	76	76	100	102	83	86	78	116	115	85	64	72	74	86
2006	32	70	75	79	100	102	84	86	77	115	115	84	66	73	76	86
2007	23	72	74	75	101	101	87	86	81	116	115	86	63	71	76	86
2008	26	69	74	77	100	103	90	85	74	112	115	83	66	75	74	86
AVERAGE		72	78	77	99	102	86	86	76	115	115	78	62	73	77	85

Table H-1f-4

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                                              BPAHYSUM Summary
Base Study:     BA000MED : PSCEIS : BASE CASE                                    Date:    3-JAN-89 06:55:28
Incr Study:     BD120MED : PSCEIS : BASE CASE   : ALT 1.2                        Date:    6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)
*****************************************************************************************************************
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Difference Of
Priest Rapids Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	27	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0
1991	26	-2	-2	-2	0	1	0	1	0	0	0	1	0	0	-1	0
1992	18	-1	-3	-4	0	1	2	1	0	0	0	1	1	0	0	0
1993	21	-2	-2	-3	-1	1	0	1	1	0	0	1	1	-1	0	0
1994	30	-2	-2	-1	0	-1	0	0	0	0	0	0	1	1	0	0
1995	31	-2	-2	-2	-1	-1	-1	-1	1	0	0	1	1	0	-1	0
1996	29	-1	-2	-2	0	1	0	0	1	0	0	1	0	-1	1	0
1997	29	-2	-2	-1	0	1	0	0	1	0	0	1	1	0	0	0
1998	23	-2	-2	-1	-1	-1	0	0	1	0	0	1	0	0	0	0
1999	33	-2	-2	-1	-1	2	1	0	2	0	0	0	0	0	0	0
2000	27	-2	-2	-1	-1	1	1	0	1	0	0	1	0	-1	-1	0
2001	31	-2	-2	-1	0	0	0	1	1	0	0	1	0	-1	-1	0
2002	25	-2	-2	-2	-3	2	1	1	1	0	0	1	0	-2	-1	0
2003	23	-2	-2	-2	0	0	0	0	0	0	0	0	1	0	0	0
2004	24	-2	-2	-2	0	1	0	0	0	0	0	1	0	0	0	0
2005	30	-2	-2	-2	-2	0	1	1	1	0	0	1	0	1	0	0
2006	32	-2	-2	-2	-2	2	0	0	1	0	0	1	1	0	0	0
2007	23	-2	-2	-2	-1	1	1	1	1	0	0	2	0	-2	-1	0
2008	26	-2	-2	-2	-2	0	0	0	1	1	0	1	1	0	0	0
AVERAGE		-2	-2	-2	-1	1	0	0	1	0	0	1	0	0	0	0

Table H-1f-4

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410 Date: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
Priest Rapids Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	6	10	14	12	-3	1	1	-8	0	0	-10	-10	-4	-8	1
1990	27	5	9	13	8	-4	-2	-4	-5	0	0	-7	-7	-5	-5	0
1991	26	6	9	14	16	-5	-1	-6	-4	-1	0	-9	-7	-7	-8	0
1992	18	5	8	11	11	-4	-3	-3	0	2	0	-8	-6	-8	-7	0
1993	21	6	9	11	8	-7	-7	-3	-3	0	0	-8	-4	-9	-10	-1
1994	30	6	10	16	12	-9	-7	-4	-2	1	0	-6	-5	-12	-10	0
1995	31	6	9	15	12	-10	-7	-5	-3	0	0	-5	-6	-15	-10	0
1996	29	5	7	13	11	-8	-6	-3	-2	-1	0	-6	-7	-12	-7	0
1997	29	6	10	15	8	-11	-8	-4	-3	-1	0	-10	-5	-13	-9	-1
1998	23	4	10	15	11	-10	-6	-8	-6	-1	0	-6	-6	-14	-10	-1
1999	33	3	5	9	3	-9	-6	-1	-2	0	0	-6	-3	-11	-7	-1
2000	27	3	7	11	3	-7	-3	-1	-1	0	0	-10	-2	-6	-4	0
2001	31	3	6	8	3	-5	-3	-2	-1	0	0	-10	1	-8	-4	-1
2002	25	0	1	3	0	0	-2	-1	1	1	0	-7	0	-10	-5	-1
2003	23	-2	-1	3	0	-2	-3	-2	-5	-1	0	-5	3	3	3	-1
2004	24	-2	2	3	1	0	2	2	3	0	0	-11	-2	3	3	0
2005	30	0	2	6	-1	-2	2	1	1	0	0	-12	-1	4	5	0
2006	32	1	3	4	-1	0	2	1	1	0	0	-12	-2	3	3	0
2007	23	1	3	6	1	-1	1	2	-1	0	0	-11	-1	3	3	0
2008	26	-1	3	6	2	1	-1	-2	-1	-1	0	-13	-2	5	4	0
AVERAGE		3	6	10	6	-5	-3	-2	-2	0	0	-9	-4	-6	-4	0

Table H-1f-4

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****************************************************************************************************************
                                        BPAHYSUM Summary
Base Study:    BA000MED : PSCEIS : BASE CASE                          Date:    3-JAN-89 06:55:28
Incr Study:    BB415MED : PSCEIS : ALT415                             Date:   14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)
****************************************************************************************************************
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Difference Of
Priest Rapids Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	6	9	14	11	-10	-2	-3	-8	0	0	-5	-3	0	-1	1
1990	27	4	7	10	5	-7	-3	-4	-4	0	0	-5	-1	0	0	0
1991	26	4	7	12	7	-7	-4	-4	-3	-1	0	-4	-3	-4	-3	0
1992	18	3	5	5	6	-6	-5	1	0	0	0	-4	-2	-2	-2	0
1993	21	3	3	4	1	-6	-4	-1	-2	0	0	-3	0	-4	-3	-1
1994	30	1	3	5	3	-5	-4	-1	-1	0	0	-2	0	-3	-2	0
1995	31	1	2	5	0	-5	-3	-2	-1	0	0	-2	0	-4	-2	-1
1996	29	1	1	3	1	-2	-3	0	0	0	0	-2	-1	-4	-2	0
1997	29	0	0	1	0	-2	-3	-1	-1	-1	0	-1	1	-2	-3	-1
1998	23	-1	1	3	1	-1	-2	-1	-1	0	0	-1	0	0	-1	0
1999	33	-2	0	0	-1	1	-1	1	0	0	0	-1	0	6	3	0
2000	27	-2	-1	2	-2	1	2	2	3	1	0	-7	4	6	4	1
2001	31	-1	2	3	-1	1	2	2	3	1	0	-6	2	4	4	1
2002	25	0	0	2	0	3	3	2	5	2	0	-6	1	-2	-2	1
2003	23	-1	-2	-1	-2	-1	-2	-2	-2	0	0	0	1	3	3	-1
2004	24	-2	1	1	0	0	1	2	2	0	0	-6	-3	6	6	0
2005	30	0	2	2	0	0	1	3	3	1	0	-7	-3	7	7	0
2006	32	1	3	0	0	1	0	2	0	0	0	-7	-4	3	4	0
2007	23	1	1	2	0	2	1	4	-2	0	0	-6	-3	4	4	0
2008	26	0	1	2	1	1	0	0	-1	0	0	-8	-5	5	4	0
AVERAGE		1	2	4	2	-2	-1	0	-1	0	0	-4	-1	1	1	0

Table H-1f-4

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BA430MED : PSCEIS : ALT43 Date: 21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
Priest Rapids Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	-5	-8	-7	2	-1	3	2	-2	2	0	2	2	0	-1	-1
1990	27	-3	-5	-4	2	1	3	0	0	1	0	1	0	2	-1	0
1991	26	-4	-5	-6	1	1	1	1	0	0	0	1	2	-3	-2	-1
1992	18	-3	-4	-7	0	-1	1	2	-1	0	0	0	1	-2	-4	-1
1993	21	-2	-3	-5	-2	-1	1	-2	0	0	0	2	0	-4	-5	-1
1994	30	-4	-4	-3	0	-2	0	0	0	1	0	0	2	-1	-3	-1
1995	31	-4	-5	-4	-1	-2	-1	-2	-1	1	0	0	2	-4	-5	-2
1996	29	-4	-4	-4	-1	0	0	0	1	0	1	0	-1	-5	-3	-1
1997	29	-3	-3	-2	-2	0	0	-1	1	1	0	0	1	-3	-3	-1
1998	23	-4	-3	-2	-3	-1	1	0	0	0	0	1	-2	-8	-5	-2
1999	33	-3	-5	-5	-3	-3	-3	-2	-1	3	2	5	-1	-3	-4	-2
2000	27	-5	-4	-3	-1	-1	1	-3	-1	0	0	2	-1	-2	-4	-2
2001	31	-4	-3	-4	0	0	0	-1	0	1	0	1	1	-2	-1	-1
2002	25	-3	-3	-2	-2	3	0	0	0	1	0	2	-2	-10	-7	-1
2003	23	-4	-7	-8	-4	-7	-4	-4	-8	0	2	8	8	-2	0	-2
2004	24	-5	-4	-5	0	-2	1	-3	-4	0	2	3	3	0	1	-1
2005	30	-2	-3	-3	0	-3	2	0	1	1	0	2	1	1	1	0
2006	32	-3	-2	-4	-2	-3	1	-2	-2	1	1	1	1	-1	-1	-1
2007	23	-2	-3	-3	0	-3	1	-1	0	-1	1	3	0	-4	-2	-1
2008	26	-4	-5	-5	-1	-1	-1	-1	-4	1	2	0	0	-1	0	-1
AVERAGE		-4	-4	-4	-1	-1	0	-1	-1	1	1	2	1	-2	-2	-1

Table H-1f-4

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BC440MED : PSCEIS : ALT44   Date: 28-JAN-89 06:06:31
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
Priest Rapids Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AVERAGE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table H-1f-5

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28

Number of Games: 200

Average Over Typical Water Years (Mid 80 Percent)

****

Priest Rapids Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	74	85	90	115	156	138	131	107	136	151	158	148	112	86	122
1990	154	75	86	88	112	155	143	129	106	140	152	157	152	116	87	123
1991	154	75	82	86	114	154	144	131	109	135	152	159	152	115	88	123
1992	160	77	84	86	114	149	141	129	109	142	150	159	149	119	88	122
1993	155	77	82	85	112	156	143	129	107	135	149	157	150	113	85	122
1994	155	75	79	86	112	154	147	128	111	136	152	153	145	112	84	121
1995	154	78	80	85	112	157	145	130	108	138	155	154	149	112	85	122
1996	148	74	80	85	109	153	145	130	109	138	152	154	148	115	87	121
1997	155	77	82	88	114	157	147	132	111	140	150	153	151	114	85	123
1998	155	79	84	87	114	155	145	131	115	140	156	159	148	113	85	124
1999	149	77	81	85	110	156	147	130	110	138	152	157	154	115	86	123
2000	151	76	82	87	115	157	147	136	120	143	157	159	150	112	85	125
2001	152	79	82	87	113	155	145	134	113	139	158	158	147	114	86	124
2002	157	75	81	85	112	152	138	126	110	138	149	154	146	111	84	120
2003	163	76	83	88	114	155	145	132	113	139	158	154	146	112	84	123
2004	146	76	81	85	113	154	143	132	113	137	153	157	148	111	85	122
2005	151	77	81	85	113	153	143	131	111	138	150	159	153	112	85	122
2006	145	73	79	85	114	152	141	130	113	145	158	156	145	113	85	122
2007	155	78	80	86	113	155	141	129	109	137	145	156	148	110	84	121
2008	159	73	79	85	115	157	147	133	118	138	150	159	155	115	87	124
AVERAGE		76	82	86	113	155	144	131	111	139	152	157	149	113	85	122

Table H-1f-5

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                                        BPAHYSUM Summary
Base Study:    BA000MED : PSCEIS : BASE CASE                     Date:   3-JAN-89 06:55:28
Incr Study:    BD120MED : PSCEIS : BASE CASE   : ALT 1.2         Date:   6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)
****************************************************************************************************************
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Difference Of
Priest Rapids Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	154	-1	-1	0	0	0	0	1	1	0	0	0	0	0	0	0
1991	154	-1	-2	-1	0	1	0	1	1	0	0	1	0	0	0	0
1992	160	-1	-2	-1	0	0	1	1	1	1	1	0	0	0	0	0
1993	155	-1	-2	-1	0	0	0	2	1	1	1	0	0	0	0	0
1994	155	-1	-2	-1	0	1	0	2	1	1	0	0	0	0	0	0
1995	154	-1	-1	0	0	0	0	1	1	1	0	0	0	0	0	0
1996	148	-1	-1	-1	0	0	1	2	1	0	0	0	0	0	0	0
1997	155	-1	-1	-1	0	0	0	2	1	0	0	0	0	0	0	0
1998	155	-1	-1	0	0	0	0	1	1	0	0	0	0	0	0	0
1999	149	-2	-2	0	1	0	0	1	1	1	0	0	0	0	0	0
2000	151	-1	-1	-1	0	0	1	1	0	0	0	0	0	0	0	0
2001	152	-2	-1	-1	0	1	0	2	1	0	0	0	0	0	0	0
2002	157	-2	-1	-1	0	0	0	2	1	0	0	0	1	0	0	0
2003	163	-2	-2	-1	1	0	1	1	1	1	1	0	1	0	0	0
2004	146	-1	-1	-1	1	0	0	1	1	1	1	0	0	0	0	0
2005	151	-2	-2	-2	0	1	1	2	1	1	1	0	0	0	0	0
2006	145	-2	-1	-1	0	1	1	1	1	1	1	0	0	0	0	0
2007	155	-2	-1	-1	0	0	0	2	1	1	1	0	0	0	0	0
2008	159	-1	-1	0	1	0	0	2	1	0	0	0	0	0	0	0
AVERAGE		-1	-1	-1	0	0	0	1	1	0	0	0	0	0	0	0

Table H-1f-5

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410 — Date: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
Priest Rapids Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	6	10	9	2	-2	-3	-7	-3	-2	-2	-2	-6	-3	-1	0
1990	154	5	8	8	0	-2	-3	-6	-4	0	0	-1	-5	-5	-2	0
1991	154	6	9	8	0	-3	-4	-7	-3	-1	-1	-2	-3	-3	-1	0
1992	160	4	7	6	0	-3	-4	-5	-4	0	1	-1	-2	-3	-2	0
1993	155	6	10	10	3	-4	-5	-8	-5	-3	-1	-2	-2	-4	-2	0
1994	155	7	11	11	3	-3	-9	-8	-3	-3	-3	-2	-2	-4	-2	0
1995	154	6	12	12	2	-2	-5	-8	-3	-7	-4	-2	-3	-4	-2	0
1996	148	6	11	11	6	-2	-8	-10	-4	-5	-3	-2	-2	-3	-2	0
1997	155	6	12	12	5	-1	-7	-11	-4	-6	-3	-1	-3	-3	-2	0
1998	155	7	11	12	4	-1	-8	-8	-5	-5	-4	-2	-3	-3	-2	0
1999	149	4	8	9	3	-2	-6	-6	-3	-4	-2	0	-2	-2	-1	0
2000	151	5	8	7	1	-2	-4	-5	-1	-2	-3	-1	-1	-1	0	0
2001	152	3	7	4	1	-1	-3	-4	-1	-3	-2	-1	-1	-1	-1	0
2002	157	2	4	2	2	0	-1	-3	-2	-4	-1	-1	0	-1	-1	0
2003	163	-2	0	0	1	0	1	0	0	0	1	0	1	1	0	0
2004	146	-1	1	1	0	-3	-2	0	-1	4	2	0	0	1	1	0
2005	151	0	2	1	-1	-3	-4	-2	-1	6	3	0	0	1	1	0
2006	145	0	2	2	0	-2	-3	-3	-1	4	1	0	0	1	1	0
2007	155	0	4	3	-1	-3	-3	-5	1	3	1	0	0	1	1	0
2008	159	1	4	4	1	-4	-5	-5	-3	3	1	1	1	1	1	0
AVERAGE		4	7	7	2	-2	-4	-6	-3	-1	-1	-1	-2	-2	-1	0

Table H-1f-5

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415 Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
Priest Rapids Discharge (kcfs)

YEAR	/ NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	5	9	8	1	-2	-2	-7	-3	-2	-1	-1	-5	-3	-1	0
1990	154	4	7	6	0	-1	-2	-5	-3	-1	-1	-1	-4	-4	-1	0
1991	154	4	6	4	-1	-2	-1	-5	-2	0	-1	0	-2	-2	0	0
1992	160	2	4	3	0	-1	-2	-3	-3	0	1	-1	-1	-1	-1	0
1993	155	2	4	5	0	-2	-2	-4	-2	-2	-1	-1	-1	-1	0	0
1994	155	2	4	3	2	-1	-3	-3	-1	-2	-1	0	0	-1	0	0
1995	154	1	5	2	1	0	-1	-2	-1	-4	-2	0	0	-1	-1	0
1996	148	2	3	2	3	-1	-1	-3	-1	-3	-1	0	-1	0	0	0
1997	155	1	3	1	1	0	0	-1	0	-3	-1	0	0	0	0	0
1998	155	0	2	1	0	0	0	0	0	-1	-1	1	0	0	0	0
1999	149	-2	-1	-1	-1	0	0	2	1	1	1	0	1	1	0	0
2000	151	-2	0	1	-1	-1	0	0	1	1	1	0	0	1	1	0
2001	152	0	2	0	-1	0	-1	-1	1	2	0	0	0	1	1	0
2002	157	1	3	1	-1	0	0	-3	-2	-1	-1	-1	0	0	0	0
2003	163	-2	-2	-2	-2	0	1	1	1	2	2	0	1	1	0	0
2004	146	-1	0	-1	-2	-1	-1	1	1	3	2	0	0	1	1	0
2005	151	-1	1	-1	-3	0	-2	-1	1	4	2	0	0	1	1	0
2006	145	0	1	1	-3	-1	-2	-1	1	3	1	0	0	1	1	0
2007	155	0	1	1	-1	0	0	-2	0	1	0	0	0	1	1	0
2008	159	1	2	1	-1	0	0	-2	-1	0	-1	0	0	1	1	0
AVERAGE		1	3	2	-1	-1	-1	-2	-1	0	0	0	-1	0	0	0

Table H-1f-5

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BA430MED : PSCEIS : ALT43 Date: 21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
Priest Rapids Discharge (kcfs)

YEAR / NUM		SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	-4	-7	-3	2	0	0	3	6	0	1	1	1	1	0	0
1990	154	-2	-3	-1	3	0	0	1	1	-1	1	1	0	1	0	0
1991	154	-3	-4	-1	1	1	0	0	1	1	2	1	1	0	0	0
1992	160	-2	-3	-1	0	0	1	3	0	1	1	0	1	0	0	0
1993	155	-2	-3	0	2	1	0	1	1	0	0	0	0	0	-1	0
1994	155	-2	-2	0	4	1	0	1	1	0	-1	0	0	-1	-1	0
1995	154	-2	0	2	3	1	1	1	1	-4	-2	0	1	0	0	0
1996	148	-2	-1	1	5	-1	0	2	1	-2	-1	0	1	0	0	0
1997	155	-2	-1	2	3	0	0	3	1	-3	-1	0	0	0	-1	0
1998	155	-1	0	2	3	1	0	0	0	-3	-2	0	0	-1	-1	0
1999	149	-4	-5	-1	4	0	1	5	2	1	0	0	1	0	0	0
2000	151	-3	-2	1	4	1	1	4	2	-2	-1	0	0	0	0	0
2001	152	-2	0	2	4	0	0	1	1	-3	-2	0	0	0	-1	0
2002	157	-1	-1	1	3	1	1	0	0	-2	-2	0	1	-1	-1	0
2003	163	-4	-5	-2	2	1	2	3	1	1	2	1	1	0	0	0
2004	146	-4	-4	0	3	1	1	3	2	1	1	1	1	0	0	0
2005	151	-2	-3	0	3	1	0	2	1	0	1	0	0	0	0	0
2006	145	-2	-2	0	2	1	1	1	0	-1	0	0	0	0	0	0
2007	155	-1	-2	1	3	0	0	1	-1	-1	-1	0	0	0	0	0
2008	159	-2	-2	2	4	0	0	0	0	-2	-2	0	0	0	0	0
AVERAGE		-2	-2	0	3	1	1	2	1	-1	0	0	1	0	0	0

Table H-1f-5

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BC440MED : PSCEIS : ALT44 Date: 28-JAN-89 06:06:31
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

****

Difference Of
Priest Rapids Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	149	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	163	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	159	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AVERAGE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Tablel H-1f-6

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28

Number of Games: 200

Average Over High Water Years (Top 10 Percent)

****

Priest Rapids Discharge (kcfs)

YEAR	/ NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	70	104	107	123	144	142	162	133	155	222	280	187	126	110	150
1990	19	70	97	101	124	144	147	165	136	166	232	275	187	124	108	151
1991	20	73	96	101	121	146	143	161	136	150	220	282	189	127	112	149
1992	22	75	98	100	118	147	142	161	135	145	212	289	191	129	113	150
1993	24	73	89	100	122	144	139	166	132	175	238	273	187	123	107	150
1994	15	72	94	99	119	145	148	166	135	166	230	278	188	125	109	151
1995	15	74	94	100	118	148	145	162	136	148	215	288	190	129	113	150
1996	23	72	86	98	121	144	148	168	138	177	237	271	187	123	106	150
1997	16	73	91	98	118	146	145	163	136	157	224	283	188	126	111	150
1998	22	75	93	98	119	146	144	164	137	159	223	282	189	126	110	150
1999	18	74	97	100	118	149	141	159	135	137	206	293	191	131	115	149
2000	22	74	91	99	120	145	148	166	138	167	229	277	188	125	109	150
2001	17	73	87	100	120	145	143	164	137	165	230	279	187	124	109	150
2002	18	72	89	97	121	146	147	165	137	163	227	278	188	125	109	150
2003	14	71	96	101	119	148	142	161	136	149	212	284	190	128	113	149
2004	30	73	95	101	121	146	139	163	134	159	219	278	188	126	110	149
2005	19	70	93	103	121	145	140	164	136	165	226	277	187	124	109	149
2006	23	70	92	101	121	146	145	165	137	161	223	280	188	126	110	150
2007	22	73	85	98	121	145	147	166	137	168	229	276	188	125	108	150
2008	15	70	90	98	122	145	147	165	137	166	230	279	188	125	109	150
AVERAGE		72	93	100	120	146	144	164	136	160	224	280	188	126	110	150

Table H-1f-6

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2 Date: 6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

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Difference Of
Priest Rapids Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	19	-1	-1	1	0	0	1	0	0	0	0	0	0	0	0	0
1991	20	0	1	-1	1	0	1	0	0	0	0	-1	0	0	0	0
1992	22	-1	0	0	0	0	0	0	0	0	2	1	0	0	0	0
1993	24	-2	0	0	0	0	3	0	-1	0	0	0	0	0	0	0
1994	15	-2	-1	-1	2	0	1	0	0	0	1	0	0	0	0	0
1995	15	-2	0	-1	1	0	0	0	0	0	1	1	0	0	0	0
1996	23	-2	0	1	2	0	1	0	0	0	0	1	0	0	0	0
1997	16	-1	0	-1	1	0	1	0	0	0	0	0	0	0	0	0
1998	22	-2	0	-1	1	0	1	0	0	0	0	0	0	0	0	0
1999	18	-2	-1	0	0	0	1	0	0	0	1	1	0	0	0	0
2000	22	-2	0	-1	2	0	1	0	-1	0	0	0	0	0	0	0
2001	17	-2	0	-1	0	0	1	0	1	0	1	0	0	0	0	0
2002	18	-3	1	0	2	0	1	0	0	0	0	0	0	0	0	0
2003	14	-2	-1	0	1	0	1	0	0	0	0	1	0	0	0	0
2004	30	-1	0	0	0	0	2	0	0	0	1	1	0	0	0	0
2005	19	-2	1	-2	1	0	2	0	-1	0	1	0	0	0	0	0
2006	23	-2	0	-1	1	0	1	0	-1	0	1	0	0	0	0	0
2007	22	-3	0	1	2	0	1	0	0	0	0	0	0	0	0	0
2008	15	-2	0	1	1	0	1	0	0	0	1	0	0	0	0	0
AVERAGE		-2	0	0	1	0	1	0	0	0	1	0	0	0	0	0

Table H-1f-6

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410 Late: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

****

Difference Of
Priest Rapids Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	6	8	7	-2	1	-4	-1	0	0	-3	-7	-4	-2	0	0
1990	19	6	5	2	-6	-2	-1	1	-1	0	-1	-1	-2	0	0	0
1991	20	6	6	0	-1	0	-1	-1	-3	0	-3	-2	-1	0	0	0
1992	22	3	3	1	-4	0	-2	-1	-3	0	-1	-2	0	0	0	0
1993	24	5	11	6	2	0	-3	-9	-5	-1	-5	-3	0	0	0	0
1994	15	5	14	15	1	0	-11	-8	-9	-1	-6	-7	0	0	0	0
1995	15	5	16	13	-1	1	-7	-5	-11	-1	-8	-10	1	0	0	0
1996	23	6	15	16	5	1	-12	-16	-6	-1	-4	-5	0	0	0	0
1997	16	4	17	15	6	1	-8	-12	-10	-1	-9	-9	1	0	0	0
1998	22	4	16	13	6	1	-7	-13	-11	-1	-7	-9	0	0	0	0
1999	18	4	13	11	4	1	-2	-7	-12	-1	-8	-11	0	0	0	0
2000	22	3	11	10	7	1	-11	-8	-5	-1	-5	-6	0	0	0	0
2001	17	5	14	6	4	1	-6	-9	-3	-1	-7	-6	0	0	0	0
2002	18	1	9	8	4	-1	-8	-3	-4	-1	-5	-4	0	0	0	0
2003	14	1	4	5	0	0	-2	-2	-3	0	1	0	0	0	0	0
2004	30	-1	0	0	0	-1	2	0	2	0	2	1	0	0	0	0
2005	19	0	1	-6	-2	0	6	0	-1	0	0	-1	0	0	0	0
2006	23	0	-1	-5	-2	0	4	0	0	1	2	0	0	0	0	0
2007	22	-1	4	0	0	-1	1	0	-1	0	-2	-1	0	0	0	0
2008	15	-1	2	2	-2	0	0	0	0	0	-2	0	0	0	0	0
AVERAGE		3	8	6	1	0	-3	-4	-4	0	-3	-4	0	0	0	0

Table H-1f-6

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE
Incr Study: BB415MED : PSCEIS : ALT415
Date: 3-JAN-89 06:55:28
Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

****

Difference Of
Priest Rapids Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	6	7	1	-3	1	-1	0	0	0	-2	-6	-2	0	0	0
1990	19	5	3	-1	-8	-2	1	0	0	0	1	0	0	0	0	0
1991	20	5	5	-1	-5	0	2	1	-1	0	-1	-2	-1	0	0	0
1992	22	1	0	0	-4	0	1	-1	0	0	1	-1	0	0	0	0
1993	24	2	6	2	-2	0	0	-3	0	-1	-4	-1	0	0	0	0
1994	15	1	6	9	0	0	-7	-1	-1	-1	-5	-4	0	0	0	0
1995	15	2	10	7	-6	0	-4	0	-2	-1	-4	-3	0	0	0	0
1996	23	1	8	7	0	0	-11	-1	-1	0	-2	0	0	0	0	0
1997	16	-1	8	2	-2	0	-5	-1	-1	0	-3	-1	0	0	0	0
1998	22	-1	6	-1	-5	0	-2	0	1	0	2	1	0	-1	0	0
1999	18	-1	1	-6	0	0	0	1	2	1	3	1	0	0	0	0
2000	22	-2	-1	-4	1	1	2	0	0	0	1	0	0	0	0	0
2001	17	1	1	-6	0	0	-1	0	0	0	2	0	0	0	0	0
2002	18	-1	7	-3	-5	0	-1	0	0	0	0	0	0	0	0	0
2003	14	-2	0	-8	-4	0	2	0	0	1	7	2	0	0	0	0
2004	30	-1	-4	-8	-2	0	7	1	3	1	6	2	0	0	0	0
2005	19	0	-4	-12	-1	0	9	1	0	1	4	1	0	0	0	0
2006	23	0	-3	-6	-1	0	4	0	2	1	4	1	0	0	0	0
2007	22	-1	1	-5	0	0	3	0	1	0	1	0	0	0	0	0
2008	15	0	1	-2	-3	0	1	0	0	0	1	0	0	0	0	0
AVERAGE		1	3	-2	-2	0	0	0	0	0	1	0	0	0	0	0

Table H-1f-6

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28

Incr Study: BA430MED : PSCEIS : ALT43 — Date: 21-JAN-89 05:14:29

Difference = (Incr Study) - (Base Study)

Number of Games: 200

Average Over High Water Years (Top 10 Percent)

****

Difference Of

Priest Rapids Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	-3	-3	-2	0	-1	2	0	1	0	4	0	0	0	0	0
1990	19	-2	1	2	-1	-1	1	0	-1	0	0	1	0	0	0	0
1991	20	-3	2	-1	-2	-2	3	0	-4	1	4	2	0	0	0	0
1992	22	-3	4	0	2	0	-1	-1	0	0	1	0	0	0	0	0
1993	24	-3	2	0	7	0	0	0	4	-1	-4	-1	0	0	0	0
1994	15	-3	2	5	6	0	-6	0	2	-1	-3	0	0	0	0	0
1995	15	-2	8	5	4	-1	-5	0	-2	-1	-6	-1	0	0	0	0
1996	23	-3	6	7	6	-1	-9	0	-1	0	-3	0	0	0	0	0
1997	16	-3	8	7	7	0	-5	-1	-1	-1	-6	-2	1	1	0	0
1998	22	-2	6	7	5	0	-6	-1	-1	-1	-5	-3	0	0	0	0
1999	18	-3	4	3	2	0	1	0	0	-1	-2	1	0	0	0	0
2000	22	-5	4	5	6	0	-5	0	-1	-1	-2	0	0	0	0	0
2001	17	-2	9	4	5	0	-3	-1	0	0	-5	-2	0	0	0	0
2002	18	-2	7	9	5	0	-8	-1	-2	-1	-4	-1	0	0	0	0
2003	14	-3	2	3	4	0	-2	-2	-2	0	2	0	0	0	0	0
2004	30	-4	0	2	3	0	3	1	1	0	1	1	0	0	0	1
2005	19	-2	1	1	4	0	1	0	-1	0	-1	0	0	0	0	0
2006	23	-3	1	3	4	0	-2	0	-1	0	0	0	0	0	0	0
2007	22	-3	5	5	4	0	-4	0	-1	-1	-3	0	0	0	0	0
2008	15	-3	4	5	5	0	-5	-1	-1	-1	-3	0	0	0	0	0
AVERAGE		-3	3	3	4	0	-2	0	-1	0	-2	0	0	0	0	0

Table H-1f-6

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BC440MED : PSCEIS : ALT44 — Date: 28-JAN-89 06:06:31
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

****

Difference Of
Priest Rapids Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AVERAGE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table H-1f-7

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28

Number of Games: 200

Average Over Low Water Years (Bottom 10 Percent)

****

The Dalles Discharge (kcfs)

YEAR	/ NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	100	116	119	138	134	126	127	121	167	192	134	103	92	95	127
1990	27	100	116	120	141	141	127	134	128	166	192	146	98	89	97	130
1991	26	101	110	112	133	135	126	127	118	168	190	135	102	98	98	126
1992	18	104	113	118	140	137	127	127	124	164	191	136	97	95	99	128
1993	21	103	112	118	144	140	132	134	127	165	192	139	97	101	103	130
1994	30	100	109	114	137	140	132	130	118	168	194	135	101	106	101	128
1995	31	104	111	116	140	142	131	130	120	168	191	134	102	108	103	129
1996	29	103	113	118	142	141	130	132	128	167	193	138	100	103	102	130
1997	29	103	112	117	144	145	131	135	128	167	194	134	103	107	106	131
1998	23	104	107	114	138	136	129	130	121	168	189	131	100	108	101	127
1999	33	106	112	118	144	143	132	131	126	164	192	134	102	105	104	130
2000	27	103	112	116	145	141	128	130	127	164	191	148	96	101	103	130
2001	31	104	108	116	141	138	127	127	119	167	191	139	99	107	101	128
2002	25	104	114	120	146	142	130	131	127	166	195	149	99	108	107	132
2003	23	102	113	118	142	140	129	130	126	168	192	137	100	102	97	129
2004	24	104	109	116	140	139	126	130	121	166	193	146	104	99	97	129
2005	30	102	109	116	143	141	127	130	125	166	192	149	104	98	96	130
2006	32	99	108	118	141	142	129	131	124	167	194	147	106	100	99	130
2007	23	103	109	116	143	141	129	129	131	166	192	149	102	99	100	130
2008	26	99	106	116	140	140	132	129	119	165	193	146	105	103	97	129
AVERAGE		102	111	117	141	140	129	130	124	166	192	140	101	102	100	129

Table H-1f-7

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2   Date: 6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
The Dalles Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	27	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0
1991	26	-2	-2	-2	-1	1	0	1	0	0	0	1	0	0	0	0
1992	18	-1	-3	-4	-1	1	1	1	0	0	0	1	1	0	0	0
1993	21	-2	-2	-3	-1	1	-1	1	1	0	0	1	1	0	0	0
1994	30	-2	-2	-1	-1	-2	0	0	0	1	0	0	2	1	1	0
1995	31	-2	-2	-2	-1	-1	-1	-1	2	1	0	1	1	-1	-1	-1
1996	29	-2	-2	-2	0	1	0	1	1	0	0	1	0	0	1	0
1997	29	-2	-3	-2	0	2	0	0	1	0	0	1	1	0	0	0
1998	23	-3	-2	-1	-1	0	0	0	1	1	0	1	1	1	0	0
1999	33	-2	-2	0	-1	2	1	0	3	0	0	1	0	0	0	0
2000	27	-2	-2	-1	-1	1	1	1	1	0	0	1	0	-1	-1	0
2001	31	-2	-2	-1	-1	0	1	1	1	0	0	1	0	-1	-1	0
2002	25	-3	-3	-2	-3	2	1	1	1	0	0	2	1	-2	-1	0
2003	23	-3	-2	-2	-1	0	0	0	0	0	0	1	1	1	0	0
2004	24	-3	-2	-2	0	1	0	0	0	0	0	1	0	0	0	-1
2005	30	-3	-2	-1	-2	1	1	1	1	0	0	1	0	1	0	0
2006	32	-2	-2	-2	-2	2	1	0	1	0	0	1	1	0	0	0
2007	23	-3	-3	-2	-1	1	1	1	1	0	0	2	0	-1	-1	0
2008	26	-3	-2	-2	-2	0	0	0	1	0	0	1	1	0	-1	0
AVERAGE		-2	-2	-2	-1	1	0	1	1	0	0	1	1	0	0	0

Table H-1f-7

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE
Incr Study: BE410MED : PSCEIS : ALT410
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

Date: 3-JAN-89 06:55:28
Date: 1-FEB-89 16:02:55

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Difference Of
The Dalles Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	9	10	14	15	-2	1	1	-10	-1	-1	-11	-11	-7	-10	1
1990	27	6	10	13	11	-5	-1	-4	-6	-1	-1	-9	-8	-7	-6	0
1991	26	8	9	15	18	-4	-1	-7	-4	-2	0	-10	-8	-9	-9	1
1992	18	6	8	12	12	-2	-3	-3	-1	2	-1	-9	-8	-9	-8	0
1993	21	8	9	12	9	-7	-6	-4	-3	-1	-1	-9	-6	-12	-11	-1
1994	30	8	10	16	14	-8	-7	-4	-3	1	-1	-7	-6	-13	-11	0
1995	31	7	9	16	13	-9	-6	-5	-3	-1	-1	-6	-7	-16	-11	0
1996	29	6	8	14	12	-8	-6	-3	-3	-2	-1	-6	-8	-14	-9	0
1997	29	7	11	16	9	-11	-8	-5	-3	-2	-1	-11	-6	-15	-12	-1
1998	23	6	11	15	13	-9	-8	-9	-6	-1	0	-7	-7	-15	-11	-1
1999	33	3	6	9	4	-10	-7	-2	-2	-1	-1	-7	-5	-11	-7	-2
2000	27	4	8	11	4	-7	-3	-2	-1	0	0	-12	-2	-7	-4	0
2001	31	3	7	9	3	-5	-3	-2	0	0	-1	-12	0	-8	-4	-1
2002	25	0	1	4	0	0	-2	-1	1	1	0	-7	0	-10	-5	-1
2003	23	-2	-1	3	0	-2	-4	-2	-4	0	0	-7	4	5	5	-1
2004	24	-2	2	3	1	0	3	2	3	0	0	-13	-3	4	4	0
2005	30	0	2	7	-1	-2	2	1	1	0	0	-14	-2	7	7	0
2006	32	1	3	4	0	0	2	1	1	0	0	-13	-3	5	5	0
2007	23	1	3	7	1	-2	1	2	-1	0	0	-13	-3	5	5	0
2008	26	-1	3	6	2	1	-1	-2	0	0	0	-15	-3	6	5	0
AVERAGE		4	7	10	7	-5	-3	-2	-2	0	-1	-10	-5	-6	-4	0

Table H-1f-7

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415   Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
The Dalles Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	8	10	14	14	-9	-3	-3	-9	-1	-1	-6	-5	-1	-3	1
1990	27	5	7	10	7	-8	-4	-4	-4	-1	-1	-6	-1	0	0	0
1991	26	5	7	13	9	-7	-5	-4	-3	-1	0	-5	-3	-4	-4	0
1992	18	3	6	6	7	-6	-5	0	0	0	-1	-5	-2	-2	-1	0
1993	21	3	3	5	2	-6	-5	-2	-3	0	0	-4	-1	-4	-3	-1
1994	30	2	3	6	3	-5	-5	-2	-1	0	0	-2	-1	-3	-2	0
1995	31	1	2	5	1	-5	-4	-2	-1	0	0	-2	0	-4	-2	-1
1996	29	1	1	3	2	-3	-3	0	0	-1	0	-2	-1	-4	-1	0
1997	29	0	0	1	0	-2	-4	-2	-1	-1	0	-2	1	-1	-2	-1
1998	23	-1	1	3	1	-1	-3	-1	-2	-1	0	-1	0	0	-1	0
1999	33	-2	-1	0	-1	1	-1	1	0	0	0	-2	0	7	5	0
2000	27	-2	-1	3	-2	1	3	3	3	1	0	-9	4	6	4	1
2001	31	-1	2	3	0	2	2	2	3	0	-1	-7	3	5	4	1
2002	25	0	0	2	0	3	3	2	5	2	0	-6	1	-3	-3	1
2003	23	-1	-3	-1	-3	-1	-3	-2	-2	1	0	0	1	5	5	-1
2004	24	-3	1	1	1	1	2	3	2	0	0	-7	-4	9	8	0
2005	30	0	2	2	1	0	1	3	3	1	0	-8	-4	8	8	1
2006	32	1	2	1	1	1	1	2	0	0	0	-7	-6	5	5	0
2007	23	1	1	2	0	1	2	4	-1	0	0	-8	-5	5	5	0
2008	26	-1	1	2	1	1	1	0	0	0	-1	-9	-6	6	5	0
AVERAGE		1	2	4	2	-2	-1	0	0	0	0	-5	-1	2	2	0

Table H-1f-7

BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BA430MED : PSCEIS : ALT43 — Date: 21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

Difference Of
The Dalles Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	-6	-9	-7	0	0	3	3	-2	3	0	2	2	-3	-3	-1
1990	27	-3	-5	-4	2	2	3	1	1	1	1	0	-1	1	-2	0
1991	26	-4	-5	-6	-1	1	1	1	0	0	0	1	2	-4	-2	-1
1992	18	-4	-4	-8	-1	-1	0	3	-2	0	0	0	0	-4	-4	-2
1993	21	-3	-3	-5	-2	0	1	-2	0	0	1	1	-1	-5	-5	-2
1994	30	-4	-5	-3	-2	-2	0	0	0	1	1	0	2	-1	-2	-1
1995	31	-4	-5	-4	-3	-2	-1	-1	0	2	1	-1	1	-5	-5	-2
1996	29	-5	-4	-4	-2	0	0	0	2	0	1	1	-1	-6	-3	-1
1997	29	-4	-3	-2	-2	1	0	-1	2	2	0	0	1	-3	-4	-1
1998	23	-4	-3	-2	-3	-1	0	0	0	0	1	1	-2	-8	-5	-2
1999	33	-4	-6	-5	-4	-2	-4	-3	-1	3	2	5	-2	-3	-4	-2
2000	27	-6	-5	-4	-2	-1	0	-3	-1	0	1	2	-2	-2	-4	-2
2001	31	-4	-3	-4	-2	1	0	-1	0	1	0	1	1	-2	-1	-1
2002	25	-4	-3	-2	-2	2	1	1	0	1	1	2	-2	-11	-8	-1
2003	23	-4	-8	-8	-6	-7	-6	-5	-8	1	3	8	9	-1	0	-2
2004	24	-6	-5	-5	0	-2	2	-3	-4	0	2	2	3	1	1	-1
2005	30	-3	-3	-3	-1	-3	2	0	1	1	1	2	1	2	2	0
2006	32	-3	-3	-4	-2	-3	1	-2	-2	1	1	1	0	1	0	-1
2007	23	-3	-3	-3	0	-3	0	-1	0	-1	1	2	0	-3	-1	-1
2008	26	-4	-5	-5	-1	-1	-1	-2	-4	1	2	0	-1	-1	0	-2
AVERAGE		-4	-4	-4	-2	-1	0	-1	-1	1	1	1	0	-3	-2	-1

Table H-1f-7

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BC440MED : PSCEIS : ALT44 Date: 28-JAN-89 06:06:31
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
The Dalles Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AVERAGE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table H-1f-8

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28

Number of Games: 200

Average Over Typical Water Years (Mid 80 Percent)

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The Dalles Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	108	124	134	167	209	209	203	198	240	257	264	197	145	112	185
1990	154	107	124	132	163	209	214	201	201	251	261	261	201	149	114	186
1991	154	108	120	129	167	207	214	204	199	235	255	263	200	148	115	185
1992	160	110	121	130	169	206	214	202	203	250	256	265	200	152	115	186
1993	155	110	119	127	162	208	212	201	200	241	256	260	199	146	112	184
1994	155	108	116	129	164	207	215	201	203	240	260	252	193	146	112	183
1995	154	110	118	129	163	208	213	201	201	245	267	257	196	145	112	184
1996	148	106	116	127	161	208	217	201	200	243	259	254	196	148	114	183
1997	155	109	120	132	165	210	216	202	203	240	253	255	199	147	112	184
1998	155	111	122	131	166	207	213	204	210	247	260	259	198	146	112	186
1999	149	110	118	127	164	213	220	202	205	247	260	261	205	149	114	186
2000	151	108	120	131	170	214	220	209	214	246	264	259	197	144	112	187
2001	152	111	120	131	166	210	219	208	208	246	266	263	197	147	114	187
2002	157	107	119	128	162	202	204	196	201	238	254	253	194	144	111	181
2003	163	108	120	131	167	209	217	204	210	248	267	255	195	145	111	186
2004	146	108	118	128	166	208	216	205	206	245	262	264	198	144	112	186
2005	151	110	119	128	166	208	216	207	206	249	261	268	204	145	113	187
2006	145	105	116	128	167	207	212	205	212	257	266	254	194	146	112	185
2007	155	110	118	129	163	206	208	200	199	237	249	253	196	142	111	181
2008	159	105	116	128	166	211	212	203	209	237	252	260	204	148	114	184
AVERAGE		109	119	129	165	208	214	203	204	244	259	259	198	146	113	185

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Table H-1f-8

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2 — Date: 6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
The Dalles Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	154	-1	-1	0	0	0	0	1	1	0	0	0	0	0	0	0
1991	154	-1	-2	-1	0	1	0	1	1	0	0	1	0	0	0	0
1992	160	-1	-2	-1	-1	1	1	1	1	1	0	0	0	0	0	0
1993	155	-2	-2	-1	0	0	1	2	2	1	1	0	0	0	0	0
1994	155	-2	-2	-1	0	1	0	2	1	1	0	0	0	0	-1	0
1995	154	-1	-1	0	0	1	0	1	1	1	0	0	0	0	0	0
1996	148	-1	-1	-1	0	1	1	2	1	0	0	0	0	0	0	0
1997	155	-2	-1	-1	0	0	0	2	1	0	0	0	0	0	0	0
1998	155	-2	-1	0	0	1	0	1	1	0	0	0	0	0	0	0
1999	149	-2	-2	0	0	0	1	1	1	1	0	0	0	0	0	0
2000	151	-2	-1	-1	0	1	1	1	1	0	0	0	0	0	0	0
2001	152	-2	-1	-1	0	1	0	2	1	0	0	0	0	-1	-1	0
2002	157	-2	-1	-1	-1	1	1	2	1	0	0	0	1	0	0	0
2003	163	-2	-2	-1	0	1	1	1	2	1	1	0	1	0	0	0
2004	146	-2	-1	-1	0	0	1	1	1	1	1	0	0	0	0	0
2005	151	-2	-2	-2	0	1	1	2	1	1	1	0	0	0	0	0
2006	145	-2	-1	-1	0	1	1	1	1	1	1	0	0	0	0	0
2007	155	-2	-1	-1	0	0	0	2	1	1	1	0	0	0	0	0
2008	159	-2	-1	-1	1	1	0	2	1	0	0	0	0	0	0	0
AVERAGE		-2	-1	-1	0	1	1	1	1	1	0	0	0	0	0	0

Table H-1f-8

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                                              BPAHYSUM Summary
Base Study:    BA000MED : PSCEIS : BASE CASE                                  Date:   3-JAN-89 06:55:28
Incr Study:    BE410MED : PSCEIS : ALT410                                     Date:   1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)
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Difference Of
The Dalles Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	8	11	9	3	-2	-4	-8	-4	-3	-2	-2	-6	-4	-2	0
1990	154	6	8	8	1	-3	-4	-7	-5	-1	0	-1	-5	-5	-2	0
1991	154	8	10	8	1	-4	-5	-8	-4	-1	-2	-2	-3	-3	-1	0
1992	160	5	7	6	0	-3	-4	-5	-4	-1	1	-1	-2	-3	-2	0
1993	155	8	10	10	3	-5	-5	-8	-6	-3	-1	-2	-2	-4	-2	0
1994	155	8	12	12	4	-4	-9	-9	-4	-4	-3	-2	-2	-5	-3	0
1995	154	8	13	12	2	-2	-5	-9	-2	-8	-5	-2	-3	-5	-3	0
1996	148	8	11	12	6	-3	-9	-10	-4	-6	-3	-2	-2	-4	-2	0
1997	155	7	12	13	5	-2	-8	-11	-3	-7	-3	-2	-2	-4	-2	0
1998	155	8	12	13	4	-2	-8	-8	-5	-6	-4	-2	-3	-4	-2	0
1999	149	5	9	10	3	-2	-7	-6	-4	-4	-2	0	-2	-2	-1	0
2000	151	6	9	8	1	-2	-4	-5	-1	-2	-3	-1	-1	-1	0	0
2001	152	4	8	5	1	-1	-3	-4	-1	-4	-2	-1	-1	-2	-1	0
2002	157	3	4	3	2	0	-1	-3	-2	-4	-2	-1	0	-1	-1	0
2003	163	-3	0	0	1	0	2	0	1	0	1	0	1	1	0	0
2004	146	-1	1	1	0	-3	-2	0	-2	3	3	0	0	1	1	0
2005	151	0	3	1	-1	-3	-4	-2	-2	7	4	0	0	1	1	0
2006	145	0	2	2	0	-3	-3	-3	-2	4	2	0	0	2	2	0
2007	155	0	4	4	-1	-3	-3	-5	0	3	1	0	0	1	1	0
2008	159	1	4	4	1	-4	-5	-5	-4	3	1	1	1	1	1	0
AVERAGE		4	7	7	2	-3	-5	-6	-3	-2	-1	-1	-2	-2	-1	0

Table H-1f-8

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415   Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
The Dalles Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	7	11	8	1	-2	-3	-7	-3	-3	-1	-1	-5	-3	-1	0
1990	154	5	7	6	0	-2	-3	-6	-3	-1	-1	-1	-4	-4	-1	0
1991	154	5	7	4	-1	-2	-2	-5	-3	-1	-1	0	-2	-2	-1	0
1992	160	3	4	3	-1	-1	-2	-3	-3	0	1	-1	-1	-1	-1	0
1993	155	3	5	5	0	-2	-2	-4	-3	-2	-1	-1	-1	-1	0	0
1994	155	3	4	3	2	-2	-3	-3	-1	-2	-1	0	0	-1	0	0
1995	154	2	5	3	1	0	-1	-2	-1	-5	-2	0	0	-1	-1	0
1996	148	2	4	2	3	-1	-1	-2	-1	-4	-2	0	-1	0	0	0
1997	155	1	3	1	1	0	0	-1	0	-3	-1	0	0	0	0	0
1998	155	0	2	1	0	0	0	0	0	-1	-1	1	0	0	0	0
1999	149	-2	-1	-1	-2	0	1	2	1	2	1	0	0	1	1	0
2000	151	-2	0	1	-1	-1	0	0	1	1	1	0	0	1	1	0
2001	152	-1	2	1	-1	-1	-1	-2	0	2	0	0	0	1	1	0
2002	157	1	3	1	-1	-1	0	-3	-2	-1	-1	-1	0	0	0	0
2003	163	-2	-2	-2	-2	0	1	1	1	2	2	0	1	1	0	0
2004	146	-1	0	-1	-2	0	-1	1	1	4	2	0	0	2	1	0
2005	151	-1	1	-1	-3	0	-2	-1	1	5	3	0	0	1	1	0
2006	145	0	1	1	-3	-1	-2	-1	1	3	1	0	0	1	1	0
2007	155	0	1	1	-1	0	0	-2	-1	1	0	0	0	2	1	0
2008	159	1	2	1	-1	0	0	-2	-1	0	-1	0	0	1	1	0
AVERAGE		1	3	2	-1	-1	-1	-2	-1	0	0	0	-1	0	0	0

Table H-1f-8

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BA430MED : PSCEIS : ALT43 — Date: 21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
The Dalles Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	-5	-7	-3	1	1	1	3	6	1	1	1	1	1	0	0
1990	154	-2	-3	-1	3	1	1	1	1	0	1	1	0	1	0	0
1991	154	-3	-4	-1	0	2	0	0	2	1	2	1	1	0	0	0
1992	160	-2	-3	-1	-1	1	2	3	0	1	1	0	1	0	-1	0
1993	155	-3	-3	0	2	1	1	2	1	0	0	1	0	-1	-1	0
1994	155	-2	-2	0	4	1	1	1	2	-1	-1	0	0	-1	-1	0
1995	154	-3	0	2	3	1	2	2	1	-4	-2	0	1	-1	-1	0
1996	148	-2	-1	2	5	-1	0	2	1	-2	-1	0	1	-1	-1	0
1997	155	-3	-1	2	3	0	0	3	1	-2	-1	0	0	-1	-1	0
1998	155	-1	0	3	3	1	0	0	0	-3	-2	0	0	-2	-1	0
1999	149	-4	-5	-1	4	1	2	5	2	2	0	0	1	-1	-1	0
2000	151	-3	-2	1	4	1	2	4	3	-2	-1	0	0	0	0	0
2001	152	-2	0	3	4	1	0	1	2	-3	-2	0	1	-1	-1	0
2002	157	-1	0	2	3	1	1	1	0	-2	-2	0	1	-2	-1	0
2003	163	-5	-5	-2	2	2	2	3	1	2	2	1	1	0	-1	0
2004	146	-5	-4	0	3	1	1	4	2	1	1	1	1	0	0	0
2005	151	-3	-3	0	3	1	0	2	1	1	1	0	0	0	0	0
2006	145	-2	-2	0	2	1	1	1	0	-1	0	0	0	0	0	0
2007	155	-1	-2	1	3	0	1	1	-1	-1	-1	0	0	0	0	0
2008	159	-2	-2	3	4	0	0	1	0	-2	-2	0	0	0	0	0
AVERAGE		-3	-3	0	3	1	1	2	1	-1	0	0	1	0	-1	0

Table H-1f-8

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BC440MED : PSCEIS : ALT44 Date: 28-JAN-89 06:06:31
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
The Dalles Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	149	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	157	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	163	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	159	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AVERAGE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table H-1f-9

****

BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

****

The Dalles Discharge (kcfs)

YEAR	/ NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	102	143	160	192	220	222	240	230	296	386	468	246	162	137	233
1990	19	101	133	153	197	222	229	248	236	317	399	455	244	160	134	234
1991	20	103	132	152	187	220	222	237	230	287	383	473	248	163	138	231
1992	22	107	133	153	182	220	221	232	227	274	374	486	251	164	140	230
1993	24	105	124	151	195	224	222	250	232	330	406	450	242	158	132	233
1994	15	103	130	151	190	223	228	246	233	314	396	461	245	160	135	233
1995	15	105	129	152	183	221	224	234	229	278	378	483	249	164	139	230
1996	23	103	121	149	196	224	231	253	240	333	405	446	242	158	132	233
1997	16	105	126	150	185	222	224	240	232	294	389	472	247	161	137	231
1998	22	106	129	150	188	222	225	241	233	298	388	470	247	162	137	232
1999	18	105	132	152	179	219	217	228	223	257	366	496	252	166	142	228
2000	22	105	126	150	191	223	229	247	236	315	396	458	245	160	134	233
2001	17	104	122	151	190	223	224	244	234	310	396	462	244	160	135	232
2002	18	103	124	148	191	223	227	244	234	306	393	463	246	161	135	232
2003	14	101	131	153	184	221	221	234	229	281	375	477	249	164	139	229
2004	30	104	130	152	189	222	219	241	230	300	384	465	246	161	136	230
2005	19	101	128	154	192	222	222	244	233	310	392	460	244	160	135	231
2006	23	101	127	153	191	222	226	242	233	303	389	466	246	161	136	232
2007	22	103	120	149	193	223	229	246	234	315	396	457	244	160	134	232
2008	15	102	125	149	193	223	229	245	235	312	397	461	245	160	135	233
AVERAGE		103	128	152	190	222	224	242	232	302	390	466	246	161	136	232

Table H-1f-9

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2 Date: 6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

****

Difference Of
The Dalles Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	19	-1	-1	1	0	0	0	0	0	0	0	0	0	0	0	0
1991	20	-1	1	-1	1	0	1	0	0	0	0	-1	0	0	0	0
1992	22	-2	0	0	0	0	0	0	0	0	2	1	0	0	0	0
1993	24	-2	0	0	0	0	3	0	-1	0	1	0	0	0	0	0
1994	15	-3	-1	0	2	0	1	0	0	0	1	1	0	0	0	0
1995	15	-2	1	-1	1	0	0	0	0	0	1	1	0	0	0	0
1996	23	-2	0	1	2	0	1	0	0	0	0	1	0	0	0	0
1997	16	-2	0	-1	2	0	1	0	0	0	1	0	0	0	0	0
1998	22	-2	0	-1	1	0	1	0	0	0	1	0	0	0	0	0
1999	18	-2	-1	0	0	0	2	0	0	0	1	1	0	0	0	0
2000	22	-3	0	-1	2	0	1	0	-1	0	0	0	0	0	0	0
2001	17	-1	0	-1	0	0	1	0	0	0	1	0	0	0	0	0
2002	18	-3	1	0	2	0	1	0	0	0	0	0	0	0	0	0
2003	14	-2	-1	0	1	0	1	0	0	0	0	2	0	0	0	0
2004	30	-2	0	0	0	0	2	0	0	0	1	1	0	0	0	0
2005	19	-2	1	-2	2	0	2	0	-1	0	1	0	0	0	0	0
2006	23	-3	0	-1	2	0	1	0	-1	0	1	0	0	0	0	0
2007	22	-3	0	1	2	0	1	0	0	0	0	0	0	0	0	0
2008	15	-3	0	1	1	0	1	0	0	0	1	0	0	0	0	0
AVERAGE		-2	0	0	1	0	1	0	0	0	1	0	0	0	0	0

Table H-1f-9

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410 — Date: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

****

Difference Of
The Dalles Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	8	9	7	-2	0	-5	0	0	-1	-3	-8	-4	-2	0	0
1990	19	8	5	2	-7	-2	-2	0	-1	-1	-2	-2	-2	0	0	0
1991	20	8	7	0	-1	0	-1	0	-3	-1	-4	-3	-1	0	0	0
1992	22	4	3	1	-5	0	-3	0	-3	0	-1	-3	0	0	0	0
1993	24	7	12	6	1	-1	-4	-6	-5	-3	-5	-3	0	0	0	0
1994	15	7	16	16	1	-1	-12	-5	-9	-2	-7	-8	0	0	0	0
1995	15	7	18	14	-2	-1	-8	-1	-11	-1	-9	-13	1	0	0	0
1996	23	7	16	17	5	-1	-14	-12	-6	-1	-5	-7	0	0	0	0
1997	16	6	19	15	6	-1	-9	-9	-9	-1	-10	-11	1	0	0	0
1998	22	6	17	14	5	-1	-9	-9	-10	-2	-7	-12	1	0	0	0
1999	18	5	14	11	4	-1	-2	-4	-11	0	-7	-15	1	0	0	0
2000	22	3	12	11	7	-1	-13	-4	-3	-3	-5	-8	0	0	0	0
2001	17	6	15	5	4	-1	-8	-6	-1	-2	-6	-8	0	0	0	0
2002	18	2	10	9	4	-2	-9	-1	-2	-1	-6	-5	0	0	0	0
2003	14	0	4	5	0	0	-3	-1	-2	-1	1	0	0	0	0	0
2004	30	-1	0	0	0	-1	1	0	2	-1	3	1	0	0	0	0
2005	19	0	2	-6	-2	0	6	1	0	-2	1	-1	0	0	0	0
2006	23	0	-1	-5	-1	0	4	1	0	-1	2	0	0	0	0	0
2007	22	0	4	0	0	-1	0	1	2	-2	-2	-1	0	0	0	0
2008	15	-1	2	3	-2	0	0	0	2	-2	-2	0	0	0	0	0
AVERAGE		4	9	6	1	-1	-4	-3	-3	-1	-3	-5	0	0	0	0

Table H-1f-9

BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415 — Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

Difference Of
The Dalles Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	8	8	1	-3	0	-1	0	0	-1	-2	-6	-3	-1	0	0
1990	19	6	3	-1	-9	-1	1	0	-1	-1	1	0	0	0	0	0
1991	20	6	5	-2	-6	-1	1	1	-1	-1	-2	-2	-1	0	0	0
1992	22	1	0	0	-4	1	0	0	0	0	1	-1	0	0	0	0
1993	24	3	7	3	-3	0	-1	-2	1	-2	-4	-1	0	0	0	0
1994	15	1	7	9	0	-1	-7	0	0	-1	-5	-4	0	0	0	0
1995	15	2	10	8	-7	-1	-4	0	-1	-1	-5	-3	0	0	0	0
1996	23	1	9	8	-1	-1	-11	0	0	0	-2	0	0	0	0	0
1997	16	-1	9	2	-2	0	-5	-1	0	0	-3	-1	0	0	0	0
1998	22	-1	6	-1	-6	0	-2	0	1	-1	2	1	0	-1	0	0
1999	18	-1	1	-6	0	1	1	0	1	0	4	1	0	0	0	0
2000	22	-2	-1	-4	0	0	2	0	1	-2	2	0	0	0	0	0
2001	17	1	1	-7	1	0	-1	0	0	-2	2	0	0	0	0	0
2002	18	0	8	-4	-6	0	-1	0	1	-1	1	-1	0	0	0	0
2003	14	-2	0	-9	-4	0	2	0	-1	0	7	3	0	0	0	0
2004	30	-1	-5	-8	-2	1	7	1	2	-1	7	2	0	0	0	0
2005	19	0	-4	-13	0	1	9	1	0	-1	5	1	0	0	0	0
2006	23	0	-3	-7	0	0	4	1	1	-1	5	0	0	0	0	0
2007	22	-1	1	-5	0	0	3	0	2	-2	1	0	0	0	0	0
2008	15	-1	1	-2	-3	0	2	0	1	-1	1	0	0	0	0	0
AVERAGE		1	3	-2	-3	0	0	0	0	-1	1	0	0	0	0	0

Table H-1f-9

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BA430MED : PSCEIS : ALT43 — Date: 21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

****

Difference Of
The Dalles Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	-3	-4	-2	0	0	2	0	1	1	5	0	0	0	0	0
1990	19	-2	1	2	-1	-1	1	0	-1	0	0	1	0	0	0	0
1991	20	-4	2	-1	-1	-2	3	1	-5	2	4	2	0	0	0	0
1992	22	-4	4	0	2	0	-2	0	0	0	1	1	0	0	0	0
1993	24	-3	3	0	7	0	1	0	5	-1	-4	-1	0	0	0	0
1994	15	-3	2	5	6	-1	-6	0	3	-1	-4	0	0	0	0	0
1995	15	-3	9	6	5	-1	-5	0	0	0	-7	-1	0	0	0	0
1996	23	-3	6	8	7	-1	-9	0	-1	1	-3	-1	0	0	0	0
1997	16	-4	9	7	7	-1	-5	-1	0	1	-8	-2	0	1	0	0
1998	22	-2	7	8	5	-1	-7	0	-1	1	-6	-3	0	0	0	0
1999	18	-4	5	3	2	0	2	0	0	1	-2	0	0	0	0	1
2000	22	-6	4	6	7	-1	-5	0	-1	0	-3	0	0	0	0	0
2001	17	-2	10	4	6	-1	-3	-1	0	1	-6	-2	0	0	0	0
2002	18	-3	7	10	5	-1	-9	0	-1	0	-5	-2	0	0	0	0
2003	14	-4	3	3	4	-1	-3	-1	-3	1	1	1	0	0	0	0
2004	30	-4	-1	3	4	0	3	0	1	1	1	1	0	0	0	1
2005	19	-2	1	1	4	0	1	0	0	0	-1	0	0	0	0	0
2006	23	-3	2	3	4	0	-3	0	-1	0	-1	0	0	0	0	0
2007	22	-4	5	6	4	-1	-4	0	0	0	-4	0	0	0	0	0
2008	15	-4	4	6	5	-1	-5	-1	0	0	-4	0	0	0	0	0
AVERAGE		-3	4	4	4	-1	-2	0	0	0	-2	0	0	0	0	0

Table H-1f-9

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BC440MED : PSCEIS : ALT44 Date: 28-JAN-89 06:06:31
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

****

Difference Of
The Dalles Discharge (kcfs)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AVERAGE		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

H-1g

VERNITA BAR DATA

Data on Flows for Flathead and Kootenai Rivers

Table H-1g-1

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2 — Date: 6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Low Water Years (Bottom 10 Percent)

****

Frequency Distribution ===> Vernita Bar

Priest Rapids Discharge GE 125 kcfs

Year	Num	(Base) Oct	(Base) Nov	(Incr) Oct	(Incr) Nov	(Diff) Oct	(Diff) Nov
1989	25	0	0	0	0	0	0
1990	27	0	0	0	0	0	0
1991	26	0	0	0	0	0	0
1992	18	0	0	0	0	0	0
1993	21	0	0	0	0	0	0
1994	30	0	0	0	0	0	0
1995	31	0	0	0	0	0	0
1996	29	0	0	0	0	0	0
1997	29	0	0	0	0	0	0
1998	23	0	0	0	0	0	0
1999	33	0	0	0	0	0	0
2000	27	0	0	0	0	0	0
2001	31	0	0	0	0	0	0
2002	25	0	0	0	0	0	0
2003	23	0	0	0	0	0	0
2004	24	0	0	0	0	0	0
2005	30	0	0	0	0	0	0
2006	32	0	0	0	0	0	0
2007	23	0	0	0	0	0	0
2008	26	0	0	0	0	0	0

Priest Rapids Discharge LT 70 kcfs

Year	(Base) Dec	Jan	Feb	Mar	Apl	Ap2	(Incr) Dec	Jan	Feb	Mar	Apl	Ap2	(Diff) Dec	Jan	Feb	Mar	Apl	Ap2
1989	0	0	0	0	15	0	0	0	0	0	15	0	0	0	0	0	0	0
1990	1	0	1	0	10	0	1	0	1	0	10	0	0	0	0	0	0	0
1991	0	0	1	0	17	0	0	0	1	0	16	0	0	0	0	0	-1	0
1992	1	0	0	1	11	1	1	0	0	1	11	1	0	0	0	0	0	0
1993	0	0	0	0	8	0	0	0	0	0	5	0	0	0	0	0	-3	0
1994	1	0	0	0	17	1	1	0	0	0	15	1	0	0	0	0	-2	0
1995	0	0	3	0	18	0	0	0	2	0	17	0	0	0	-1	0	-1	0
1996	0	0	0	0	11	0	0	0	0	0	12	0	0	0	0	0	1	0
1997	0	0	0	0	10	0	0	0	0	0	9	0	0	0	0	0	-1	0
1998	0	0	0	0	12	0	0	0	1	0	12	0	0	0	1	0	0	0
1999	3	0	1	1	13	3	3	0	0	1	10	3	0	0	-1	0	-3	0
2000	0	0	1	0	12	0	0	0	1	0	12	0	0	0	0	0	0	0
2001	0	0	1	0	19	0	0	0	0	0	18	0	0	0	-1	0	-1	0
2002	1	0	1	1	8	1	1	0	1	0	7	1	0	0	0	-1	-1	0
2003	0	0	0	0	9	0	0	0	0	0	9	0	0	0	0	0	0	0
2004	0	0	0	0	13	0	0	0	0	0	14	0	0	0	0	0	1	0
2005	0	0	1	0	14	0	0	0	1	0	14	0	0	0	0	0	0	0
2006	0	0	3	1	15	0	0	0	2	1	14	0	0	0	-1	0	-1	0
2007	0	0	0	0	11	0	0	0	0	0	11	0	0	0	0	0	0	0
2008	2	0	1	1	12	1	2	0	1	1	10	1	0	0	0	0	-2	0

Table H-1g-1

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2   Date: 6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Typical Water Years (Mid 80 Percent)

****

Frequency Distribution ===> Vernita Bar

Priest Rapids Discharge GE 125 kcfs

Year	Num	(Base) Oct	(Base) Nov	(Incr) Oct	(Incr) Nov	(Diff) Oct	(Diff) Nov
1989	153	4	6	4	6	0	0
1990	154	8	9	8	8	0	-1
1991	154	10	4	10	3	0	-1
1992	160	10	4	10	0	0	-4
1993	155	8	0	5	0	-3	0
1994	155	2	0	0	0	-2	0
1995	154	0	0	0	0	0	0
1996	148	0	0	0	0	0	0
1997	155	1	0	0	1	-1	1
1998	155	1	0	0	0	-1	0
1999	149	2	0	1	0	-1	0
2000	151	0	0	0	0	0	0
2001	152	1	1	1	1	0	0
2002	157	1	1	0	2	-1	1
2003	163	6	3	3	2	-3	-1
2004	146	2	3	3	1	1	-2
2005	151	1	5	1	0	0	-5
2006	145	0	3	0	1	0	-2
2007	155	0	1	0	0	0	-1
2008	159	1	1	0	0	-1	-1

Priest Rapids Discharge LT 70 kcfs

Year	Num	(Base) Dec	(Base) Jan	(Base) Feb	(Base) Mar	(Base) Apl	(Base) Ap2	(Incr) Dec	(Incr) Jan	(Incr) Feb	(Incr) Mar	(Incr) Apl	(Incr) Ap2	(Diff) Dec	(Diff) Jan	(Diff) Feb	(Diff) Mar	(Diff) Apl	(Diff) Ap2
1989	153	5	0	5	1	23	0	5	0	5	1	23	0	0	0	0	0	0	0
1990	154	1	0	4	1	20	0	1	0	3	1	19	0	0	0	-1	0	-1	0
1991	154	1	0	4	4	16	0	1	0	5	4	12	0	0	0	1	0	-4	0
1992	160	2	0	2	3	23	0	2	0	0	3	20	0	0	0	-2	0	-3	0
1993	155	7	0	0	3	19	0	7	0	1	1	19	0	0	0	1	-2	0	0
1994	155	10	0	0	3	19	0	10	0	0	2	19	0	0	0	0	-1	0	0
1995	154	10	0	1	3	19	0	9	0	1	3	19	0	-1	0	0	0	0	0
1996	148	6	0	1	1	24	0	5	0	0	0	21	0	-1	0	-1	-1	-3	0
1997	155	8	0	0	2	20	0	8	0	0	1	20	0	0	0	0	-1	0	0
1998	155	8	0	3	2	12	0	7	0	1	1	13	0	-1	0	-2	-1	1	0
1999	149	14	0	1	1	18	0	13	0	0	1	20	0	-1	0	-1	0	2	0
2000	151	5	0	0	1	13	0	5	0	0	0	14	0	0	0	0	-1	1	0
2001	152	5	0	1	1	22	0	5	0	1	0	22	0	0	0	0	-1	0	0
2002	157	7	0	0	0	22	0	7	0	0	1	22	0	0	0	0	1	0	0
2003	163	9	0	1	2	18	0	8	0	1	2	18	0	-1	0	0	0	0	0
2004	146	6	0	1	4	18	0	6	0	1	3	17	0	0	0	0	-1	-1	0
2005	151	12	0	1	1	11	0	11	0	0	1	12	0	-1	0	-1	0	1	0
2006	145	5	0	0	4	18	0	5	0	3	4	17	0	0	0	3	0	-1	0
2007	155	8	0	0	2	23	0	8	0	0	2	25	0	0	0	0	0	2	0
2008	159	11	0	0	1	13	0	10	0	0	0	13	0	-1	0	0	-1	0	0

Table H-1g-1

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****************************************************************************************************
                                        BPAHYSUM Summary
Base Study:    BA000MED : PSCEIS : BASE CASE                              Date:    3-JAN-89 06:55:28
Incr Study:    BD120MED : PSCEIS : BASE CASE   : ALT 1.2                  Date:    6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
High Water Years (Top 10 Percent)
****************************************************************************************************
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Frequency Distribution ===> Vernita Bar

Priest Rapids Discharge GE 125 kcfs (Oct–Nov); Priest Rapids Discharge LT 70 kcfs (Dec–Ap2)

Year	Num	(Base) Oct	(Base) Nov	(Incr) Oct	(Incr) Nov	(Diff) Oct	(Diff) Nov	(Base) Dec	(Base) Jan	(Base) Feb	(Base) Mar	(Base) Ap1	(Base) Ap2	(Incr) Dec	(Incr) Jan	(Incr) Feb	(Incr) Mar	(Incr) Ap1	(Incr) Ap2	(Diff) Dec	(Diff) Jan	(Diff) Feb	(Diff) Mar	(Diff) Ap1	(Diff) Ap2
1989	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table H-1g-1

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2   Date: 6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
All Water Years

****

Frequency Distribution ===> Vernita Bar

Priest Rapids Discharge GE 125 kcfs

Year	Num	(Base) Oct	(Base) Nov	(Incr) Oct	(Incr) Nov	(Diff) Oct	(Diff) Nov
1989	200	4	6	4	6	0	0
1990	200	8	9	8	8	0	-1
1991	200	10	4	10	3	0	-1
1992	200	10	4	10	0	0	-4
1993	200	8	0	5	0	-3	0
1994	200	2	0	0	0	-2	0
1995	200	0	0	0	0	0	0
1996	200	0	0	0	0	0	0
1997	200	1	0	0	1	-1	1
1998	200	1	0	0	0	-1	0
1999	200	2	0	1	0	-1	0
2000	200	0	0	0	0	0	0
2001	200	1	1	1	1	0	0
2002	200	1	1	0	2	-1	1
2003	200	6	3	3	2	-3	-1
2004	200	2	3	3	1	1	-2
2005	200	1	5	1	0	0	-5
2006	200	0	3	0	1	0	-2
2007	200	0	1	0	0	0	-1
2008	200	1	1	0	0	-1	-1

Priest Rapids Discharge LT 70 kcfs

Year	(Base) Dec	Jan	Feb	Mar	Apl	Ap2	(Incr) Dec	Jan	Feb	Mar	Apl	Ap2	(Diff) Dec	Jan	Feb	Mar	Apl	Ap2
1989	5	0	5	1	38	0	5	0	5	1	38	0	0	0	0	0	0	0
1990	2	0	5	1	30	0	2	0	4	1	29	0	0	0	-1	0	-1	0
1991	1	0	5	4	33	0	1	0	6	4	28	0	0	0	1	0	-5	0
1992	3	0	2	4	34	1	3	0	0	4	31	1	0	0	-2	0	-3	0
1993	7	0	0	3	27	0	7	0	1	1	24	0	0	0	1	-2	-3	0
1994	11	0	0	3	36	1	11	0	0	2	34	1	0	0	0	-1	-2	0
1995	10	0	4	3	37	0	9	0	3	3	36	0	-1	0	-1	0	-1	0
1996	6	0	1	1	35	0	5	0	0	0	33	0	-1	0	-1	-1	-2	0
1997	8	0	0	2	30	0	8	0	0	1	29	0	0	0	0	-1	-1	0
1998	8	0	3	2	24	0	7	0	2	1	25	0	-1	0	-1	-1	1	0
1999	17	0	2	2	31	3	16	0	0	2	30	3	-1	0	-2	0	-1	0
2000	5	0	1	1	25	0	5	0	1	0	26	0	0	0	0	-1	1	0
2001	5	0	2	1	41	0	5	0	1	0	40	0	0	0	-1	-1	-1	0
2002	8	0	1	1	30	1	8	0	1	1	29	1	0	0	0	0	-1	0
2003	9	0	1	2	27	0	8	0	1	2	27	0	-1	0	0	0	0	0
2004	6	0	1	4	31	0	6	0	1	3	31	0	0	0	0	-1	0	0
2005	12	0	2	1	25	0	11	0	1	1	26	0	-1	0	-1	0	1	0
2006	5	0	3	5	33	0	5	0	5	5	31	0	0	0	2	0	-2	0
2007	8	0	0	2	34	0	8	0	0	2	36	0	0	0	0	0	2	0
2008	13	0	1	2	25	1	12	0	1	1	23	1	-1	0	0	-1	-2	0

Table H-1g-2

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415 — Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Low Water Years (Bottom 10 Percent)

****

Frequency Distribution ===> Vernita Bar

Priest Rapids Discharge GE 125 kcfs

Year	Num	(Base) Oct	(Base) Nov	(Incr) Oct	(Incr) Nov	(Diff) Oct	(Diff) Nov
1989	25	0	0	0	0	0	0
1990	27	0	0	0	0	0	0
1991	26	0	0	0	0	0	0
1992	18	0	0	0	0	0	0
1993	21	0	0	0	0	0	0
1994	30	0	0	0	0	0	0
1995	31	0	0	0	0	0	0
1996	29	0	0	0	0	0	0
1997	29	0	0	0	0	0	0
1998	23	0	0	0	0	0	0
1999	33	0	0	0	0	0	0
2000	27	0	0	0	0	0	0
2001	31	0	0	0	0	0	0
2002	25	0	0	0	0	0	0
2003	23	0	0	0	0	0	0
2004	24	0	0	0	0	0	0
2005	30	0	0	0	0	0	0
2006	32	0	0	0	0	0	0
2007	23	0	0	0	0	0	0
2008	26	0	0	0	0	0	0

Priest Rapids Discharge LT 70 kcfs

Year	(Base) Dec	Jan	Feb	Mar	Apl	Ap2	(Incr) Dec	Jan	Feb	Mar	Apl	Ap2	(Diff) Dec	Jan	Feb	Mar	Apl	Ap2
1989	0	0	0	0	15	0	0	1	4	3	15	0	0	1	4	3	0	0
1990	1	0	1	0	10	0	1	0	1	3	10	0	0	0	0	3	0	0
1991	0	0	1	0	17	0	0	0	2	5	19	0	0	0	1	5	2	0
1992	1	0	0	1	11	1	1	0	0	0	11	1	0	0	0	-1	0	0
1993	0	0	0	0	8	0	0	0	0	0	10	0	0	0	0	0	2	0
1994	1	0	0	0	17	1	1	0	2	1	19	1	0	0	2	1	2	0
1995	0	0	3	0	18	0	0	0	4	1	19	0	0	0	1	1	1	0
1996	0	0	0	0	11	0	0	0	1	1	14	0	0	0	1	1	3	0
1997	0	0	0	0	10	0	0	0	2	1	11	0	0	0	2	1	1	0
1998	0	0	0	0	12	0	0	0	1	0	13	0	0	0	1	0	1	0
1999	3	0	1	1	13	3	3	0	0	1	12	3	0	0	-1	0	-1	0
2000	0	0	1	0	12	0	0	0	0	0	8	0	0	0	-1	0	-4	0
2001	0	0	1	0	19	0	0	0	0	0	17	0	0	0	-1	0	-2	0
2002	1	0	1	1	8	1	1	0	1	1	6	1	0	0	0	0	-2	0
2003	0	0	0	0	9	0	0	0	1	1	11	0	0	0	1	1	2	0
2004	0	0	0	0	13	0	0	0	0	0	11	0	0	0	0	0	-2	0
2005	0	0	1	0	14	0	0	0	0	0	7	0	0	0	-1	0	-7	0
2006	0	0	3	1	15	0	0	0	1	1	14	0	0	0	-2	0	-1	0
2007	0	0	0	0	11	0	0	0	0	0	7	0	0	0	0	0	-4	0
2008	2	0	1	1	12	1	2	0	0	1	14	2	0	0	-1	0	2	1

Table H-1g-2

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415 Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Typical Water Years (Mid 80 Percent)

****

Frequency Distribution ===> Vernita Bar

Priest Rapids Discharge GE 125 kcfs (Oct–Nov); Priest Rapids Discharge LT 70 kcfs (Dec–Ap2)

		(Base)		(Incr)		(Diff)		--- (Base) ---						--- (Incr) ---						--- (Diff) ---					
Year	Num	Oct	Nov	Oct	Nov	Oct	Nov	Dec	Jan	Feb	Mar	Apl	Ap2	Dec	Jan	Feb	Mar	Apl	Ap2	Dec	Jan	Feb	Mar	Apl	Ap2
1989	153	4	6	4	6	0	0	5	0	5	1	23	0	7	0	10	1	22	0	2	0	5	0	-1	0
1990	154	8	9	7	5	-1	-4	1	0	4	1	20	0	4	0	4	2	22	0	3	0	0	1	2	0
1991	154	10	4	8	1	-2	-3	1	0	4	4	16	0	5	0	5	4	21	0	4	0	1	0	5	0
1992	160	10	4	10	0	0	-4	2	0	2	3	23	0	3	0	4	4	24	0	1	0	2	1	1	0
1993	155	8	0	7	3	-1	3	7	0	0	3	19	0	8	0	3	4	20	0	1	0	3	1	1	0
1994	155	2	0	7	3	5	3	10	0	0	3	19	0	10	0	1	3	18	0	0	0	1	0	-1	0
1995	154	0	0	8	0	8	0	10	0	1	3	19	0	10	0	2	3	20	0	0	0	1	0	1	0
1996	148	0	0	7	0	7	0	6	0	1	1	24	0	6	0	0	1	24	0	0	0	-1	0	0	0
1997	155	1	0	15	0	14	0	8	0	0	2	20	0	8	0	0	1	21	0	0	0	0	-1	1	0
1998	155	1	0	8	0	7	0	8	0	3	2	12	0	7	0	0	2	13	0	-1	0	-3	0	1	0
1999	149	2	0	1	0	-1	0	14	0	1	1	18	0	13	0	0	1	21	0	-1	0	-1	0	3	0
2000	151	0	0	0	1	0	1	5	0	0	1	13	0	5	0	0	3	13	0	0	0	0	2	0	0
2001	152	1	1	0	2	-1	1	5	0	1	1	22	0	7	0	0	1	19	0	2	0	-1	0	-3	0
2002	157	1	1	8	2	7	1	7	0	0	0	22	0	9	0	0	0	19	0	2	0	0	0	-3	0
2003	163	6	3	3	0	-3	-3	9	0	1	2	18	0	9	0	1	2	17	0	0	0	0	0	-1	0
2004	146	2	3	1	1	-1	-2	6	0	1	4	18	0	7	0	1	2	17	0	1	0	0	-2	-1	0
2005	151	1	5	2	0	1	-5	12	0	1	1	11	0	11	0	0	2	9	0	-1	0	-1	1	-2	0
2006	145	0	3	0	0	0	-3	5	0	0	4	18	0	6	0	1	4	16	0	1	0	1	0	-2	0
2007	155	0	1	1	0	1	-1	8	0	0	2	23	0	8	0	1	4	21	0	0	0	1	2	-2	0
2008	159	1	1	2	0	1	-1	11	0	0	1	13	0	11	0	0	1	13	0	0	0	0	0	0	0

Table H-1g-2

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415   Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
High Water Years (Top 10 Percent)

****

Frequency Distribution ===> Vernita Bar

Priest Rapids Discharge GE 125 kcfs

		(Base)		(Incr)		(Diff)	
Year	Num	Oct	Nov	Oct	Nov	Oct	Nov
1989	22	0	0	0	0	0	0
1990	19	0	0	0	0	0	0
1991	20	0	0	0	0	0	0
1992	22	0	0	0	0	0	0
1993	24	0	0	0	0	0	0
1994	15	0	0	0	0	0	0
1995	15	0	0	0	0	0	0
1996	23	0	0	0	0	0	0
1997	16	0	0	0	0	0	0
1998	22	0	0	0	0	0	0
1999	18	0	0	0	0	0	0
2000	22	0	0	0	0	0	0
2001	17	0	0	0	0	0	0
2002	18	0	0	0	0	0	0
2003	14	0	0	0	0	0	0
2004	30	0	0	0	0	0	0
2005	19	0	0	0	0	0	0
2006	23	0	0	0	0	0	0
2007	22	0	0	0	0	0	0
2008	15	0	0	0	0	0	0

Priest Rapids Discharge LT 70 kcfs

	--- (Base) ---						--- (Incr) ---						--- (Diff) ---					
Year	Dec	Jan	Feb	Mar	Apl	Ap2	Dec	Jan	Feb	Mar	Apl	Ap2	Dec	Jan	Feb	Mar	Apl	Ap2
1989	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table H-1g-2

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415 Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
All Water Years

****

Frequency Distribution ===> Vernita Bar

Priest Rapids Discharge GE 125 kcfs

Year	Num	(Base) Oct	(Base) Nov	(Incr) Oct	(Incr) Nov	(Diff) Oct	(Diff) Nov
1989	200	4	6	4	6	0	0
1990	200	8	9	7	5	-1	-4
1991	200	10	4	8	1	-2	-3
1992	200	10	4	10	0	0	-4
1993	200	8	0	7	3	-1	3
1994	200	2	0	7	3	5	3
1995	200	0	0	8	0	8	0
1996	200	0	0	7	0	7	0
1997	200	1	0	15	0	14	0
1998	200	1	0	8	0	7	0
1999	200	2	0	1	0	-1	0
2000	200	0	0	0	1	0	1
2001	200	1	1	0	2	-1	1
2002	200	1	1	8	2	7	1
2003	200	6	3	3	0	-3	-3
2004	200	2	3	1	1	-1	-2
2005	200	1	5	2	0	1	-5
2006	200	0	3	0	0	0	-3
2007	200	0	1	1	0	1	-1
2008	200	1	1	2	0	1	-1

Priest Rapids Discharge LT 70 kcfs

Year	(Base) Dec	Jan	Feb	Mar	Apl	Ap2	(Incr) Dec	Jan	Feb	Mar	Apl	Ap2	(Diff) Dec	Jan	Feb	Mar	Apl	Ap2
1989	5	0	5	1	38	0	7	1	14	4	37	0	2	1	9	3	-1	0
1990	2	0	5	1	30	0	5	0	5	5	32	0	3	0	0	4	2	0
1991	1	0	5	4	33	0	5	0	7	9	40	0	4	0	2	5	7	0
1992	3	0	2	4	34	1	4	0	4	4	35	1	1	0	2	0	1	0
1993	7	0	0	3	27	0	8	0	3	4	30	0	1	0	3	1	3	0
1994	11	0	0	3	36	1	11	0	3	4	37	1	0	0	3	1	1	0
1995	10	0	4	3	37	0	10	0	6	4	39	0	0	0	2	1	2	0
1996	6	0	1	1	35	0	6	0	1	2	38	0	0	0	0	1	3	0
1997	8	0	0	2	30	0	8	0	2	2	32	0	0	0	2	0	2	0
1998	8	0	3	2	24	0	7	0	1	2	26	0	-1	0	-2	0	2	0
1999	17	0	2	2	31	3	16	0	0	2	33	3	-1	0	-2	0	2	0
2000	5	0	1	1	25	0	5	0	0	3	21	0	0	0	-1	2	-4	0
2001	5	0	2	1	41	0	7	0	0	1	36	0	2	0	-2	0	-5	0
2002	8	0	1	1	30	1	10	0	1	1	25	1	2	0	0	0	-5	0
2003	9	0	1	2	27	0	9	0	2	3	28	0	0	0	1	1	1	0
2004	6	0	1	4	31	0	7	0	1	2	28	0	1	0	0	-2	-3	0
2005	12	0	2	1	25	0	11	0	0	2	16	0	-1	0	-2	1	-9	0
2006	5	0	3	5	33	0	6	0	2	5	30	0	1	0	-1	0	-3	0
2007	8	0	0	2	34	0	8	0	1	4	28	0	0	0	1	2	-6	0
2008	13	0	1	2	25	1	13	0	0	2	27	2	0	0	-1	0	2	1

Table H-1g-3

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410 Date: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Low Water Years (Bottom 10 Percent)

****

Frequency Distribution ===> Vernita Bar

Priest Rapids Discharge GE 125 kcfs (Oct, Nov columns)

Priest Rapids Discharge LT 70 kcfs (Dec–Ap2 columns)

Year	Num	Base Oct	Base Nov	Incr Oct	Incr Nov	Diff Oct	Diff Nov	Base Dec	Base Jan	Base Feb	Base Mar	Base Ap1	Base Ap2	Incr Dec	Incr Jan	Incr Feb	Incr Mar	Incr Ap1	Incr Ap2	Diff Dec	Diff Jan	Diff Feb	Diff Mar	Diff Ap1	Diff Ap2
1989	25	0	0	0	0	0	0	0	0	0	0	15	0	0	0	3	0	15	0	0	0	3	0	0	0
1990	27	0	0	0	0	0	0	1	0	1	0	10	0	1	0	1	1	10	0	0	0	0	1	0	0
1991	26	0	0	0	0	0	0	0	0	1	0	17	0	0	0	4	6	19	0	0	0	3	6	2	0
1992	18	0	0	0	0	0	0	1	0	0	1	11	1	0	0	0	5	11	0	-1	0	0	4	0	-1
1993	21	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	10	0	0	0	0	0	2	0
1994	30	0	0	0	0	0	0	1	0	0	0	17	1	0	0	3	2	20	0	-1	0	3	2	3	-1
1995	31	0	0	0	0	0	0	0	0	3	0	18	0	0	0	5	1	19	0	0	0	2	1	1	0
1996	29	0	0	0	0	0	0	0	0	0	0	11	0	0	0	1	1	14	0	0	0	1	1	3	0
1997	29	0	0	0	0	0	0	0	0	0	0	10	0	0	0	4	2	11	0	0	0	4	2	1	0
1998	23	0	0	0	0	0	0	0	0	0	0	12	0	0	0	2	2	17	0	0	0	2	2	5	0
1999	33	0	0	0	0	0	0	3	0	1	1	13	3	3	0	3	3	14	2	0	0	2	2	1	-1
2000	27	0	0	0	0	0	0	0	0	1	0	12	0	0	0	1	1	13	0	0	0	0	1	1	0
2001	31	0	0	0	0	0	0	0	0	1	0	19	0	0	0	3	1	19	0	0	0	2	1	0	0
2002	25	0	0	0	0	0	0	1	0	1	1	8	1	1	0	1	3	7	1	0	0	0	2	-1	0
2003	23	0	0	0	0	0	0	0	0	0	0	9	0	1	0	1	1	12	0	1	0	1	1	3	0
2004	24	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	7	0	0	0	0	0	-6	0
2005	30	0	0	0	0	0	0	0	0	1	0	14	0	0	0	1	0	13	0	0	0	0	0	-1	0
2006	32	0	0	0	0	0	0	0	0	3	1	15	0	0	0	2	0	15	0	0	0	-1	-1	0	0
2007	23	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	10	0	0	0	0	0	-1	0
2008	26	0	0	0	0	0	0	2	0	1	1	12	1	2	0	1	2	11	2	0	0	0	1	-1	1

Table H-1g-3

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*****************************************************************************************************
                                          BPAHYSUM Summary
Base Study:     BA000MED : PSCEIS : BASE CASE                        Date:    3-JAN-89 06:55:28
Incr Study:     BE410MED : PSCEIS : ALT410                           Date:    1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Typical Water Years (Mid 80 Percent)
*****************************************************************************************************
```

Frequency Distribution ===> Vernita Bar

Priest Rapids Discharge GE 125 kcfs

Year	Num	(Base) Oct	(Base) Nov	(Incr) Oct	(Incr) Nov	(Diff) Oct	(Diff) Nov
1989	153	4	6	4	9	0	3
1990	154	8	9	9	8	1	-1
1991	154	10	4	7	4	-3	0
1992	160	10	4	11	0	1	-4
1993	155	8	0	9	3	1	3
1994	155	2	0	8	13	6	13
1995	154	0	0	12	17	12	17
1996	148	0	0	7	9	7	9
1997	155	1	0	17	23	16	23
1998	155	1	0	16	21	15	21
1999	149	2	0	9	13	7	13
2000	151	0	0	14	17	14	17
2001	152	1	1	16	11	15	10
2002	157	1	1	11	2	10	1
2003	163	6	3	7	2	1	-1
2004	146	2	3	4	1	2	-2
2005	151	1	5	3	0	2	-5
2006	145	0	3	1	0	1	-3
2007	155	0	1	2	0	2	-1
2008	159	1	1	1	0	0	-1

Priest Rapids Discharge LT 70 kcfs

Year	(Base) Dec	(Base) Jan	(Base) Feb	(Base) Mar	(Base) Apl	(Base) Ap2	(Incr) Dec	(Incr) Jan	(Incr) Feb	(Incr) Mar	(Incr) Apl	(Incr) Ap2	(Diff) Dec	(Diff) Jan	(Diff) Feb	(Diff) Mar	(Diff) Apl	(Diff) Ap2
1989	5	0	5	1	23	0	8	0	3	1	23	0	3	0	-2	0	0	0
1990	1	0	4	1	20	0	6	0	3	2	25	0	5	0	-1	1	5	0
1991	1	0	4	4	16	0	7	0	5	4	20	0	6	0	1	0	4	0
1992	2	0	2	3	23	0	1	1	7	4	25	0	-1	1	5	1	2	0
1993	7	0	0	3	19	0	7	0	4	5	20	0	0	0	4	2	1	0
1994	10	0	0	3	19	0	10	0	0	6	15	0	0	0	0	3	-4	0
1995	10	0	1	3	19	0	14	0	3	6	15	0	4	0	2	3	-4	0
1996	6	0	1	1	24	0	9	0	3	3	23	0	3	0	2	2	-1	0
1997	8	0	0	2	20	0	8	0	3	3	23	0	0	0	3	1	3	0
1998	8	0	3	2	12	0	9	0	5	6	11	0	1	0	2	4	-1	0
1999	14	0	1	1	18	0	16	0	2	1	21	0	2	0	1	0	3	0
2000	5	0	0	1	13	0	5	0	0	3	14	0	0	0	0	2	1	0
2001	5	0	1	1	22	0	8	0	3	2	18	0	3	0	2	1	-4	0
2002	7	0	0	0	22	0	11	0	0	3	25	0	4	0	0	3	3	0
2003	9	0	1	2	18	0	9	0	0	3	20	0	0	0	-1	1	2	0
2004	6	0	1	4	18	0	6	0	0	4	20	0	0	0	-1	0	2	0
2005	12	0	1	1	11	0	12	0	0	1	15	0	0	0	-1	0	4	0
2006	5	0	0	4	18	0	5	0	0	1	19	0	0	0	0	-3	1	0
2007	8	0	0	2	23	0	10	0	0	6	26	1	2	0	0	4	3	1
2008	11	0	0	1	13	0	11	0	0	2	15	0	0	0	0	1	2	0

Table H-1g-3

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*****************************************************************************************************************
                                              BPAHYSUM Summary
Base Study:    BA000MED : PSCEIS : BASE CASE                            Date:    3-JAN-89 06:55:28
Incr Study:    BE410MED : PSCEIS : ALT410                               Date:    1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
High Water Years (Top 10 Percent)
*****************************************************************************************************************
```

Frequency Distribution ===> Vernita Bar

		Priest Rapids Discharge GE 125 kcfs														Priest Rapids Discharge LT 70 kcfs											
		(Base)		(Incr)		(Diff)		(Base)						(Incr)						(Diff)					
Year	Num	Oct	Nov	Oct	Nov	Oct	Nov	Dec	Jan	Feb	Mar	Ap1	Ap2	Dec	Jan	Feb	Mar	Ap1	Ap2	Dec	Jan	Feb	Mar	Ap1	Ap2
1989	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table H-1g-3

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410 Date: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
All Water Years

****

Frequency Distribution ===> Vernita Bar

		Priest Rapids Discharge GE 125 kcfs														Priest Rapids Discharge LT 70 kcfs											
		(Base)		(Incr)		(Diff)		--- (Base) ---						--- (Incr) ---						--- (Diff) ---					
Year	Num	Oct	Nov	Oct	Nov	Oct	Nov	Dec	Jan	Feb	Mar	Apl	Ap2	Dec	Jan	Feb	Mar	Apl	Ap2	Dec	Jan	Feb	Mar	Apl	Ap2
1989	200	4	6	4	9	0	3	5	0	5	1	38	0	8	0	6	1	38	0	3	0	1	0	0	0
1990	200	8	9	9	8	1	-1	2	0	5	1	30	0	7	0	4	3	35	0	5	0	-1	2	5	0
1991	200	10	4	7	4	-3	0	1	0	5	4	33	0	7	0	9	10	39	0	6	0	4	6	6	0
1992	200	10	4	11	0	1	-4	3	0	2	4	34	1	1	1	7	9	36	0	-2	1	5	5	2	-1
1993	200	8	0	9	3	1	3	7	0	0	3	27	0	7	0	4	5	30	0	0	0	4	2	3	0
1994	200	2	0	8	13	6	13	11	0	0	3	36	1	10	0	3	8	35	0	-1	0	3	5	-1	-1
1995	200	0	0	12	17	12	17	10	0	4	3	37	0	14	0	8	7	34	0	4	0	4	4	-3	0
1996	200	0	0	7	9	7	9	6	0	1	1	35	0	9	0	4	4	37	0	3	0	3	3	2	0
1997	200	1	0	17	23	16	23	8	0	0	2	30	0	8	0	7	5	34	0	0	0	7	3	4	0
1998	200	1	0	16	21	15	21	8	0	3	2	24	0	9	0	7	8	28	0	1	0	4	6	4	0
1999	200	2	0	9	13	7	13	17	0	2	2	31	3	19	0	5	4	35	2	2	0	3	2	4	-1
2000	200	0	0	14	17	14	17	5	0	1	1	25	0	5	0	1	4	27	0	0	0	0	3	2	0
2001	200	1	1	16	11	15	10	5	0	2	1	41	0	8	0	6	3	37	0	3	0	4	2	-4	0
2002	200	1	1	11	2	10	1	8	0	1	1	30	1	12	0	1	6	32	1	4	0	0	5	2	0
2003	200	6	3	7	2	1	-1	9	0	1	2	27	0	10	0	1	4	32	0	1	0	0	2	5	0
2004	200	2	3	4	1	2	-2	6	0	1	4	31	0	6	0	0	4	27	0	0	0	-1	0	-4	0
2005	200	1	5	3	0	2	-5	12	0	2	1	25	0	12	0	1	1	28	0	0	0	-1	0	3	0
2006	200	0	3	1	0	1	-3	5	0	3	5	33	0	5	0	2	1	34	0	0	0	-1	-4	1	0
2007	200	0	1	2	0	2	-1	8	0	0	2	34	0	10	0	0	6	36	1	2	0	0	4	2	1
2008	200	1	1	1	0	0	-1	13	0	1	2	25	1	13	0	1	4	26	2	0	0	0	2	1	1

Table H-1g-4

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BA430MED : PSCEIS : ALT43 Date: 21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Low Water Years (Bottom 10 Percent)

****

Frequency Distribution ===> Vernita Bar

Priest Rapids Discharge GE 125 kcfs

Year	Num	(Base) Oct	(Base) Nov	(Incr) Oct	(Incr) Nov	(Diff) Oct	(Diff) Nov
1989	25	0	0	0	0	0	0
1990	27	0	0	0	0	0	0
1991	26	0	0	0	0	0	0
1992	18	0	0	0	0	0	0
1993	21	0	0	0	0	0	0
1994	30	0	0	0	0	0	0
1995	31	0	0	0	0	0	0
1996	29	0	0	0	0	0	0
1997	29	0	0	0	0	0	0
1998	23	0	0	0	0	0	0
1999	33	0	0	0	0	0	0
2000	27	0	0	0	0	0	0
2001	31	0	0	0	0	0	0
2002	25	0	0	0	0	0	0
2003	23	0	0	0	0	0	0
2004	24	0	0	0	0	0	0
2005	30	0	0	0	0	0	0
2006	32	0	0	0	0	0	0
2007	23	0	0	0	0	0	0
2008	26	0	0	0	0	0	0

Priest Rapids Discharge LT 70 kcfs

Year	Num	(Base) Dec	Jan	Feb	Mar	Ap1	Ap2	(Incr) Dec	Jan	Feb	Mar	Ap1	Ap2	(Diff) Dec	Jan	Feb	Mar	Ap1	Ap2
1989	25	0	0	0	0	15	0	0	0	0	0	15	0	0	0	0	0	0	0
1990	27	1	0	1	0	10	0	0	0	1	0	6	0	-1	0	0	0	-4	0
1991	26	0	0	1	0	17	0	0	0	0	1	15	0	0	0	-1	1	-2	0
1992	18	1	0	0	1	11	1	1	0	0	0	10	1	0	0	0	-1	-1	0
1993	21	0	0	0	0	8	0	0	0	0	0	5	0	0	0	0	0	-3	0
1994	30	1	0	0	0	17	1	0	0	0	0	16	0	-1	0	0	0	-1	-1
1995	31	0	0	3	0	18	0	0	0	2	0	17	0	0	0	-1	0	-1	0
1996	29	0	0	0	0	11	0	0	0	0	0	12	0	0	0	0	0	1	0
1997	29	0	0	0	0	10	0	0	0	1	0	7	0	0	0	1	0	-3	0
1998	23	0	0	0	0	12	0	0	0	1	0	9	0	0	0	1	0	-3	0
1999	33	3	0	1	1	13	3	1	0	0	2	16	1	-2	0	-1	1	3	-2
2000	27	0	0	1	0	12	0	0	0	1	0	13	0	0	0	0	0	1	0
2001	31	0	0	1	0	19	0	0	0	0	0	19	0	0	0	-1	0	0	0
2002	25	1	0	1	1	8	1	1	0	1	0	8	1	0	0	0	-1	0	0
2003	23	0	0	0	0	9	0	0	0	1	1	13	0	0	0	1	1	4	0
2004	24	0	0	0	0	13	0	0	0	0	0	14	0	0	0	0	0	1	0
2005	30	0	0	1	0	14	0	0	0	0	0	14	0	0	0	-1	0	0	0
2006	32	0	0	3	1	15	0	0	0	0	0	17	0	0	0	-3	-1	2	0
2007	23	0	0	0	0	11	0	0	0	0	0	10	0	0	0	0	0	-1	0
2008	26	2	0	1	1	12	1	1	0	1	2	15	1	-1	0	0	1	3	0

Table H-1g-4

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BA430MED : PSCEIS : ALT43 Date: 21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Typical Water Years (Mid 80 Percent)

****

Frequency Distribution ===> Vernita Bar

Priest Rapids Discharge GE 125 kcfs

Year	Num	(Base) Oct	(Base) Nov	(Incr) Oct	(Incr) Nov	(Diff) Oct	(Diff) Nov
1989	153	4	6	4	4	0	-2
1990	154	8	9	14	10	6	1
1991	154	10	4	8	6	-2	2
1992	160	10	4	10	3	0	-1
1993	155	8	0	9	3	1	3
1994	155	2	0	6	0	4	0
1995	154	0	0	10	0	10	0
1996	148	0	0	4	0	4	0
1997	155	1	0	17	11	16	11
1998	155	1	0	15	5	14	5
1999	149	2	0	1	0	-1	0
2000	151	0	0	8	7	8	7
2001	152	1	1	16	10	15	9
2002	157	1	1	10	13	9	12
2003	163	6	3	2	3	-4	0
2004	146	2	3	4	5	2	2
2005	151	1	5	2	2	1	-3
2006	145	0	3	1	1	1	-2
2007	155	0	1	5	4	5	3
2008	159	1	1	0	3	-1	2

Priest Rapids Discharge LT 70 kcfs

Year	(Base) Dec	Jan	Feb	Mar	Apl	Ap2	(Incr) Dec	Jan	Feb	Mar	Apl	Ap2	(Diff) Dec	Jan	Feb	Mar	Apl	Ap2
1989	5	0	5	1	23	0	5	0	5	1	10	0	0	0	0	0	-13	0
1990	1	0	4	1	20	0	1	0	3	1	14	0	0	0	-1	0	-6	0
1991	1	0	4	4	16	0	1	0	3	2	16	0	0	0	-1	-2	0	0
1992	2	0	2	3	23	0	0	0	2	4	22	0	-2	0	0	1	-1	0
1993	7	0	0	3	19	0	7	0	1	2	20	0	0	0	1	-1	1	0
1994	10	0	0	3	19	0	10	0	0	5	15	0	0	0	0	2	-4	0
1995	10	0	1	3	19	0	10	0	1	3	15	0	0	0	0	0	-4	0
1996	6	0	1	1	24	0	5	0	2	2	20	0	-1	0	1	1	-4	0
1997	8	0	0	2	20	0	8	0	0	2	19	0	0	0	0	0	-1	0
1998	8	0	3	2	12	0	7	0	1	2	14	0	-1	0	-2	0	2	0
1999	14	0	1	1	18	0	12	0	0	0	20	0	-2	0	-1	-1	2	0
2000	5	0	0	1	13	0	6	0	0	1	10	0	1	0	0	0	-3	0
2001	5	0	1	1	22	0	5	0	3	2	17	0	0	0	2	1	-5	0
2002	7	0	0	0	22	0	6	0	1	1	18	0	-1	0	1	1	-4	0
2003	9	0	1	2	18	0	8	0	1	3	16	0	-1	0	0	1	-2	0
2004	6	0	1	4	18	0	6	0	0	4	12	0	0	0	-1	0	-6	0
2005	12	0	1	1	11	0	10	0	1	1	8	0	-2	0	0	0	-3	0
2006	5	0	0	4	18	0	4	0	2	3	14	0	-1	0	2	-1	-4	0
2007	8	0	0	2	23	0	8	0	1	0	26	0	0	0	1	-2	3	0
2008	11	0	0	1	13	0	11	0	1	0	10	0	0	0	1	-1	-3	0

Table H-1g-4

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BA430MED : PSCEIS : ALT43 Date: 21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
High Water Years (Top 10 Percent)

****

Frequency Distribution ===> Vernita Bar

		Priest Rapids Discharge GE 125 kcfs						Priest Rapids Discharge LT 70 kcfs																	
		(Base)		(Incr)		(Diff)		(Base)						(Incr)						(Diff)					
Year	Num	Oct	Nov	Oct	Nov	Oct	Nov	Dec	Jan	Feb	Mar	Apl	Ap2	Dec	Jan	Feb	Mar	Apl	Ap2	Dec	Jan	Feb	Mar	Apl	Ap2
1989	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1998	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1999	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2001	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2002	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2005	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2006	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2007	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2008	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table H-1g-4

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BA430MED : PSCEIS : ALT43   Date: 21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
All Water Years

****

Frequency Distribution ===> Vernita Bar

Priest Rapids Discharge GE 125 kcfs

Year	Num	(Base) Oct	(Base) Nov	(Incr) Oct	(Incr) Nov	(Diff) Oct	(Diff) Nov
1989	200	4	6	4	4	0	-2
1990	200	8	9	14	10	6	1
1991	200	10	4	8	6	-2	2
1992	200	10	4	10	3	0	-1
1993	200	8	0	9	3	1	3
1994	200	2	0	6	0	4	0
1995	200	0	0	10	0	10	0
1996	200	0	0	4	0	4	0
1997	200	1	0	17	11	16	11
1998	200	1	0	15	5	14	5
1999	200	2	0	1	0	-1	0
2000	200	0	0	8	7	8	7
2001	200	1	1	16	10	15	9
2002	200	1	1	10	13	9	12
2003	200	6	3	2	3	-4	0
2004	200	2	3	4	5	2	2
2005	200	1	5	2	2	1	-3
2006	200	0	3	1	1	1	-2
2007	200	0	1	5	4	5	3
2008	200	1	1	0	3	-1	2

Priest Rapids Discharge LT 70 kcfs

Year	Num	(Base) Dec	Jan	Feb	Mar	Apl	Ap2	(Incr) Dec	Jan	Feb	Mar	Apl	Ap2	(Diff) Dec	Jan	Feb	Mar	Apl	Ap2
1989	200	5	0	5	1	38	0	5	0	5	1	25	0	0	0	0	0	-13	0
1990	200	2	0	5	1	30	0	1	0	4	1	20	0	-1	0	-1	0	-10	0
1991	200	1	0	5	4	33	0	1	0	3	3	31	0	0	0	-2	-1	-2	0
1992	200	3	0	2	4	34	1	1	0	2	4	32	1	-2	0	0	0	-2	0
1993	200	7	0	0	3	27	0	7	0	1	2	25	0	0	0	1	-1	-2	0
1994	200	11	0	0	3	36	1	10	0	0	5	31	0	-1	0	0	2	-5	-1
1995	200	10	0	4	3	37	0	10	0	3	3	32	0	0	0	-1	0	-5	0
1996	200	6	0	1	1	35	0	5	0	2	2	32	0	-1	0	1	1	-3	0
1997	200	8	0	0	2	30	0	8	0	1	2	26	0	0	0	1	0	-4	0
1998	200	8	0	3	2	24	0	7	0	2	2	23	0	-1	0	-1	0	-1	0
1999	200	17	0	2	2	31	3	13	0	0	2	36	1	-4	0	-2	0	5	-2
2000	200	5	0	1	1	25	0	6	0	1	1	23	0	1	0	0	0	-2	0
2001	200	5	0	2	1	41	0	5	0	3	2	36	0	0	0	1	1	-5	0
2002	200	8	0	1	1	30	1	7	0	2	1	26	1	-1	0	1	0	-4	0
2003	200	9	0	1	2	27	0	8	0	2	4	29	0	-1	0	1	2	2	0
2004	200	6	0	1	4	31	0	6	0	0	4	26	0	0	0	-1	0	-5	0
2005	200	12	0	2	1	25	0	10	0	1	1	22	0	-2	0	-1	0	-3	0
2006	200	5	0	3	5	33	0	4	0	2	3	31	0	-1	0	-1	-2	-2	0
2007	200	8	0	0	2	34	0	8	0	1	0	36	0	0	0	1	-2	2	0
2008	200	13	0	1	2	25	1	12	0	2	2	25	1	-1	0	1	0	0	0

H-1h

WATER BUDGET DATA

Table H-1h-1

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2   Date: 6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Low Water Years (Bottom 10 Percent)

****

Frequency Distribution

		Grand Coulee Elev LT 1240 feet			Priest Rapids Discharge LT 115 kcfs					
		(Base)	(Incr)	(Diff)	(Base)		(Incr)		(Diff)	
Year	Num	May	May	May	Ap2	May	Ap2	May	Ap2	May
1989	25	0	0	0	0	0	0	0	0	0
1990	27	0	0	0	0	0	0	0	0	0
1991	26	0	0	0	0	0	0	0	0	0
1992	18	0	0	0	0	0	0	0	0	0
1993	21	0	0	0	0	0	0	0	0	0
1994	30	0	0	0	0	0	0	0	0	0
1995	31	0	0	0	0	0	0	0	0	0
1996	29	0	0	0	0	0	0	0	0	0
1997	29	0	0	0	0	0	0	0	0	0
1998	23	0	0	0	0	0	0	0	0	0
1999	33	0	0	0	0	0	0	0	0	0
2000	27	0	0	0	0	0	0	0	0	0
2001	31	0	0	0	0	0	0	0	0	0
2002	25	0	0	0	0	0	0	0	0	0
2003	23	0	0	0	0	0	0	0	0	0
2004	24	0	0	0	0	0	0	0	0	0
2005	30	0	0	0	0	0	0	0	0	0
2006	32	0	0	0	0	0	0	0	0	0
2007	23	0	0	0	0	0	0	0	0	0
2008	26	0	0	0	0	1	0	1	0	0

Table H-1h-1

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2 Date: 6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Typical Water Years (Mid 80 Percent)

****

Frequency Distribution

		Grand Coulee Elev LT 1240 feet			Priest Rapids Discharge LT 115 kcfs					
		(Base)	(Incr)	(Diff)	(Base)		(Incr)		(Diff)	
Year	Num	May	May	May	Ap2	May	Ap2	May	Ap2	May
1989	153	34	34	0	0	0	0	0	0	0
1990	154	34	34	0	0	0	0	0	0	0
1991	154	42	42	0	0	0	0	0	0	0
1992	160	35	35	0	0	0	0	0	0	0
1993	155	38	38	0	0	0	0	0	0	0
1994	155	37	37	0	0	0	0	0	0	0
1995	154	38	38	0	0	0	0	0	0	0
1996	148	32	32	0	0	0	0	0	0	0
1997	155	37	37	0	0	0	0	0	0	0
1998	155	43	43	0	0	0	0	0	0	0
1999	149	30	30	0	0	0	0	0	0	0
2000	151	41	41	0	0	0	0	0	0	0
2001	152	45	45	0	0	0	0	0	0	0
2002	157	33	33	0	0	0	0	0	0	0
2003	163	40	40	0	0	0	0	0	0	0
2004	146	40	40	0	0	0	0	0	0	0
2005	151	31	31	0	0	0	0	0	0	0
2006	145	36	36	0	0	0	0	0	0	0
2007	155	23	23	0	0	0	0	0	0	0
2008	159	49	49	0	0	0	0	0	0	0

Table H-1h-1

****

BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2 Date: 6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
High Water Years (Top 10 Percent)

****

Frequency Distribution

		Grand Coulee Elev LT 1240 feet			Priest Rapids Discharge LT 115 kcfs					
		(Base)	(Incr)	(Diff)	(Base)		(Incr)		(Diff)	
Year	Num	May	May	May	Ap2	May	Ap2	May	Ap2	May
1989	22	0	0	0	0	0	0	0	0	0
1990	19	0	0	0	0	0	0	0	0	0
1991	20	0	0	0	0	0	0	0	0	0
1992	22	0	0	0	0	0	0	0	0	0
1993	24	0	0	0	0	0	0	0	0	0
1994	15	0	0	0	0	0	0	0	0	0
1995	15	0	0	0	0	0	0	0	0	0
1996	23	0	0	0	0	0	0	0	0	0
1997	16	0	0	0	0	0	0	0	0	0
1998	22	0	0	0	0	0	0	0	0	0
1999	18	0	0	0	0	0	0	0	0	0
2000	22	0	0	0	0	0	0	0	0	0
2001	17	0	0	0	0	0	0	0	0	0
2002	18	0	0	0	0	0	0	0	0	0
2003	14	0	0	0	0	0	0	0	0	0
2004	30	0	0	0	0	0	0	0	0	0
2005	19	0	0	0	0	0	0	0	0	0
2006	23	0	0	0	0	0	0	0	0	0
2007	22	0	0	0	0	0	0	0	0	0
2008	15	0	0	0	0	0	0	0	0	0

Table H-1h-1

****

BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2 Date: 6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
All Water Years

****

Frequency Distribution

		Grand Coulee Elev LT 1240 feet			Priest Rapids Discharge LT 115 kcfs					
		(Base)	(Incr)	(Diff)	(Base)		(Incr)		(Diff)	
Year	Num	May	May	May	Ap2	May	Ap2	May	Ap2	May
1989	200	34	34	0	0	0	0	0	0	0
1990	200	34	34	0	0	0	0	0	0	0
1991	200	42	42	0	0	0	0	0	0	0
1992	200	35	35	0	0	0	0	0	0	0
1993	200	38	38	0	0	0	0	0	0	0
1994	200	37	37	0	0	0	0	0	0	0
1995	200	38	38	0	0	0	0	0	0	0
1996	200	32	32	0	0	0	0	0	0	0
1997	200	37	37	0	0	0	0	0	0	0
1998	200	43	43	0	0	0	0	0	0	0
1999	200	30	30	0	0	0	0	0	0	0
2000	200	41	41	0	0	0	0	0	0	0
2001	200	45	45	0	0	0	0	0	0	0
2002	200	33	33	0	0	0	0	0	0	0
2003	200	40	40	0	0	0	0	0	0	0
2004	200	40	40	0	0	0	0	0	0	0
2005	200	31	31	0	0	0	0	0	0	0
2006	200	36	36	0	0	0	0	0	0	0
2007	200	23	23	0	0	0	0	0	0	0
2008	200	49	49	0	0	1	0	1	0	0

Table H-1h-2

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415 Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Low Water Years (Bottom 10 Percent)

****

Frequency Distribution

		Grand Coulee Elev LT 1240 feet			Priest Rapids Discharge LT 115 kcfs					
		(Base)	(Incr)	(Diff)	(Base)		(Incr)		(Diff)	
Year	Num	May	May	May	Ap2	May	Ap2	May	Ap2	May
1989	25	0	0	0	0	0	0	0	0	0
1990	27	0	0	0	0	0	0	0	0	0
1991	26	0	0	0	0	0	0	0	0	0
1992	18	0	0	0	0	0	0	0	0	0
1993	21	0	0	0	0	0	0	0	0	0
1994	30	0	0	0	0	0	0	0	0	0
1995	31	0	0	0	0	0	0	0	0	0
1996	29	0	0	0	0	0	0	0	0	0
1997	29	0	0	0	0	0	0	0	0	0
1998	23	0	0	0	0	0	0	0	0	0
1999	33	0	0	0	0	0	0	0	0	0
2000	27	0	0	0	0	0	0	0	0	0
2001	31	0	0	0	0	0	0	0	0	0
2002	25	0	0	0	0	0	0	0	0	0
2003	23	0	0	0	0	0	0	0	0	0
2004	24	0	0	0	0	0	0	0	0	0
2005	30	0	0	0	0	0	0	0	0	0
2006	32	0	0	0	0	0	0	0	0	0
2007	23	0	0	0	0	0	0	0	0	0
2008	26	0	0	0	0	1	0	1	0	0

Table H-1h-2

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415   Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Typical Water Years (Mid 80 Percent)

****

Frequency Distribution

		Grand Coulee Elev LT 1240 feet			Priest Rapids Discharge LT 115 kcfs					
		(Base)	(Incr)	(Diff)	(Base)		(Incr)		(Diff)	
Year	Num	May	May	May	Ap2	May	Ap2	May	Ap2	May
1989	153	34	34	0	0	0	0	0	0	0
1990	154	34	34	0	0	0	0	0	0	0
1991	154	42	42	0	0	0	0	0	0	0
1992	160	35	35	0	0	0	0	0	0	0
1993	155	38	38	0	0	0	0	0	0	0
1994	155	37	37	0	0	0	0	0	0	0
1995	154	38	38	0	0	0	0	0	0	0
1996	148	32	32	0	0	0	0	0	0	0
1997	155	37	37	0	0	0	0	0	0	0
1998	155	43	43	0	0	0	0	0	0	0
1999	149	30	30	0	0	0	0	0	0	0
2000	151	41	41	0	0	0	0	0	0	0
2001	152	45	45	0	0	0	0	0	0	0
2002	157	33	33	0	0	0	0	0	0	0
2003	163	40	40	0	0	0	0	0	0	0
2004	146	40	40	0	0	0	0	0	0	0
2005	151	31	31	0	0	0	0	0	0	0
2006	145	36	36	0	0	0	0	0	0	0
2007	155	23	23	0	0	0	0	0	0	0
2008	159	49	49	0	0	0	0	0	0	0

Table H-1h-2

****

BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415 Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
High Water Years (Top 10 Percent)

****

Frequency Distribution

		Grand Coulee Elev LT 1240 feet			Priest Rapids Discharge LT 115 kcfs					
		(Base)	(Incr)	(Diff)	(Base)		(Incr)		(Diff)	
Year	Num	May	May	May	Ap2	May	Ap2	May	Ap2	May
1989	22	0	0	0	0	0	0	0	0	0
1990	19	0	0	0	0	0	0	0	0	0
1991	20	0	0	0	0	0	0	0	0	0
1992	22	0	0	0	0	0	0	0	0	0
1993	24	0	0	0	0	0	0	0	0	0
1994	15	0	0	0	0	0	0	0	0	0
1995	15	0	0	0	0	0	0	0	0	0
1996	23	0	0	0	0	0	0	0	0	0
1997	16	0	0	0	0	0	0	0	0	0
1998	22	0	0	0	0	0	0	0	0	0
1999	18	0	0	0	0	0	0	0	0	0
2000	22	0	0	0	0	0	0	0	0	0
2001	17	0	0	0	0	0	0	0	0	0
2002	18	0	0	0	0	0	0	0	0	0
2003	14	0	0	0	0	0	0	0	0	0
2004	30	0	0	0	0	0	0	0	0	0
2005	19	0	0	0	0	0	0	0	0	0
2006	23	0	0	0	0	0	0	0	0	0
2007	22	0	0	0	0	0	0	0	0	0
2008	15	0	0	0	0	0	0	0	0	0

Table H-1h-2

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415   Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
All Water Years

****

Frequency Distribution

		Grand Coulee Elev LT 1240 feet			Priest Rapids Discharge LT 115 kcfs					
		(Base)	(Incr)	(Diff)	(Base)		(Incr)		(Diff)	
Year	Num	May	May	May	Ap2	May	Ap2	May	Ap2	May
1989	200	34	34	0	0	0	0	0	0	0
1990	200	34	34	0	0	0	0	0	0	0
1991	200	42	42	0	0	0	0	0	0	0
1992	200	35	35	0	0	0	0	0	0	0
1993	200	38	38	0	0	0	0	0	0	0
1994	200	37	37	0	0	0	0	0	0	0
1995	200	38	38	0	0	0	0	0	0	0
1996	200	32	32	0	0	0	0	0	0	0
1997	200	37	37	0	0	0	0	0	0	0
1998	200	43	43	0	0	0	0	0	0	0
1999	200	30	30	0	0	0	0	0	0	0
2000	200	41	41	0	0	0	0	0	0	0
2001	200	45	45	0	0	0	0	0	0	0
2002	200	33	33	0	0	0	0	0	0	0
2003	200	40	40	0	0	0	0	0	0	0
2004	200	40	40	0	0	0	0	0	0	0
2005	200	31	31	0	0	0	0	0	0	0
2006	200	36	36	0	0	0	0	0	0	0
2007	200	23	23	0	0	0	0	0	0	0
2008	200	49	49	0	0	1	0	1	0	0

Table H-1h-3

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410 Date: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Low Water Years (Bottom 10 Percent)

****

Frequency Distribution

		Grand Coulee Elev LT 1240 feet			Priest Rapids Discharge LT 115 kcfs					
		(Base)	(Incr)	(Diff)	(Base)		(Incr)		(Diff)	
Year	Num	May	May	May	Ap2	May	Ap2	May	Ap2	May
1989	25	0	0	0	0	0	0	0	0	0
1990	27	0	0	0	0	0	0	0	0	0
1991	26	0	0	0	0	0	0	0	0	0
1992	18	0	0	0	0	0	0	0	0	0
1993	21	0	0	0	0	0	0	0	0	0
1994	30	0	0	0	0	0	0	0	0	0
1995	31	0	0	0	0	0	0	0	0	0
1996	29	0	0	0	0	0	0	0	0	0
1997	29	0	0	0	0	0	0	0	0	0
1998	23	0	0	0	0	0	0	0	0	0
1999	33	0	0	0	0	0	0	0	0	0
2000	27	0	0	0	0	0	0	0	0	0
2001	31	0	0	0	0	0	0	0	0	0
2002	25	0	0	0	0	0	0	0	0	0
2003	23	0	0	0	0	0	0	0	0	0
2004	24	0	0	0	0	0	0	0	0	0
2005	30	0	0	0	0	0	0	0	0	0
2006	32	0	0	0	0	0	0	0	0	0
2007	23	0	0	0	0	0	0	0	0	0
2008	26	0	0	0	0	1	0	1	0	0

Table H-1h-3

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410   Date: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Typical Water Years (Mid 80 Percent)

****

Frequency Distribution

		Grand Coulee Elev LT 1240 feet			Priest Rapids Discharge LT 115 kcfs					
		(Base)	(Incr)	(Diff)	(Base)		(Incr)		(Diff)	
Year	Num	May	May	May	Ap2	May	Ap2	May	Ap2	May
1989	153	34	34	0	0	0	0	0	0	0
1990	154	34	34	0	0	0	0	0	0	0
1991	154	42	42	0	0	0	0	0	0	0
1992	160	35	35	0	0	0	0	0	0	0
1993	155	38	38	0	0	0	0	0	0	0
1994	155	37	37	0	0	0	0	0	0	0
1995	154	38	38	0	0	0	0	0	0	0
1996	148	32	32	0	0	0	0	0	0	0
1997	155	37	37	0	0	0	0	0	0	0
1998	155	43	43	0	0	0	0	0	0	0
1999	149	30	30	0	0	0	0	0	0	0
2000	151	41	41	0	0	0	0	0	0	0
2001	152	45	45	0	0	0	0	0	0	0
2002	157	33	33	0	0	0	0	0	0	0
2003	163	40	40	0	0	0	0	0	0	0
2004	146	40	40	0	0	0	0	0	0	0
2005	151	31	31	0	0	0	0	0	0	0
2006	145	36	36	0	0	0	0	0	0	0
2007	155	23	23	0	0	0	0	0	0	0
2008	159	49	49	0	0	0	0	0	0	0

Table H-1h-3

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410   Date: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
High Water Years (Top 10 Percent)

****

Frequency Distribution

		Grand Coulee Elev LT 1240 feet			Priest Rapids Discharge LT 115 kcfs					
		(Base)	(Incr)	(Diff)	(Base)		(Incr)		(Diff)	
Year	Num	May	May	May	Ap2	May	Ap2	May	Ap2	May
1989	22	0	0	0	0	0	0	0	0	0
1990	19	0	0	0	0	0	0	0	0	0
1991	20	0	0	0	0	0	0	0	0	0
1992	22	0	0	0	0	0	0	0	0	0
1993	24	0	0	0	0	0	0	0	0	0
1994	15	0	0	0	0	0	0	0	0	0
1995	15	0	0	0	0	0	0	0	0	0
1996	23	0	0	0	0	0	0	0	0	0
1997	16	0	0	0	0	0	0	0	0	0
1998	22	0	0	0	0	0	0	0	0	0
1999	18	0	0	0	0	0	0	0	0	0
2000	22	0	0	0	0	0	0	0	0	0
2001	17	0	0	0	0	0	0	0	0	0
2002	18	0	0	0	0	0	0	0	0	0
2003	14	0	0	0	0	0	0	0	0	0
2004	30	0	0	0	0	0	0	0	0	0
2005	19	0	0	0	0	0	0	0	0	0
2006	23	0	0	0	0	0	0	0	0	0
2007	22	0	0	0	0	0	0	0	0	0
2008	15	0	0	0	0	0	0	0	0	0

Table H-1h-3

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410 — Date: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
All Water Years

****

Frequency Distribution

		Grand Coulee Elev LT 1240 feet			Priest Rapids Discharge LT 115 kcfs					
		(Base)	(Incr)	(Diff)	(Base)		(Incr)		(Diff)	
Year	Num	May	May	May	Ap2	May	Ap2	May	Ap2	May
1989	200	34	34	0	0	0	0	0	0	0
1990	200	34	34	0	0	0	0	0	0	0
1991	200	42	42	0	0	0	0	0	0	0
1992	200	35	35	0	0	0	0	0	0	0
1993	200	38	38	0	0	0	0	0	0	0
1994	200	37	37	0	0	0	0	0	0	0
1995	200	38	38	0	0	0	0	0	0	0
1996	200	32	32	0	0	0	0	0	0	0
1997	200	37	37	0	0	0	0	0	0	0
1998	200	43	43	0	0	0	0	0	0	0
1999	200	30	30	0	0	0	0	0	0	0
2000	200	41	41	0	0	0	0	0	0	0
2001	200	45	45	0	0	0	0	0	0	0
2002	200	33	33	0	0	0	0	0	0	0
2003	200	40	40	0	0	0	0	0	0	0
2004	200	40	40	0	0	0	0	0	0	0
2005	200	31	31	0	0	0	0	0	0	0
2006	200	36	36	0	0	0	0	0	0	0
2007	200	23	23	0	0	0	0	0	0	0
2008	200	49	49	0	0	1	0	1	0	0

Table H-1h-4

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BA430MED : PSCEIS : ALT43 Date: 21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Low Water Years (Bottom 10 Percent)

****

Frequency Distribution

		Grand Coulee Elev LT 1240 feet			Priest Rapids Discharge LT 115 kcfs					
		(Base)	(Incr)	(Diff)	(Base)		(Incr)		(Diff)	
Year	Num	May	May	May	Ap2	May	Ap2	May	Ap2	May
1989	25	0	0	0	0	0	0	0	0	0
1990	27	0	0	0	0	0	0	0	0	0
1991	26	0	0	0	0	0	0	0	0	0
1992	18	0	0	0	0	0	0	0	0	0
1993	21	0	0	0	0	0	0	0	0	0
1994	30	0	0	0	0	0	0	0	0	0
1995	31	0	0	0	0	0	0	0	0	0
1996	29	0	0	0	0	0	0	0	0	0
1997	29	0	0	0	0	0	0	0	0	0
1998	23	0	0	0	0	0	0	0	0	0
1999	33	0	0	0	0	0	0	0	0	0
2000	27	0	0	0	0	0	0	0	0	0
2001	31	0	0	0	0	0	0	0	0	0
2002	25	0	0	0	0	0	0	0	0	0
2003	23	0	0	0	0	0	0	0	0	0
2004	24	0	0	0	0	0	0	0	0	0
2005	30	0	0	0	0	0	0	0	0	0
2006	32	0	0	0	0	0	0	0	0	0
2007	23	0	0	0	0	0	0	0	0	0
2008	26	0	0	0	0	1	0	0	0	-1

Table H-1h-4

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*****************************************************************************************************************************
                                                    BPAHYSUM Summary
Base Study:    BA000MED : PSCEIS : BASE CASE                                    Date:   3-JAN-89 06:55:28
Incr Study:    BA430MED : PSCEIS : ALT43                                        Date:  21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Typical Water Years (Mid 80 Percent)
*****************************************************************************************************************************
```

Frequency Distribution

		Grand Coulee Elev LT 1240 feet			Priest Rapids Discharge LT 115 kcfs					
		(Base)	(Incr)	(Diff)	(Base)		(Incr)		(Diff)	
Year	Num	May	May	May	Ap2	May	Ap2	May	Ap2	May
1989	153	34	34	0	0	0	0	0	0	0
1990	154	34	34	0	0	0	0	0	0	0
1991	154	42	42	0	0	0	0	0	0	0
1992	160	35	35	0	0	0	0	0	0	0
1993	155	38	38	0	0	0	0	0	0	0
1994	155	37	37	0	0	0	0	0	0	0
1995	154	38	38	0	0	0	0	0	0	0
1996	148	32	32	0	0	0	0	0	0	0
1997	155	37	37	0	0	0	0	0	0	0
1998	155	43	43	0	0	0	0	0	0	0
1999	149	30	30	0	0	0	0	0	0	0
2000	151	41	41	0	0	0	0	0	0	0
2001	152	45	45	0	0	0	0	0	0	0
2002	157	33	33	0	0	0	0	0	0	0
2003	163	40	40	0	0	0	0	0	0	0
2004	146	40	40	0	0	0	0	0	0	0
2005	151	31	31	0	0	0	0	0	0	0
2006	145	36	36	0	0	0	0	0	0	0
2007	155	23	23	0	0	0	0	0	0	0
2008	159	49	49	0	0	0	0	0	0	0

Table H-1h-4

```
*******************************************************************************************************************
                                              BPAHYSUM Summary
Base Study:     BA000MED : PSCEIS : BASE CASE                                  Date:   3-JAN-89 06:55:28
Incr Study:     BA430MED : PSCEIS : ALT43                                      Date:  21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
High Water Years (Top 10 Percent)
*******************************************************************************************************************
```

Frequency Distribution

Year	Num	Grand Coulee Elev LT 1240 feet (Base) May	Grand Coulee Elev LT 1240 feet (Incr) May	Grand Coulee Elev LT 1240 feet (Diff) May	Priest Rapids Discharge LT 115 kcfs (Base) Ap2	Priest Rapids Discharge LT 115 kcfs (Base) May	Priest Rapids Discharge LT 115 kcfs (Incr) Ap2	Priest Rapids Discharge LT 115 kcfs (Incr) May	Priest Rapids Discharge LT 115 kcfs (Diff) Ap2	Priest Rapids Discharge LT 115 kcfs (Diff) May
1989	22	0	0	0	0	0	0	0	0	0
1990	19	0	0	0	0	0	0	0	0	0
1991	20	0	0	0	0	0	0	0	0	0
1992	22	0	0	0	0	0	0	0	0	0
1993	24	0	0	0	0	0	0	0	0	0
1994	15	0	0	0	0	0	0	0	0	0
1995	15	0	0	0	0	0	0	0	0	0
1996	23	0	0	0	0	0	0	0	0	0
1997	16	0	0	0	0	0	0	0	0	0
1998	22	0	0	0	0	0	0	0	0	0
1999	18	0	0	0	0	0	0	0	0	0
2000	22	0	0	0	0	0	0	0	0	0
2001	17	0	0	0	0	0	0	0	0	0
2002	18	0	0	0	0	0	0	0	0	0
2003	14	0	0	0	0	0	0	0	0	0
2004	30	0	0	0	0	0	0	0	0	0
2005	19	0	0	0	0	0	0	0	0	0
2006	23	0	0	0	0	0	0	0	0	0
2007	22	0	0	0	0	0	0	0	0	0
2008	15	0	0	0	0	0	0	0	0	0

Table H-1h-4

BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BA430MED : PSCEIS : ALT43 — Date: 21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
All Water Years

Frequency Distribution

		Grand Coulee Elev LT 1240 feet			Priest Rapids Discharge LT 115 kcfs					
		(Base)	(Incr)	(Diff)	(Base)		(Incr)		(Diff)	
Year	Num	May	May	May	Ap2	May	Ap2	May	Ap2	May
1989	200	34	34	0	0	0	0	0	0	0
1990	200	34	34	0	0	0	0	0	0	0
1991	200	42	42	0	0	0	0	0	0	0
1992	200	35	35	0	0	0	0	0	0	0
1993	200	38	38	0	0	0	0	0	0	0
1994	200	37	37	0	0	0	0	0	0	0
1995	200	38	38	0	0	0	0	0	0	0
1996	200	32	32	0	0	0	0	0	0	0
1997	200	37	37	0	0	0	0	0	0	0
1998	200	43	43	0	0	0	0	0	0	0
1999	200	30	30	0	0	0	0	0	0	0
2000	200	41	41	0	0	0	0	0	0	0
2001	200	45	45	0	0	0	0	0	0	0
2002	200	33	33	0	0	0	0	0	0	0
2003	200	40	40	0	0	0	0	0	0	0
2004	200	40	40	0	0	0	0	0	0	0
2005	200	31	31	0	0	0	0	0	0	0
2006	200	36	36	0	0	0	0	0	0	0
2007	200	23	23	0	0	0	0	0	0	0
2008	200	49	49	0	0	1	0	0	0	-1

CHANGE IN FLOWS FOR FLATHEAD & KOOTENAI RIVERS

Libby:

Mean Change in End of Period Flows

Frequency of Flows Less Than 4 KCFS (%)

Columbia Falls:

Mean Change in End of Period Flows

Frequency of Flows Less Than 3.5 KCFS (%)

Frequency of Flows Less Than 4.5 KCFS (%)

Table H-1i-1

COMPARISONS FOR PLANT: LIBBY
MEAN CHANGE IN END OF PERIOD FLOWS.KCFS

STUDY	YEAR	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR1	APR2	MAY	JUNE	JULY	AUG1	AUG2
BA000MED	1991	8.4	9.1	16.3	21.1	19.5	15.9	5.2	3.7	4.6	9.8	7.3	13.2	10.0	7.3
BD120MED	1991	-0.2	-0.4	-0.4	0.9	0.0	-0.1	0.0	0.0	0.0	0.1	0.1	0.0	-0.2	-0.1
BE410MED	1991	1.5	2.5	1.6	-3.6	0.2	-0.3	-0.1	0.2	-0.2	-0.6	-0.6	-0.4	-0.8	-0.4
BB415MED	1991	0.9	1.9	0.8	-2.4	0.0	-0.5	0.0	0.0	-0.2	-0.2	-0.3	-0.1	-0.3	-0.1
BA430MED	1991	-0.5	-0.8	-0.4	1.2	0.0	-0.3	0.0	0.0	0.2	0.3	0.2	0.1	-0.2	-0.1
BC440MED	1991	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BA000MED	1993	8.7	8.8	16.0	21.4	18.7	15.7	5.1	3.4	4.3	10.7	7.2	12.7	10.1	7.2
BD120MED	1993	-0.3	-0.5	-0.4	1.1	-0.2	-0.1	0.0	-0.1	0.0	0.1	0.1	0.0	-0.1	0.0
BE410MED	1993	1.8	2.6	1.9	-5.0	0.8	-0.7	0.0	0.0	0.0	-0.4	-0.3	-0.3	-1.0	-0.4
BB415MED	1993	0.7	1.4	1.0	-2.6	0.2	-0.4	0.1	0.0	-0.1	-0.1	-0.1	-0.1	-0.3	-0.1
BA430MED	1993	-0.5	-0.6	-0.1	0.9	0.0	-0.5	0.2	0.1	0.3	0.2	0.2	0.0	-0.4	-0.2
BC440MED	1993	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BA000MED	1995	8.7	8.2	15.6	21.7	18.1	15.4	5.5	3.7	4.5	9.8	6.9	11.7	10.5	7.2
BD120MED	1995	-0.3	-0.2	-0.2	0.8	0.0	-0.1	0.1	-0.1	0.0	0.0	0.0	0.0	-0.2	0.0
BE410MED	1995	1.7	3.3	3.1	-5.7	0.4	-0.9	-0.3	0.1	0.0	-0.5	-0.2	-0.2	-1.4	-0.4
BB415MED	1995	0.3	1.2	1.1	-1.8	-0.1	-0.4	0.0	-0.1	0.0	0.0	0.0	-0.2	-0.4	-0.1
BA430MED	1995	-0.6	-0.1	0.9	-0.3	0.3	-0.6	0.0	-0.1	0.1	0.2	0.3	0.0	-0.6	-0.2
BC440MED	1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BA000MED	1997	8.6	8.5	15.8	22.4	18.1	15.8	5.2	3.7	4.6	9.6	6.9	12.3	10.5	7.2
BD120MED	1997	-0.2	-0.4	-0.4	0.9	0.1	0.1	0.0	-0.1	0.1	0.1	0.1	0.0	-0.2	0.0
BE410MED	1997	1.3	3.5	3.4	-6.6	1.1	-1.1	-0.1	-0.1	0.0	-0.6	-0.2	-0.3	-1.1	-0.4
BB415MED	1997	0.1	0.5	0.6	-0.9	0.0	-0.2	0.0	-0.1	0.0	0.1	0.0	-0.1	-0.4	-0.1
BA430MED	1997	-0.5	-0.3	0.8	-0.4	0.5	0.0	0.1	-0.1	0.2	0.1	0.0	0.0	-0.5	-0.2
BC440MED	1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BA000MED	2001	9.0	8.1	15.7	22.2	18.5	15.6	4.8	3.5	4.6	10.3	6.8	12.6	10.5	7.2
BD120MED	2001	-0.4	-0.2	-0.3	0.7	0.2	-0.3	0.1	0.0	0.0	0.0	0.1	0.0	-0.2	0.0
BE410MED	2001	0.7	2.1	1.6	-3.4	0.2	-0.3	0.1	0.2	0.0	-0.3	-0.2	-0.2	-0.7	0.2
BB415MED	2001	-0.3	0.5	0.0	-0.7	0.2	0.3	0.1	0.1	-0.1	-0.2	-0.2	0.0	0.6	0.3
BA430MED	2001	-0.5	0.0	0.9	-0.5	0.3	-0.3	0.2	0.0	0.1	0.0	0.1	0.0	-0.3	-0.1
BC440MED	2001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BA000MED	2005	8.5	8.3	15.8	22.0	18.4	15.0	5.1	3.5	4.0	10.3	6.6	12.5	10.3	7.0
BD120MED	2005	-0.3	-0.3	-0.8	1.2	0.1	-0.1	0.1	-0.1	0.1	0.1	0.0	-0.1	-0.1	0.0
BE410MED	2005	-0.1	0.6	0.2	-0.3	0.2	-0.1	0.1	0.1	0.0	-0.3	-0.2	-0.4	0.2	0.3
BB415MED	2005	-0.2	0.3	-0.6	0.4	0.1	0.1	0.1	0.1	0.0	-0.1	-0.2	-0.2	0.5	0.3
BA430MED	2005	-0.3	-0.6	-0.3	1.1	0.1	-0.3	0.2	0.0	0.3	0.1	0.1	0.0	-0.2	0.0
BC440MED	2005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table H-1i-2

THE FREQUENCY OF FLOWS LESS THAN 4 KCFS (%)
COMPARISONS FOR PROJECT: LIBBY

SIMULATIONS: 200

YEAR	STUDY	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR1	APR2	MAY	JUNE	JULY	AUG1	AUG2
1991	BA000MED	3.0	2.5	0.5	0.0	15.5	5.5	46.0	86.0	79.5	15.5	34.5	14.5	7.5	6.0
	BD120MED	3.0	2.5	0.5	0.0	16.0	6.5	47.5	85.5	80.0	14.5	35.0	14.0	8.0	6.0
	BE410MED	8.0	3.5	2.0	0.0	9.5	1.5	50.5	83.5	84.0	22.0	48.0	17.5	14.5	14.0
	BB415MED	4.5	3.5	0.5	0.0	9.5	5.5	50.5	86.0	81.5	18.0	40.5	16.0	9.0	9.5
	BA430MED	6.0	4.0	1.0	0.0	16.5	7.0	45.0	84.0	79.0	14.0	35.0	13.0	7.5	7.5
	BC440MED	3.0	2.5	0.5	0.0	15.5	5.5	46.0	86.0	79.5	15.5	34.5	14.5	7.5	6.0
1993	BA000MED	3.5	5.0	0.5	0.0	16.5	2.0	45.0	91.0	86.5	11.5	36.5	17.5	3.0	2.0
	BD120MED	4.0	4.5	0.5	0.0	18.0	3.5	44.5	93.5	85.0	10.0	35.5	16.0	2.0	2.0
	BE410MED	6.5	5.5	1.0	0.0	11.0	1.5	41.0	89.0	84.0	16.5	44.0	20.0	13.0	12.0
	BB415MED	4.5	3.5	0.5	0.0	14.0	4.0	43.5	92.0	86.5	12.5	36.5	18.0	6.0	6.5
	BA430MED	5.0	5.5	0.5	0.0	18.0	6.5	42.5	90.0	81.0	8.5	33.0	16.5	5.0	7.0
	BC440MED	3.5	5.0	0.5	0.0	16.5	2.0	45.0	91.0	86.5	11.5	36.5	17.5	3.0	2.0
1995	BA000MED	5.5	8.0	3.5	1.0	16.0	3.0	36.5	85.0	83.0	18.5	38.0	20.5	3.5	4.5
	BD120MED	5.0	7.5	1.5	1.0	17.5	4.0	34.5	86.5	83.5	18.0	37.5	20.5	3.5	5.5
	BE410MED	10.0	5.0	2.0	0.5	12.0	2.5	37.5	84.0	81.0	22.0	46.0	23.5	13.0	14.5
	BB415MED	5.0	5.0	1.0	1.0	15.5	5.5	37.0	87.5	[illegible]	19.0	40.0	24.0	4.5	5.5
	BA430MED	7.0	6.0	3.0	0.5	17.5	8.0	31.5	85.0	80.0	17.0	36.5	21.0	9.0	10.0
	BC440MED	5.5	8.0	3.5	1.0	16.0	3.0	36.5	85.0	83.0	18.5	38.0	20.5	3.5	4.5
1997	BA000MED	7.5	6.0	0.5	0.0	16.5	1.0	38.0	84.5	84.5	14.0	41.0	20.5	3.5	4.0
	BD120MED	6.0	6.0	0.5	0.0	18.0	1.5	38.5	87.0	84.0	13.0	40.5	20.0	3.5	4.0
	BE410MED	10.0	6.0	0.5	0.0	9.5	1.5	38.5	88.5	84.0	21.5	51.0	24.5	12.0	13.5
	BB415MED	4.0	4.5	0.5	0.0	18.5	1.5	39.0	87.5	85.0	13.5	39.0	22.5	7.5	8.5
	BA430MED	9.0	7.5	0.5	0.0	17.5	4.5	37.0	87.0	82.5	14.0	41.5	20.0	5.5	7.0
	BC440MED	7.5	6.0	0.5	0.0	16.5	1.0	38.0	84.5	84.5	14.0	41.0	20.5	3.5	4.0
2001	BA000MED	6.0	12.0	2.5	0.5	17.5	3.5	50.0	89.5	84.0	15.5	42.0	18.0	3.5	6.5
	BD120MED	6.5	10.5	2.5	1.0	16.5	6.0	48.0	89.0	84.5	15.5	41.5	19.5	3.0	6.5
	BE410MED	3.5	6.0	0.0	0.5	13.0	3.0	48.0	88.5	84.0	16.5	45.0	22.0	12.0	12.0
	BB415MED	7.5	11.0	2.0	1.0	13.5	1.5	49.0	87.5	84.5	19.0	45.0	19.0	2.0	8.0
	BA430MED	9.5	9.5	2.5	0.0	17.5	7.5	44.5	89.5	83.5	15.0	40.5	20.0	4.0	9.0
	BC440MED	6.0	12.0	2.5	0.5	17.5	3.5	50.0	89.5	84.0	15.5	42.0	18.0	3.5	6.5
2005	BA000MED	5.5	8.0	2.0	0.0	19.5	3.0	45.0	90.0	87.0	15.5	48.5	15.5	2.0	9.5
	BD120MED	5.0	6.0	2.5	0.0	20.0	6.0	42.0	92.5	86.5	13.5	48.5	16.0	1.0	10.0
	BE410MED	4.5	2.5	0.5	0.0	15.5	2.5	44.0	87.0	87.0	18.5	53.5	21.5	3.5	3.0
	BB415MED	6.5	5.5	1.5	0.0	17.0	1.0	42.0	85.5	87.5	15.5	52.0	19.5	1.0	3.0
	BA430MED	5.0	8.5	2.5	0.0	20.5	8.5	39.0	88.5	83.5	14.0	47.5	16.5	2.0	8.0
	BC440MED	5.5	8.0	2.0	0.0	19.5	3.0	45.0	90.0	87.0	15.5	48.5	15.5	2.0	9.5

Table H-1i-3

THE FREQUENCY OF FLOWS LESS THAN 4.5 KCFS (%)
COMPARISONS FOR PROJECT: COLUMBIA FALLS

YEAR	STUDY	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR1	APR2	MAY	JUNE	JULY	AUG1	AUG2
1991	BA000MED	35.4	30.8	49.2	52.3	20.0	23.1	20.0	20.0	1.5	0.0	0.0	13.8	27.7	64.6
	BD120MED	38.5	38.5	55.4	60.0	21.5	18.5	18.5	20.0	1.5	0.0	0.0	13.8	29.2	66.2
	BB415MED	6.2	18.5	43.1	52.3	27.7	20.0	23.1	27.7	1.5	0.0	0.0	13.8	27.7	61.5
	BE410MED	3.1	15.4	36.9	33.8	30.8	20.0	27.7	27.7	3.1	0.0	0.0	13.8	33.8	70.8
	BA430MED	53.8	50.8	61.5	58.5	15.4	18.5	18.5	18.5	0.0	0.0	0.0	13.8	29.2	67.7
	BC440MED	35.4	30.8	49.2	52.3	20.0	23.1	20.0	20.0	1.5	0.0	0.0	13.8	27.7	64.6
1993	BA000MED	24.6	32.3	56.9	55.4	26.2	21.5	20.0	30.8	4.6	0.0	0.0	10.8	30.8	69.2
	BD120MED	29.2	35.4	64.6	69.2	24.6	20.0	20.0	26.2	3.1	0.0	0.0	10.8	29.2	69.2
	BB415MED	10.8	26.2	56.9	44.6	33.8	20.0	21.5	29.2	3.1	0.0	0.0	10.8	32.3	72.3
	BE410MED	7.7	24.6	47.7	41.5	35.4	16.9	32.3	33.8	4.6	0.0	0.0	12.3	38.5	81.5
	BA430MED	33.8	38.5	64.6	60.0	23.1	21.5	18.5	26.2	1.5	0.0	0.0	10.8	30.8	72.3
	BC440MED	24.6	32.3	56.9	55.4	26.2	21.5	20.0	30.8	4.6	0.0	0.0	10.8	30.8	69.2
1995	BA000MED	27.7	36.9	58.5	60.0	27.7	21.5	35.4	21.5	1.5	0.0	0.0	1.5	35.4	69.2
	BD120MED	44.6	41.5	61.5	61.5	23.1	21.5	35.4	21.5	1.5	0.0	0.0	1.5	32.3	69.2
	BB415MED	18.5	32.3	53.8	52.3	26.2	21.5	30.8	26.2	1.5	0.0	0.0	1.5	35.4	70.8
	BE410MED	12.3	27.7	45.1	27.7	35.4	23.1	33.8	29.2	1.5	0.0	0.0	1.5	38.5	75.4
	BA430MED	49.2	46.2	61.5	53.8	21.5	27.7	35.4	26.2	3.1	0.0	0.0	4.6	35.4	70.8
	BC440MED	27.7	36.9	58.5	60.0	27.7	21.5	35.4	21.5	1.5	0.0	0.0	1.5	35.4	69.2
1997	BA000MED	20.0	44.6	52.3	56.9	21.5	20.0	24.6	33.8	6.2	0.0	0.0	3.1	24.6	69.2
	BD120MED	24.6	44.6	61.5	63.1	20.0	18.5	21.5	35.4	6.2	0.0	0.0	3.1	24.6	67.7
	BB415MED	27.7	36.9	55.4	49.2	23.1	18.5	21.5	33.8	7.7	0.0	0.0	3.1	23.1	66.2
	BE410MED	3.1	23.1	41.5	27.7	24.6	16.9	23.1	36.9	1.5	0.0	0.0	6.2	27.7	73.8
	BA430MED	40.0	60.0	64.6	55.4	18.5	16.9	15.4	35.4	6.2	0.0	0.0	4.6	23.1	67.7
	BC440MED	20.0	44.6	52.3	56.9	21.5	20.0	24.6	33.8	6.2	0.0	0.0	3.1	24.6	69.2
2001	BA000MED	27.7	43.1	55.4	52.3	33.8	26.2	35.4	24.6	6.2	0.0	0.0	4.7	9.4	50.0
	BD120MED	30.8	44.6	55.4	58.5	33.8	23.1	30.8	21.5	4.6	0.0	0.0	4.7	9.4	45.3
	BB415MED	20.0	33.8	58.5	58.5	36.9	29.2	33.8	21.5	6.2	0.0	0.0	3.1	6.3	42.2
	BE410MED	9.2	24.6	43.1	47.7	40.0	26.2	32.3	26.2	9.2	0.0	0.0	3.1	6.3	46.9
	BA430MED	40.0	46.2	58.5	53.8	30.8	24.6	20.0	18.5	0.0	0.0	0.0	4.7	9.4	43.8
	BC440MED	27.7	43.1	55.4	52.3	33.8	26.2	35.4	24.6	6.2	0.0	0.0	4.7	9.4	50.0
2005	BA000MED	43.8	37.5	64.1	57.8	25.0	25.0	34.4	28.1	1.6	0.0	0.0	10.9	34.4	76.6
	BD120MED	43.8	46.9	65.6	64.1	28.1	25.0	35.9	26.6	1.6	0.0	0.0	10.9	34.4	73.4
	BB415MED	40.6	35.9	60.9	64.1	28.1	29.7	32.8	26.6	1.6	0.0	0.0	10.9	25.0	59.4
	BE410MED	35.9	29.7	50.0	53.1	35.9	23.4	39.1	29.7	1.6	0.0	0.0	10.9	26.6	59.4
	BA430MED	56.3	56.3	68.8	67.2	29.7	23.4	21.9	23.4	1.6	0.0	0.0	9.4	32.8	70.3
	BC440MED	43.8	37.5	64.1	57.8	25.0	25.0	34.4	28.1	1.6	0.0	0.0	10.9	34.4	76.6

Table H-1i-4

THE FREQUENCY OF FLOWS LESS THAN 3.5 KCFS (%)
COMPARISONS FOR PROJECT: COLUMBIA FALLS

YEAR	STUDY	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR1	APR2	MAY	JUNE	JULY	AUG1	AUG2
1991	BA000MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BD120MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BE410MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BB415MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BA430MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BC440MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	BA000MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BD120MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BE410MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BB415MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BA430MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BC440MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	BA000MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BD120MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BE410MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BB415MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BA430MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BC440MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	BA000MED	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0
	BD120MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BE410MED	0.0	0.0	0.0	0.0	0.0	0.0	3.1	1.5	0.0	0.0	0.0	0.0	0.0	0.0
	BB415MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0
	BA430MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BC440MED	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.5	0.0	0.0	0.0	0.0	0.0	0.0
2001	BA000MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BD120MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BE410MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BB415MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BA430MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BC440MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	BA000MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BD120MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BE410MED	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BB415MED	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BA430MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	BC440MED	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table H-1i-5

COMPARISONS FOR PLANT: COLUMBIA FALLS
MEAN CHANGE IN END OF PERIOD FLOWS,KCFS

STUDY	YEAR	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR1	APR2	MAY	JUNE	JULY	AUG1	AUG2
BA000MED	1991	5.8	4.8	4.6	4.3	9.0	9.1	7.9	7.8	15.1	23.8	23.1	11.0	5.9	4.5
BD120MED	1991	-0.3	0.0	-0.1	0.0	0.0	0.1	0.2	0.0	-0.1	0.1	0.1	-0.1	-0.1	-0.1
BE410MED	1991	3.3	-0.1	0.0	0.2	-0.8	-0.3	-0.5	-0.2	0.4	-0.3	-0.3	-0.3	-0.3	-0.2
BB415MED	1991	2.0	-0.1	0.0	0.0	-0.6	-0.3	-0.5	-0.1	0.2	-0.1	-0.1	-0.1	0.0	0.1
BA430MED	1991	-1.0	-0.1	-0.1	-0.1	0.3	0.3	0.3	0.2	0.0	0.2	0.0	0.0	-0.3	-0.1
BC440MED	1991	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BA000MED	1993	6.5	4.5	4.2	4.1	8.8	8.4	7.2	6.6	16.9	23.4	23.0	10.8	6.0	4.7
BD120MED	1993	-0.5	0.0	0.0	-0.1	0.3	0.2	0.2	0.1	0.3	0.0	0.0	0.0	-0.1	0.0
BE410MED	1993	2.5	0.0	0.1	0.2	-0.3	-0.4	-0.8	-0.3	-0.2	-0.3	-0.1	-0.2	-0.6	-0.6
BB415MED	1993	0.9	0.0	0.0	0.1	-0.2	-0.1	-0.4	0.0	0.2	-0.2	0.0	0.0	-0.2	-0.2
BA430MED	1993	-1.0	0.0	0.0	0.0	0.5	0.5	0.2	0.1	0.2	0.1	0.0	-0.1	-0.3	-0.1
BC440MED	1993	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BA000MED	1995	6.4	5.2	4.7	4.3	8.5	8.3	7.3	8.1	15.8	23.5	22.9	10.1	5.9	5.0
BD120MED	1995	-0.6	0.0	0.0	0.0	0.4	0.2	0.1	0.0	-0.2	0.1	0.0	0.1	0.0	-0.1
BE410MED	1995	2.3	-0.3	0.0	0.3	0.0	-0.4	-0.3	-0.2	0.4	-0.3	-0.3	-0.1	-0.3	-0.7
BB415MED	1995	0.3	-0.1	0.0	0.1	0.4	-0.1	0.1	-0.2	[illegible]	0.0	-0.1	0.0	-0.2	-0.3
BA430MED	1995	-1.1	-0.1	0.0	0.1	0.8	0.1	0.2	0.0	0.1	0.0	0.0	-0.2	-0.2	-0.3
BC440MED	1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BA000MED	1997	6.5	4.6	4.4	4.2	8.7	8.8	7.6	7.3	14.9	22.3	25.8	11.3	6.1	4.8
BD120MED	1997	-0.3	0.0	-0.1	-0.1	0.0	0.2	0.2	-0.1	0.0	0.0	0.1	0.0	-0.1	0.0
BE410MED	1997	2.2	0.0	0.1	0.3	-0.4	-0.3	-0.7	-0.2	0.7	-0.1	-0.5	-0.4	-0.6	-0.7
BB415MED	1997	-0.2	0.1	0.0	0.1	-0.1	-0.1	0.0	0.0	-0.2	0.0	0.0	0.0	0.0	0.0
BA430MED	1997	-1.1	-0.1	0.0	0.1	0.2	0.3	0.5	0.0	0.0	0.1	0.1	-0.1	-0.3	-0.3
BC440MED	1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BA000MED	2001	6.8	4.5	4.3	4.2	7.8	7.8	6.6	6.6	15.2	21.6	24.3	11.4	7.1	5.6
BD120MED	2001	-0.7	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.1	0.0	0.0	0.0	-0.1	0.0
BE410MED	2001	1.1	0.0	0.1	0.0	0.0	-0.3	0.0	-0.1	-0.4	0.0	-0.5	0.0	-0.2	-0.3
BB415MED	2001	0.1	0.0	0.0	0.0	-0.1	0.3	0.0	0.3	0.1	0.0	-0.2	0.0	0.2	0.3
BA430MED	2001	-1.0	0.0	0.0	0.0	0.2	0.4	0.7	0.3	0.5	0.0	0.1	0.0	-0.1	0.2
BC440MED	2001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BA000MED	2005	5.6	4.7	4.2	4.0	8.3	8.1	6.6	6.9	15.1	22.3	23.0	10.2	6.0	4.7
BD120MED	2005	-0.3	0.0	0.0	0.0	-0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
BE410MED	2005	0.4	0.1	0.1	0.0	-0.3	-0.1	0.0	-0.2	0.2	0.0	-0.4	0.0	0.2	0.5
BB415MED	2005	0.0	0.0	0.0	0.0	-0.1	0.1	0.2	0.0	0.1	0.0	-0.2	0.1	0.3	0.6
BA430MED	2005	-0.7	-0.2	-0.1	0.0	0.0	0.1	0.5	0.2	0.7	0.1	0.1	0.1	0.2	0.1
BC440MED	2005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

H-1j

RESERVOIR ELEVATIONS AND DIFFERENCES

Hungry Horse

Grand Coulee

Libby

Dworshak

Table H-1j-1

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Base Study: BA000MED : PSCEIS : BASE CASE BPAHYSUM Summary
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent) Date: 3-JAN-89 06:55:28

****

Hungry Horse Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	3553.0	3548.3	3542.8	3536.5	3518.3	3504.0	3496.9	3499.7	3502.6	3528.0	3537.0	3524.6	3514.6	3506.6	3524.9
1990	27	3546.2	3542.1	3537.3	3531.6	3516.6	3504.4	3497.4	3500.9	3504.0	3527.6	3533.2	3519.8	3508.1	3500.6	3521.7
1991	26	3533.4	3528.1	3522.1	3514.9	3497.3	3484.1	3474.2	3476.8	3481.0	3511.5	3519.0	3506.3	3498.1	3491.6	3505.3
1992	18	3539.6	3534.4	3528.0	3520.5	3502.2	3482.4	3468.1	3470.3	3474.4	3505.1	3512.0	3494.4	3482.6	3471.9	3502.7
1993	21	3535.7	3531.6	3526.4	3520.2	3504.2	3488.2	3476.3	3479.1	3481.8	3509.6	3514.1	3494.2	3481.8	3470.4	3504.4
1994	30	3529.8	3523.9	3517.5	3509.6	3488.9	3469.0	3450.4	3451.3	3457.2	3492.7	3505.9	3494.1	3484.5	3474.8	3492.8
1995	31	3540.5	3535.0	3528.8	3521.7	3501.3	3482.0	3464.7	3466.7	3473.1	3504.3	3509.6	3493.0	3482.9	3473.5	3502.3
1996	29	3536.9	3531.5	3525.9	3518.5	3499.3	3478.9	3463.8	3467.2	3471.5	3503.3	3511.4	3495.5	3484.4	3474.7	3500.9
1997	29	3539.8	3534.6	3528.8	3521.7	3502.5	3487.9	3476.9	3480.9	3485.5	3513.4	3522.3	3505.6	3494.8	3483.2	3508.5
1998	23	3515.0	3509.0	3502.3	3493.6	3472.1	3452.3	3434.9	3438.2	3442.9	3480.0	3486.4	3470.9	3460.6	3453.7	3476.1
1999	33	3529.3	3523.1	3516.6	3508.3	3490.6	3477.1	3469.1	3473.5	3478.6	3503.9	3512.3	3493.8	3482.8	3472.6	3498.0
2000	27	3532.5	3527.9	3522.4	3515.6	3499.2	3483.9	3474.4	3478.3	3484.4	3511.6	3510.5	3488.1	3473.4	3460.6	3500.9
2001	31	3528.4	3522.6	3515.8	3507.6	3488.4	3471.6	3458.8	3462.9	3470.1	3501.3	3505.1	3489.0	3477.3	3468.3	3493.9
2002	25	3536.4	3530.4	3523.9	3516.0	3496.7	3479.3	3466.4	3469.4	3474.3	3503.8	3508.1	3490.1	3477.8	3465.1	3499.2
2003	23	3527.6	3521.3	3514.2	3506.0	3484.9	3467.0	3451.8	3454.4	3461.7	3493.4	3502.1	3487.4	3477.5	3469.8	3490.6
2004	24	3537.8	3533.4	3528.3	3521.7	3506.1	3493.1	3485.3	3487.9	3490.4	3517.0	3517.1	3498.0	3484.2	3472.3	3508.4
2005	30	3531.8	3526.7	3520.8	3513.6	3495.5	3482.3	3474.0	3478.3	3483.4	3510.3	3511.9	3494.4	3482.0	3470.2	3501.2
2006	32	3535.0	3530.5	3524.9	3517.9	3499.8	3484.5	3475.3	3478.8	3483.4	3512.2	3520.6	3505.6	3493.7	3481.6	3505.9
2007	23	3539.8	3534.9	3529.5	3522.7	3505.3	3492.3	3483.9	3487.0	3490.7	3518.0	3516.7	3493.3	3478.8	3465.6	3507.7
2008	26	3517.8	3512.1	3505.6	3496.8	3478.4	3463.1	3452.0	3452.9	3455.2	3487.3	3499.3	3487.8	3477.8	3468.4	3485.3
AVERAGE		3534.2	3529.0	3523.0	3515.6	3497.2	3481.3	3469.7	3472.7	3477.4	3506.7	3512.9	3496.5	3485.1	3475.0	3501.5

Table H-1j-1

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2 — Date: 6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
Hungry Horse Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	-0.1	-0.1	-0.1	0.0
1990	27	0.1	0.1	0.1	0.1	0.8	1.3	1.7	1.7	1.1	0.9	1.2	1.5	1.7	1.4	0.9
1991	26	2.9	3.1	3.8	4.4	6.4	6.9	7.2	7.3	5.6	4.4	3.7	4.1	4.0	3.7	4.7
1992	18	2.3	2.5	3.2	3.6	4.4	6.5	7.7	7.6	7.4	5.9	6.4	7.8	7.1	4.9	5.2
1993	21	2.7	2.9	3.4	3.8	5.0	6.6	9.1	8.7	8.5	6.8	6.3	6.9	6.4	4.8	5.6
1994	30	2.0	2.2	2.2	2.4	4.8	6.0	9.4	10.6	10.2	7.6	7.0	8.1	8.1	6.2	5.7
1995	31	0.6	0.6	0.7	0.8	2.8	5.2	7.7	8.3	8.6	6.7	6.4	7.4	6.0	5.3	4.4
1996	29	1.2	1.3	1.4	1.6	3.2	4.5	7.9	7.5	7.9	6.3	5.1	5.0	4.4	3.4	4.1
1997	29	1.1	1.3	1.4	1.8	3.6	4.5	4.7	4.3	4.5	3.5	3.1	3.4	2.7	1.9	2.9
1998	23	4.5	4.6	4.8	5.1	7.8	10.1	10.7	11.2	10.1	8.2	7.2	6.4	6.3	4.9	7.0
1999	33	2.0	2.1	2.1	2.1	3.3	4.2	4.8	4.6	4.3	3.6	3.0	3.1	2.3	0.9	3.0
2000	27	3.1	3.2	3.3	3.5	5.4	7.5	8.0	7.6	6.9	5.8	5.2	5.5	5.4	3.6	5.1
2001	31	3.5	3.6	3.9	4.4	6.0	6.0	6.1	6.0	5.6	4.4	4.5	5.2	5.1	2.6	4.6
2002	25	1.8	1.8	1.9	2.4	5.2	5.8	9.5	9.4	9.0	6.6	5.6	5.3	4.3	3.5	4.9
2003	23	2.9	3.1	3.2	3.4	4.9	7.2	8.9	10.1	9.4	7.3	6.3	6.7	6.7	6.0	5.8
2004	24	3.0	3.1	3.3	3.7	5.5	6.0	6.9	6.8	6.4	5.2	5.7	6.4	6.8	4.1	4.9
2005	30	2.0	2.2	2.5	2.9	6.4	6.9	7.7	7.3	6.7	5.5	6.2	7.1	7.3	6.0	5.2
2006	32	2.2	2.5	2.8	3.0	4.1	5.9	6.9	6.7	5.8	4.9	4.6	4.9	5.6	5.4	4.4
2007	23	1.0	1.2	1.3	1.4	3.7	4.1	5.0	4.8	3.5	3.0	3.8	4.6	4.9	2.6	2.9
2008	26	1.8	1.9	1.9	2.4	4.8	5.4	6.5	6.8	8.4	6.5	6.1	6.4	6.3	4.7	4.7
AVERAGE		2.0	2.1	2.3	2.6	4.4	5.5	6.7	6.8	6.4	5.1	4.8	5.2	5.0	3.8	4.2

Table H-1j-1

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410   Date: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
Hungry Horse Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	-6.0	-6.3	-7.9	-9.7	-15.6	-24.2	-37.7	-39.0	-37.5	-30.5	-26.1	-18.1	-12.9	-7.3	-18.9
1990	27	-4.8	-5.4	-7.4	-9.6	-13.1	-18.8	-23.6	-23.4	-21.5	-17.7	-13.5	-6.4	-2.4	2.5	-11.6
1991	26	-7.1	-7.9	-9.3	-11.3	-21.2	-34.3	-41.7	-41.9	-41.1	-32.4	-24.2	-18.4	-15.1	-12.5	-21.8
1992	18	-4.5	-5.2	-5.2	-6.6	-12.3	-15.6	-21.1	-23.4	-24.3	-18.5	-11.8	-4.0	-0.3	3.6	-10.4
1993	21	-3.2	-3.7	-5.2	-7.2	-11.6	-16.1	-15.9	-15.6	-14.4	-11.7	-7.1	0.4	4.8	11.2	-7.0
1994	30	-4.0	-4.7	-6.3	-8.3	-14.5	-21.9	-23.4	-25.7	-28.6	-21.7	-16.5	-12.3	-8.3	-4.4	-13.9
1995	31	-5.9	-6.6	-8.1	-10.1	-14.8	-19.4	-20.3	-20.0	-20.2	-16.3	-10.5	-6.1	-3.8	0.6	-11.5
1996	29	-4.5	-4.8	-6.3	-7.9	-9.7	-13.8	-16.3	-17.7	-17.3	-13.5	-9.0	-2.8	-0.9	2.7	-8.6
1997	29	-7.6	-8.3	-10.1	-12.2	-11.7	-16.2	-17.2	-17.9	-16.3	-13.9	-9.7	2.7	6.1	11.9	-9.0
1998	23	3.4	2.6	1.7	0.3	-8.2	-11.4	-10.1	-10.7	-8.7	-6.4	-2.9	-0.6	3.2	6.7	-2.8
1999	33	-1.3	-1.5	-2.6	-3.5	-3.5	-2.8	-0.3	-0.3	0.2	-0.2	3.0	9.2	10.6	11.4	0.7
2000	27	1.5	0.9	-0.2	-1.3	-4.8	-5.7	-6.0	-5.9	-5.6	-4.0	1.1	0.9	2.3	5.3	-1.5
2001	31	-0.7	-1.4	-1.9	-2.9	-5.1	-4.6	-5.4	-6.0	-5.0	-4.1	1.8	2.5	3.8	4.9	-1.8
2002	25	0.6	0.6	0.6	1.0	1.9	2.4	4.4	4.6	4.6	3.3	7.1	8.0	7.4	7.1	3.5
2003	23	2.0	1.5	1.5	0.8	3.1	6.3	10.6	11.6	11.2	9.2	12.6	14.6	14.3	11.6	7.1
2004	24	4.0	3.7	3.3	3.2	2.0	-0.4	-3.5	-3.5	-2.8	-2.2	2.1	1.2	3.4	3.6	1.2
2005	30	0.1	-0.2	-0.7	-1.3	-1.6	-3.1	-4.9	-4.7	-5.2	-4.2	0.0	0.9	1.8	4.0	-1.4
2006	32	-1.8	-1.8	-2.0	-2.1	-3.9	-5.7	-6.9	-6.9	-6.8	-5.8	-0.6	1.5	2.8	2.8	-2.7
2007	23	-0.5	-0.8	-1.2	-1.9	-4.5	-7.5	-10.0	-9.7	-9.9	-7.6	-2.3	-2.1	-0.5	0.8	-3.9
2008	26	1.4	1.5	1.0	1.1	0.1	-1.3	-2.3	-1.9	-1.6	-2.7	0.7	1.4	3.0	4.0	0.3
AVERAGE		-2.0	-2.5	-3.4	-4.6	-7.4	-10.7	-12.4	-12.8	-12.4	-10.0	-5.2	-1.3	1.0	3.5	-5.7

Table H-1j-1

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415 Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
Hungry Horse Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	-5.5	-5.7	-7.2	-9.0	-12.6	-18.1	-22.9	-23.4	-23.7	-18.5	-17.3	-14.8	-13.2	-9.6	-13.8
1990	27	-4.8	-5.2	-6.8	-8.9	-9.6	-9.5	-9.9	-9.5	-9.0	-7.4	-4.9	-2.7	-2.2	-2.1	-6.7
1991	26	-6.7	-7.4	-8.6	-10.3	-15.4	-21.0	-22.6	-22.4	-19.6	-15.0	-11.3	-9.3	-8.6	-8.1	-12.9
1992	18	-2.4	-3.0	-3.1	-3.6	-6.5	-6.7	-6.0	-7.3	-8.2	-5.9	-2.3	-1.1	0.2	1.8	-3.9
1993	21	-1.8	-2.1	-2.3	-3.0	-2.9	-3.1	-0.8	-0.7	1.3	0.9	2.4	5.1	6.7	8.3	0.2
1994	30	-0.9	-1.2	-1.8	-2.7	-4.3	-4.5	-2.2	-1.3	-0.4	-0.6	0.4	1.1	2.0	3.8	-1.1
1995	31	-1.2	-1.4	-1.7	-1.9	-1.9	-1.6	0.6	1.6	1.9	1.5	3.1	4.2	4.0	4.8	0.5
1996	29	0.4	0.3	-0.2	-0.1	-2.3	-1.8	-0.3	-0.4	0.5	0.7	2.7	3.5	3.4	3.6	0.6
1997	29	-0.7	-0.9	-0.9	-0.9	-0.3	1.4	2.5	2.5	4.0	3.1	4.6	8.8	8.2	9.1	2.5
1998	23	4.7	4.6	4.6	4.9	5.9	8.3	8.1	8.0	7.6	6.2	6.4	6.6	6.3	6.2	6.2
1999	33	2.7	2.8	2.8	3.1	3.0	4.0	4.6	4.5	4.3	3.6	5.0	5.8	4.4	1.7	3.6
2000	27	5.1	5.3	5.3	5.7	5.1	4.5	2.8	2.6	1.2	1.1	3.4	0.9	0.6	0.0	3.4
2001	31	0.8	0.7	0.8	1.1	-0.2	-4.2	-8.3	-9.5	-9.9	-7.7	-4.5	-5.8	-5.6	-5.8	-3.6
2002	25	-1.7	-1.7	-1.7	-1.7	-1.7	-4.7	-8.7	-8.4	-9.2	-7.8	-7.2	-8.2	-7.9	-7.7	-5.2
2003	23	-0.3	-0.4	-0.2	-0.1	2.7	6.0	8.6	9.6	8.4	7.5	9.7	10.9	10.9	8.8	5.1
2004	24	4.6	4.6	4.5	4.8	3.2	1.8	-1.5	-1.4	-1.8	-1.4	1.9	2.4	3.3	2.2	2.1
2005	30	2.1	1.9	1.9	1.6	0.7	-1.3	-5.2	-5.1	-5.8	-4.8	-2.2	-2.3	-2.0	-0.9	-1.2
2006	32	-0.1	-0.4	-0.5	-0.8	-2.1	-4.0	-5.8	-6.2	-6.1	-5.0	-1.9	-0.3	-0.2	-0.7	-2.3
2007	23	1.0	1.5	1.8	1.6	0.6	-3.1	-8.6	-8.3	-8.4	-6.8	-5.0	-3.6	-2.5	-0.6	-2.5
2008	26	3.3	3.2	3.1	3.3	2.6	1.0	0.7	0.9	1.0	0.1	1.7	2.6	3.8	4.2	2.2
AVERAGE		0.0	-0.2	-0.4	-0.8	-1.7	-2.8	-3.7	-3.6	-3.5	-2.7	-0.7	0.2	0.5	0.9	-1.3

Table H-1j-1

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BA430MED : PSCEIS : ALT43 Date: 21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
Hungry Horse Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	2.0	3.0	3.8	5.0	8.8	12.6	12.6	11.5	9.4	7.5	7.5	11.5	14.5	18.4	8.5
1990	27	4.9	5.4	5.8	6.3	7.0	7.4	6.5	5.9	4.4	3.6	2.5	5.7	7.9	10.9	5.9
1991	26	8.5	9.2	10.3	11.5	16.1	18.4	18.9	18.4	15.2	12.0	11.1	12.2	13.4	14.9	13.2
1992	18	4.3	4.8	5.7	6.3	9.2	12.8	16.6	16.4	15.2	11.7	14.2	20.9	22.9	25.3	12.2
1993	21	8.7	9.1	9.8	10.4	12.8	15.4	19.3	18.6	16.8	14.0	15.4	21.4	22.8	22.7	14.7
1994	30	8.5	9.1	9.7	10.4	12.7	15.0	19.2	19.4	17.8	13.7	13.4	18.6	19.2	19.3	14.0
1995	31	7.1	7.6	8.0	9.0	13.3	17.8	21.7	22.9	21.7	17.2	18.3	23.2	23.1	22.7	15.6
1996	29	5.7	6.4	6.6	7.5	10.3	13.2	16.6	16.0	15.5	12.1	11.9	16.1	16.3	15.9	11.5
1997	29	3.4	3.8	4.2	4.8	8.6	8.6	9.6	9.2	9.4	7.5	7.5	13.1	13.6	14.4	7.9
1998	23	12.0	12.5	13.1	14.6	18.2	20.8	19.7	19.3	18.1	15.0	13.3	13.8	14.1	12.8	15.3
1999	33	3.9	4.6	4.9	5.4	10.7	14.2	16.5	15.9	14.2	14.5	14.2	21.5	22.0	21.7	12.2
2000	27	11.0	11.6	12.3	13.4	17.9	21.5	23.8	23.1	21.1	17.3	19.7	26.0	27.3	26.6	18.5
2001	31	9.1	9.7	10.6	12.0	14.9	17.4	18.9	18.4	16.6	13.3	13.5	15.5	16.1	14.6	13.8
2002	25	3.8	4.2	4.5	5.0	7.3	7.9	9.5	9.5	8.9	6.4	5.1	9.3	9.4	13.7	7.1
2003	23	8.8	9.5	10.5	11.7	20.1	28.4	37.8	38.1	33.6	28.6	29.0	32.2	33.1	31.1	23.5
2004	24	8.1	8.6	9.2	10.3	12.1	13.6	14.4	14.0	12.9	10.6	13.8	16.7	18.6	17.6	12.3
2005	30	7.0	7.6	8.2	9.1	14.2	15.2	15.8	15.1	12.7	10.6	11.9	11.7	11.1	9.7	11.1
2006	32	4.9	5.2	5.6	6.4	9.6	10.6	12.0	11.4	10.4	8.4	11.0	14.6	16.2	17.1	9.7
2007	23	3.9	4.4	5.2	5.9	10.2	9.3	9.0	8.7	8.1	6.4	9.6	13.1	14.3	12.9	8.2
2008	26	10.6	11.6	12.4	14.4	16.8	15.7	14.9	15.7	16.7	16.3	15.9	16.2	17.5	16.8	14.9
AVERAGE		6.8	7.4	8.0	8.9	12.5	14.7	16.6	16.3	14.9	12.3	12.9	16.6	17.5	17.8	12.4

Table H-1j-1

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BC440MED : PSCEIS : ALT44 Date: 28-JAN-89 06:06:31
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
Hungry Horse Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2007	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVERAGE		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table H-1j-2

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Hungry Horse Res Elev (feet)

YEAR	/ NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	3554.2	3551.3	3549.5	3546.8	3527.4	3507.9	3490.4	3490.0	3491.3	3524.4	3553.5	3559.2	3558.6	3557.6	3534.5
1990	154	3544.8	3542.6	3541.8	3539.7	3522.6	3503.7	3487.0	3487.4	3489.6	3523.1	3552.5	3558.3	3557.9	3556.9	3530.2
1991	154	3544.2	3541.3	3540.3	3538.3	3521.2	3503.1	3486.6	3486.7	3489.4	3524.1	3553.1	3558.7	3557.9	3556.6	3529.7
1992	160	3539.5	3537.2	3535.6	3533.2	3515.9	3497.1	3481.1	3481.6	3484.7	3520.9	3551.2	3557.4	3556.5	3555.0	3525.7
1993	155	3540.2	3537.7	3536.7	3534.2	3516.5	3498.6	3482.8	3483.1	3486.5	3521.0	3550.5	3556.4	3555.5	3554.1	3526.3
1994	155	3540.0	3537.8	3536.8	3534.5	3517.2	3499.3	3483.7	3483.7	3487.0	3522.4	3551.5	3556.9	3555.7	3553.8	3526.7
1995	154	3530.7	3529.0	3528.6	3526.7	3510.7	3494.1	3478.0	3478.2	3482.3	3519.2	3549.6	3555.5	3554.4	3552.4	3521.4
1996	148	3531.9	3529.7	3529.2	3527.2	3512.0	3496.0	3481.2	3481.5	3484.4	3521.2	3551.2	3557.1	3556.2	3554.7	3523.0
1997	155	3534.3	3531.9	3531.0	3528.4	3511.2	3493.0	3476.7	3477.1	3479.7	3516.4	3548.2	3554.6	3553.7	3552.2	3521.5
1998	155	3534.6	3532.8	3532.3	3530.5	3514.0	3496.0	3479.8	3480.4	3484.8	3519.5	3549.5	3555.9	3555.1	3553.5	3523.6
1999	149	3533.8	3530.8	3530.1	3527.8	3510.6	3492.5	3476.2	3476.6	3478.7	3516.5	3548.9	3555.2	3554.4	3552.9	3521.2
2000	151	3530.0	3528.5	3528.5	3526.7	3510.5	3492.5	3476.0	3476.6	3481.3	3519.0	3549.4	3555.7	3555.4	3554.4	3521.1
2001	152	3533.1	3531.5	3530.4	3528.5	3512.6	3496.3	3480.6	3481.0	3484.4	3520.1	3550.3	3557.1	3556.1	3554.4	3523.3
2002	157	3533.3	3530.3	3528.9	3526.1	3510.6	3493.6	3478.0	3478.4	3481.2	3517.5	3548.5	3554.7	3553.7	3551.9	3521.2
2003	163	3534.5	3532.7	3532.1	3530.0	3513.6	3496.5	3479.8	3480.1	3484.3	3520.5	3550.2	3556.6	3555.7	3554.2	3523.8
2004	146	3537.5	3535.1	3534.1	3532.1	3515.4	3497.8	3481.9	3482.1	3485.2	3521.2	3551.1	3557.2	3556.4	3555.1	3525.3
2005	151	3540.1	3537.6	3536.6	3534.8	3516.9	3497.9	3481.3	3481.9	3484.5	3518.3	3550.3	3557.0	3556.2	3554.8	3525.9
2006	145	3534.7	3531.8	3530.6	3528.0	3511.4	3493.2	3477.6	3478.2	3482.3	3520.2	3549.9	3555.9	3555.5	3554.5	3522.5
2007	155	3533.3	3530.5	3529.6	3527.3	3511.6	3494.9	3479.7	3480.4	3482.8	3517.3	3548.1	3554.3	3553.6	3552.4	3521.8
2008	159	3537.8	3535.6	3535.3	3533.8	3516.3	3497.6	3480.9	3481.3	3483.7	3519.1	3550.7	3556.5	3556.0	3555.0	3525.2
AVERAGE		3537.1	3534.8	3533.9	3531.7	3514.9	3497.1	3481.0	3481.3	3484.4	3520.1	3550.4	3556.5	3555.7	3554.3	3524.7

Table H-1j-2

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2   Date: 6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
Hungry Horse Res Elev (feet)

YEAR / NUM		SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0:0	0.0	0.0	0.0	0.1	0.1	0.0
1990	154	0.3	0.3	0.3	0.4	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2
1991	154	0.7	0.7	0.9	1.1	0.9	0.7	0.2	0.1	0.4	0.0	0.0	0.0	0.2	0.4	0.5
1992	160	2.3	2.1	2.3	2.5	1.9	1.4	0.9	0.8	0.9	0.4	0.2	0.2	0.4	0.6	1.3
1993	155	2.1	2.1	2.2	2.4	1.9	1.4	0.8	0.8	0.7	0.3	0.2	0.2	0.4	0.5	1.2
1994	155	1.1	1.2	1.2	1.3	1.1	0.9	0.6	0.5	0.5	0.2	0.2	0.1	0.3	0.5	0.7
1995	154	2.8	2.8	2.9	2.9	2.4	1.8	1.6	1.4	1.3	0.8	0.6	0.5	0.6	1.0	1.8
1996	148	2.0	2.0	2.1	2.2	1.7	1.4	0.9	0.8	0.9	0.5	0.2	0.2	0.3	0.4	1.2
1997	155	1.6	1.6	1.8	2.1	2.1	1.7	1.3	1.3	1.2	0.8	0.6	0.6	0.7	0.8	1.3
1998	155	2.0	1.7	1.8	1.8	1.2	0.8	0.5	0.6	0.3	0.2	0.1	0.1	0.3	0.5	0.9
1999	149	2.3	2.4	2.4	2.5	1.9	1.6	1.1	1.2	1.1	0.6	0.5	0.4	0.5	0.8	1.5
2000	151	1.5	1.5	1.5	1.7	1.5	1.2	0.8	0.8	0.7	0.3	0.1	0.1	0.2	0.3	0.9
2001	152	2.2	2.2	2.2	2.3	2.1	1.7	1.0	0.9	0.7	0.4	0.3	0.2	0.4	0.7	1.3
2002	157	1.9	2.0	2.0	2.0	1.9	1.5	1.5	1.7	1.5	1.0	0.7	0.6	0.8	1.1	1.5
2003	163	2.9	2.9	2.9	3.0	2.6	1.9	1.6	1.3	1.0	0.6	0.5	0.3	0.5	0.6	1.7
2004	146	2.0	2.0	2.1	2.0	1.7	1.4	0.9	0.7	0.4	0.2	0.1	0.0	0.2	0.4	1.1
2005	151	1.5	1.7	1.8	1.9	2.0	1.5	1.3	1.2	0.9	0.6	0.4	0.3	0.4	0.6	1.2
2006	145	2.2	2.3	2.4	2.4	2.1	1.8	1.4	1.1	0.8	0.5	0.4	0.4	0.4	0.5	1.4
2007	155	2.3	2.3	2.4	2.4	2.1	1.6	1.6	1.7	1.5	1.0	0.7	0.6	0.8	0.9	1.6
2008	159	1.8	1.8	1.9	2.0	1.7	1.3	1.0	1.0	0.8	0.6	0.4	0.3	0.4	0.6	1.2
AVERAGE		1.8	1.8	1.9	1.9	1.7	1.3	0.9	0.9	0.8	0.5	0.3	0.3	0.4	0.6	1.1

Table H-1j-2

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410 Date: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
Hungry Horse Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	-6.0	-5.7	-5.8	-6.4	-5.1	-4.4	-2.5	-2.2	-3.1	-1.3	-0.4	-0.2	0.3	0.8	-3.3
1990	154	-5.3	-5.1	-5.4	-5.9	-5.6	-4.8	-2.6	-2.0	-2.2	-1.3	-0.9	-0.8	-0.4	0.0	-3.3
1991	154	-8.1	-8.1	-8.4	-8.9	-7.1	-6.0	-3.8	-3.3	-3.7	-1.7	-1.0	-0.6	0.0	0.7	-4.7
1992	160	-6.5	-6.5	-6.4	-6.8	-6.2	-5.0	-3.3	-2.7	-2.4	-1.2	-0.8	-0.4	0.3	1.1	-3.7
1993	155	-6.3	-6.3	-6.6	-7.2	-5.9	-4.3	-1.9	-1.4	-1.9	-0.8	-0.4	-0.3	0.3	1.0	-3.4
1994	155	-4.6	-4.7	-4.8	-5.6	-5.1	-4.4	-3.0	-2.4	-1.9	-0.9	-0.3	-0.1	0.8	1.8	-2.8
1995	154	-5.3	-5.2	-5.4	-6.3	-6.3	-5.6	-3.7	-3.1	-3.5	-1.4	-0.9	-0.8	0.0	1.2	-3.6
1996	148	-5.2	-5.4	-5.8	-6.7	-5.8	-4.6	-2.9	-2.1	-2.3	-1.1	-0.4	-0.3	0.3	1.0	-3.3
1997	155	-4.8	-4.3	-4.4	-5.1	-4.7	-3.3	-1.5	-1.1	-1.5	-0.8	-0.1	0.1	0.7	1.4	-2.4
1998	155	-3.9	-3.4	-3.6	-4.5	-4.6	-2.9	-2.0	-1.5	-2.1	-0.7	-0.2	0.0	0.5	1.3	-2.2
1999	149	-2.7	-2.3	-2.5	-3.1	-2.8	-2.1	-0.5	-0.2	-1.0	-0.4	-0.1	0.0	0.4	1.0	-1.4
2000	151	1.1	1.2	0.7	0.2	-0.3	0.0	1.4	1.5	0.4	0.6	0.7	0.8	0.7	0.7	0.6
2001	152	-1.3	-1.0	-1.2	-1.6	-1.7	-1.5	-0.8	-0.6	-1.0	-0.3	-0.2	-0.1	0.2	0.6	-0.8
2002	157	1.1	1.3	1.0	0.6	-0.1	-0.2	0.3	0.8	0.5	0.7	0.5	0.4	0.6	1.0	0.6
2003	163	3.1	3.0	3.0	3.0	2.6	1.9	1.6	1.4	1.0	0.5	0.4	0.2	0.1	-0.2	1.7
2004	146	1.7	1.4	1.1	0.9	0.8	1.1	0.7	0.7	0.5	0.3	0.1	0.0	-0.3	-0.7	0.6
2005	151	-0.7	-0.9	-1.2	-1.3	-0.4	-0.5	0.0	0.1	-0.4	-0.1	0.0	-0.1	-0.4	-0.9	-0.5
2006	145	-0.2	-0.2	-0.4	-0.4	-0.1	0.0	-0.4	-0.2	-0.2	0.0	0.1	0.1	-0.5	-1.4	-0.3
2007	155	-0.8	-0.9	-1.2	-1.3	-1.3	-0.8	-0.6	-0.3	-0.3	-0.2	-0.2	-0.2	-0.5	-1.0	-0.7
2008	159	-0.9	-1.4	-1.8	-2.2	-1.6	-1.5	-0.5	0.0	0.4	0.2	-0.1	-0.1	-0.4	-0.9	-0.9
AVERAGE		-2.8	-2.7	-3.0	-3.4	-3.1	-2.5	-1.3	-0.9	-1.2	-0.5	-0.2	-0.1	0.1	0.4	-1.7

Table H-1j-2

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415 Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
Hungry Horse Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	-5.6	-5.3	-5.4	-5.9	-4.6	-4.0	-2.0	-1.8	-2.4	-1.0	-0.3	-0.1	0.1	0.3	-3.0
1990	154	-5.1	-4.8	-5.1	-5.5	-5.0	-4.1	-1.8	-1.5	-2.0	-0.9	-0.6	-0.4	-0.3	-0.2	-3.0
1991	154	-5.5	-5.5	-5.7	-5.9	-4.4	-3.8	-1.7	-1.4	-1.9	-0.8	-0.3	-0.2	0.0	0.3	-3.0
1992	160	-3.9	-3.8	-3.9	-4.0	-3.7	-3.3	-2.1	-1.9	-2.1	-1.0	-0.8	-0.5	-0.3	-0.1	-2.4
1993	155	-3.2	-3.1	-3.3	-3.6	-2.8	-2.1	-0.6	-0.4	-1.0	-0.4	-0.2	-0.2	0.0	0.1	-1.7
1994	155	0.4	0.3	0.1	-0.2	-0.4	-0.2	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.5	0.1
1995	154	-0.1	-0.2	-0.3	-0.5	-1.1	-0.8	-0.6	-0.3	0.0	0.0	0.0	0.1	0.3	0.8	-0.2
1996	148	0.2	-0.2	-0.4	-0.7	-0.6	-0.6	-0.8	-0.6	-0.5	-0.3	-0.2	-0.2	-0.2	-0.3	-0.4
1997	155	0.6	0.5	0.5	0.4	0.2	0.6	0.6	0.6	0.8	0.5	0.4	0.4	0.5	0.6	0.5
1998	155	2.4	2.3	2.2	2.1	1.5	1.2	0.9	0.9	0.6	0.6	0.3	0.3	0.4	0.5	1.3
1999	149	2.6	2.7	2.8	3.1	2.7	2.0	1.5	1.5	1.4	0.8	0.6	0.5	0.2	-0.1	1.7
2000	151	2.0	1.8	1.8	1.8	1.8	1.3	0.9	0.9	0.5	0.4	0.3	0.3	-0.1	-0.6	1.0
2001	152	-0.7	-0.9	-1.1	-1.1	-1.0	-0.9	-0.5	-0.7	-1.0	-0.5	-0.4	-0.4	-0.7	-1.3	-0.8
2002	157	-1.6	-1.3	-1.5	-1.6	-1.8	-1.8	-1.2	-0.9	-1.2	-0.5	-0.3	-0.3	-0.5	-0.8	-1.2
2003	163	-0.3	-0.1	0.0	0.2	0.6	0.7	0.9	0.8	0.4	0.3	0.1	-0.1	-0.2	-0.4	0.2
2004	146	1.3	1.0	0.9	0.9	0.8	0.6	0.4	0.1	-0.2	0.0	-0.1	-0.2	-0.6	-1.0	0.4
2005	151	-0.4	-0.6	-0.6	-0.5	0.3	0.1	0.2	0.2	-0.1	0.0	-0.1	-0.2	-0.6	-1.1	-0.3
2006	145	-0.5	-0.4	-0.5	-0.4	-0.1	-0.1	-0.2	-0.3	-0.4	-0.1	0.0	0.0	-0.3	-0.8	-0.3
2007	155	0.3	0.4	0.4	0.4	0.4	0.4	0.1	0.1	0.2	-0.1	-0.1	-0.2	-0.5	-0.8	0.1
2008	159	0.2	0.0	-0.1	-0.2	-0.3	-0.2	0.0	0.2	0.6	0.5	0.4	0.3	0.0	-0.4	0.1
AVERAGE		-0.9	-0.9	-1.0	-1.1	-0.9	-0.8	-0.3	-0.2	-0.4	-0.1	-0.1	0.0	-0.1	-0.2	-0.6

Table H-1j-2

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BA430MED : PSCEIS : ALT43 — Date: 21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
Hungry Horse Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	1.9	2.8	3.3	3.7	2.6	2.4	1.1	0.3	1.3	0.7	0.4	0.0	0.0	0.1	1.7
1990	154	4.6	5.2	5.3	5.4	3.8	2.9	1.7	1.5	1.5	0.8	0.4	0.2	0.2	0.3	2.7
1991	154	3.4	4.0	4.3	4.5	3.7	3.1	1.9	1.6	1.8	1.0	0.6	0.4	0.5	0.7	2.5
1992	160	5.2	5.4	5.6	5.8	5.3	4.5	3.3	3.1	3.2	1.7	1.2	1.0	1.3	1.6	3.7
1993	155	6.0	6.2	6.4	6.7	5.8	4.9	4.0	3.7	3.4	2.0	1.5	1.3	1.7	2.1	4.2
1994	155	5.9	6.1	6.1	6.0	4.9	4.0	2.6	2.4	1.6	0.9	0.7	0.6	1.0	1.5	3.4
1995	154	7.3	7.5	7.6	7.7	5.9	5.1	4.1	3.8	3.5	2.3	1.7	1.4	1.6	2.0	4.7
1996	148	7.6	7.9	7.8	7.6	6.7	5.8	4.3	4.0	3.3	2.1	1.4	1.1	1.3	1.6	4.8
1997	155	6.2	6.6	6.7	6.9	6.4	5.8	4.5	4.4	4.3	2.8	2.3	2.0	2.2	2.5	4.8
1998	155	6.2	6.3	6.3	6.0	4.6	3.8	3.3	[illegible]	2.3	1.6	1.3	1.2	1.6	2.2	3.7
1999	149	5.7	6.5	6.7	6.9	6.4	5.4	4.2	[illegible]	3.6	2.3	1.6	1.5	1.8	2.3	4.4
2000	151	8.5	8.8	8.8	8.8	7.4	6.3	4.8	4.0	3.4	2.2	1.6	1.5	1.6	1.8	5.3
2001	152	8.0	8.3	8.4	8.4	7.5	6.1	4.3	3.9	3.4	2.2	1.7	1.4	1.6	1.9	5.1
2002	157	5.2	5.6	5.6	5.7	4.7	4.4	4.2	4.4	3.9	2.5	1.9	1.6	2.0	2.6	4.0
2003	163	5.6	5.9	6.0	6.2	5.3	4.0	3.5	3.0	2.1	1.4	1.1	0.9	1.2	1.6	3.6
2004	146	7.5	7.8	8.0	8.1	6.2	4.8	3.1	[illegible]	2.0	1.1	0.9	0.8	0.9	1.1	4.3
2005	151	4.2	4.9	5.1	5.1	4.8	4.2	[illegible]	[illegible]	2.7	1.9	1.2	0.9	1.0	1.1	3.3
2006	145	2.8	3.3	3.4	3.6	3.1	2.6	[illegible]	1.7	1.4	0.9	0.7	0.6	0.7	0.7	2.1
2007	155	5.4	5.9	6.0	6.0	5.4	4.6	4.0	4.0	[illegible]	2.5	1.9	1.6	1.8	1.9	4.1
2008	159	4.7	5.2	5.2	5.2	4.4	3.9	[illegible]	3.0	2.9	2.0	1.4	1.2	1.3	1.5	3.4
AVERAGE		5.6	6.0	6.1	6.2	5.2	4.4	[illegible]	[illegible]	2.8	1.7	1.3	1.1	1.3	1.6	3.8

H-1j-

Table H-1j-2

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BPAHYSUM Summary

Base Study:	BA000MED : PSCEIS : BASE CASE	Date: 3-JAN-89 06:55:28
Incr Study:	BC440MED : PSCEIS : ALT44	Date: 28-JAN-89 06:06:31

Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
Hungry Horse Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	148	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	149	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	151	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	157	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	163	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	151	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2007	155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	159	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVERAGE		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table H-1j-3

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28

Number of Games: 200

Average Over High Water Years (Top 10 Percent)

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Hungry Horse Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	3557.1	3559.8	3560.0	3557.6	3532.7	3504.4	3475.0	3471.1	3471.5	3520.3	3553.7	3560.0	3560.0	3560.0	3534.4
1990	19	3556.0	3559.2	3559.6	3557.7	3532.4	3504.2	3473.4	3469.3	3470.1	3519.0	3553.5	3560.0	3560.0	3560.0	3533.8
1991	20	3538.0	3542.7	3544.1	3542.2	3521.8	3498.5	3473.6	3469.5	3472.4	3520.9	3553.8	3560.0	3560.0	3560.0	3527.3
1992	22	3543.2	3548.1	3549.3	3547.2	3526.3	3501.4	3476.3	3472.4	3474.5	3521.7	3553.9	3560.0	3560.0	3560.0	3530.2
1993	24	3537.4	3541.8	3544.1	3543.3	3522.7	3498.1	3468.8	3465.3	3468.1	3517.9	3553.3	3559.8	3559.9	3559.9	3526.3
1994	15	3552.3	3555.4	3556.3	3555.1	3532.4	3504.5	3474.2	3470.0	3471.2	3519.5	3553.6	3560.0	3560.0	3560.0	3532.9
1995	15	3543.5	3548.6	3549.9	3548.1	3526.4	3501.1	3474.7	3470.3	3472.7	3520.8	3553.8	3560.0	3560.0	3560.0	3530.0
1996	23	3541.3	3545.8	3547.6	3547.1	3524.7	3498.3	3467.6	3463.6	3465.7	3517.0	3553.1	3559.8	3559.9	3559.9	3527.3
1997	16	3539.8	3543.8	3545.4	3544.6	3523.2	3498.0	3471.6	3467.8	3471.5	3520.1	3553.8	3560.0	3560.0	3560.0	3527.6
1998	22	3544.0	3548.7	3550.3	3549.1	3527.3	3502.1	3475.2	3471.2	3472.4	3520.3	3553.7	3560.0	3560.0	3560.0	3530.3
1999	18	3536.1	3541.4	3543.2	3541.7	3523.7	3501.2	3476.4	3471.8	3474.3	3521.9	3553.9	3559.8	3559.9	3559.9	3527.8
2000	22	3544.2	3548.5	3550.1	3549.3	3527.9	3501.5	3471.7	3467.5	3469.0	3518.8	3553.5	3559.9	3560.0	3560.0	3529.5
2001	17	3534.6	3539.0	3540.7	3540.0	3520.5	3497.2	3471.2	3467.9	3471.1	3519.5	3553.6	3560.0	3560.0	3560.0	3525.6
2002	18	3536.9	3541.2	3542.9	3542.2	3522.2	3497.3	3468.9	3464.7	3467.6	3518.1	3553.2	3559.6	3559.8	3559.8	3525.8
2003	14	3529.0	3533.9	3535.9	3534.2	3516.8	3494.6	3471.1	3467.2	3470.0	3520.4	3553.7	3559.9	3560.0	3560.0	3523.3
2004	30	3529.6	3534.7	3536.9	3535.4	3515.6	3492.8	3467.2	3463.7	3465.4	3517.6	3552.4	3558.8	3559.0	3559.0	3522.1
2005	19	3535.3	3540.0	3541.4	3539.8	3518.5	3493.7	3466.6	3463.1	3466.4	3518.1	3553.2	3559.7	3559.9	3559.9	3524.4
2006	23	3540.9	3545.4	3547.2	3545.9	3524.0	3498.9	3470.8	3466.7	3469.0	3519.0	3553.5	3559.9	3560.0	3560.0	3527.9
2007	22	3535.0	3540.2	3542.7	3542.4	3522.1	3498.0	3468.7	3464.5	3466.9	3517.7	3553.0	3559.5	3559.6	3559.6	3525.5
2008	15	3543.9	3547.3	3549.0	3548.5	3527.5	3501.8	3473.7	3470.0	3471.4	3519.5	3553.6	3560.0	3560.0	3560.0	3529.7
AVERAGE		3540.7	3545.1	3546.7	3545.4	3524.3	3499.2	3471.6	3467.7	3469.8	3519.3	3553.5	3559.8	3559.9	3559.9	3528.0

BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Dat[illegible] [illegible]:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2 Date [illegible] JAN-8[illegible] 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

Difference Of
Hungry Horse Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	19	0.4	0.3	0.2	0.3	0.3	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1991	20	-0.3	-0.4	-0.5	-0.5	-0.6	-0.7	-0.6	-0.7	-0.5	-0.1	0.0	0.0	0.0	0.0	-0.4
1992	22	2.2	1.7	1.4	1.5	0.4	0.4	0.5	0.5	0.6	0.0	0.0	0.0	0.0	0.0	0.7
1993	24	2.4	2.2	2.1	2.2	1.1	0.7	0.5	0.4	0.3	0.1	0.1	0.1	0.1	0.1	1.0
1994	15	1.8	1.5	1.4	1.3	0.2	0.1	0.1	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.5
1995	15	5.3	4.4	3.9	4.1	2.8	2.6	2.4	2.6	2.2	0.8	0.1	0.0	0.0	0.0	2.4
1996	23	3.1	2.8	2.7	2.8	2.2	2.2	2.0	2.1	1.9	1.2	0.3	0.2	0.1	0.1	1.8
1997	16	0.2	0.1	0.1	0.0	-0.1	-0.1	-0.1	-0.2	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0
1998	22	1.7	1.1	0.8	1.0	0.8	0.2	-0.1	-0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.5
1999	18	2.4	2.4	2.4	2.4	1.8	0.8	0.3	0.4	0.3	0.0	0.0	0.0	0.0	0.0	1.1
2000	22	0.4	0.2	0.1	0.1	-0.6	-0.3	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	17	1.1	0.7	0.6	0.9	1.1	0.6	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.4
2002	18	1.3	1.3	1.2	1.1	0.1	-0.1	-0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.4
2003	14	0.0	0.0	-0.3	-0.3	-0.9	-1.2	-1.5	-1.7	-1.6	-0.9	-0.1	-0.1	0.0	0.0	-0.6
2004	30	3.9	3.6	3.4	3.1	2.4	1.8	0.8	0.7	0.8	0.2	0.2	0.2	0.2	0.1	1.7
2005	19	2.1	1.9	1.6	1.5	1.4	1.2	1.5	1.5	1.6	0.7	0.2	0.1	0.1	0.1	1.2
2006	23	1.4	1.4	1.1	0.9	0.4	0.2	0.2	0.1	0.3	0.0	0.0	-0.1	-0.1	0.0	0.5
2007	22	3.6	3.6	3.3	2.9	1.2	0.0	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0	1.2
2008	15	2.0	2.1	2.1	1.8	0.6	0.1	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.7
AVERAGE		1.8	1.6	1.4	1.4	0.8	0.5	0.3	0.3	0.4	0.1	0.0	0.0	0.0	0.0	0.7

Table H-1j-3

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410 — Date: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

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Difference Of
Hungry Horse Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	-5.9	-3.6	-1.9	-1.9	-1.2	-1.5	-1.4	-1.0	-1.6	0.0	0.0	0.0	0.0	0.0	-1.6
1990	19	-8.2	-6.6	-4.5	-4.1	-2.3	-0.9	-0.4	-0.4	-0.5	0.0	0.0	0.0	0.0	0.0	-2.3
1991	20	-2.0	-1.0	0.0	0.1	1.2	2.1	1.7	1.7	-0.6	0.0	0.0	0.0	0.0	0.0	0.1
1992	22	-12.3	-11.2	-9.9	-9.7	-8.0	-4.2	-2.1	-2.2	-1.2	0.0	0.0	0.0	0.0	0.0	-4.9
1993	24	-5.4	-4.6	-4.0	-4.6	-4.3	-2.4	-1.2	-1.0	-1.8	0.0	0.0	0.0	0.0	0.0	-2.4
1994	15	-4.2	-2.4	-1.3	-2.2	-3.1	-3.2	-2.3	-1.8	-2.2	0.0	0.0	0.0	0.0	0.0	-1.7
1995	15	-8.6	-7.6	-7.0	-7.8	-6.6	-4.4	-3.3	-2.5	-3.0	0.0	0.0	0.0	0.0	0.0	-4.0
1996	23	-5.1	-4.5	-3.5	-4.5	-3.8	-3.2	-1.5	-1.1	-1.4	0.1	0.1	0.1	0.1	0.1	-2.3
1997	16	-2.9	-1.4	-0.7	-2.0	-1.5	-2.2	-1.1	-0.4	-1.7	0.4	0.0	0.0	0.0	0.0	-1.1
1998	22	-8.2	-7.4	-6.8	-7.6	-6.9	-5.7	-4.2	-3.2	-2.5	0.0	0.0	0.0	0.0	0.0	-4.1
1999	18	-3.0	-1.9	-1.8	-3.1	-4.6	-4.4	-3.6	-2.8	-3.1	-0.1	-0.1	-0.1	-0.1	-0.1	-2.2
2000	22	-5.2	-4.3	-3.6	-4.7	-5.2	-4.1	-3.2	-3.0	-2.5	-0.2	0.0	0.0	0.0	0.0	-2.8
2001	17	-6.5	-5.5	-4.4	-5.0	-5.1	-5.1	-3.2	-2.9	-2.2	0.0	0.0	0.0	0.0	0.0	-3.1
2002	18	-0.3	0.2	0.1	-1.1	-2.1	-1.2	-0.1	-0.2	-0.7	0.6	0.1	0.0	-0.1	-0.1	-0.4
2003	14	3.2	3.0	2.7	2.5	2.1	2.6	3.4	3.7	2.9	0.9	0.1	0.1	0.0	0.0	2.0
2004	30	3.5	3.2	2.9	3.0	2.6	2.1	2.1	2.0	2.6	1.3	0.8	0.8	0.7	0.7	2.1
2005	19	1.1	0.9	1.0	1.2	1.1	0.8	1.1	1.2	1.3	0.6	0.2	0.1	0.0	0.0	0.8
2006	23	-0.2	-0.1	-0.1	0.5	1.2	0.8	0.6	0.5	0.8	0.2	0.0	-0.1	-0.1	0.0	0.3
2007	22	0.0	0.0	-0.1	-0.4	0.3	0.4	0.7	0.7	0.5	0.6	0.3	0.2	0.1	0.1	0.2
2008	15	-0.3	-0.3	-0.5	-0.6	0.1	0.4	0.4	0.1	-0.4	0.0	0.0	0.0	0.0	0.0	-0.1
AVERAGE		-3.5	-2.8	-2.2	-2.6	-2.3	-1.6	-0.8	-0.6	-0.8	0.2	0.1	0.1	0.1	0.1	-1.3

Table H-1j-3

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415   Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

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Difference Of
Hungry Horse Res Elev (feet)

YEAR	/ NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	-5.7	-3.4	-1.7	-1.7	-1.0	-1.0	-1.1	-0.8	-1.1	0.0	0.0	0.0	0.0	0.0	-1.4
1990	19	-5.4	-3.9	-2.2	-1.4	-0.2	0.3	0.1	0.0	0.3	0.0	0.0	0.0	0.0	0.0	-1.0
1991	20	-5.7	-4.4	-3.3	-2.8	-1.4	-0.1	-0.3	-0.1	-0.6	0.0	0.0	0.0	0.0	0.0	-1.5
1992	22	-6.7	-5.9	-4.9	-4.4	-3.8	-2.4	-0.6	-1.2	-1.1	-0.5	0.0	0.0	0.0	0.0	-2.5
1993	24	-3.3	-2.7	-2.3	-2.8	-2.7	-1.7	-0.4	-0.4	-1.0	0.0	0.0	0.0	0.0	0.0	-1.4
1994	15	0.4	1.5	1.3	0.7	-0.8	-0.4	-1.1	-1.1	-1.6	0.0	0.0	0.0	0.0	0.0	0.0
1995	15	-1.6	-1.3	-1.4	-1.8	-1.7	-0.8	-0.8	-0.7	-1.0	0.0	0.0	0.0	0.0	0.0	-0.9
1996	23	1.3	1.0	1.1	0.4	0.2	-0.1	0.3	0.3	0.1	0.3	0.2	0.2	0.1	0.1	0.4
1997	16	0.6	0.6	0.4	-0.3	-0.5	-0.3	-0.2	0.0	-0.4	0.2	-0.1	-0.1	-0.1	0.0	0.0
1998	22	0.1	0.0	-0.2	-0.1	-0.3	-0.4	-0.5	-0.4	0.5	0.0	0.0	0.0	0.0	0.0	-0.1
1999	18	2.8	2.7	2.8	2.9	2.5	1.4	0.8	0.8	1.0	0.1	0.0	0.0	0.0	0.0	1.4
2000	22	-0.4	-0.5	-0.5	-0.3	-1.5	-1.2	-0.6	-0.6	0.2	0.0	0.0	0.0	0.0	0.0	-0.4
2001	17	-1.9	-1.1	-0.8	-0.2	0.3	0.2	0.2	0.1	0.2	-0.1	-0.1	0.0	0.0	0.0	-0.3
2002	18	-2.9	-2.5	-2.6	-2.7	-1.4	-0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	-0.1	-1.0
2003	14	-1.3	-0.8	-0.8	0.2	1.7	2.1	1.6	1.3	2.0	0.1	0.1	0.1	0.0	0.0	0.4
2004	30	3.1	3.1	2.9	3.9	4.2	3.6	2.5	1.8	2.9	0.8	0.6	0.6	0.6	0.6	2.4
2005	19	2.5	2.3	2.7	4.0	4.2	4.1	4.0	3.9	4.0	1.3	0.2	0.1	0.0	0.0	2.4
2006	23	2.6	2.2	1.8	2.6	3.5	3.2	2.7	2.3	2.2	0.5	0.0	0.0	0.0	0.0	1.8
2007	22	2.1	1.8	1.3	1.3	1.8	1.6	1.8	1.8	0.6	-0.1	-0.4	-0.5	-0.5	-0.5	0.9
2008	15	-1.8	-1.6	-2.0	-1.9	-0.3	-0.1	-0.3	-0.4	0.3	0.0	0.0	0.0	0.0	0.0	-0.6
AVERAGE		-1.0	-0.6	-0.3	-0.1	0.2	0.4	0.5	0.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0

Table H-1j-3

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BA430MED : PSCEIS : ALT43 — Date: 21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

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Difference Of
Hungry Horse Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	0.4	0.2	0.0	0.0	0.0	0.2	0.8	0.5	1.4	0.0	0.0	0.0	0.0	0.0	0.2
1990	19	0.6	0.3	0.1	0.2	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1991	20	6.0	5.3	5.0	5.0	5.5	4.9	3.3	3.1	1.7	0.0	0.0	0.0	0.0	0.0	3.0
1992	22	8.3	7.0	6.4	6.0	4.3	3.1	1.5	1.0	0.3	0.0	0.0	0.0	0.0	0.0	3.1
1993	24	6.3	5.7	4.9	4.3	2.2	0.8	0.6	0.5	-0.4	0.4	0.2	0.2	0.1	0.1	2.1
1994	15	2.2	1.9	1.7	1.2	-0.6	-0.4	-0.4	-0.3	-0.8	0.0	0.0	0.0	0.0	0.0	0.4
1995	15	9.2	7.9	7.1	6.5	4.8	3.2	2.1	2.2	0.2	0.8	0.1	0.0	0.0	0.0	3.5
1996	23	5.8	5.0	4.7	3.9	3.0	3.2	3.4	3.6	2.0	1.3	0.3	0.2	0.1	0.1	2.7
1997	16	4.1	3.5	2.9	1.5	1.2	1.0	1.0	0.7	-1.6	-0.1	0.0	0.0	0.0	0.0	1.1
1998	22	5.1	4.2	3.6	2.7	1.9	0.3	-0.9	-1.2	-1.6	0.0	0.0	0.0	0.0	0.0	1.3
1999	18	8.6	8.2	7.7	6.8	2.5	0.6	0.2	0.6	-0.1	0.2	0.1	0.1	0.1	0.1	2.9
2000	22	7.5	6.5	6.0	5.0	2.8	2.3	1.8	2.0	0.9	0.6	0.1	0.1	0.0	0.0	2.8
2001	17	8.8	7.9	7.3	6.4	4.3	2.7	0.6	0.2	-1.5	0.0	0.0	0.0	0.0	0.0	3.0
2002	18	4.4	4.0	3.7	2.5	0.4	0.2	0.5	0.7	-0.1	0.8	0.3	0.3	0.2	0.2	1.4
2003	14	7.7	7.0	6.5	6.2	4.5	4.9	4.0	3.9	3.2	0.9	0.1	0.1	0.0	0.0	3.8
2004	30	10.0	9.2	8.6	8.4	6.7	5.3	3.8	3.3	3.5	1.6	1.0	0.9	0.8	0.7	5.0
2005	19	5.9	5.4	4.9	4.7	4.5	3.9	3.5	3.5	2.5	1.3	0.4	0.3	0.1	0.1	3.1
2006	23	5.3	4.9	4.4	3.8	2.8	2.6	2.9	2.9	2.1	1.0	0.1	0.1	0.0	0.0	2.5
2007	22	6.8	6.0	5.4	4.4	2.5	2.1	2.3	2.4	1.3	1.0	0.4	0.4	0.3	0.3	2.7
2008	15	1.4	1.4	1.4	0.5	-1.1	-0.8	-0.6	-0.4	-0.8	0.0	0.0	0.0	0.0	0.0	0.1
AVERAGE		5.8	5.2	4.7	4.1	2.8	2.1	1.6	1.5	0.7	0.5	0.2	0.2	0.1	0.1	2.3

Table H-1j-3

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BC440MED : PSCEIS : ALT44   Date: 28-JAN-89 06:06:31
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

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Difference Of
Hungry Horse Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2007	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVERAGE		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table H-1j-4

BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

Grand Coulee Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	1289.1	1288.7	1288.7	1288.1	1288.0	1288.0	1281.4	1286.6	1284.6	1271.2	1286.5	1289.6	1290.0	1290.0	1286.1
1990	27	1289.1	1288.8	1288.8	1288.0	1288.0	1288.0	1281.5	1287.8	1286.0	1275.4	1285.6	1289.6	1290.0	1290.0	1286.6
1991	26	1288.7	1288.5	1288.6	1288.0	1288.0	1288.0	1280.8	1285.2	1282.4	1266.5	1285.0	1289.7	1289.9	1289.9	1285.4
1992	18	1288.7	1288.4	1288.2	1287.5	1285.2	1283.6	1276.3	1280.7	1278.9	1266.4	1285.5	1289.6	1290.0	1290.0	1284.0
1993	21	1288.7	1288.7	1288.8	1288.0	1288.0	1288.0	1280.8	1286.0	1283.8	1267.9	1283.5	1289.6	1290.0	1290.0	1285.5
1994	30	1288.7	1288.6	1288.6	1288.0	1287.1	1285.9	1276.0	1280.8	1277.9	1263.3	1285.2	1289.7	1290.0	1290.0	1284.1
1995	31	1288.6	1288.5	1288.6	1288.0	1287.5	1287.3	1278.7	1283.6	1280.8	1266.7	1284.6	1289.7	1290.0	1290.0	1284.9
1996	29	1288.7	1288.5	1288.6	1288.0	1287.6	1287.4	1279.6	1284.6	1282.2	1269.2	1284.7	1289.7	1290.0	1290.0	1285.4
1997	29	1288.8	1288.7	1288.7	1288.0	1287.6	1287.0	1279.0	1284.8	1282.6	1271.2	1284.9	1289.6	1290.0	1290.0	1285.5
1998	23	1288.4	1288.4	1288.5	1288.0	1287.7	1287.5	1277.9	1281.8	1278.6	1260.6	1282.5	1289.6	1289.9	1289.9	1284.0
1999	33	1288.7	1288.6	1288.6	1287.9	1285.0	1281.9	1273.2	1278.3	1276.6	1268.9	1284.3	1289.6	1289.9	1289.9	1283.6
2000	27	1288.8	1288.7	1288.8	1288.0	1287.9	1288.0	1280.9	1286.3	1285.1	1270.8	1283.2	1289.6	1290.0	1290.0	1285.8
2001	31	1288.6	1288.6	1288.6	1288.1	1288.0	1288.0	1280.3	1285.1	1282.8	1268.4	1284.0	1289.7	1289.9	1289.9	1285.4
2002	25	1288.8	1288.6	1288.6	1288.0	1286.4	1284.9	1276.9	1282.6	1280.2	1270.5	1283.3	1289.6	1290.0	1290.0	1284.7
2003	23	1288.6	1288.5	1288.5	1288.0	1287.4	1286.8	1277.7	1282.3	1279.1	1266.9	1284.4	1289.7	1290.0	1290.0	1284.6
2004	24	1288.8	1288.8	1288.8	1288.0	1288.0	1288.0	1281.1	1286.2	1284.8	1268.8	1284.1	1289.7	1290.0	1290.0	1285.7
2005	30	1288.9	1288.8	1288.8	1288.2	1288.0	1288.0	1281.3	1286.5	1285.4	1271.3	1284.2	1289.6	1290.0	1290.0	1286.0
2006	32	1289.0	1288.9	1288.8	1288.2	1288.0	1287.8	1280.3	1285.5	1282.9	1271.0	1284.7	1289.6	1290.0	1290.0	1285.8
2007	23	1288.9	1288.9	1288.9	1288.3	1288.0	1287.8	1280.7	1285.9	1285.2	1271.2	1283.2	1289.6	1290.0	1290.0	1285.9
2008	26	1288.8	1288.8	1288.7	1288.0	1285.4	1282.4	1272.9	1277.2	1273.7	1264.7	1281.6	1288.3	1288.6	1288.7	1282.7
AVERAGE		1288.8	1288.7	1288.7	1288.0	1287.4	1286.7	1278.8	1283.9	1281.7	1268.6	1284.3	1289.6	1289.9	1289.9	1285.1

Table H-1j-4

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2   Date: 6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
Grand Coulee Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	27	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.2	0.1	0.3	0.1	0.0	0.0	0.0	0.1
1991	26	0.1	0.2	0.1	0.2	0.0	0.0	0.3	0.2	0.7	1.0	0.4	0.0	0.1	0.1	0.2
1992	18	0.1	0.3	0.5	0.4	0.9	0.6	0.4	0.7	1.2	1.6	0.5	0.0	0.0	0.0	0.5
1993	21	0.1	0.2	0.2	0.2	0.0	0.0	0.3	0.3	1.0	1.3	0.5	0.0	-0.1	0.0	0.3
1994	30	0.1	0.1	0.1	0.2	0.2	0.5	1.0	0.8	1.1	1.2	0.5	0.0	0.0	0.0	0.4
1995	31	0.1	0.1	0.1	0.1	0.5	0.7	1.3	1.2	1.5	1.2	0.6	0.0	0.0	0.0	0.5
1996	29	0.2	0.2	0.1	0.1	0.2	0.2	0.3	0.3	1.1	0.9	0.3	0.0	0.0	0.0	0.3
1997	29	0.1	0.2	0.2	0.2	0.1	0.3	0.5	0.5	0.8	0.6	0.1	0.0	0.0	0.0	0.3
1998	23	0.1	0.1	0.1	0.1	0.2	0.3	0.9	0.9	1.4	1.3	0.2	0.0	0.0	0.0	0.4
1999	33	0.1	0.1	0.1	0.2	0.5	0.6	0.9	0.2	0.5	0.5	0.3	0.0	0.0	0.1	0.3
2000	27	0.2	0.2	0.2	0.2	0.1	0.0	0.3	0.4	0.4	0.7	0.2	0.0	0.0	0.0	0.2
2001	31	0.1	0.1	0.1	0.1	0.0	0.0	0.4	0.5	0.5	0.6	0.3	0.0	0.1	0.1	0.2
2002	25	0.2	0.2	0.2	0.3	0.5	0.9	0.9	0.4	1.3	1.0	0.2	0.0	0.0	0.0	0.5
2003	23	0.1	0.2	0.1	0.0	0.0	0.0	0.6	0.5	0.7	1.2	0.2	0.0	0.0	0.0	0.3
2004	24	0.1	0.2	0.2	0.2	0.0	0.0	0.3	0.6	0.7	1.3	0.5	0.0	0.0	0.0	0.3
2005	30	0.2	0.2	0.2	0.3	0.0	0.0	0.4	0.9	0.6	1.4	0.5	0.0	0.0	0.0	0.3
2006	32	0.1	0.2	0.2	0.4	0.1	0.2	0.5	0.6	0.7	1.1	0.4	0.0	0.0	0.0	0.3
2007	23	0.2	0.2	0.2	0.4	0.0	0.0	0.1	0.4	0.4	1.0	0.0	0.0	0.0	0.0	0.2
2008	26	0.2	0.2	0.2	0.3	0.6	1.0	1.5	1.7	1.8	1.1	0.4	0.1	0.1	0.1	0.6
AVERAGE		0.1	0.2	0.2	0.2	0.2	0.3	0.6	0.6	0.8	1.0	0.3	0.0	0.0	0.0	0.3

Table H-1j-4

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410 — Date: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
Grand Coulee Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	-0.3	-0.5	-0.4	-0.2	-2.0	-2.0	-4.9	-4.4	-6.3	-7.3	-1.6	-0.1	0.0	0.0	-2.1
1990	27	-0.4	-0.6	-0.5	-0.1	-0.5	-0.3	-1.0	-1.0	-2.3	-3.8	-0.8	-0.2	0.0	0.0	-0.9
1991	26	-0.3	-0.4	-0.4	-0.2	-2.1	-2.4	-3.3	-3.1	-5.1	-5.3	-0.7	0.1	0.1	0.1	-1.7
1992	18	-0.1	-0.2	0.0	0.3	-0.2	-0.7	-1.5	-0.5	-3.8	-3.5	-1.1	-0.1	0.0	0.0	-0.9
1993	21	-0.2	-0.5	-0.5	-0.1	-0.2	-0.3	-1.0	-0.3	-1.7	-1.8	-0.3	0.1	0.0	0.0	-0.5
1994	30	-0.2	-0.4	-0.4	-0.2	-2.2	-2.2	-2.9	-2.2	-5.1	-2.6	-1.0	-0.3	-0.2	-0.1	-1.5
1995	31	-0.2	-0.4	-0.4	-0.2	-1.8	-1.7	-2.0	-1.5	-2.5	-2.4	-0.6	0.0	0.0	0.0	-1.0
1996	29	-0.2	-0.4	-0.4	-0.2	-1.6	-2.1	-2.5	-1.5	-2.7	-2.3	-0.4	-0.1	0.0	0.0	-1.1
1997	29	-0.2	-0.5	-0.5	-0.1	-1.0	-0.4	-0.1	0.5	-0.2	-0.6	0.7	0.0	0.0	0.0	-0.2
1998	23	-0.1	-0.4	-0.4	-0.2	-1.0	-0.8	-0.4	0.0	-0.9	-0.8	0.6	0.1	0.1	0.1	-0.3
1999	33	-0.1	-0.3	-0.3	-0.1	-0.1	0.1	0.4	0.3	0.0	0.3	0.5	0.0	0.1	0.1	0.1
2000	27	-0.1	-0.3	-0.4	-0.1	-0.1	-0.2	-0.6	-0.5	-1.1	-1.2	0.8	0.0	0.0	0.0	-0.3
2001	31	-0.1	-0.3	-0.3	-0.2	-0.6	-0.7	-1.2	-0.6	-0.9	-1.6	0.4	-0.1	-0.1	0.0	-0.5
2002	25	0.1	0.0	0.0	-0.1	-0.8	-0.6	0.2	-0.2	0.5	0.1	1.9	0.0	0.0	0.0	0.1
2003	23	0.2	0.2	0.1	0.1	-0.1	-0.1	0.4	0.9	0.8	2.4	1.3	-0.1	-0.1	0.0	0.4
2004	24	0.1	-0.1	-0.1	0.0	-0.5	-0.6	-1.1	-1.2	-1.7	-2.7	0.1	-0.2	-0.2	-0.2	-0.6
2005	30	-0.1	-0.1	-0.2	-0.1	0.0	0.0	-0.5	-1.1	-1.1	-2.1	0.5	0.0	0.0	0.0	-0.3
2006	32	-0.1	-0.1	-0.1	-0.2	-0.8	-1.0	-1.9	-1.3	-1.8	-2.2	0.4	-0.1	-0.1	-0.1	-0.7
2007	23	-0.1	-0.2	-0.2	-0.3	-0.3	-0.4	-1.0	-1.0	-2.0	-2.9	0.0	0.0	0.0	0.0	-0.6
2008	26	0.0	-0.1	-0.2	-0.6	-2.7	-3.1	-1.9	-1.6	-1.4	-2.1	1.8	0.3	0.2	0.2	-0.8
AVERAGE		-0.1	-0.3	-0.3	-0.1	-0.9	-1.0	-1.3	-1.0	-1.9	-2.1	0.1	0.0	0.0	0.0	-0.7

Table H-1j-4

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415 Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
Grand Coulee Res Elev (feet)

YEAR	/ NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	-0.3	-0.5	-0.4	-0.2	-1.2	-0.6	-1.7	-2.3	-2.7	-4.3	-0.8	0.0	0.0	0.0	-1.1
1990	27	-0.3	-0.5	-0.4	-0.1	0.0	0.0	-0.3	-0.6	-0.7	-1.4	0.0	0.0	0.0	0.0	-0.3
1991	26	-0.2	-0.3	-0.3	-0.2	-0.3	-0.2	-1.1	-1.5	-2.2	-3.2	-0.4	0.1	0.1	0.1	-0.7
1992	18	-0.1	-0.1	0.1	0.3	0.8	1.0	-0.8	-0.8	-1.2	-0.7	0.4	0.0	0.0	0.0	0.0
1993	21	-0.1	-0.2	-0.2	0.0	0.0	0.0	0.0	0.2	0.5	0.7	0.9	0.0	0.0	0.0	0.1
1994	30	-0.1	-0.1	-0.2	0.0	0.1	0.7	0.7	0.5	0.3	0.3	0.4	0.0	0.0	0.0	0.2
1995	31	0.0	-0.1	-0.1	0.0	0.2	0.4	0.7	0.7	1.1	0.9	0.9	0.0	0.0	0.0	0.3
1996	29	0.0	-0.1	-0.1	0.0	0.1	0.0	-0.2	0.0	0.2	0.0	0.4	0.0	0.0	0.0	0.0
1997	29	0.0	0.0	0.0	0.1	0.3	0.7	1.2	1.6	1.7	1.7	0.8	0.0	0.0	0.0	0.5
1998	23	0.1	0.0	0.0	0.0	0.0	0.1	0.8	1.0	1.1	1.4	0.8	0.0	0.0	0.0	0.3
1999	33	0.1	0.1	0.0	0.0	-0.1	0.0	0.2	0.3	0.5	0.6	0.3	0.0	0.0	0.0	0.1
2000	27	0.0	0.0	0.0	0.0	0.1	0.0	-0.2	-0.6	-0.9	-1.3	0.3	0.0	0.0	0.0	-0.2
2001	31	0.0	-0.1	-0.1	-0.1	-0.3	-0.7	-1.6	-1.3	-1.4	-2.2	-0.2	-0.1	-0.1	-0.1	-0.6
2002	25	-0.1	-0.1	-0.1	-0.1	-0.3	-1.2	-1.3	-2.0	-2.4	-2.9	-0.1	0.0	0.0	0.0	-0.7
2003	23	0.1	0.1	0.1	0.1	0.0	0.0	0.8	1.3	1.5	2.4	0.9	-0.1	0.0	0.0	0.5
2004	24	0.0	-0.1	0.0	0.0	0.0	0.0	-0.3	-0.7	-0.8	-1.4	0.0	0.0	0.0	0.0	-0.2
2005	30	-0.1	-0.1	-0.1	-0.1	0.0	0.0	-0.6	-1.3	-1.3	-2.4	-0.4	0.0	0.0	0.0	-0.4
2006	32	-0.2	-0.2	-0.2	-0.2	-0.1	0.0	-0.9	-0.8	-0.9	-1.6	0.2	0.0	0.0	0.0	-0.3
2007	23	-0.1	-0.2	-0.2	-0.3	0.0	0.1	-0.5	-0.7	-1.5	-2.3	-0.3	0.0	0.0	0.0	-0.4
2008	26	-0.1	-0.1	-0.1	-0.1	-0.5	-0.7	-0.9	-0.9	-0.4	-1.3	1.5	0.4	0.3	0.2	-0.2
AVERAGE		-0.1	-0.1	-0.1	-0.1	-0.1	0.0	-0.3	-0.4	-0.4	-0.9	0.3	0.0	0.0	0.0	-0.1

Table H-1j-4

BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE
Incr Study: BA430MED : PSCEIS : ALT43
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

Date: 3-JAN-89 06:55:28
Date: 21-JAN-89 05:14:29

Difference Of
Grand Coulee Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	0.3	0.5	0.4	0.5	0.1	0.0	0.6	1.1	1.1	3.0	0.4	0.1	0.0	0.0	0.6
1990	27	0.2	0.2	0.2	0.1	0.1	0.0	0.5	0.0	0.0	0.7	0.2	0.0	0.0	0.0	0.2
1991	26	0.3	0.3	0.3	0.2	0.0	0.0	0.9	0.9	1.5	2.9	0.9	0.1	0.1	0.1	0.6
1992	18	0.1	0.4	0.6	0.5	1.5	1.8	0.9	0.8	2.3	3.8	0.8	0.0	0.0	0.0	1.0
1993	21	0.2	0.2	0.3	0.3	0.1	0.0	0.9	0.7	1.5	3.8	1.4	0.0	0.0	0.0	0.7
1994	30	0.3	0.3	0.3	0.3	0.6	1.3	2.8	2.2	2.1	4.0	1.5	0.0	0.0	0.0	1.1
1995	31	0.3	0.3	0.3	0.2	0.6	0.7	2.5	2.0	2.7	4.3	1.5	0.0	0.0	0.0	1.1
1996	29	0.3	0.3	0.3	0.1	0.3	0.4	1.6	1.2	2.4	3.1	1.5	0.0	0.0	0.0	0.9
1997	29	0.2	0.2	0.2	0.2	0.4	1.0	1.9	1.8	2.0	2.5	1.2	0.0	0.0	0.0	0.8
1998	23	0.2	0.2	0.1	0.1	0.2	0.5	1.9	1.6	2.6	3.5	1.6	0.1	0.1	0.1	0.9
1999	33	0.3	0.3	0.4	0.4	1.4	3.2	5.1	5.2	4.2	4.9	1.5	0.1	0.1	0.1	1.8
2000	27	0.4	0.4	0.4	0.3	0.2	0.0	1.5	1.4	1.7	4.8	1.1	0.1	0.0	0.0	0.9
2001	31	0.2	0.3	0.2	0.0	0.0	0.0	1.1	1.4	1.2	2.7	1.0	0.0	0.1	0.1	0.6
2002	25	0.2	0.2	0.2	0.1	0.7	1.2	1.2	0.4	1.4	1.6	0.7	0.0	0.0	0.0	0.6
2003	23	0.4	0.5	0.5	0.5	0.7	1.1	4.0	4.5	5.0	9.2	2.2	0.0	0.0	0.0	2.0
2004	24	0.4	0.4	0.4	0.4	0.1	0.1	1.6	1.3	1.4	5.0	1.3	0.0	0.0	0.0	0.9
2005	30	0.2	0.3	0.3	0.2	0.1	0.0	0.6	0.8	0.6	2.5	0.4	0.0	0.0	0.0	0.4
2006	32	0.2	0.2	0.2	0.3	0.2	0.3	1.6	1.1	1.4	3.6	0.9	0.0	0.0	0.0	0.8
2007	23	0.2	0.2	0.3	0.2	0.1	0.3	1.8	0.9	1.2	3.7	0.9	0.0	0.0	0.0	0.7
2008	26	0.3	0.3	0.3	0.3	1.4	2.7	5.0	5.4	6.1	4.2	2.6	1.1	1.2	1.1	2.1
AVERAGE		0.2	0.3	0.3	0.3	0.4	0.7	1.9	1.8	2.1	3.7	1.2	0.1	0.1	0.1	0.9

Table H-1j-4

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*************************************************************************************************************************
                                                  BPAHYSUM Summary
Base Study:     BA000MED : PSCEIS : BASE CASE                                          Date:    3-JAN-89 06:55:28
Incr Study:     BC440MED : PSCEIS : ALT44                                              Date:   28-JAN-89 06:06:31
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)
*************************************************************************************************************************
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Difference Of
Grand Coulee Res Elev (feet)

YEAR /	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2007	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVERAGE		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table H-1j-5

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28

Number of Games: 200

Average Over Typical Water Years (Mid 80 Percent)

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Grand Coulee Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	1289.1	1288.8	1288.8	1288.3	1276.7	1261.0	1234.1	1224.9	1217.2	1249.3	1286.0	1290.0	1290.0	1290.0	1271.6
1990	154	1289.1	1288.8	1288.9	1288.5	1277.0	1259.8	1232.2	1223.6	1216.0	1247.5	1285.2	1290.0	1290.0	1290.0	1271.1
1991	154	1288.9	1288.8	1289.0	1288.3	1278.3	1261.8	1234.9	1225.2	1217.3	1247.4	1285.2	1290.0	1290.0	1290.0	1271.7
1992	160	1288.8	1288.6	1288.8	1288.2	1277.5	1260.8	1233.3	1224.3	1217.0	1248.9	1285.5	1290.0	1290.0	1290.0	1271.5
1993	155	1288.8	1288.7	1289.0	1288.4	1275.9	1259.3	1231.0	1221.8	1215.5	1247.3	1285.3	1290.0	1290.0	1290.0	1270.8
1994	155	1289.0	1288.9	1289.0	1288.5	1276.7	1259.3	1231.1	1221.6	1215.9	1250.2	1286.3	1290.0	1290.0	1290.0	1271.2
1995	154	1288.8	1288.9	1289.1	1288.7	1276.1	1258.8	1230.8	1221.9	1216.1	1249.5	1286.6	1290.0	1290.0	1290.0	1271.1
1996	148	1288.8	1288.8	1289.0	1288.7	1277.2	1260.1	1230.9	1221.8	1216.1	1249.2	1285.5	1290.0	1290.0	1290.0	1271.2
1997	155	1288.9	1288.9	1289.1	1288.7	1276.6	1259.7	1231.4	1222.9	1216.6	1247.3	1286.6	1290.0	1290.0	1290.0	1271.2
1998	155	1288.9	1288.8	1289.1	1288.4	1277.4	1260.1	1233.3	1224.4	1217.8	1246.6	1285.0	1290.0	1290.0	1290.0	1271.3
1999	149	1288.8	1288.7	1288.8	1288.1	1275.2	1257.0	1227.5	1218.0	1213.3	1246.9	1286.0	1290.0	1290.0	1290.0	1270.0
2000	151	1288.9	1288.9	1289.1	1288.7	1277.4	1261.0	1233.1	1223.0	1216.2	1248.3	1286.7	1290.0	1290.0	1290.0	1271.5
2001	152	1288.8	1288.9	1289.1	1288.8	1277.3	1261.0	1231.8	1223.2	1217.2	1246.5	1284.7	1290.0	1290.0	1290.0	1271.2
2002	157	1289.0	1288.9	1289.1	1288.8	1277.5	1262.3	1236.4	1227.6	1220.2	1250.7	1286.4	1290.0	1290.0	1290.0	1272.5
2003	163	1288.8	1288.8	1288.9	1288.5	1275.9	1258.5	1229.9	1220.4	1215.2	1247.0	1285.5	1290.0	1290.0	1290.0	1270.6
2004	146	1288.8	1288.8	1289.0	1288.4	1277.0	1260.2	1231.1	1220.9	1215.5	1246.5	1285.6	1290.0	1290.0	1290.0	1270.9
2005	151	1289.0	1289.0	1289.1	1288.5	1276.5	1260.4	1230.6	1221.8	1216.4	1249.8	1286.5	1290.0	1290.0	1290.0	1271.3
2006	145	1289.1	1289.0	1289.1	1288.6	1278.2	1261.0	1232.9	1223.3	1216.8	1249.1	1285.2	1290.0	1290.0	1290.0	1271.6
2007	155	1289.0	1289.1	1289.2	1288.9	1277.2	1261.3	1234.7	1226.7	1219.4	1250.7	1286.3	1290.0	1290.0	1290.0	1272.1
2008	159	1289.2	1289.2	1289.4	1289.0	1278.3	1262.1	1234.4	1224.5	1217.7	1246.0	1285.8	1290.0	1290.0	1290.0	1271.8
AVERAGE		1288.9	1288.9	1289.0	1288.6	1277.0	1260.3	1232.3	1223.1	1216.7	1248.2	1285.8	1290.0	1290.0	1290.0	1271.3

Table H-1j-5

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2   Date: 6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
Grand Coulee Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	154	0.1	0.1	0.1	0.1	0.3	0.4	0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1991	154	0.1	0.1	0.1	0.2	0.5	0.5	0.5	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.2
1992	160	0.1	0.1	0.1	0.1	0.6	0.8	0.8	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.2
1993	155	0.1	0.1	0.1	0.2	0.8	0.8	0.8	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.3
1994	155	0.1	0.1	0.1	0.2	0.7	0.8	0.6	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.2
1995	154	0.1	0.1	0.1	0.1	0.4	0.5	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1996	148	0.1	0.1	0.1	0.1	0.4	0.6	0.0	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.1
1997	155	0.1	0.1	0.1	0.1	0.6	0.8	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2
1998	155	0.1	0.1	0.1	0.4	0.6	0.5	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.2
1999	149	0.1	0.2	0.2	0.2	0.5	0.7	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2
2000	151	0.1	0.1	0.1	0.1	0.5	0.6	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.2
2001	152	0.1	0.1	0.1	0.1	0.4	0.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
2002	157	0.2	0.1	0.1	0.2	0.5	0.7	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.2
2003	163	0.1	0.1	0.1	0.0	0.5	0.7	0.8	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.2
2004	146	0.1	0.1	0.1	0.1	0.[illegible]	0.6	0.4	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.2
2005	151	0.2	0.2	0.2	0.3	0.6	0.6	0.7	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.3
2006	145	0.2	0.2	0.2	0.3	0.6	0.5	0.6	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.2
2007	155	0.1	0.1	0.1	0.[illegible]	0.6	0.6	0.5	0.4	0.3	0.1	0.0	0.0	0.0	0.0	0.2
2008	159	0.2	0.1	0.1	0.2	0.5	0.5	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2
AVERAGE		0.1	0.1	0.1	0.2	0.5	0.6	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.2

Table H-1j-5

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410 Date: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
Grand Coulee Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	-0.3	-0.5	-0.4	-0.2	-2.1	-3.5	-2.6	-1.3	-0.4	-0.2	-0.1	0.0	0.0	0.0	-0.9
1990	154	-0.3	-0.5	-0.4	-0.1	-1.9	-2.6	-1.7	0.2	0.1	0.0	0.0	0.0	0.0	0.0	-0.6
1991	154	-0.3	-0.4	-0.4	0.0	-1.6	-2.9	-1.6	-0.7	0.0	0.0	0.0	0.0	0.0	0.0	-0.6
1992	160	-0.1	-0.3	-0.2	0.2	-1.1	-1.8	-1.0	0.2	0.4	0.0	0.0	0.0	0.0	0.0	-0.3
1993	155	-0.2	-0.5	-0.5	-0.2	-2.4	-4.1	-3.0	-1.6	-0.6	-0.1	0.0	0.0	0.0	0.0	-1.0
1994	155	-0.3	-0.6	-0.6	-0.3	-3.3	-4.6	-3.3	-2.8	-1.3	-0.1	0.0	0.0	0.0	0.0	-1.2
1995	154	-0.3	-0.7	-0.7	-0.6	-3.6	-5.6	-5.4	-4.9	-2.4	-0.6	0.0	0.0	0.0	0.0	-1.7
1996	148	-0.3	-0.6	-0.7	-0.7	-4.2	-5.4	-4.3	-3.6	-1.7	-0.5	0.0	0.0	0.0	0.0	-1.5
1997	155	-0.3	-0.6	-0.7	-0.7	-4.3	-6.6	-5.3	-4.8	-2.5	-0.6	0.0	0.0	0.0	0.0	-1.8
1998	155	-0.3	-0.6	-0.7	-0.4	-3.5	-5.3	-5.1	-4.2	-2.2	-0.5	0.0	0.0	0.0	0.0	-1.5
1999	149	-0.1	-0.4	-0.3	-0.1	-2.5	-3.0	-2.6	-1.8	-0.4	-0.1	0.0	0.0	0.0	0.0	-0.8
2000	151	-0.2	-0.5	-0.5	-0.5	-2.4	-2.9	-2.4	-2.1	-1.2	-0.3	0.0	0.0	0.0	0.0	-0.9
2001	152	-0.2	-0.4	-0.4	-0.5	-2.4	-2.6	-2.6	-2.1	-0.8	-0.2	0.0	0.0	0.0	0.0	-0.8
2002	157	-0.2	-0.3	-0.3	-0.6	-1.9	-2.1	-2.4	-1.9	-0.7	-0.3	0.0	0.0	0.0	0.0	-0.7
2003	163	0.2	0.1	0.1	-0.1	0.1	0.5	0.6	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.1
2004	146	0.0	0.0	0.0	0.0	0.3	1.0	1.9	2.2	1.0	0.1	0.0	0.0	0.0	0.0	0.4
2005	151	0.0	-0.1	0.0	0.0	0.3	1.3	3.3	3.7	1.4	0.0	0.0	0.0	0.0	0.0	0.5
2006	145	0.0	-0.1	-0.1	-0.1	0.0	0.5	2.2	2.4	1.0	0.2	0.1	0.0	0.0	0.0	0.3
2007	155	-0.1	-0.2	-0.2	-0.4	-0.9	-0.3	1.8	1.4	0.7	0.3	0.1	0.0	0.0	0.0	0.1
2008	159	-0.1	-0.2	-0.3	-0.5	-0.7	-0.1	1.8	2.2	1.2	0.4	0.1	0.0	0.0	0.0	0.1
AVERAGE		-0.2	-0.4	-0.4	-0.3	-1.9	-2.5	-1.6	-1.0	-0.4	-0.1	0.0	0.0	0.0	0.0	-0.6

Table H-1j-5

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415 Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
Grand Coulee Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	-0.3	-0.5	-0.4	-0.1	-1.8	-3.1	-2.0	-0.9	-0.2	-0.2	0.0	0.0	0.0	0.0	-0.7
1990	154	-0.3	-0.4	-0.3	0.0	-1.7	-2.3	-1.8	-0.6	-0.2	0.0	0.0	0.0	0.0	0.0	-0.6
1991	154	-0.2	-0.3	-0.3	0.1	-1.0	-2.1	-1.1	-0.3	0.0	0.1	0.0	0.0	0.0	0.0	-0.4
1992	160	-0.1	-0.2	-0.1	0.2	-0.6	-1.4	-0.8	0.1	0.2	0.0	0.0	0.0	0.0	0.0	-0.2
1993	155	-0.1	-0.2	-0.3	-0.1	-1.3	-2.0	-1.6	-0.7	-0.1	-0.1	0.0	0.0	0.0	0.0	-0.5
1994	155	-0.2	-0.3	-0.2	-0.3	-1.4	-1.5	-1.0	-0.8	-0.2	0.1	0.0	0.0	0.0	0.0	-0.4
1995	154	-0.1	-0.3	-0.2	-0.4	-1.6	-1.5	-1.9	-1.7	-0.4	0.0	0.0	0.0	0.0	0.0	-0.5
1996	148	-0.1	-0.2	-0.2	-0.5	-1.7	-1.6	-1.9	-1.5	-0.5	-0.1	0.0	0.0	0.0	0.0	-0.6
1997	155	-0.1	-0.2	-0.1	-0.3	-1.0	-0.9	-1.1	-1.3	-0.2	0.0	0.0	0.0	0.0	0.0	-0.3
1998	155	-0.1	-0.1	0.0	0.1	-0.2	-0.3	-0.2	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
1999	149	0.1	0.1	0.2	0.3	0.8	1.0	0.8	0.7	0.5	0.1	0.0	0.0	0.0	0.0	0.3
2000	151	0.0	0.0	0.0	0.1	0.4	0.3	1.0	0.6	0.3	0.0	0.0	0.0	0.0	0.0	0.2
2001	152	0.0	-0.1	-0.1	0.0	-0.2	-0.1	0.8	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0
2002	157	-0.3	-0.3	-0.3	-0.3	-1.3	-1.4	-1.3	-0.6	-0.1	0.0	0.0	0.0	0.0	0.0	-0.4
2003	163	0.1	0.1	0.1	0.2	0.8	1.1	1.5	1.2	0.7	0.0	0.0	0.0	0.0	0.0	0.4
2004	146	0.0	0.0	0.1	0.4	1.0	1.2	2.3	2.2	0.9	0.1	0.0	0.0	0.0	0.0	0.5
2005	151	0.0	-0.1	0.0	0.3	0.8	1.1	2.4	2.6	1.0	0.0	0.0	0.0	0.0	0.0	0.5
2006	145	-0.1	-0.1	-0.1	0.1	0.4	0.5	1.6	1.6	0.4	0.0	0.0	0.0	0.0	0.0	0.2
2007	155	-0.1	-0.1	-0.1	-0.1	-0.3	-0.3	0.5	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0
2008	159	-0.2	-0.2	-0.2	-0.2	-0.6	-0.5	-0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.2
AVERAGE		-0.1	-0.2	-0.1	0.0	-0.5	-0.7	-0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	-0.1

Table H-1j-5

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE
Incr Study: BA430MED : PSCEIS : ALT43
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

Date: 3-JAN-89 06:55:28
Date: 21-JAN-89 05:14:29

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Difference Of
Grand Coulee Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	0.3	0.4	0.3	0.4	1.4	2.1	2.9	1.3	0.3	0.5	0.0	0.0	0.0	0.0	0.7
1990	154	0.2	0.2	0.1	0.1	0.4	0.5	0.7	0.3	0.1	0.1	-0.1	0.0	0.0	0.0	0.2
1991	154	0.2	0.3	0.2	0.2	0.5	0.9	1.5	0.9	0.1	0.3	0.0	0.0	0.0	0.0	0.3
1992	160	0.1	0.2	0.2	0.1	1.0	1.1	0.6	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.3
1993	155	0.2	0.2	0.1	-0.1	0.3	0.4	0.3	-0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.1
1994	155	0.2	0.2	0.1	0.0	0.1	0.1	-0.3	-0.9	-0.5	0.1	0.0	0.0	0.0	0.0	0.0
1995	154	0.1	0.0	-0.1	-0.5	-0.7	-0.4	-1.6	-2.2	-1.0	0.0	0.0	0.0	0.0	0.0	-0.3
1996	148	0.2	0.2	0.0	-0.5	-0.3	0.4	-0.5	-0.8	-0.4	0.0	0.0	0.0	0.0	0.0	-0.1
1997	155	0.2	0.1	-0.1	-0.5	-0.3	0.3	-1.0	-1.3	-0.5	0.1	0.0	0.0	0.0	0.0	-0.1
1998	155	0.0	0.0	-0.1	-0.2	-0.7	-0.5	-1.2	-1.4	-0.7	0.0	0.0	0.0	0.0	0.0	-0.3
1999	149	0.3	0.4	0.4	0.5	1.3	1.6	0.3	-0.1	-0.2	0.0	0.0	0.0	0.0	0.0	0.4
2000	151	0.3	0.2	0.1	-0.2	0.3	0.6	-0.7	-1.5	-1.0	-0.2	0.0	0.0	0.0	0.0	-0.1
2001	152	0.1	0.1	-0.1	-0.6	-0.9	-0.5	-1.6	-2.2	-1.2	-0.2	0.0	0.0	0.0	0.0	-0.4
2002	157	0.1	0.0	-0.1	-0.6	-0.9	-0.7	-1.7	-1.6	-1.1	-0.2	0.0	0.0	0.0	0.0	-0.4
2003	163	0.4	0.4	0.3	0.1	1.2	1.7	1.5	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.5
2004	146	0.3	0.4	0.3	0.1	0.7	1.3	1.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.3
2005	151	0.2	0.2	0.2	0.1	0.4	0.6	0.5	0.3	0.2	-0.1	0.0	0.0	0.0	0.0	0.2
2006	145	0.2	0.2	0.1	0.0	0.1	0.2	-0.2	-0.4	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
2007	155	0.1	0.1	0.0	-0.3	0.0	0.0	-0.8	-0.6	-0.2	0.2	0.0	0.0	0.0	0.0	-0.1
2008	159	0.2	0.2	0.0	-0.4	-0.3	-0.4	-1.3	-1.4	-0.7	-0.1	0.0	0.0	0.0	0.0	-0.2
AVERAGE		0.2	0.2	0.1	-0.1	0.2	0.5	-0.1	-0.5	-0.3	0.0	0.0	0.0	0.0	0.0	0.1

Table H-1j-5

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BC440MED : PSCEIS : ALT44   Date: 28-JAN-89 06:06:31
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
Grand Coulee Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	148	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	149	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	151	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	157	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	163	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	151	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2007	155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	159	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVERAGE		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table H-1j-6

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28

Number of Games: 200

Average Over High Water Years (Top 10 Percent)

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Grand Coulee Res Elev (feet)

YEAR	/ NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	1289.2	1288.9	1288.9	1288.3	1282.0	1266.0	1227.9	1215.1	1211.6	1250.2	1290.0	1290.0	1290.0	1290.0	1271.9
1990	19	1289.2	1289.1	1289.3	1289.1	1284.5	1266.4	1227.5	1215.4	1212.3	1252.4	1290.0	1290.0	1290.0	1290.0	1272.5
1991	20	1288.8	1289.2	1289.3	1288.9	1282.3	1267.2	1229.5	1215.3	1211.7	1249.2	1290.0	1290.0	1290.0	1290.0	1272.2
1992	22	1288.8	1289.2	1289.4	1289.1	1282.0	1267.6	1230.2	1215.0	1211.4	1247.8	1290.0	1290.0	1290.0	1290.0	1272.1
1993	24	1288.8	1289.1	1289.2	1288.9	1282.4	1266.0	1227.0	1215.7	1212.8	1253.2	1290.0	1290.0	1290.0	1290.0	1272.3
1994	15	1289.0	1289.3	1289.5	1289.4	1284.4	1266.8	1228.1	1215.4	1212.3	1251.6	1290.0	1290.0	1290.0	1290.0	1272.5
1995	15	1288.8	1289.5	1289.6	1289.4	1283.1	1267.9	1230.7	1215.3	1211.7	1248.1	1290.0	1290.0	1290.0	1290.0	1272.4
1996	23	1288.9	1289.3	1289.5	1289.5	1285.1	1266.0	1226.5	1214.9	1212.5	1253.6	1290.0	1290.0	1290.0	1290.0	1272.6
1997	16	1288.9	1289.5	1289.6	1289.6	1283.5	1267.5	1230.0	1216.0	1212.3	1249.9	1290.0	1290.0	1290.0	1290.0	1272.6
1998	22	1288.8	1289.3	1289.5	1289.3	1283.3	1267.1	1229.0	1215.4	1212.0	1250.2	1290.0	1290.0	1290.0	1290.0	1272.4
1999	18	1288.7	1289.3	1289.5	1289.1	1281.2	1267.9	1231.2	1214.4	1211.2	1246.1	1290.0	1290.0	1290.0	1290.0	1272.0
2000	22	1288.9	1289.3	1289.5	1289.4	1284.3	1266.7	1227.8	1214.9	1212.1	1251.8	1290.0	1290.0	1290.0	1290.0	1272.5
2001	17	1288.8	1289.5	1289.5	1289.4	1283.3	1267.1	1228.7	1216.0	1212.4	1251.5	1290.0	1290.0	1290.0	1290.0	1272.5
2002	18	1288.9	1289.5	1289.7	1289.5	1284.1	1266.9	1228.4	1215.0	1212.1	1251.0	1290.0	1290.0	1290.0	1290.0	1272.5
2003	14	1288.7	1289.2	1289.3	1289.0	1281.4	1266.6	1228.4	1213.2	1211.1	1248.5	1290.0	1290.0	1290.0	1290.0	1271.9
2004	30	1288.8	1289.0	1289.1	1288.4	1280.8	1265.6	1226.6	1213.7	1211.3	1250.4	1290.0	1290.0	1290.0	1290.0	1271.7
2005	19	1289.0	1289.2	1289.2	1288.7	1281.4	1266.0	1227.5	1214.6	1211.9	1251.4	1290.0	1290.0	1290.0	1290.0	1272.0
2006	23	1289.1	1289.4	1289.5	1289.2	1283.2	1266.9	1228.3	1215.0	1211.9	1250.6	1290.0	1290.0	1290.0	1290.0	1272.3
2007	22	1288.8	1289.5	1289.6	1289.5	1284.2	1266.6	1227.6	1215.0	1212.2	1251.8	1290.0	1290.0	1290.0	1290.0	1272.5
2008	15	1289.1	1289.5	1289.7	1289.6	1284.6	1267.0	1228.6	1215.9	1212.4	1251.6	1290.0	1290.0	1290.0	1290.0	1272.7
AVERAGE		1288.9	1289.3	1289.4	1289.1	1283.0	1266.7	1228.3	1215.0	1212.0	1250.6	1290.0	1290.0	1290.0	1290.0	1272.3

Table H-1j-6

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*************************************************************************************************************
                                            BPAHYSUM Summary
Base Study:    BA000MED : PSCEIS : BASE CASE                              Date:    3-JAN-89 06:55:28
Incr Study:    BD120MED : PSCEIS : BASE CASE   : ALT 1.2                  Date:    6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)
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Difference Of
Grand Coulee Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	19	0.1	0.1	0.0	0.0	0.3	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1991	20	0.1	0.0	0.0	0.0	0.1	-0.1	-0.1	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	22	0.1	0.1	0.1	0.1	0.3	0.4	0.7	0.7	0.3	0.0	0.0	0.0	0.0	0.0	0.2
1993	24	0.1	0.1	0.1	0.1	0.3	0.2	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1994	15	0.2	0.2	0.1	0.1	0.2	0.2	0.3	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.1
1995	15	0.1	0.0	0.1	0.0	0.0	0.2	0.3	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.1
1996	23	0.2	0.2	0.1	0.1	0.2	0.3	0.3	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.1
1997	16	0.2	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1998	22	0.1	0.1	0.1	0.0	0.2	0.1	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1
1999	18	0.1	0.1	0.1	0.1	0.2	0.4	0.3	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.1
2000	22	0.1	0.1	0.1	0.0	0.3	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	17	0.1	0.0	0.1	0.1	0.3	0.1	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.1
2002	18	0.2	0.1	0.1	0.0	0.1	0.0	-0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	14	0.2	0.1	0.1	0.0	0.3	0.3	0.4	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.1
2004	30	0.1	0.1	0.1	0.2	0.8	0.4	0.6	0.7	0.2	0.0	0.0	0.0	0.0	0.0	0.2
2005	19	0.1	0.1	0.1	0.1	0.6	0.0	-0.1	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.1
2006	23	0.2	0.2	0.2	0.2	0.5	0.1	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.1
2007	22	0.2	0.1	0.1	0.0	0.2	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1
2008	15	0.2	0.2	0.1	0.1	0.3	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.1
AVERAGE		0.1	0.1	0.1	0.1	0.3	0.1	0.2	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.1

Table H-1j-6

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                                                  BPAHYSUM Summary
Base Study:    BA000MED : PSCEIS : BASE CASE                                      Date:    3-JAN-89 06:55:28
Incr Study:    BE410MED : PSCEIS : ALT410                                         Date:    1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)
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Difference Of
Grand Coulee Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	-0.3	-0.6	-0.5	-0.1	-3.2	-2.2	-3.0	-2.2	-0.8	0.0	0.0	0.0	0.0	0.0	-0.9
1990	19	-0.4	-0.5	-0.4	0.0	-0.8	-0.3	-0.8	-0.8	-0.2	0.0	0.0	0.0	0.0	0.0	-0.3
1991	20	-0.2	-0.5	-0.3	-0.1	-1.6	-1.7	-2.3	-1.9	-0.6	0.0	0.0	0.0	0.0	0.0	-0.6
1992	22	-0.2	-0.3	-0.2	0.1	-1.0	-0.6	-1.0	-1.3	-0.1	0.0	0.0	0.0	0.0	0.0	-0.3
1993	24	-0.1	-0.7	-0.6	-0.5	-2.9	-4.3	-3.0	-1.6	-0.9	0.0	0.0	0.0	0.0	0.0	-1.1
1994	15	-0.2	-0.9	-1.0	-1.1	-5.8	-5.3	-4.8	-3.1	-1.1	0.0	0.0	0.0	0.0	0.0	-1.7
1995	15	-0.2	-1.0	-1.1	-1.2	-5.1	-5.3	-7.1	-5.1	-1.5	0.0	0.0	0.0	0.0	0.0	-1.9
1996	23	-0.2	-0.9	-1.1	-1.4	-6.7	-6.6	-3.8	-2.6	-0.8	0.0	0.0	0.0	0.0	0.0	-1.8
1997	16	-0.2	-1.0	-1.1	-1.6	-6.2	-7.2	-6.7	-5.1	-1.6	0.0	0.0	0.0	0.0	0.0	-2.1
1998	22	-0.2	-0.9	-1.0	-1.3	-5.8	-6.7	-6.6	-4.4	-1.2	0.0	0.0	0.0	0.0	0.0	-2.0
1999	18	-0.1	-0.8	-0.9	-1.1	-4.0	-5.6	-7.2	-5.0	-1.4	0.0	0.0	0.0	0.0	0.0	-1.8
2000	22	-0.2	-0.7	-0.8	-1.4	-5.2	-4.7	-3.8	-3.3	-0.8	0.0	0.0	0.0	0.0	0.0	-1.5
2001	17	-0.2	-0.8	-0.8	-1.4	-4.2	-4.9	-3.7	-4.2	-1.1	0.0	0.0	0.0	0.0	0.0	-1.4
2002	18	-0.1	-0.6	-0.7	-1.5	-3.7	-2.5	-2.9	-2.6	-0.8	0.0	0.0	0.0	0.0	0.0	-1.1
2003	14	0.2	-0.1	-0.3	-0.5	-0.7	-0.7	-0.4	0.7	0.1	0.0	0.0	0.0	0.0	0.0	-0.2
2004	30	0.1	0.1	0.1	0.2	1.1	0.7	1.0	0.6	0.3	0.0	0.0	0.0	0.0	0.0	0.3
2005	19	0.0	-0.1	0.2	0.5	2.4	0.1	-0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2
2006	23	0.0	0.0	0.2	0.5	1.7	0.3	0.5	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.3
2007	22	0.0	-0.2	-0.1	-0.2	0.1	-0.5	-0.9	-0.7	-0.3	0.0	0.0	0.0	0.0	0.0	-0.2
2008	15	0.0	-0.1	-0.2	-0.2	-0.3	-0.3	-0.5	-0.4	-0.2	0.0	0.0	0.0	0.0	0.0	-0.1
AVERAGE		-0.1	-0.5	-0.5	-0.6	-2.5	-2.8	-2.7	-2.0	-0.6	0.0	0.0	0.0	0.0	0.0	-0.9

Table H-1.i-6

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415 — Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

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Difference Of
Grand Coulee Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	-0.3	-0.5	-0.3	0.1	-1.4	-1.5	-2.2	-1.6	-0.5	0.0	0.0	0.0	0.0	0.0	-0.5
1990	19	-0.3	-0.3	-0.2	0.4	0.7	0.2	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1
1991	20	-0.2	-0.4	-0.2	0.2	0.4	-0.5	-1.2	-1.0	-0.3	0.0	0.0	0.0	0.0	0.0	-0.2
1992	22	-0.1	0.0	0.0	0.3	0.1	0.1	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1
1993	24	-0.1	-0.4	-0.3	-0.3	-1.0	-1.5	-1.4	-0.9	-0.6	0.0	0.0	0.0	0.0	0.0	-0.5
1994	15	-0.1	-0.4	-0.6	-0.9	-3.4	-1.7	-2.3	-2.3	-0.8	0.0	0.0	0.0	0.0	0.0	-0.9
1995	15	-0.1	-0.6	-0.7	-0.8	-2.1	-1.2	-2.0	-1.5	-0.6	0.0	0.0	0.0	0.0	0.0	-0.7
1996	23	0.0	-0.4	-0.6	-0.9	-3.4	-0.6	-0.6	-0.4	-0.2	0.0	0.0	0.0	0.0	0.0	-0.6
1997	16	0.1	-0.5	-0.5	-0.7	-1.8	-0.7	-0.9	-0.5	-0.4	0.0	0.0	0.0	0.0	0.0	-0.5
1998	22	0.0	-0.3	-0.2	0.1	-0.1	0.5	0.8	0.8	0.3	0.0	0.0	0.0	0.0	0.0	0.1
1999	18	0.1	0.0	0.3	0.4	0.7	1.0	1.4	1.6	0.4	0.0	0.0	0.0	0.0	0.0	0.4
2000	22	0.0	0.1	0.2	0.3	1.0	0.3	0.5	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.2
2001	17	-0.1	-0.2	0.2	0.2	0.3	0.3	0.7	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.1
2002	18	-0.2	-0.5	-0.2	0.1	-0.4	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
2003	14	0.0	0.0	0.3	0.8	1.6	1.4	2.4	2.6	1.0	0.0	0.0	0.0	0.0	0.0	0.6
2004	30	0.0	0.3	0.6	1.3	3.2	1.6	2.4	1.7	0.8	0.0	0.0	0.0	0.0	0.0	0.8
2005	19	-0.1	0.1	0.6	1.2	3.6	0.8	1.1	0.9	0.5	0.0	0.0	0.0	0.0	0.0	0.7
2006	23	-0.1	0.1	0.4	0.8	1.8	0.8	1.4	0.9	0.4	0.0	0.0	0.0	0.0	0.0	0.5
2007	22	-0.1	0.0	0.2	0.4	1.1	0.2	0.3	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.2
2008	15	-0.1	-0.1	0.0	0.3	0.6	0.3	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.1
AVERAGE		-0.1	-0.2	0.0	0.2	0.2	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0

Table H-1j-6

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BA430MED : PSCEIS : ALT43 Date: 21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

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Difference Of
Grand Coulee Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	0.3	0.3	0.3	0.6	1.8	1.1	1.5	1.0	0.7	0.0	0.0	0.0	0.0	0.0	0.5
1990	19	0.1	0.0	-0.1	-0.1	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	20	0.2	0.0	0.1	0.2	1.3	0.5	0.8	1.0	0.5	0.0	0.0	0.0	0.0	0.0	0.3
1992	22	0.1	-0.1	0.0	-0.3	-0.6	0.0	0.2	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0
1993	24	0.2	0.0	0.0	-0.5	-0.7	-0.3	-0.9	-0.9	-0.6	0.0	0.0	0.0	0.0	0.0	-0.2
1994	15	0.3	0.1	-0.2	-0.9	-2.6	-0.4	-0.7	-0.7	-0.4	0.0	0.0	0.0	0.0	0.0	-0.4
1995	15	0.1	-0.4	-0.5	-1.3	-2.7	-1.4	-2.1	-1.5	-0.9	0.0	0.0	0.0	0.0	0.0	-0.8
1996	23	0.3	-0.1	-0.4	-1.2	-3.4	-0.7	-1.3	-1.0	-0.5	0.0	0.0	0.0	0.0	0.0	-0.6
1997	16	0.2	-0.3	-0.5	-1.4	-2.6	-1.6	-2.4	-1.8	-1.0	0.0	0.0	0.0	0.0	0.0	-0.8
1998	22	0.1	-0.3	-0.5	-1.2	-2.9	-1.8	-2.1	-2.5	-0.8	0.0	0.0	0.0	0.0	0.0	-0.8
1999	18	0.4	0.0	-0.1	-0.3	-0.1	-0.1	-0.5	0.6	-0.2	0.0	0.0	0.0	0.0	0.0	-0.1
2000	22	0.4	0.0	-0.2	-0.9	-2.2	-0.6	-0.9	-0.3	-0.3	0.0	0.0	0.0	0.0	0.0	-0.4
2001	17	0.1	-0.3	-0.4	-1.2	-2.2	-1.6	-2.0	-1.9	-0.9	0.0	0.0	0.0	0.0	0.0	-0.7
2002	18	0.2	-0.3	-0.6	-1.4	-3.3	-1.4	-2.0	-1.2	-0.7	0.0	0.0	0.0	0.0	0.0	-0.8
2003	14	0.4	0.1	0.0	-0.5	-0.6	-0.5	0.0	0.7	0.3	0.0	0.0	0.0	0.0	0.0	-0.1
2004	30	0.4	0.4	0.2	0.2	0.8	0.6	0.7	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.3
2005	19	0.2	0.1	0.1	-0.2	0.0	-0.2	-0.6	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	-0.1
2006	23	0.3	0.1	-0.1	-0.5	-1.2	-0.3	-0.5	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	-0.2
2007	22	0.2	-0.1	-0.3	-0.8	-1.8	-0.6	-1.1	-0.8	-0.4	0.0	0.0	0.0	0.0	0.0	-0.4
2008	15	0.3	0.0	-0.3	-0.9	-2.4	-0.7	-1.0	-0.7	-0.4	0.0	0.0	0.0	0.0	0.0	-0.5
AVERAGE		0.2	0.0	-0.1	-0.6	-1.2	-0.5	-0.7	-0.4	-0.2	0.0	0.0	0.0	0.0	0.0	-0.3

Table H-1j-6

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BC440MED : PSCEIS : ALT44 Date: 28-JAN-89 06:06:31
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

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Difference Of
Grand Coulee Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2007	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVERAGE		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table H-1j-7

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Libby Reservoir Elev (feet)

YEAR / NUM		SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	2456.8	2451.4	2430.7	2406.2	2387.0	2376.6	2374.1	2376.1	2380.0	2404.0	2433.8	2443.2	2444.6	2445.6	2415.8
1990	27	2455.8	2451.7	2433.1	2408.7	2395.1	2382.8	2381.1	2383.5	2387.7	2410.1	2436.4	2444.8	2445.6	2446.4	2419.5
1991	26	2453.3	2448.6	2430.6	2405.9	2382.0	2367.9	2365.0	2366.0	2368.2	2397.9	2430.4	2438.3	2438.6	2438.9	2410.6
1992	18	2451.4	2444.9	2424.3	2399.2	2380.2	2364.6	2363.5	2364.6	2366.7	2394.1	2425.0	2434.0	2434.6	2435.4	2406.9
1993	21	2454.7	2451.6	2434.0	2406.6	2389.5	2371.9	2370.9	2372.4	2374.6	2401.5	2429.5	2434.9	2434.0	2434.0	2412.8
1994	30	2451.5	2447.1	2428.0	2401.7	2380.1	2358.0	2356.3	2355.8	2359.0	2389.5	2424.4	2433.1	2433.1	2433.5	2405.2
1995	31	2453.8	2448.9	2429.7	2403.4	2382.1	2363.0	2361.6	2361.8	2366.5	2396.0	2427.3	2434.9	2433.8	2433.7	2408.4
1996	29	2452.8	2447.8	2429.1	2402.4	2384.6	2365.8	2364.7	2366.3	2369.9	2398.3	2427.7	2435.1	2434.3	2434.5	2409.4
1997	29	2453.4	2449.8	2431.7	2405.3	2391.1	2372.6	2371.2	2373.0	2378.4	2404.5	2432.1	2439.3	2437.7	2437.4	2413.9
1998	23	2447.9	2444.7	2427.7	2401.3	2376.4	2358.2	2354.7	2354.4	2356.5	2387.5	2419.7	2423.9	2421.7	2421.9	2401.7
1999	33	2449.9	2445.3	2425.4	2399.0	2384.9	2366.0	2364.8	2366.9	2371.8	2395.7	2425.4	2432.7	2431.6	2431.5	2407.7
2000	27	2454.0	2450.7	2433.3	2405.6	2389.9	2373.8	2372.9	2375.0	2378.5	2403.5	2429.4	2433.4	2431.2	2431.1	2413.0
2001	31	2451.7	2448.2	2429.6	2402.4	2381.2	2364.0	2362.0	2363.6	2367.3	2395.9	2424.9	2431.8	2430.7	2430.9	2407.5
2002	25	2452.3	2447.7	2428.1	2399.6	2388.2	2368.5	2367.5	2369.1	2373.1	2399.4	2426.6	2433.0	2431.2	2430.6	2409.5
2003	23	2453.1	2447.6	2427.7	2401.4	2380.5	2360.9	2358.3	2358.7	2363.1	2393.6	2424.4	2432.1	2431.6	2432.4	2406.3
2004	24	2453.0	2450.2	2433.1	2407.1	2385.8	2371.9	2370.2	2372.3	2375.4	2401.2	2429.9	2434.2	2432.7	2433.7	2412.1
2005	30	2452.9	2450.1	2433.1	2404.9	2387.0	2373.6	2372.0	2374.3	2378.7	2403.9	2431.5	2435.6	2433.5	2434.4	2413.1
2006	32	2452.8	2450.3	2432.6	2403.7	2388.9	2374.3	2373.1	2374.3	2378.0	2403.2	2433.5	2440.1	2438.9	2439.5	2414.2
2007	23	2453.7	2451.4	2434.8	2405.2	2390.0	2376.2	2374.5	2375.8	2378.7	2402.2	2428.0	2431.9	2430.1	2430.4	2413.1
2008	26	2448.1	2445.3	2427.1	2399.3	2380.5	2363.3	2360.3	2359.9	2362.6	2387.9	2422.2	2427.9	2427.6	2428.2	2404.4
AVERAGE		2452.6	2448.7	2430.2	2403.4	2385.3	2368.7	2366.9	2368.2	2371.9	2398.6	2428.2	2434.8	2434.0	2434.3	2410.3

Table H-1j-7

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2 Date: 6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
Libby Reservoir Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.2	-0.1	-0.1	0.0	0.0	-0.1	0.0	0.0
1990	27	0.1	0.5	1.0	0.1	1.0	1.4	1.0	1.0	1.1	0.7	0.4	0.3	0.3	0.3	0.7
1991	26	0.6	1.2	2.1	1.2	0.9	1.5	1.5	1.6	1.8	1.0	0.8	1.1	1.5	1.5	1.3
1992	18	1.0	2.5	3.7	2.4	2.7	3.5	2.2	2.4	2.2	1.3	0.9	1.4	1.6	1.5	2.1
1993	21	0.7	1.2	2.6	1.2	2.3	4.0	2.6	2.4	2.7	1.4	0.9	1.7	1.8	1.7	1.9
1994	30	0.9	1.4	2.3	1.0	0.8	5.6	3.8	4.7	3.8	2.8	1.7	2.0	2.0	2.1	2.4
1995	31	0.6	1.2	2.2	1.2	1.9	3.3	2.5	3.2	3.1	2.2	1.4	1.9	1.9	2.0	2.0
1996	29	0.7	1.6	2.9	1.6	1.3	3.5	3.3	3.4	3.1	2.1	1.2	1.6	1.7	1.4	2.0
1997	29	0.5	1.5	2.5	0.5	1.4	1.8	1.7	2.0	1.8	0.8	0.5	0.5	0.7	0.7	1.2
1998	23	1.3	1.9	2.1	1.2	0.6	2.0	1.1	1.1	1.9	2.0	1.1	1.3	1.7	1.8	1.5
1999	33	1.1	2.1	2.7	1.6	0.7	0.4	-0.1	0.0	0.0	0.1	0.0	0.3	0.5	0.6	0.8
2000	27	0.5	1.4	2.2	1.1	1.4	2.0	0.5	0.3	0.5	0.7	0.2	0.8	0.9	1.2	1.0
2001	31	0.9	1.4	2.0	1.3	0.6	4.5	3.1	3.3	3.6	2.9	2.1	2.0	1.7	1.8	2.2
2002	25	1.1	2.1	3.6	3.3	2.0	3.6	3.5	3.8	3.9	2.6	2.0	2.2	2.4	2.4	2.7
2003	23	0.7	1.5	2.4	1.6	4.2	4.7	4.4	4.6	4.1	2.9	2.1	2.2	2.0	1.9	2.7
2004	24	0.7	1.2	2.4	1.0	2.2	5.9	5.1	5.0	4.2	2.8	2.0	2.4	2.5	2.5	2.7
2005	30	1.3	1.9	3.0	2.0	1.9	4.9	3.5	3.7	3.3	1.8	1.4	2.0	1.9	1.9	2.4
2006	32	0.9	1.3	2.5	1.5	1.3	4.1	3.3	3.2	2.9	2.0	1.2	1.6	1.5	1.5	2.0
2007	23	0.7	1.4	2.7	1.0	1.2	3.5	2.9	3.0	2.4	1.3	0.8	0.4	0.9	1.2	1.6
2008	26	0.8	1.4	2.7	1.8	2.6	3.3	2.9	3.4	2.8	2.2	1.2	1.5	1.5	1.6	2.1
AVERAGE		0.8	1.4	2.4	1.3	1.5	3.1	2.4	2.6	2.5	1.7	1.1	1.4	1.4	1.5	1.7

Table H-1j-7

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410   Date: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
Libby Reservoir Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	-1.8	-6.9	-12.4	-14.7	-20.9	-25.6	-24.3	-25.0	-24.3	-15.8	-10.4	-9.4	-8.9	-8.5	-14.6
1990	27	-2.6	-7.3	-11.1	-10.5	-25.1	-24.2	-22.6	-22.1	-21.1	-12.9	-9.2	-8.7	-8.2	-7.7	-13.6
1991	26	-4.4	-8.2	-12.7	-15.3	-14.4	-20.9	-19.5	-20.2	-19.9	-15.5	-10.3	-8.6	-6.9	-5.6	-12.9
1992	18	0.0	-3.1	-6.7	-7.4	-15.7	-20.8	-20.9	-22.0	-21.3	-14.9	-11.0	-10.7	-9.5	-8.8	-11.8
1993	21	-2.2	-6.2	-9.8	-6.7	-18.3	-14.0	-13.7	-13.8	-13.2	-9.6	-6.8	-5.8	-3.3	-2.0	-9.0
1994	30	-1.5	-5.5	-11.2	-11.9	-15.8	-15.3	-15.2	-16.2	-15.6	-11.0	-7.8	-6.7	-4.7	-3.7	-10.1
1995	31	-2.4	-5.8	-11.8	-11.6	-16.5	-15.8	-15.8	-15.1	-14.9	-10.6	-7.5	-6.1	-3.4	-1.9	-10.0
1996	29	-1.2	-4.9	-9.9	-9.3	-18.1	-17.2	-16.9	-17.4	-16.7	-11.4	-8.2	-7.0	-5.3	-4.2	-10.4
1997	29	-1.8	-6.3	-11.7	-8.8	-23.6	-19.4	-18.3	-17.4	-16.7	-10.9	-8.1	-5.9	-3.1	-1.5	-11.1
1998	23	0.1	-3.6	-9.7	-11.5	-8.0	-7.4	-6.1	-6.0	-4.9	-3.3	-1.6	1.6	4.9	6.0	-4.0
1999	33	-0.4	-2.9	-6.4	-3.0	-8.9	-1.9	-1.8	-2.0	-2.2	-1.3	-0.8	0.9	3.5	4.8	-2.0
2000	27	-0.4	-4.0	-8.0	-5.2	-14.3	-12.8	-12.7	-12.8	-12.4	-8.0	-5.7	-2.0	0.9	2.1	-7.0
2001	31	-0.5	-2.8	-6.2	-4.7	-6.0	-7.1	-6.9	-7.3	-6.4	-4.5	-2.7	-1.4	0.6	1.6	-4.0
2002	25	0.7	-0.3	-1.8	-0.7	-3.1	-2.6	-3.0	-2.3	-1.9	-1.6	-0.4	1.9	4.1	5.4	-0.6
2003	23	0.3	1.1	0.5	-1.3	1.0	3.0	3.4	4.6	4.5	1.9	1.5	3.2	3.9	3.4	1.9
2004	24	0.2	-0.6	-2.2	-2.0	-3.5	-6.0	-5.5	-5.8	-5.5	-3.4	-2.5	-0.5	0.3	-0.2	-2.6
2005	30	0.1	-0.4	-2.8	-2.0	-3.7	-5.3	-5.2	-5.6	-5.8	-3.1	-1.7	1.1	1.0	-0.1	-2.4
2006	32	-0.3	-1.1	-3.7	-2.0	-2.8	-8.3	-8.5	-8.8	-8.0	-5.5	-3.4	-1.3	-0.3	-0.7	-3.8
2007	23	-0.1	-1.4	-4.4	-2.7	-2.6	-8.9	-8.1	-8.1	-7.5	-3.2	-1.9	-0.6	0.0	-0.9	-3.5
2008	26	-1.1	-2.6	-6.0	-6.2	-7.8	-9.7	-9.3	-8.7	-8.2	-4.8	-2.7	0.1	0.1	-0.3	-4.9
AVERAGE		-1.0	-3.7	-7.5	-6.9	-11.4	-11.9	-11.4	-11.5	-11.0	-7.4	-5.0	-3.2	-1.6	-1.0	-6.8

Table H-1j-7

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415 Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
Libby Reservoir Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	-1.6	-6.5	-11.7	-14.0	-14.2	-15.6	-14.1	-15.0	-14.3	-7.6	-4.7	-4.1	-4.7	-4.8	-9.4
1990	27	-1.9	-5.6	-8.5	-6.8	-18.6	-13.0	-11.3	-11.0	-10.4	-5.6	-3.8	-3.6	-3.3	-3.0	-7.7
1991	26	-2.0	-4.8	-9.7	-9.5	-8.1	-8.9	-7.6	-8.0	-7.3	-5.5	-4.0	-3.2	-2.2	-1.6	-6.0
1992	18	0.5	-1.7	-3.1	-3.4	-5.5	-6.0	-6.6	-7.4	-7.1	-5.3	-3.8	-2.7	-2.0	-1.6	-3.9
1993	21	-0.8	-2.2	-3.7	-1.9	-3.2	0.0	-0.7	-0.4	0.4	-0.7	-0.4	0.8	2.2	2.9	-0.8
1994	30	0.3	-1.1	-3.1	-2.6	-0.9	0.8	0.1	1.1	1.2	0.7	0.3	1.1	2.0	2.3	-0.1
1995	31	-0.1	-0.9	-2.7	-2.3	-1.2	0.9	0.7	1.6	1.4	0.9	0.6	2.5	3.5	3.9	0.3
1996	29	0.5	-0.1	-1.0	-0.9	0.8	1.9	2.0	2.0	2.0	1.1	0.3	1.4	2.4	2.5	0.9
1997	29	0.1	0.2	0.1	-0.7	0.7	2.8	3.3	3.8	3.7	1.5	0.8	1.4	2.8	3.4	1.4
1998	23	1.9	1.6	-0.2	-0.9	-1.5	0.7	0.5	0.3	1.3	1.0	1.4	2.7	3.2	3.2	1.0
1999	33	1.3	1.4	1.0	1.1	0.2	2.3	1.7	1.8	1.8	0.6	0.2	1.2	0.4	-0.4	1.0
2000	27	0.6	0.9	-0.4	0.6	-2.3	-2.9	-3.0	-3.3	-3.5	-2.3	-1.8	-0.8	-1.8	-2.6	-1.5
2001	31	0.1	-0.7	-2.1	-0.9	-3.0	-4.8	-4.7	-5.9	-5.5	-4.0	-2.5	-2.7	-3.9	-4.6	-2.9
2002	25	-0.3	-0.8	-1.8	0.3	-5.8	-9.8	-10.8	-11.1	-10.4	-7.3	-4.6	-4.3	-3.8	-3.1	-4.9
2003	23	-0.1	1.1	1.4	0.8	3.2	5.4	6.1	6.7	6.0	3.4	2.3	3.5	3.7	3.2	3.0
2004	24	0.7	0.3	-0.2	0.0	0.7	0.6	0.6	0.1	-0.4	-0.6	-0.3	1.1	0.7	-0.6	0.2
2005	30	0.4	-0.2	-1.3	-0.1	-1.2	-2.2	-2.6	-3.3	-3.4	-2.2	-1.2	-0.2	-1.0	-2.1	-1.3
2006	32	0.0	-0.9	-2.0	-0.1	-1.6	-5.4	-5.7	-5.7	-5.1	-3.2	-2.0	0.1	0.7	-0.1	-2.2
2007	23	0.4	-0.1	-1.8	0.5	-0.7	-5.9	-5.0	-4.8	-4.3	-1.8	-0.7	0.2	0.4	-0.5	-1.6
2008	26	0.5	0.0	-1.7	-0.9	-3.7	-6.6	-6.0	-5.0	-5.1	-2.4	-1.1	2.0	1.5	1.0	-2.0
AVERAGE		0.0	-1.0	-2.6	-2.0	-3.2	-3.2	-3.0	-3.0	-2.8	-1.9	-1.2	-0.1	0.1	-0.1	-1.8

Table H-1j-7

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BA430MED : PSCEIS : ALT43   Date: 21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
Libby Reservoir Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	1.0	3.7	7.8	4.4	10.6	12.8	8.8	8.6	6.7	4.9	3.3	2.6	2.5	2.4	5.8
1990	27	1.1	2.8	4.3	1.9	4.0	3.0	2.0	2.1	1.6	1.8	0.8	0.2	0.2	0.4	2.0
1991	26	1.4	2.9	5.1	3.6	4.7	6.4	5.3	5.3	5.8	3.6	2.7	2.3	2.8	3.2	3.9
1992	18	1.8	3.7	6.2	4.9	4.2	7.2	4.7	4.9	5.4	3.3	1.9	2.4	3.4	3.6	4.1
1993	21	1.1	2.1	4.0	2.7	3.8	10.7	8.3	8.4	7.9	4.6	3.0	4.6	5.8	6.6	5.0
1994	30	2.3	3.9	5.9	4.2	3.2	12.0	9.1	9.6	8.4	6.4	4.3	5.6	6.0	6.4	6.0
1995	31	1.9	3.5	5.1	4.3	4.1	12.4	10.1	11.3	10.1	6.7	4.4	5.7	7.4	8.3	6.4
1996	29	1.9	3.2	5.4	4.5	4.4	10.0	7.5	7.4	7.5	5.2	3.8	5.0	6.1	6.6	5.4
1997	29	1.3	2.6	4.0	3.0	2.1	6.5	5.5	5.8	5.3	2.9	2.2	2.4	3.6	4.2	3.5
1998	23	2.4	3.0	3.6	4.0	1.6	5.7	4.7	4.7	5.2	4.2	4.2	6.3	8.4	9.0	4.5
1999	33	1.7	3.7	7.3	4.7	7.2	14.8	13.1	12.2	11.0	8.8	5.8	6.9	8.1	9.0	7.8
2000	27	2.0	3.6	5.3	3.6	6.6	11.0	6.8	6.6	6.3	4.7	2.5	4.8	6.0	6.5	5.3
2001	31	2.1	3.0	4.6	4.4	3.4	9.8	8.2	8.5	8.1	6.3	4.6	5.1	5.1	5.5	5.4
2002	25	1.7	2.5	4.0	4.6	0.2	2.5	2.4	2.9	3.2	2.2	1.7	2.2	4.4	6.0	2.8
2003	23	1.7	4.5	8.3	5.9	13.7	25.7	26.6	27.3	25.1	16.7	11.7	11.1	11.5	11.4	13.5
2004	24	2.3	3.7	6.3	3.2	7.8	16.1	13.8	13.0	11.0	7.9	5.2	5.3	5.5	5.1	7.3
2005	30	1.4	2.5	4.2	2.9	4.8	9.6	7.5	7.5	5.8	4.2	2.4	2.8	3.1	2.9	4.3
2006	32	1.3	2.0	4.1	3.3	3.4	9.2	7.6	7.5	6.1	5.2	2.7	3.5	4.8	4.7	4.4
2007	23	1.2	1.9	3.5	2.6	2.7	7.4	6.9	7.3	6.3	5.1	3.0	3.1	4.2	4.6	4.0
2008	26	3.3	4.8	7.2	5.9	6.6	11.4	10.0	10.5	9.6	9.8	6.6	7.5	8.1	8.3	7.6
AVERAGE		1.7	3.2	5.3	3.9	4.9	10.2	8.4	8.6	7.8	5.7	3.8	4.5	5.4	5.8	5.4

Table H-1j-7

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BC440MED : PSCEIS : ALT44 — Date: 28-JAN-89 06:06:31
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
Libby Reservoir Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2007	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVERAGE		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table H-1j-8

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Libby Reservoir Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	2457.0	2452.1	2434.7	2409.1	2378.5	2350.8	2347.5	2352.0	2361.2	2399.4	2448.8	2458.9	2458.7	2458.6	2413.0
1990	154	2455.7	2451.5	2436.1	2410.2	2377.7	2350.1	2346.4	2351.6	2362.5	2399.2	2448.5	2458.9	2458.7	2458.6	2412.9
1991	154	2455.3	2451.4	2436.7	2410.0	2377.3	2346.7	2343.3	2348.3	2358.0	2399.9	2448.7	2459.0	2458.6	2458.4	2412.1
1992	160	2453.5	2449.2	2433.9	2407.7	2375.6	2347.4	2344.8	2350.1	2361.2	2400.5	2448.6	2458.9	2458.4	2458.1	2411.6
1993	155	2454.2	2450.7	2436.2	2409.0	2378.9	2351.1	2347.7	2352.4	2363.0	2400.1	2447.4	2458.9	2458.5	2458.3	2413.0
1994	155	2454.6	2451.6	2436.9	2408.5	2378.2	2349.9	2346.8	2352.0	2362.3	2400.0	2447.2	2458.7	2458.0	2457.7	2412.7
1995	154	2451.5	2449.6	2436.2	2408.5	2378.5	2350.1	2345.5	2350.2	2360.6	2400.4	2447.9	2458.8	2458.0	2457.8	2412.1
1996	148	2452.7	2450.1	2436.2	2408.7	2378.6	2349.7	2346.5	2351.2	2361.2	2398.9	2447.2	2458.7	2458.1	2457.9	2412.2
1997	155	2453.0	2450.4	2436.2	2407.2	2376.2	2346.9	2343.1	2348.6	2358.8	2397.9	2447.3	2458.5	2458.0	2457.8	2411.1
1998	155	2453.2	2450.4	2436.8	2408.0	2375.6	2346.2	2342.0	2347.9	2359.1	2397.7	2447.0	2458.8	2458.2	2458.0	2411.1
1999	149	2451.6	2448.2	2434.3	2407.3	2375.1	2346.5	2342.5	2347.4	2358.5	2397.0	2447.6	2458.9	2458.4	2458.2	2410.5
2000	151	2451.7	2449.4	2436.4	2408.2	2375.4	2344.3	2341.3	2347.3	2358.2	2401.5	2449.0	2458.9	2458.5	2458.4	2411.1
2001	152	2452.8	2450.9	2437.2	2408.6	2377.7	2348.7	2346.4	2351.9	2361.9	2399.9	2448.2	2458.9	2458.2	2458.0	2412.4
2002	157	2452.4	2449.7	2436.0	2406.0	2377.0	2349.6	2345.2	2350.4	2360.8	2399.8	2447.7	2458.8	2458.2	2457.8	2411.7
2003	163	2452.9	2449.4	2434.4	2407.8	2375.3	2346.3	2342.7	2348.0	2359.0	2399.3	2447.9	2458.8	2458.4	2458.2	2411.0
2004	146	2453.6	2450.6	2436.0	2409.0	2377.0	2348.4	2344.9	2349.5	2360.4	2400.3	2448.3	2459.0	2458.5	2458.4	2412.1
2005	151	2454.3	2451.9	2438.0	2409.4	2378.3	2350.6	2346.9	2352.0	2362.6	2398.1	2448.0	2458.9	2458.4	2458.2	2412.9
2006	145	2453.5	2451.5	2437.6	2408.0	2378.2	2349.8	2347.0	2352.5	2364.1	2403.5	2448.5	2458.8	2458.6	2458.4	2413.2
2007	155	2453.6	2451.9	2438.9	2408.3	2378.3	2352.0	2347.2	2352.5	2362.2	2397.9	2447.5	2458.5	2458.3	2458.1	2412.9
2008	159	2454.7	2453.1	2440.9	2409.6	2375.6	2344.4	2340.8	2346.2	2356.8	2396.5	2447.0	2458.8	2458.6	2458.5	2411.4
AVERAGE		2453.6	2450.7	2436.5	2408.5	2377.1	2348.5	2344.9	2350.1	2360.6	2399.4	2447.9	2458.8	2458.4	2458.2	2412.0

Table H-1j-8

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                                    BPAHYSUM Summary
Base Study:    BA000MED : PSCEIS : BASE CASE                     Date:   3-JAN-89 06:55:28
Incr Study:    BD120MED : PSCEIS : BASE CASE  : ALT 1.2          Date:   6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)
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Difference Of
Libby Reservoir Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	154	0.1	0.5	0.8	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
1991	154	0.3	1.0	1.6	0.1	0.2	0.4	0.4	0.4	0.3	0.2	0.0	0.0	0.1	0.2	0.4
1992	160	0.7	1.3	1.8	0.7	0.7	0.3	0.1	0.1	0.1	0.1	0.2	0.0	0.1	0.2	0.5
1993	155	0.6	1.3	1.9	0.3	0.6	0.6	0.7	0.8	0.7	0.4	0.2	0.0	0.1	0.1	0.6
1994	155	0.4	1.0	1.9	0.4	0.5	0.4	0.3	0.4	0.4	0.3	0.2	0.0	0.2	0.2	0.5
1995	154	0.9	1.2	1.4	0.3	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.4
1996	148	0.6	1.1	1.7	0.5	0.5	0.5	0.4	0.4	0.3	0.2	0.1	0.1	0.2	0.2	0.5
1997	155	0.6	1.2	1.8	0.7	0.5	0.2	0.2	0.4	0.3	0.1	0.0	0.0	0.2	0.2	0.5
1998	155	0.6	1.0	1.3	0.4	0.3	0.4	0.4	0.4	0.4	0.3	0.2	0.0	0.1	0.1	0.4
1999	149	0.9	1.4	1.6	0.4	0.4	0.2	0.2	0.3	0.3	0.2	0.1	0.0	0.2	0.2	0.5
2000	151	0.6	1.0	1.6	0.6	0.5	0.4	0.5	0.5	0.5	0.2	0.1	0.1	0.1	0.1	0.5
2001	152	0.7	1.0	1.5	0.5	0.3	0.3	0.3	0.3	0.2	0.1	0.0	0.0	0.2	0.2	0.4
2002	157	0.8	1.2	1.7	0.9	0.9	0.8	0.8	0.9	0.8	0.5	0.3	0.1	0.2	0.2	0.7
2003	163	1.0	1.6	2.1	1.0	0.9	0.5	0.5	0.5	0.5	0.3	0.1	0.0	0.2	0.2	0.7
2004	146	0.6	0.9	1.5	0.4	0.4	0.3	0.5	0.5	0.4	0.2	0.0	0.0	0.1	0.1	0.4
2005	151	0.6	1.2	2.4	0.5	0.4	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.2	0.5
2006	145	0.8	1.2	2.3	0.7	0.8	0.8	0.8	0.8	0.6	0.3	0.1	0.0	0.1	0.1	0.7
2007	155	0.7	1.1	1.7	0.7	0.9	0.7	0.7	0.7	0.6	0.4	0.1	0.1	0.1	0.2	0.6
2008	159	0.6	0.9	1.4	0.2	0.2	0.6	0.5	0.5	0.5	0.2	0.1	0.0	0.1	0.1	0.4
AVERAGE		0.6	1.1	1.6	0.5	0.5	0.4	0.4	0.4	0.4	0.2	0.1	0.0	0.1	0.2	0.5

Table H-1j-8

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410 — Date: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
Libby Reservoir Elev (feet)

YEAR / NUM		SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	-1.6	-5.8	-9.2	-4.1	-3.2	-3.0	-2.9	-2.7	-2.3	-1.0	-0.8	-0.1	0.2	0.3	-2.8
1990	154	-2.2	-6.2	-8.5	-3.6	-3.1	-2.6	-2.6	-2.6	-2.3	-1.2	-0.7	-0.2	0.1	0.2	-2.7
1991	154	-2.6	-6.2	-9.2	-3.9	-5.2	-4.0	-3.9	-4.0	-3.5	-1.7	-0.7	-0.2	0.2	0.4	-3.4
1992	160	-2.0	-4.6	-6.3	-2.0	-3.2	-2.1	-2.4	-2.4	-2.1	-0.9	-0.5	-0.1	0.4	0.6	-2.1
1993	155	-3.0	-6.3	-9.7	-2.6	-3.3	-2.4	-2.6	-2.6	-2.4	-1.3	-0.8	-0.3	0.2	0.4	-2.9
1994	155	-2.1	-7.0	-11.4	-3.0	-4.2	-2.6	-2.9	-2.8	-2.6	-1.5	-0.8	-0.2	0.6	0.7	-3.1
1995	154	-2.1	-6.8	-11.6	-3.3	-3.7	-1.7	-0.8	-1.0	-0.9	-0.5	-0.3	0.0	0.7	0.8	-2.6
1996	148	-1.8	-6.0	-10.5	-3.2	-3.9	-1.9	-1.8	-1.9	-1.8	-0.8	-0.5	0.1	0.5	0.5	-2.6
1997	155	-2.0	-6.6	-11.9	-2.5	-3.0	-1.1	-1.0	-0.8	-0.8	-0.4	-0.2	0.0	0.4	0.6	-2.4
1998	155	-2.0	-6.2	-11.4	-2.6	-4.1	-2.1	-1.6	-1.7	-1.6	-0.8	-0.5	-0.3	0.2	0.3	-2.7
1999	149	-0.3	-4.1	-8.1	-0.7	-0.9	0.0	0.0	0.0	-0.1	0.0	-0.1	0.0	0.3	0.4	-1.2
2000	151	0.0	-3.7	-7.5	-1.6	-2.1	-0.9	-1.1	-1.1	-1.1	-0.5	-0.4	0.0	0.0	-0.1	-1.6
2001	152	-0.6	-3.5	-5.7	-1.0	-1.3	-0.4	-0.7	-0.7	-0.8	-0.4	-0.2	0.0	0.2	0.2	-1.2
2002	157	0.0	-1.9	-3.7	0.0	0.0	0.5	0.6	0.6	0.5	0.4	0.2	0.1	0.3	0.3	-0.3
2003	163	1.4	1.7	1.8	1.1	1.0	0.6	0.6	0.7	0.7	0.5	0.3	0.1	-0.1	-0.2	0.8
2004	146	0.4	0.1	-0.6	-1.2	-1.0	-0.8	-1.5	-1.5	-1.3	-0.6	-0.2	-0.1	-0.3	-0.4	-0.6
2005	151	-0.3	-1.3	-1.5	-1.1	-1.4	-1.1	-1.5	-1.6	-1.5	-0.8	-0.4	-0.1	-0.2	-0.4	-0.9
2006	145	-0.3	-1.3	-2.4	-1.4	-0.9	-1.4	-2.2	-2.2	-1.8	-0.8	-0.3	-0.3	-0.6	-0.8	-1.2
2007	155	-0.5	-1.8	-3.7	-1.6	-1.7	-1.6	-1.5	-1.4	-1.2	-0.6	-0.2	-0.3	-0.5	-0.7	-1.3
2008	159	-0.6	-1.9	-4.0	-1.5	-1.4	-1.1	-1.2	-1.2	-1.0	-0.2	0.0	-0.1	-0.3	-0.5	-1.1
AVERAGE		-1.1	-4.0	-6.7	-2.0	-2.3	-1.5	-1.5	-1.5	-1.4	-0.7	-0.4	-0.1	0.1	0.1	-1.8

Table H-1j-8

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415 — Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
Libby Reservoir Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	-1.5	-5.5	-8.4	-3.9	-2.7	-2.1	-2.0	-1.9	-1.6	-0.8	-0.6	-0.1	0.0	0.1	-2.4
1990	154	-1.8	-5.2	-6.9	-3.1	-2.5	-2.1	-1.9	-1.8	-1.6	-0.9	-0.5	-0.1	0.0	0.0	-2.2
1991	154	-1.5	-4.3	-5.6	-2.3	-2.8	-1.7	-1.8	-1.7	-1.4	-0.9	-0.2	0.0	0.1	0.2	-1.9
1992	160	-1.0	-2.9	-3.6	-1.3	-1.7	-1.2	-1.5	-1.5	-1.4	-0.6	-0.4	-0.1	0.1	0.1	-1.3
1993	155	-1.0	-2.8	-4.5	-0.7	-1.0	-0.4	-0.6	-0.5	-0.4	-0.3	-0.1	0.0	0.1	0.1	-1.0
1994	155	-0.3	-2.1	-3.5	-0.6	-0.9	-0.3	-0.7	-0.7	-0.7	-0.4	-0.1	0.0	0.2	0.2	-0.8
1995	154	0.2	-1.5	-3.0	-0.6	-0.6	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.3	-0.4
1996	148	0.3	-1.1	-2.3	-0.2	-0.4	0.0	-0.3	-0.3	-0.3	-0.1	0.0	0.1	0.1	0.1	-0.3
1997	155	0.2	-0.5	-1.3	-0.1	-0.4	-0.3	-0.4	-0.2	-0.3	-0.2	-0.1	-0.1	0.0	0.0	-0.3
1998	155	0.5	-0.2	-0.7	0.1	-0.1	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	149	1.0	1.1	1.3	0.7	0.5	0.2	0.2	0.2	0.2	0.2	0.1	0.0	-0.1	-0.2	0.5
2000	151	0.6	0.2	-0.2	-0.2	-0.5	-0.6	-0.9	-0.9	-0.8	-0.4	-0.2	-0.1	-0.3	-0.5	-0.3
2001	152	-0.4	-1.1	-1.3	-0.2	-0.4	-0.9	-1.2	-1.1	-1.0	-0.5	-0.2	-0.1	-0.3	-0.4	-0.6
2002	157	-0.9	-2.5	-3.6	0.1	-0.6	-0.7	-0.9	-0.9	-0.8	-0.3	-0.2	-0.1	-0.2	-0.2	-0.9
2003	163	0.1	1.0	2.1	0.9	1.1	0.7	0.6	0.7	0.6	0.4	0.2	0.1	0.0	-0.1	0.6
2004	146	0.4	0.3	0.6	-0.5	-0.4	-0.5	-1.0	-1.1	-0.9	-0.5	-0.2	0.0	-0.3	-0.4	-0.3
2005	151	-0.1	-0.7	-0.2	-0.4	-0.6	-0.9	-1.2	-1.2	-1.1	-0.6	-0.3	-0.1	-0.4	-0.4	-0.6
2006	145	-0.5	-1.2	-1.6	-0.5	-0.3	-0.7	-1.4	-1.4	-1.2	-0.6	-0.2	-0.1	-0.3	-0.4	-0.7
2007	155	0.1	-0.5	-1.4	0.1	-0.2	-0.5	-0.6	-0.7	-0.5	-0.3	-0.1	0.0	-0.2	-0.3	-0.4
2008	159	-0.3	-1.3	-2.1	-0.1	-0.2	-0.4	-0.5	-0.4	-0.3	0.0	0.0	0.1	-0.2	-0.3	-0.4
AVERAGE		-0.3	-1.6	-2.3	-0.6	-0.7	-0.6	-0.8	-0.8	-0.7	-0.3	-0.1	0.0	-0.1	-0.1	-0.7

Table H-1j-8

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BA430MED : PSCEIS : ALT43   Date: 21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
Libby Reservoir Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	0.9	3.5	5.3	1.9	1.5	1.2	0.9	0.9	0.7	0.5	0.0	0.0	0.0	0.1	1.4
1990	154	0.9	2.3	2.4	0.6	0.6	0.5	0.6	0.6	0.4	0.2	-0.1	0.0	0.1	0.1	0.7
1991	154	0.6	2.0	2.5	0.8	0.7	1.1	1.3	1.2	0.8	0.4	0.0	0.0	0.1	0.2	0.9
1992	160	1.3	2.3	2.7	1.9	1.4	1.2	1.2	1.1	0.9	0.7	0.2	0.0	0.2	0.3	1.2
1993	155	1.1	2.1	2.2	1.0	0.9	1.2	1.1	1.1	0.8	0.4	0.2	0.0	0.3	0.3	1.0
1994	155	1.3	2.2	2.5	1.4	1.7	2.0	1.6	1.7	1.4	0.8	0.5	0.2	0.6	0.6	1.4
1995	154	2.4	2.5	1.1	1.6	0.9	1.1	1.5	1.5	1.4	0.8	0.4	0.1	0.3	0.3	1.2
1996	148	1.9	2.5	1.7	1.2	0.9	1.3	1.3	1.2	1.1	0.6	0.4	0.2	0.4	0.4	1.1
1997	155	2.0	2.4	1.5	2.4	1.5	1.0	1.1	1.2	1.0	0.6	0.4	0.3	0.5	0.6	1.2
1998	155	1.4	1.3	-0.4	1.7	1.1	1.3	1.8	1.8	1.4	0.7	0.3	0.0	0.4	0.5	0.9
1999	149	2.4	4.0	5.0	2.7	2.4	1.7	1.7	1.7	1.6	0.7	0.4	0.0	0.3	0.4	1.9
2000	151	2.5	3.3	2.8	1.9	1.3	1.1	1.1	1.1	0.9	0.3	0.1	0.1	0.3	0.3	1.3
2001	152	1.7	1.8	0.3	1.1	0.7	0.5	0.5	0.5	0.4	0.1	0.1	0.0	0.3	0.3	0.6
2002	157	1.5	1.7	0.4	2.3	2.0	1.0	1.1	1.2	1.1	0.6	0.4	0.1	0.5	0.6	1.1
2003	163	1.9	3.7	5.3	2.3	2.4	2.0	2.2	2.3	2.0	1.1	0.5	0.1	0.3	0.4	2.0
2004	146	2.3	3.5	3.9	1.3	1.3	1.0	1.1	1.1	0.8	0.4	0.1	0.0	0.2	0.2	1.3
2005	151	1.1	2.1	2.4	1.0	0.5	0.3	0.3	0.3	0.2	0.0	0.0	0.0	0.1	0.2	0.7
2006	145	1.0	1.8	2.1	1.5	1.3	1.0	0.7	0.7	0.5	0.2	0.1	0.0	0.1	0.2	0.9
2007	155	1.2	1.6	0.8	1.4	1.5	1.3	1.5	1.5	1.4	0.9	0.3	0.3	0.3	0.4	1.0
2008	159	1.1	1.5	0.6	0.8	0.7	0.7	0.5	0.6	0.5	0.2	0.0	0.1	0.1	0.2	0.6
AVERAGE		1.5	2.4	2.3	1.5	1.3	1.1	1.2	1.2	1.0	0.5	0.2	0.1	0.3	0.3	1.1

Table H-1j-8

BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BC440MED : PSCEIS : ALT44   Date: 28-JAN-89 06:06:31
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

Difference Of
Libby Reservoir Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	148	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	149	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	151	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	157	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	163	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	151	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2007	155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	159	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVERAGE		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table H-1j-9

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

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Libby Reservoir Elev (feet)

YEAR	/ NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	2457.7	2454.1	2436.6	2411.0	2363.7	2324.4	2310.8	2309.6	2331.4	2397.9	2459.0	2459.0	2459.0	2459.0	2405.4
1990	19	2457.4	2455.1	2440.7	2411.0	2362.6	2321.1	2311.6	2312.0	2334.4	2396.7	2459.0	2459.0	2459.0	2459.0	2405.6
1991	20	2455.2	2455.5	2441.2	2411.0	2364.4	2327.2	2312.0	2309.5	2330.9	2398.4	2459.0	2459.0	2459.0	2459.0	2406.1
1992	22	2455.1	2455.0	2441.3	2411.0	2365.3	2330.1	2312.0	2308.2	2329.2	2399.2	2459.0	2459.0	2459.0	2459.0	2406.3
1993	24	2452.9	2453.5	2440.0	2411.0	2362.1	2319.8	2311.5	2313.7	2336.3	2396.2	2459.0	2459.0	2459.0	2459.0	2405.0
1994	15	2456.5	2456.0	2442.7	2411.0	2363.0	2322.9	2311.8	2311.9	2334.1	2397.1	2459.0	2459.0	2459.0	2459.0	2406.0
1995	15	2455.8	2456.6	2443.6	2411.0	2365.1	2330.0	2312.6	2309.5	2330.5	2399.1	2459.0	2459.0	2459.0	2459.0	2406.8
1996	23	2453.9	2455.1	2443.2	2411.0	2361.8	2318.7	2311.3	2312.5	2335.4	2396.0	2459.0	2459.0	2459.0	2459.0	2405.3
1997	16	2453.7	2455.0	2443.6	2411.0	2364.1	2326.7	2312.9	2311.8	2333.2	2398.1	2459.0	2459.0	2459.0	2459.0	2406.3
1998	22	2455.2	2455.3	2442.6	2411.0	2363.8	2325.6	2312.1	2310.6	2332.3	2397.9	2459.0	2459.0	2459.0	2459.0	2406.1
1999	18	2454.1	2455.8	2442.5	2411.0	2366.2	2333.5	2312.1	2306.7	2327.2	2400.2	2459.0	2459.0	2459.0	2459.0	2406.6
2000	22	2455.2	2456.0	2443.2	2411.0	2362.9	2322.4	2311.6	2311.2	2333.5	2397.0	2459.0	2459.0	2459.0	2459.0	2405.8
2001	17	2453.3	2454.9	2443.1	2411.0	2363.1	2323.4	2312.4	2312.6	2334.6	2397.2	2459.0	2459.0	2459.0	2459.0	2405.8
2002	18	2454.0	2456.2	2444.7	2411.0	2363.4	2324.1	2311.8	2310.8	2332.8	2397.4	2459.0	2459.0	2459.0	2459.0	2406.0
2003	14	2454.1	2455.0	2440.6	2411.0	2364.8	2327.9	2310.4	2305.9	2327.5	2398.8	2459.0	2459.0	2459.0	2459.0	2405.6
2004	30	2451.6	2452.2	2438.5	2411.0	2363.2	2323.6	2309.5	2307.3	2329.6	2397.8	2459.0	2459.0	2459.0	2459.0	2404.5
2005	19	2453.4	2453.9	2439.5	2411.0	2363.0	2322.7	2311.0	2310.3	2332.6	2397.2	2459.0	2459.0	2459.0	2459.0	2405.1
2006	23	2455.6	2456.8	2443.1	2411.0	2363.6	2324.7	2311.5	2310.3	2332.2	2397.7	2459.0	2459.0	2459.0	2459.0	2406.1
2007	22	2452.9	2455.8	2444.3	2411.0	2362.9	2322.4	2311.4	2311.1	2333.5	2397.0	2459.0	2459.0	2459.0	2459.0	2405.7
2008	15	2455.5	2456.7	2445.2	2411.0	2363.1	2323.2	2312.4	2312.6	2334.6	2397.1	2459.0	2459.0	2459.0	2459.0	2406.3
AVERAGE		2454.5	2455.1	2441.8	2411.0	2363.5	2324.5	2311.5	2310.4	2332.3	2397.6	2459.0	2459.0	2459.0	2459.0	2405.7

Table H-1j-9

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2 Date: 6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

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Difference Of
Libby Reservoir Elev (feet)

YEAR	/ NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	19	0.2	0.7	0.5	0.0	0.0	0.1	0.1	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.1
1991	20	0.2	0.2	0.5	0.0	0.0	-0.1	-0.2	-0.4	-0.3	0.0	0.0	0.0	0.0	0.0	0.0
1992	22	0.6	0.7	1.0	0.0	0.0	0.5	0.7	1.3	1.2	0.0	0.0	0.0	0.0	0.0	0.4
1993	24	1.0	1.1	1.3	0.0	0.0	0.0	0.1	0.5	0.4	0.0	0.0	0.0	0.0	0.0	0.3
1994	15	0.6	0.7	1.5	0.0	0.0	0.2	0.3	0.6	0.5	0.0	0.0	0.0	0.0	0.0	0.3
1995	15	0.6	0.4	0.8	0.0	0.0	0.2	0.4	0.8	0.7	0.0	0.0	0.0	0.0	0.0	0.3
1996	23	1.3	1.5	1.4	0.0	0.0	0.2	0.3	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.4
1997	16	0.3	0.5	1,1	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2
1998	22	0.5	0.7	1.1	0.0	0.0	0.2	0.3	0.6	0.5	0.0	0.0	0.0	0.0	0.0	0.3
1999	18	0.5	0.7	1.1	0.0	0.0	0.3	0.4	0.7	0.6	0.0	0.0	0.0	0.0	0.0	0.3
2000	22	0.4	0.4	1.1	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
2001	17	0.2	0.2	0.8	0.0	0.0	0.2	0.3	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.2
2002	18	0.8	0.4	0.8	0.0	0.0	0.0	-0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.2
2003	14	0.5	0.9	1.4	0.0	0.0	0.3	0.4	1.0	0.8	0.0	0.0	0.0	0.0	0.0	0.4
2004	30	1.5	1.4	1.3	0.0	0.1	0.4	0.6	1.3	1.1	0.0	0.0	0.0	0.0	0.0	0.5
2005	19	0.7	0.4	1.5	0.0	0.1	-0.1	-0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2
2006	23	0.5	0.4	1.5	0.0	0.0	0.1	0.2	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.3
2007	22	1.0	0.7	0.7	0.0	0.0	0.0	0.1	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.2
2008	15	0.8	0.8	0.9	0.0	0.0	0.2	0.2	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.3
AVERAGE		0.6	0.7	1.0	0.0	0.0	0.1	0.2	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.3

Table H-1J-9

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410   Date: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

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Difference Of
Libby Reservoir Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	-1.6	-6.6	-9.7	0.0	0.0	-2.7	-3.2	-4.9	-4.2	0.0	0.0	0.0	0.0	0.0	-2.3
1990	19	-1.9	-5.5	-6.8	0.0	0.0	-0.4	-0.9	-1.3	-1.1	0.0	0.0	0.0	0.0	0.0	-1.4
1991	20	-2.0	-4.9	-5.8	0.0	-0.2	-1.7	-2.5	-3.6	-3.1	0.0	0.0	0.0	0.0	0.0	-1.7
1992	22	-2.7	-3.8	-4.1	0.0	-0.1	-0.7	-1.1	-1.9	-1.6	0.0	0.0	0.0	0.0	0.0	-1.2
1993	24	-1.0	-6.4	-9.2	0.0	-0.1	-2.3	-3.2	-3.4	-3.0	0.0	0.0	0.0	0.0	0.0	-2.1
1994	15	-1.2	-8.4	-15.3	0.0	-0.1	-3.8	-5.1	-6.5	-5.6	0.0	0.0	0.0	0.0	0.0	-3.3
1995	15	-2.3	-8.1	-15.2	0.0	-0.2	-5.4	-7.6	-11.0	-9.4	0.0	0.0	0.0	0.0	0.0	-4.0
1996	23	-1.5	-8.0	-15.5	0.0	-0.1	-2.9	-4.1	-5.8	-4.9	0.0	0.0	0.0	0.0	0.0	-3.1
1997	16	-1.5	-8.9	-16.5	0.0	-0.2	-5.2	-7.2	-10.8	-9.2	0.0	0.0	0.0	0.0	0.0	-4.1
1998	22	-1.7	-8.1	-14.5	0.0	-0.1	-4.7	-7.1	-9.6	-8.1	0.0	0.0	0.0	0.0	0.0	-3.7
1999	18	-1.4	-6.8	-11.9	0.0	-0.1	-5.4	-7.8	-10.4	-8.9	0.0	0.0	0.0	0.0	0.0	-3.5
2000	22	-0.8	-5.0	-10.5	0.0	-0.1	-2.9	-4.2	-6.1	-5.2	0.0	0.0	0.0	0.0	0.0	-2.4
2001	17	-1.6	-6.1	-10.4	0.0	-0.2	-3.0	-4.1	-7.0	-6.0	0.0	0.0	0.0	0.0	0.0	-2.6
2002	18	0.1	-3.2	-8.1	0.0	-0.1	-2.3	-3.2	-4.8	-4.2	0.0	0.0	0.0	0.0	0.0	-1.7
2003	14	0.8	0.0	-2.2	0.0	0.0	-0.3	-0.4	0.5	0.4	0.0	0.0	0.0	0.0	0.0	-0.1
2004	30	1.8	2.1	1.8	-0.2	0.2	0.8	1.1	1.2	1.1	0.0	0.0	0.0	0.0	0.0	0.7
2005	19	0.0	-0.3	1.8	0.0	0.1	-0.2	-0.3	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.1
2006	23	-0.3	-0.1	2.1	0.0	0.0	0.3	0.6	0.8	0.7	0.0	0.0	0.0	0.0	0.0	0.3
2007	22	0.6	-0.2	-1.3	0.0	0.0	-0.6	-0.9	-1.5	-1.3	0.0	0.0	0.0	0.0	0.0	-0.3
2008	15	0.2	-0.4	-1.9	0.0	0.0	-0.3	-0.6	-0.8	-0.7	0.0	0.0	0.0	0.0	0.0	-0.3
AVERAGE		-0.8	-4.3	-7.3	0.0	-0.1	-2.1	-2.9	-4.1	-3.5	0.0	0.0	0.0	0.0	0.0	-1.7

Table H-1j- 9

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415 Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

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Difference Of
Libby Reservoir Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	-1.6	-6.0	-6.7	0.0	0.0	-1.9	-2.4	-3.6	-3.1	0.0	0.0	0.0	0.0	0.0	-1.8
1990	19	-1.4	-3.9	-3.7	0.0	0.0	0.3	0.3	0.4	0.4	0.0	0.0	0.0	0.0	0.0	-0.7
1991	20	-1.6	-3.9	-3.9	0.0	-0.1	-0.6	-1.3	-1.7	-1.4	0.0	0.0	0.0	0.0	0.0	-1.1
1992	22	-0.8	-0.9	-0.9	0.0	0.0	0.1	0.2	0.3	0.3	0.0	0.0	0.0	0.0	0.0	-0.2
1993	24	-0.2	-2.9	-4.5	0.0	-0.1	-1.0	-1.5	-2.1	-1.8	0.0	0.0	0.0	0.0	0.0	-1.0
1994	15	0.0	-2.9	-7.4	0.0	-0.1	-1.9	-2.5	-4.3	-3.7	0.0	0.0	0.0	0.0	0.0	-1.5
1995	15	-0.7	-3.3	-7.9	0.0	0.0	-1.5	-2.2	-3.2	-2.8	0.0	0.0	0.0	0.0	0.0	-1.5
1996	23	0.6	-2.0	-6.5	0.0	0.0	-0.4	-0.7	-1.0	-0.9	0.0	0.0	0.0	0.0	0.0	-0.8
1997	16	-0.1	-2.3	-5.0	0.0	0.0	-0.6	-1.0	-1.3	-1.1	0.0	0.0	0.0	0.0	0.0	-0.8
1998	22	0.1	-1.6	-1.5	0.0	0.1	0.6	0.9	1.5	1.3	0.0	0.0	0.0	0.0	0.0	0.0
1999	18	0.6	0.1	2.7	0.0	0.1	1.1	1.6	2.4	2.1	0.0	0.0	0.0	0.0	0.0	0.7
2000	22	0.0	0.0	2.1	0.0	0.0	0.3	0.5	0.8	0.7	0.0	0.0	0.0	0.0	0.0	0.3
2001	17	-0.7	-1.1	1.1	0.0	0.0	0.4	0.7	0.9	0.8	0.0	0.0	0.0	0.0	0.0	0.1
2002	18	-0.4	-2.7	-2.6	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	-0.5
2003	14	0.0	0.2	3.7	0.0	0.1	1.7	2.6	4.6	4.0	0.0	0.0	0.0	0.0	0.0	1.0
2004	30	1.5	2.6	6.4	0.0	0.6	1.7	2.6	3.6	3.2	0.0	0.0	0.0	0.0	0.0	1.5
2005	19	-0.2	0.3	6.1	0.0	0.1	0.7	1.2	1.8	1.6	0.0	0.0	0.0	0.0	0.0	0.8
2006	23	0.1	0.4	3.9	0.0	0.0	0.8	1.5	1.9	1.7	0.0	0.0	0.0	0.0	0.0	0.7
2007	22	0.7	0.0	2.0	0.0	0.0	0.2	0.3	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.3
2008	15	0.2	-0.2	0.3	0.0	0.0	0.3	0.4	0.5	0.4	0.0	0.0	0.0	0.0	0.0	0.1
AVERAGE		-0.2	-1.4	-0.9	0.0	0.1	0.1	0.1	0.2	0.2	0.0	0.0	0.0	0.0	0.0	-0.2

Table H-1j-9

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE
Incr Study: BA430MED : PSCEIS : ALT43 Date: 3-JAN-89 06:55:28
Difference = (Incr Study) - (Base Study) Date: 21-JAN-89 05:14:29
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

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Difference Of
Libby Reservoir Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	0.5	2.1	3.7	0.0	0.0	1.3	1.6	2.1	1.8	0.0	0.0	0.0	0.0	0.0	0.9
1990	19	0.3	0.5	0.0	0.0	0.0	0.0	0.0	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.1
1991	20	1.3	0.3	0.9	0.0	0.1	0.8	0.8	2.2	1.9	0.0	0.0	0.0	0.0	0.0	0.5
1992	22	1.5	0.4	0.1	0.0	0.0	0.1	0.2	0.7	0.6	0.0	0.0	0.0	0.0	0.0	0.2
1993	24	1.5	0.9	1.0	0.0	-0.1	-0.7	-1.0	-2.1	-1.9	0.0	0.0	0.0	0.0	0.0	0.0
1994	15	0.8	0.3	-1.6	0.0	-0.1	-0.5	-0.8	-1.8	-1.6	0.0	0.0	0.0	0.0	0.0	-0.3
1995	15	0.9	-1.3	-4.8	0.0	-0.2	-1.6	-2.3	-3.4	-3.0	0.0	0.0	0.0	0.0	0.0	-1.0
1996	23	2.4	0.9	-3.4	0.0	-0.1	-0.9	-1.4	-2.1	-1.8	0.0	0.0	0.0	0.0	0.0	-0.4
1997	16	2.0	0.1	-3.9	0.0	-0.2	-1.7	-2.6	-3.9	-3.4	0.0	0.0	0.0	0.0	0.0	-0.8
1998	22	0.9	-0.9	-4.9	0.0	-0.2	-1.7	-2.3	-4.3	-3.7	0.0	0.0	0.0	0.0	0.0	-1.1
1999	18	2.2	0.6	-0.4	0.0	0.0	-0.3	-0.5	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.1
2000	22	1.8	0.4	-1.7	0.0	-0.1	-0.7	-1.0	-1.1	-1.0	0.0	0.0	0.0	0.0	0.0	-0.2
2001	17	1.6	-0.7	-3.7	0.0	-0.2	-1.6	-2.2	-3.6	-3.1	0.0	0.0	0.0	0.0	0.0	-0.8
2002	18	1.6	-0.5	-5.5	0.0	-0.1	-1.5	-2.1	-2.8	-2.4	0.0	0.0	0.0	0.0	0.0	-0.9
2003	14	1.4	0.9	0.1	0.0	0.0	-0.1	0.0	1.0	0.9	0.0	0.0	0.0	0.0	0.0	0.3
2004	30	3.7	3.7	3.1	0.0	0.5	0.6	0.8	1.2	1.0	0.0	0.0	0.0	0.0	0.0	1.1
2005	19	1.2	0.7	0.9	0.0	0.0	-0.5	-0.6	-0.6	-0.5	0.0	0.0	0.0	0.0	0.0	0.1
2006	23	0.9	0.3	-0.6	0.0	0.0	-0.4	-0.5	-0.6	-0.5	0.0	0.0	0.0	0.0	0.0	-0.1
2007	22	2.1	0.6	-2.4	0.0	0.0	-0.8	-1.2	-1.7	-1.5	0.0	0.0	0.0	0.0	0.0	-0.3
2008	15	1.1	0.1	-2.4	0.0	0.0	-0.7	-1.1	-1.5	-1.3	0.0	0.0	0.0	0.0	0.0	-0.4
AVERAGE		1.6	0.6	-1.1	0.0	0.0	-0.5	-0.7	-1.0	-0.9	0.0	0.0	0.0	0.0	0.0	-0.1

Table H-1j-9

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BC440MED : PSCEIS : ALT44 Date: 28-JAN-89 06:06:31
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

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Difference Of
Libby Reservoir Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2007	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVERAGE		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table H-1j-10

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE **Date:** 3-JAN-89 06:55:28
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Dworshak Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	1582.7	1578.0	1560.0	1545.3	1536.7	1527.7	1531.0	1539.6	1550.4	1552.5	1563.7	1557.2	1550.5	1546.3	1552.6
1990	27	1577.0	1572.8	1557.9	1549.4	1538.4	1531.9	1536.9	1544.9	1554.5	1553.9	1560.6	1554.4	1548.6	1546.2	1552.8
1991	26	1571.1	1566.8	1553.5	1541.8	1532.2	1521.5	1520.2	1530.0	1542.3	1546.4	1555.0	1547.6	1543.0	1539.9	1544.9
1992	18	1572.4	1567.8	1551.9	1535.5	1526.2	1511.7	1512.3	1523.5	1534.3	1540.3	1548.1	1539.7	1530.4	1526.1	1538.9
1993	21	1572.7	1568.7	1555.9	1544.3	1534.6	1522.0	1523.2	1532.8	1542.7	1542.8	1549.6	1538.7	1529.1	1524.2	1543.3
1994	30	1567.8	1563.4	1549.0	1534.4	1517.6	1503.0	1503.5	1514.4	1528.0	1534.6	1546.2	1538.8	1531.3	1527.0	1534.4
1995	31	1572.7	1568.5	1554.6	1539.5	1523.9	1511.8	1511.0	1523.9	1537.3	1539.0	1546.7	1536.6	1528.3	1524.6	1538.9
1996	29	1572.7	1568.4	1553.0	1537.3	1524.5	1510.5	1513.7	1524.7	1536.0	1539.0	1548.4	1539.8	1530.7	1525.7	1539.1
1997	29	1573.8	1569.7	1555.2	1542.2	1529.6	1520.7	1523.3	1534.7	1545.2	1544.6	1554.4	1544.3	1533.9	1525.9	1544.1
1998	23	1560.3	1556.2	1543.7	1529.2	1519.7	1502.6	1499.1	1511.7	1524.6	1527.5	1535.2	1521.9	1516.5	1513.6	1527.8
1999	33	1568.1	1563.6	1549.4	1535.4	1523.3	1515.8	1518.0	1529.0	1538.7	1538.9	1547.1	1534.9	1525.0	1521.0	1537.9
2000	27	1572.8	1568.9	1555.5	1542.6	1531.6	1521.5	1524.6	1536.5	1546.9	1545.9	1543.6	1531.1	1521.9	1517.6	1541.9
2001	31	1566.9	1563.0	1549.9	1533.7	1523.0	1511.4	1512.6	1525.8	1537.5	1538.0	1543.3	1532.0	1525.1	1521.2	1536.0
2002	25	1572.7	1568.5	1552.6	1535.5	1523.1	1512.2	1516.0	1526.6	1536.8	1539.1	1545.3	1535.0	1524.3	1518.3	1537.9
2003	23	1568.7	1564.4	1551.3	1534.1	1521.9	1508.0	1507.9	1520.4	1533.5	1536.3	1543.2	1533.1	1527.6	1525.2	1535.6
2004	24	1572.1	1568.2	1555.7	1545.8	1533.0	1524.7	1527.4	1536.6	1546.7	1547.1	1549.0	1532.7	1528.2	1526.0	1544.0
2005	30	1570.8	1566.7	1553.8	1541.2	1531.8	1524.1	1527.0	1537.9	1548.0	1547.1	1549.1	1531.2	1526.7	1524.8	1543.0
2006	32	1573.4	1569.3	1555.1	1541.7	1526.7	1517.1	1520.8	1530.8	1543.2	1545.5	1552.6	1538.7	1534.0	1530.9	1542.9
2007	23	1574.3	1570.5	1557.4	1544.9	1532.1	1521.9	1526.1	1537.3	1547.3	1547.8	1546.3	1529.3	1523.1	1520.1	1543.2
2008	26	1563.9	1559.9	1547.1	1534.7	1519.3	1510.0	1511.4	1518.9	1530.0	1535.2	1543.2	1531.3	1525.7	1523.5	1534.1
AVERAGE		1571.3	1567.1	1553.1	1539.4	1527.3	1516.5	1518.3	1529.1	1540.3	1542.1	1548.6	1537.5	1530.3	1526.4	1540.7

Table H-1j-10

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2 Date: 6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
Dworshak Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0	-0.1	0.0
1990	27	0.2	0.3	0.5	0.4	0.7	1.3	1.3	1.1	1.0	1.0	0.9	1.0	1.0	0.9	0.8
1991	26	1.4	1.6	2.0	4.2	3.8	4.0	4.0	3.5	3.1	3.0	2.8	2.7	3.0	3.0	3.0
1992	18	1.5	1.4	3.0	5.6	3.8	5.8	5.5	5.1	4.8	4.7	4.2	3.6	3.0	2.2	3.8
1993	21	2.2	2.3	2.6	4.4	3.8	6.3	5.9	5.4	4.8	4.7	3.8	3.7	3.2	2.5	3.9
1994	30	1.5	1.6	2.0	3.6	5.6	6.2	5.7	5.6	4.3	3.9	3.7	3.5	3.5	2.4	3.7
1995	31	0.8	1.0	1.1	2.6	4.6	4.9	5.4	4.7	3.3	3.2	2.6	1.6	2.3	2.1	2.8
1996	29	1.5	1.4	2.1	3.7	5.2	6.7	5.0	4.4	4.0	3.8	2.8	2.6	2.3	2.2	3.4
1997	29	1.6	1.8	2.2	4.3	2.7	2.5	2.4	1.6	1.2	1.2	1.1	0.5	0.5	0.7	1.8
1998	23	1.8	1.8	2.1	3.8	3.1	6.3	6.1	5.1	4.4	4.1	2.9	3.0	2.8	2.7	3.5
1999	33	1.6	1.7	2.0	3.2	2.5	2.4	2.4	1.7	1.2	1.2	0.5	0.1	-0.1	0.0	1.6
2000	27	1.1	1.1	1.1	2.6	3.8	4.0	3.4	3.2	3.0	3.0	1.4	1.3	1.4	1.2	2.3
2001	31	1.7	1.7	2.1	4.5	5.9	5.0	4.4	3.8	3.4	3.3	1.9	1.4	1.4	1.3	3.1
2002	25	1.6	1.8	2.3	5.3	6.0	6.6	6.2	5.0	4.5	4.3	2.4	2.2	2.6	2.4	3.8
2003	23	1.3	1.3	1.4	3.4	5.0	7.1	6.1	5.7	5.2	4.9	3.8	3.8	3.6	3.3	3.9
2004	24	2.0	2.1	2.3	4.4	5.4	5.1	5.4	4.9	4.7	4.5	3.8	3.3	3.2	3.2	3.8
2005	30	1.7	1.8	1.9	4.5	4.7	6.2	6.6	5.3	4.9	4.9	3.1	2.7	2.4	2.5	3.8
2006	32	1.3	1.4	1.4	2.4	4.1	4.4	4.3	4.0	2.9	2.8	2.9	2.8	2.5	2.6	2.8
2007	23	1.4	1.4	1.5	2.0	2.9	4.1	3.5	3.1	3.0	2.9	2.1	1.8	1.5	1.5	2.3
2008	26	1.7	1.8	1.6	3.0	3.1	3.7	3.8	3.4	3.0	2.9	2.6	2.2	2.7	2.6	2.7
AVERAGE		1.4	1.5	1.7	3.4	3.9	4.6	4.3	3.8	3.2	3.1	2.4	2.1	2.1	1.9	2.8

Table H-1j-10

BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410 — Date: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

Difference Of
Dworshak Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	-4.2	-4.3	-5.5	-18.3	-25.1	-26.8	-26.6	-22.1	-18.7	-17.9	-14.0	-9.0	-2.6	1.7	-14.1
1990	27	-2.3	-2.8	-5.1	-18.4	-17.1	-21.8	-20.0	-17.2	-15.6	-15.3	-8.5	-3.7	0.7	2.8	-10.7
1991	26	-6.6	-7.1	-10.2	-23.1	-33.0	-36.0	-31.7	-28.0	-24.8	-23.7	-16.2	-12.5	-10.1	-7.6	-19.4
1992	18	-1.7	-1.8	-4.5	-9.1	-21.8	-20.0	-17.2	-15.3	-13.1	-12.8	-6.1	-0.9	2.2	4.3	-8.7
1993	21	-2.5	-3.3	-7.0	-13.0	-14.5	-16.0	-13.8	-12.9	-12.1	-12.0	-5.5	1.7	8.1	12.1	-7.2
1994	30	-2.2	-2.5	-5.0	-13.6	-19.7	-16.4	-14.2	-13.3	-11.9	-11.7	-5.9	-1.6	0.2	3.4	-8.4
1995	31	-2.3	-2.8	-6.1	-14.3	-18.9	-19.6	-15.3	-13.9	-12.4	-12.3	-6.2	-0.9	2.3	5.2	-8.8
1996	29	-2.2	-2.5	-5.1	-10.2	-14.8	-14.0	-11.6	-9.9	-8.7	-8.2	-3.8	1.5	5.1	8.8	-5.9
1997	29	-3.6	-4.2	-6.9	-12.0	-13.4	-14.6	-10.9	-9.8	-8.1	-8.1	-2.1	5.8	10.3	17.1	-5.1
1998	23	0.4	-0.2	-2.6	-12.7	-22.6	-15.2	-9.9	-8.7	-7.5	-7.4	-2.4	4.7	6.8	9.1	-5.5
1999	33	-0.6	-0.9	-3.6	-5.2	-4.4	-3.5	-0.7	0.1	1.2	1.1	5.6	11.2	11.0	11.5	1.0
2000	27	-0.7	-1.3	-4.2	-7.5	-8.3	-11.0	-8.2	-7.7	-7.3	-7.1	2.5	4.0	4.0	3.9	-3.8
2001	31	-0.7	-1.2	-3.2	-6.3	-7.9	-6.7	-5.7	-5.8	-5.1	-5.0	1.6	3.6	3.1	2.6	-2.8
2002	25	1.8	1.6	0.5	1.3	-0.3	1.4	1.9	1.1	0.8	0.9	3.6	5.1	5.4	5.6	2.0
2003	23	1.7	1.7	0.6	-0.9	-0.3	5.1	7.4	5.9	4.7	4.5	9.4	8.6	5.3	1.5	3.7
2004	24	1.8	1.5	0.3	-1.5	-1.3	-3.8	-6.5	-6.2	-6.1	-6.1	1.9	6.2	2.4	-0.5	-1.2
2005	30	-0.8	-0.7	-1.4	-2.9	-1.1	-4.2	-5.6	-5.3	-4.6	-4.6	2.7	7.3	2.5	-0.9	-1.4
2006	32	-1.0	-0.8	-1.5	-2.6	-3.8	-3.7	-5.3	-4.9	-4.6	-4.4	2.8	7.4	2.5	-2.1	-1.6
2007	23	-0.2	-0.8	-2.5	-4.3	-4.3	-6.2	-7.8	-7.4	-7.1	-7.0	0.7	5.4	1.2	-2.2	-3.0
2008	26	-0.9	-1.0	-2.1	-3.6	-2.2	-4.8	-5.8	-5.2	-5.5	-5.4	1.7	5.1	3.1	0.5	-2.0
AVERAGE		-1.4	-1.7	-3.8	-8.9	-11.5	-11.7	-10.2	-9.2	-8.2	-8.0	-1.8	2.6	3.2	3.9	-5.0

Table H-1j-10

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415   Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
Dworshak Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	-3.9	-4.0	-5.2	-17.3	-22.8	-20.2	-18.6	-14.9	-12.3	-11.6	-9.9	-7.1	-3.9	-0.8	-11.2
1990	27	-1.5	-2.0	-3.7	-13.6	-9.5	-9.0	-6.7	-6.0	-5.7	-5.5	-2.4	0.2	-0.8	-0.3	-5.0
1991	26	-5.4	-5.6	-8.6	-16.6	-22.3	-20.2	-16.9	-14.3	-12.6	-11.8	-8.1	-5.9	-5.7	-5.3	-11.6
1992	18	-0.6	-0.8	-2.9	-5.7	-9.7	-8.2	-4.4	-4.1	-3.8	-3.5	0.9	1.6	1.0	-0.1	-3.1
1993	21	-0.3	-0.6	-2.6	-4.1	-2.5	-1.0	1.0	1.2	1.2	1.2	4.4	5.7	6.0	4.7	0.6
1994	30	0.3	0.2	-1.5	-4.7	-3.8	-2.2	-1.5	-1.1	-0.8	-0.9	1.0	1.4	2.1	2.4	-0.8
1995	31	0.2	0.1	-1.3	-3.5	-3.7	-1.2	1.5	1.7	1.5	1.5	3.6	2.8	3.4	3.1	0.4
1996	29	0.6	0.5	-0.7	-2.2	-0.4	0.6	0.6	1.4	1.5	1.6	3.2	3.6	3.2	2.3	0.9
1997	29	-0.3	-0.4	0.0	-0.1	0.0	1.3	2.6	2.0	1.6	1.6	5.8	6.6	6.4	4.0	1.9
1998	23	2.4	2.3	1.6	1.0	-0.5	3.7	4.5	4.4	4.6	4.4	5.1	4.8	4.9	4.5	3.2
1999	33	1.9	1.9	1.6	2.4	2.4	2.6	2.4	2.3	2.0	2.0	4.5	3.0	1.7	-2.5	2.0
2000	27	0.9	0.8	0.1	0.0	2.2	-0.7	-2.9	-3.1	-3.1	-3.0	2.8	-0.9	-1.7	-2.8	-0.6
2001	31	0.0	-0.2	-1.2	-1.8	-4.9	-5.4	-6.1	-5.8	-4.4	-4.3	-0.3	-2.7	-3.9	-5.3	-3.0
2002	25	-0.4	-0.4	-1.0	-1.1	-3.7	-5.6	-7.0	-6.6	-6.2	-5.8	-4.3	-7.3	-4.9	-2.4	-3.8
2003	23	-0.9	-0.9	-0.6	2.5	3.1	8.0	9.8	8.5	7.4	7.3	8.0	7.9	4.1	0.8	4.4
2004	24	2.6	2.4	1.5	0.2	1.1	-1.2	-3.5	-2.8	-2.6	-2.7	2.3	7.7	2.3	-2.1	0.5
2005	30	0.0	0.0	-0.8	-1.6	-1.3	-3.2	-5.5	-5.3	-4.2	-4.2	-0.6	4.2	0.1	-2.6	-1.6
2006	32	-1.0	-1.0	-1.3	-2.6	-2.1	-3.1	-4.3	-3.6	-3.3	-3.2	0.5	5.7	1.0	-2.5	-1.5
2007	23	0.3	0.1	-0.7	-1.1	0.3	-3.9	-6.6	-7.5	-7.0	-6.9	-1.6	5.3	1.4	-1.9	-2.0
2008	26	0.2	0.1	-0.2	-1.7	-1.3	-2.6	-3.0	-2.5	-2.9	-2.7	1.2	5.2	3.3	1.0	-0.6
AVERAGE		-0.2	-0.3	-1.3	-3.5	-3.8	-3.5	-3.2	-2.8	-2.4	-2.3	0.8	2.1	1.0	-0.4	-1.5

Table H-1j-10

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BA430MED : PSCEIS : ALT43 Date: 21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
Dworshak Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	2.3	2.4	4.1	11.8	8.8	10.7	8.5	6.0	5.6	5.3	5.3	7.1	12.8	16.5	7.4
1990	27	4.6	4.8	5.4	6.7	4.3	4.5	1.7	0.2	-0.1	-0.2	0.6	3.0	5.2	6.2	3.5
1991	26	3.1	3.5	4.9	10.0	8.6	9.4	9.5	6.9	6.3	6.0	7.3	8.3	10.5	11.2	7.3
1992	18	2.8	3.1	4.8	9.5	8.0	10.8	10.6	9.6	8.7	8.2	11.1	12.7	17.1	17.5	9.0
1993	21	4.9	5.1	5.8	8.8	5.6	9.2	9.1	8.4	7.6	7.6	9.2	13.4	14.9	14.0	8.3
1994	30	5.4	5.5	6.0	10.4	11.8	12.7	11.2	10.6	9.5	9.0	10.2	11.8	12.2	12.0	9.6
1995	31	3.9	4.1	4.6	10.4	12.8	13.1	12.4	10.1	7.9	7.6	10.2	11.8	13.8	13.7	9.4
1996	29	3.4	3.4	4.1	8.1	8.7	12.3	11.2	10.0	9.1	8.9	8.0	10.2	10.9	11.2	8.2
1997	29	2.8	2.7	3.2	7.4	6.9	6.4	5.9	3.5	2.6	2.6	4.9	6.8	8.3	9.9	5.2
1998	23	3.8	3.8	4.5	7.2	6.9	12.5	12.1	10.7	9.5	9.5	7.8	10.6	11.2	11.8	8.3
1999	33	4.1	4.4	5.3	8.4	7.4	8.4	10.1	8.6	8.7	8.5	8.4	13.9	15.3	14.0	8.5
2000	27	5.3	5.2	6.3	9.8	9.3	12.2	11.2	9.9	9.1	8.9	11.5	14.3	15.5	15.8	9.9
2001	31	3.2	3.2	4.6	10.8	11.0	11.7	10.8	8.4	7.4	7.3	6.7	7.4	7.6	7.3	7.6
2002	25	2.8	2.7	3.3	6.8	7.1	6.8	5.6	4.6	4.2	4.0	2.6	5.7	9.3	11.5	5.3
2003	23	4.4	4.6	6.4	14.2	14.9	23.8	27.3	22.3	20.0	19.2	19.2	17.8	17.1	16.3	15.7
2004	24	5.1	4.9	5.5	8.2	9.1	9.4	9.8	8.8	8.2	8.0	10.4	12.7	11.3	10.4	8.5
2005	30	2.8	2.9	3.7	7.0	6.2	7.5	7.5	6.0	5.3	5.3	5.3	5.7	3.7	2.7	5.2
2006	32	1.6	1.8	2.4	5.1	7.1	7.5	7.4	6.8	5.7	5.5	9.0	12.8	9.5	6.9	6.1
2007	23	2.3	2.2	2.7	3.7	5.2	5.9	4.9	4.4	4.1	4.0	7.5	10.8	8.6	6.4	5.0
2008	26	4.5	4.5	4.5	7.8	9.4	8.7	8.5	8.6	7.9	7.8	8.6	11.4	11.5	10.5	7.8
AVERAGE		3.6	3.7	4.6	8.6	8.5	10.1	9.7	8.1	7.3	7.1	8.1	10.3	11.1	11.1	7.7

Table H-1j-10

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BC440MED : PSCEIS : ALT44 Date: 28-JAN-89 06:06:31
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Low Water Years (Bottom 10 Percent)

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Difference Of
Dworshak Res Elev (feet)

YEAR / NUM		SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2007	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVERAGE		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table H-1j-11

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Dworshak Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	1583.0	1578.4	1563.3	1551.4	1529.8	1506.0	1501.8	1497.3	1510.7	1567.3	1593.5	1595.7	1595.2	1594.7	1556.3
1990	154	1576.0	1572.5	1560.9	1552.7	1529.9	1506.1	1501.1	1498.7	1510.6	1567.1	1594.6	1596.8	1596.4	1595.9	1555.3
1991	154	1576.2	1572.1	1560.3	1551.9	1530.5	1506.9	1502.5	1496.6	1515.4	1568.8	1593.7	1596.0	1595.2	1594.3	1555.7
1992	160	1573.4	1569.8	1558.1	1548.0	1527.4	1504.0	1503.3	1501.5	1514.5	1568.5	1593.4	1596.0	1594.9	1593.7	1554.2
1993	155	1574.0	1570.4	1559.5	1550.3	1528.7	1506.0	1500.7	1499.4	1513.8	1568.5	1593.7	1596.1	1595.2	1594.2	1554.7
1994	155	1574.5	1571.0	1560.2	1551.3	1529.3	1505.4	1501.3	1494.9	1508.5	1567.4	1593.9	1595.7	1594.1	1592.4	1554.2
1995	154	1568.6	1565.8	1556.8	1548.2	1527.2	1504.6	1500.9	1498.7	1508.4	1566.9	1594.5	1596.6	1595.0	1593.3	1552.6
1996	148	1569.0	1565.8	1556.4	1548.6	1527.7	1503.1	1501.5	1497.2	1508.5	1565.3	1593.1	1595.3	1594.1	1592.8	1552.3
1997	155	1570.0	1566.8	1557.4	1546.7	1526.9	1504.6	1502.3	1499.1	1513.3	1564.4	1593.1	1595.3	1594.2	1592.9	1552.8
1998	155	1570.4	1567.5	1558.1	1548.2	1527.0	1505.8	1501.6	1502.3	1515.5	1568.1	1593.0	1595.9	1594.7	1593.4	1553.7
1999	149	1570.1	1566.4	1556.3	1546.8	1526.0	1501.5	1498.9	1494.5	1507.2	1564.6	1593.7	1595.8	1594.8	1593.6	1551.7
2000	151	1568.1	1565.1	1556.4	1548.3	1528.3	1505.7	1504.2	1501.0	1515.0	1566.0	1592.2	1594.5	1593.9	1593.1	1553.1
2001	152	1570.2	1567.5	1558.8	1549.3	1528.8	1505.3	1502.8	1500.4	1512.9	1568.3	1594.1	1596.7	1595.4	1594.0	1554.1
2002	157	1569.6	1566.3	1556.7	1545.0	1526.7	1506.8	1503.1	1501.5	1516.1	1568.1	1594.4	1596.4	1595.0	1593.4	1553.5
2003	163	1571.6	1568.3	1557.1	1546.3	1525.8	1503.1	1500.9	1496.8	1509.9	1567.8	1593.2	1595.9	1594.9	1593.9	1552.8
2004	146	1573.3	1569.8	1559.4	1550.4	1528.5	1505.8	1501.8	1500.6	1514.8	1569.6	1593.6	1596.6	1595.8	1594.9	1554.9
2005	151	1574.8	1571.2	1560.7	1551.5	1528.5	1504.3	1500.0	1500.6	1510.8	1568.8	1595.4	1597.9	1596.7	1595.4	1554.9
2006	145	1571.6	1568.3	1558.3	1549.1	1528.8	1504.8	1502.9	1497.8	1510.4	1568.1	1593.5	1595.5	1594.7	1594.0	1553.8
2007	155	1570.7	1567.3	1558.5	1549.0	1528.6	1506.8	1502.5	1500.9	1514.1	1566.0	1593.8	1595.4	1594.4	1593.3	1553.8
2008	159	1574.4	1571.0	1561.8	1552.5	1531.1	1507.8	1502.7	1500.8	1515.7	1564.3	1593.4	1595.3	1594.6	1593.9	1555.3
AVERAGE		1572.5	1569.1	1558.8	1549.3	1528.3	1505.2	1501.9	1499.1	1512.3	1567.2	1593.7	1596.0	1595.0	1593.9	1554.0

Table H-1j-11

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2   Date: 6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
Dworshak Res Elev (feet)

YEAR	/ NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
1990	154	0.3	0.3	0.5	0.9	0.4	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2
1991	154	0.6	0.6	1.0	1.7	0.9	0.4	0.6	0.2	0.0	0.1	0.0	0.0	0.3	0.5	0.5
1992	160	1.4	1.3	1.7	3.1	2.1	1.3	1.1	0.2	0.3	0.0	0.0	0.0	0.2	0.4	1.1
1993	155	1.3	1.4	1.7	2.7	1.3	0.8	1.3	0.1	0.1	0.0	0.0	0.0	0.1	0.4	0.9
1994	155	1.1	1.1	1.3	2.0	0.9	0.4	0.6	0.1	0.0	0.0	0.0	0.0	0.1	0.4	0.7
1995	154	1.6	1.5	1.5	2.0	1.1	0.7	0.6	0.4	0.2	0.1	0.1	0.1	0.3	0.6	0.8
1996	148	1.4	1.3	1.8	2.6	1.5	1.1	0.6	0.0	0.1	0.0	0.0	0.0	0.1	0.2	0.9
1997	155	1.6	1.5	1.6	2.9	1.7	1.0	1.1	0.7	0.5	0.2	0.1	0.1	0.2	0.5	1.1
1998	155	1.1	1.1	1.1	1.8	1.2	0.9	1.1	0.4	0.4	0.1	0.0	0.0	0.2	0.4	0.8
1999	149	1.5	1.6	1.5	2.3	1.4	0.9	1.5	0.4	0.3	0.2	0.1	0.1	0.3	0.6	1.0
2000	151	1.3	1.1	1.1	1.6	1.1	0.7	0.6	0.3	0.2	0.1	0.0	0.0	0.1	0.2	0.7
2001	152	1.2	1.0	1.1	2.2	1.4	0.4	0.4	0.1	0.1	0.0	0.0	0.0	0.2	0.5	0.7
2002	157	1.5	1.4	1.2	2.1	1.6	0.9	0.9	0.1	0.1	0.0	0.0	0.0	0.3	0.6	0.9
2003	163	1.8	1.7	1.9	2.9	2.0	1.4	1.4	0.8	0.7	0.4	0.1	0.1	0.3	0.6	1.2
2004	146	1.2	1.1	1.1	1.7	1.1	0.6	0.5	0.2	0.1	0.0	0.0	0.0	0.2	0.4	0.6
2005	151	1.3	1.1	1.3	1.8	1.1	0.4	1.0	0.2	0.1	0.0	0.0	0.0	0.3	0.6	0.7
2006	145	1.5	1.4	1.5	1.6	1.1	0.7	0.5	0.1	0.1	0.0	0.0	0.0	0.2	0.3	0.7
2007	155	1.6	1.4	1.3	1.6	0.8	0.4	0.8	0.2	0.1	0.1	0.0	0.0	0.2	0.5	0.7
2008	159	1.1	1.0	0.9	1.0	0.6	0.2	0.5	0.2	0.1	0.0	0.0	0.0	0.2	0.4	0.5
AVERAGE		1.2	1.2	1.3	1.9	1.2	0.7	0.8	0.2	0.2	0.1	0.0	0.0	0.2	0.4	0.7

Table H-1j-11

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410 — Date: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
Dworshak Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	-3.7	-3.9	-4.9	-6.4	-4.5	-2.6	-1.4	-0.7	-0.3	-0.1	-0.1	-0.1	0.4	0.9	-2.3
1990	154	-2.8	-3.0	-4.7	-7.4	-4.9	-2.9	-1.7	-0.5	-0.5	-0.2	0.0	0.0	0.5	0.9	-2.2
1991	154	-4.5	-4.8	-6.1	-7.3	-5.1	-3.4	-1.0	0.2	-0.1	-0.2	0.0	0.0	0.8	1.6	-2.6
1992	160	-3.4	-3.5	-4.8	-3.8	-3.0	-2.4	-0.5	-0.6	-0.5	-0.2	0.0	0.0	0.6	1.4	-1.7
1993	155	-3.7	-4.3	-6.7	-5.9	-3.8	-3.6	-2.2	-1.2	-1.1	-0.3	-0.1	-0.1	0.7	1.4	-2.5
1994	155	-2.2	-2.8	-5.7	-7.2	-5.3	-5.5	-3.9	-1.5	-0.9	-0.2	-0.1	-0.1	0.9	2.1	-2.7
1995	154	-3.0	-4.2	-6.9	-6.6	-4.3	-3.9	-3.8	-3.5	-1.8	-0.2	0.0	0.0	1.1	2.2	-2.7
1996	148	-2.2	-3.0	-5.0	-6.2	-3.9	-3.1	-3.0	-2.4	-1.2	-0.1	0.1	0.1	0.8	1.4	-2.2
1997	155	-2.0	-2.7	-5.1	-5.3	-3.4	-3.0	-3.3	-2.9	-1.8	-0.2	0.0	0.0	0.7	1.5	-2.1
1998	155	-1.7	-2.7	-5.5	-5.3	-2.7	-2.6	-2.9	-3.4	-2.1	-0.7	0.0	0.0	0.5	1.1	-2.1
1999	149	-1.0	-1.6	-4.5	-2.7	-2.0	-1.0	-1.5	-0.5	0.1	0.4	0.2	0.1	0.6	1.2	-1.0
2000	151	1.1	0.4	-1.9	-2.8	-2.2	-1.8	-0.8	-0.5	-0.4	-0.2	0.0	0.0	-0.1	0.0	-0.7
2001	152	-1.0	-1.7	-3.5	-2.6	-2.2	-1.6	-2.6	-2.3	-1.2	0.0	0.0	0.0	0.3	0.7	-1.3
2002	157	0.6	0.2	-1.2	-0.6	0.1	0.0	-2.0	-1.9	-0.9	0.0	-0.1	-0.1	0.1	0.7	-0.3
2003	163	2.6	2.3	2.3	4.4	2.8	1.7	0.6	-0.4	0.0	0.3	0.0	0.0	0.0	-0.1	1.4
2004	146	0.7	0.5	-0.1	-0.3	-0.5	-0.6	-0.2	0.3	0.0	-0.1	0.0	0.0	-0.5	-0.8	-0.1
2005	151	-0.5	-0.6	-1.0	-1.1	-0.6	-0.9	1.5	2.1	0.8	-0.4	-0.1	0.0	-0.4	-0.8	-0.3
2006	145	-0.6	-0.6	-1.0	-1.5	-1.2	-0.7	0.0	0.9	0.4	-0.2	0.0	0.1	-0.3	-0.8	-0.5
2007	155	-1.1	-1.2	-2.0	-2.3	-1.9	-0.9	-1.2	0.0	-0.2	-0.3	0.0	0.1	-0.3	-0.8	-1.0
2008	159	-1.0	-1.2	-2.0	-2.7	-1.8	-1.3	-0.5	-0.2	-0.2	-0.2	-0.2	-0.2	-0.4	-0.7	-1.0
AVERAGE		-1.5	-1.9	-3.5	-3.7	-2.5	-2.0	-1.5	-1.0	-0.6	-0.1	0.0	0.0	0.3	0.7	-1.4

Table-H-1j-11

BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415   Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

Difference Of
Dworshak Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	-3.5	-3.6	-4.6	-5.9	-4.1	-2.3	-1.1	-0.5	-0.2	-0.1	-0.1	-0.1	0.1	0.3	-2.1
1990	154	-2.9	-3.0	-4.2	-6.9	-4.6	-2.6	-1.7	-0.4	-0.5	-0.1	0.0	0.0	0.1	0.1	-2.2
1991	154	-3.1	-3.3	-4.4	-5.0	-3.1	-1.9	-1.0	-0.2	-0.3	-0.1	0.0	0.0	0.4	0.7	-1.8
1992	160	-1.9	-2.1	-3.4	-2.7	-2.1	-1.4	-0.7	-0.2	-0.2	0.0	0.0	0.0	0.1	0.2	-1.2
1993	155	-1.6	-1.9	-3.3	-3.6	-2.2	-1.5	-1.4	-0.6	-0.4	0.0	0.0	0.0	0.1	0.4	-1.3
1994	155	0.2	-0.1	-1.4	-2.9	-2.1	-1.7	-2.6	-0.7	-0.3	0.0	0.0	0.0	0.1	0.2	-0.9
1995	154	0.2	-0.3	-1.5	-1.4	-1.1	-0.7	-2.5	-2.5	-1.2	-0.1	-0.1	-0.1	0.3	0.6	-0.7
1996	148	0.4	0.1	-0.7	-1.1	-0.2	0.1	-2.4	-1.7	-0.8	-0.1	-0.1	-0.1	-0.1	-0.2	-0.4
1997	155	0.7	0.4	0.0	1.0	0.5	0.6	-1.2	-1.7	-0.9	-0.1	-0.1	-0.1	-0.1	-0.1	0.0
1998	155	1.0	0.8	0.4	0.7	0.3	0.5	-0.3	-0.6	0.0	0.1	0.0	0.0	0.1	0.2	0.3
1999	149	1.7	1.7	1.5	3.0	2.0	1.4	1.7	0.8	0.4	0.2	0.1	0.1	-0.1	-0.3	1.1
2000	151	0.5	0.5	0.0	-0.5	-0.3	-0.3	0.3	0.2	0.1	0.0	0.0	0.0	-0.5	-1.0	0.0
2001	152	-0.8	-0.9	-1.4	-1.3	-1.1	-0.7	0.3	0.7	0.3	0.0	0.0	0.0	-0.4	-0.9	-0.5
2002	157	-1.3	-1.5	-2.5	-1.8	-1.0	-1.1	-2.4	-1.3	-0.8	-0.2	-0.1	-0.1	-0.3	-0.5	-1.1
2003	163	0.2	0.2	1.2	3.4	1.8	1.2	0.8	0.5	0.4	0.3	0.0	0.0	-0.1	-0.1	0.8
2004	146	0.7	0.6	0.3	-0.1	-0.3	0.1	1.1	1.6	0.7	0.1	0.1	0.1	-0.5	-0.9	0.2
2005	151	-0.5	-0.6	-0.7	-1.2	-0.7	-0.6	1.8	2.3	1.1	0.0	0.0	0.0	-0.4	-1.0	-0.2
2006	145	-0.9	-0.9	-1.1	-1.3	-1.2	-0.8	0.5	1.2	0.5	-0.1	0.0	0.1	-0.1	-0.5	-0.5
2007	155	-0.3	-0.2	-0.6	-0.4	-0.2	-0.1	-0.9	0.2	0.0	-0.1	0.0	0.1	-0.3	-0.7	-0.3
2008	159	-0.7	-0.7	-1.4	-1.3	-0.8	-0.4	-0.3	0.0	0.0	0.0	0.0	0.0	-0.2	-0.5	-0.5
AVERAGE		-0.6	-0.7	-1.4	-1.5	-1.0	-0.6	-0.6	-0.2	-0.1	0.0	0.0	0.0	-0.1	-0.2	-0.6

Table H-1j-11

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BA430MED : PSCEIS : ALT43 — Date: 21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
Dworshak Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	2.1	2.2	2.9	6.6	3.4	1.6	1.2	-0.1	-0.1	0.0	0.0	0.0	0.0	0.1	1.7
1990	154	3.5	3.5	3.1	3.2	1.7	1.3	0.1	-0.2	0.0	0.0	0.0	0.0	0.1	0.2	1.4
1991	154	2.4	2.5	2.9	3.9	1.6	0.9	0.8	0.1	0.1	0.1	0.0	0.0	0.3	0.6	1.3
1992	160	3.0	2.9	3.1	5.1	3.4	2.1	1.0	0.0	0.3	0.0	0.0	0.0	0.3	0.6	1.8
1993	155	3.3	3.4	3.2	3.9	2.2	1.2	0.7	-0.8	-0.4	-0.1	-0.1	-0.1	0.3	0.8	1.5
1994	155	2.9	2.8	2.6	3.7	1.9	1.0	0.1	-0.2	0.0	0.0	0.0	0.0	0.5	1.2	1.4
1995	154	4.4	4.1	2.9	4.6	2.9	1.1	-1.0	-1.7	-0.9	-0.1	-0.1	-0.1	0.2	0.6	1.5
1996	148	4.3	3.9	3.8	4.8	2.7	1.6	0.7	0.1	0.3	0.1	0.1	0.1	0.5	0.9	1.9
1997	155	3.9	3.7	3.1	5.1	3.7	2.1	0.9	0.4	0.1	0.2	0.0	0.0	0.4	0.9	2.0
1998	155	3.2	2.9	2.1	2.6	2.1	1.4	0.5	-0.4	0.1	0.3	0.0	0.0	0.7	1.4	1.4
1999	149	3.7	3.8	3.9	5.7	3.9	2.3	4.1	1.8	1.2	0.4	0.2	0.1	0.5	1.1	2.5
2000	151	4.6	4.4	3.9	4.5	3.0	1.8	1.0	0.6	0.4	0.2	0.1	0.1	0.3	0.6	2.1
2001	152	3.9	3.7	2.8	3.9	2.0	0.6	-0.5	-1.0	-0.5	0.0	0.0	0.0	0.3	0.6	1.4
2002	157	2.6	2.5	1.8	3.8	3.1	1.7	0.0	-0.4	-0.1	0.0	-0.1	-0.1	0.6	1.4	1.4
2003	163	3.9	3.6	4.2	7.0	4.1	2.5	2.3	1.1	0.7	0.3	0.0	0.0	0.5	1.0	2.5
2004	146	4.4	4.3	4.0	4.8	2.9	1.7	0.8	0.1	-0.1	0.0	0.0	0.0	0.2	0.5	1.9
2005	151	2.3	2.3	2.4	3.2	1.9	0.9	1.1	0.6	0.2	0.0	0.0	0.0	0.3	0.7	1.3
2006	145	1.7	1.7	1.4	2.2	1.4	0.7	0.0	0.1	0.0	0.2	0.0	0.0	0.1	0.3	0.8
2007	155	2.2	2.2	1.9	3.1	2.1	1.4	1.0	0.9	0.5	0.3	0.2	0.2	0.4	0.7	1.3
2008	159	2.1	1.9	1.2	2.0	1.0	0.3	-0.6	-0.8	-0.4	0.0	0.0	0.0	0.2	0.4	0.7
AVERAGE		3.2	3.1	2.9	4.2	2.6	1.4	0.7	0.0	0.1	0.1	0.0	0.0	0.3	0.7	1.6

Table H-1j-11

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BC440MED : PSCEIS : ALT44 Date: 28-JAN-89 06:06:31
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over Typical Water Years (Mid 80 Percent)

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Difference Of
Dworshak Res Elev (feet)

YEAR / NUM		SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	153	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	160	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	148	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	149	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	151	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	152	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	157	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	163	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	151	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2007	155	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	159	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVERAGE		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table H-1j-12

BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

Dworshak Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	1584.7	1580.1	1566.5	1556.6	1526.2	1491.6	1506.6	1514.4	1514.3	1587.4	1600.0	1600.0	1600.0	1600.0	1559.5
1990	19	1582.1	1579.5	1567.2	1557.2	1526.2	1491.6	1507.3	1519.8	1511.2	1583.9	1600.0	1600.0	1600.0	1600.0	1558.8
1991	20	1572.5	1571.1	1562.1	1556.2	1526.2	1491.6	1506.0	1514.1	1516.9	1588.3	1600.0	1600.0	1600.0	1600.0	1557.6
1992	22	1575.0	1573.7	1563.3	1555.5	1526.2	1491.6	1505.9	1511.2	1519.4	1590.8	1600.0	1600.0	1600.0	1600.0	1558.5
1993	24	1572.6	1571.6	1561.6	1555.7	1525.3	1491.3	1507.2	1522.3	1510.9	1582.4	1600.0	1600.0	1600.0	1600.0	1556.6
1994	15	1581.6	1579.0	1567.3	1557.7	1526.2	1491.6	1507.0	1518.8	1513.3	1585.1	1600.0	1600.0	1600.0	1600.0	1559.1
1995	15	1575.2	1574.6	1565.0	1556.6	1526.2	1491.6	1505.9	1512.5	1520.2	1590.5	1600.0	1600.0	1600.0	1600.0	1558.8
1996	23	1574.3	1573.3	1563.9	1556.1	1525.6	1491.4	1507.1	1521.8	1507.9	1581.5	1600.0	1600.0	1600.0	1600.0	1556.8
1997	16	1574.1	1572.7	1562.3	1555.8	1525.5	1491.5	1505.8	1516.5	1518.4	1587.3	1600.0	1600.0	1600.0	1600.0	1557.8
1998	22	1576.8	1575.7	1565.1	1556.5	1526.2	1491.6	1506.6	1515.9	1515.5	1587.3	1600.0	1600.0	1600.0	1600.0	1558.4
1999	18	1573.2	1574.0	1564.6	1556.0	1525.9	1491.6	1505.1	1508.2	1523.0	1593.2	1600.0	1600.0	1600.0	1600.0	1558.9
2000	22	1574.5	1574.1	1565.7	1557.1	1526.1	1491.6	1507.1	1519.0	1512.3	1584.6	1600.0	1600.0	1600.0	1600.0	1557.8
2001	17	1571.7	1571.0	1561.8	1556.4	1525.8	1491.6	1507.0	1518.9	1514.2	1585.2	1600.0	1600.0	1600.0	1600.0	1557.1
2002	18	1572.3	1571.5	1563.8	1555.8	1525.6	1491.5	1506.4	1517.8	1514.9	1585.7	1600.0	1600.0	1600.0	1600.0	1557.3
2003	14	1567.9	1567.5	1559.8	1554.2	1526.2	1491.6	1505.9	1511.2	1516.2	1589.5	1600.0	1600.0	1600.0	1600.0	1556.6
2004	30	1568.3	1567.4	1558.9	1553.8	1525.0	1491.0	1504.2	1512.0	1510.0	1585.2	1600.0	1600.0	1600.0	1600.0	1555.3
2005	19	1572.5	1570.3	1560.5	1554.8	1525.2	1490.9	1506.2	1516.9	1511.3	1584.9	1600.0	1600.0	1600.0	1600.0	1556.4
2006	23	1576.0	1575.0	1564.6	1556.8	1526.0	1491.6	1506.7	1515.7	1513.2	1586.5	1600.0	1600.0	1600.0	1600.0	1558.0
2007	22	1570.9	1571.6	1563.8	1555.8	1525.4	1491.2	1505.9	1518.2	1511.6	1583.9	1600.0	1600.0	1600.0	1600.0	1556.7
2008	15	1577.9	1576.5	1565.9	1558.0	1526.2	1491.6	1507.0	1519.0	1514.2	1585.2	1600.0	1600.0	1600.0	1600.0	1558.5
AVERAGE		1574.6	1573.4	1563.6	1556.1	1525.8	1491.5	1506.3	1516.2	1514.1	1586.2	1600.0	1600.0	1600.0	1600.0	1557.6

Table H-1j-12

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BD120MED : PSCEIS : BASE CASE : ALT 1.2   Date: 6-JAN-89 21:49:53
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

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Difference Of
Dworshak Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	19	0.4	0.2	0.2	0.4	0.0	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.1
1991	20	0.7	0.5	0.5	0.3	0.0	0.0	-0.4	-0.8	-0.8	-0.3	0.0	0.0	0.0	0.0	0.0
1992	22	1.2	1.0	0.6	1.2	0.0	0.0	0.0	0.4	0.9	0.0	0.0	0.0	0.0	0.0	0.4
1993	24	1.6	1.6	1.2	0.6	0.1	-0.1	-0.1	0.2	0.5	0.1	0.0	0.0	0.0	0.0	0.5
1994	15	1.3	1.0	0.4	0.5	0.0	0.0	0.0	0.4	0.5	0.0	0.0	0.0	0.0	0.0	0.3
1995	15	1.3	0.8	0.7	0.5	0.0	0.0	0.0	0.5	0.6	0.0	0.0	0.0	0.0	0.0	0.3
1996	23	2.3	2.1	1.6	1.3	0.6	0.2	0.5	0.9	1.0	0.3	0.0	0.0	0.0	0.0	0.8
1997	16	0.6	0.3	0.5	0.3	0.0	0.0	-0.1	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.2
1998	22	1.1	0.7	0.6	0.8	0.0	0.0	0.0	0.5	0.8	0.1	0.0	0.0	0.0	0.0	0.3
1999	18	1.1	1.0	0.7	0.8	-0.1	0.0	-0.2	0.2	0.4	-0.1	0.0	0.0	0.0	0.0	0.3
2000	22	0.5	-0.1	0.0	0.1	-0.3	0.0	-0.6	-0.4	-0.2	-0.4	0.0	0.0	0.0	0.0	-0.1
2001	17	0.4	0.1	0.4	0.4	-0.1	-0.1	-0.1	0.9	1.2	-0.1	0.0	0.0	0.0	0.0	0.2
2002	18	1.2	0.9	0.3	0.3	-0.1	-0.1	-0.1	-0.5	-0.5	-0.1	0.0	0.0	0.0	0.0	0.2
2003	14	0.9	0.6	0.4	0.8	0.0	0.0	0.2	0.1	0.2	0.2	0.0	0.0	0.0	0.0	0.3
2004	30	2.3	1.8	1.6	1.0	0.4	0.2	0.1	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.6
2005	19	1.0	0.6	0.6	0.4	0.1	0.1	-0.9	-1.1	-0.9	-0.6	0.0	0.0	0.0	0.0	0.0
2006	23	1.5	0.7	0.4	-0.1	-0.2	0.0	-0.2	0.2	0.6	-0.1	0.0	0.0	0.0	0.0	0.2
2007	22	1.7	1.3	0.5	0.2	0.0	0.0	0.0	-0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.3
2008	15	1.5	0.9	0.4	0.2	0.0	0.0	0.0	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.3
AVERAGE		1.2	0.8	0.6	0.5	0.0	0.0	-0.1	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.3

Table H-1j-12

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BE410MED : PSCEIS : ALT410   Date: 1-FEB-89 16:02:55
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

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Difference Of
Dworshak Res Elev (feet)

YEAR / NUM		SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	-3.8	-4.0	-4.3	-2.7	0.0	0.0	-5.3	-5.9	-7.1	-3.7	0.0	0.0	0.0	0.0	-2.6
1990	19	-3.9	-4.0	-4.0	-0.6	0.0	0.0	-0.6	-1.5	-2.3	-0.6	0.0	0.0	0.0	0.0	-1.3
1991	20	-3.5	-3.1	-3.3	-2.1	0.0	0.0	-2.6	-3.8	-3.9	-1.6	0.0	0.0	0.0	0.0	-1.7
1992	22	-6.1	-5.4	-4.1	-0.3	0.0	0.0	-1.4	-1.6	-1.2	-0.7	0.0	0.0	0.0	0.0	-1.6
1993	24	-2.7	-4.1	-5.0	-3.4	0.1	-0.1	-3.2	-5.7	-5.6	-1.0	0.0	0.0	0.0	0.0	-2.1
1994	15	-2.5	-3.9	-6.1	-3.9	0.0	0.0	-8.2	-9.7	-9.2	-4.0	0.0	0.0	0.0	0.0	-3.2
1995	15	-3.9	-5.6	-7.2	-4.2	0.0	0.0	-12.5	-15.6	-15.1	-7.7	0.0	0.0	0.0	0.0	-4.7
1996	23	-1.8	-3.2	-5.5	-3.2	0.5	0.2	-6.6	-8.4	-8.3	-4.2	0.0	0.0	0.0	0.0	-2.7
1997	16	-2.5	-4.9	-5.6	-3.9	0.2	-0.2	-10.4	-14.5	-14.9	-6.2	0.0	0.0	0.0	0.0	-4.0
1998	22	-3.9	-5.7	-7.0	-3.7	0.0	0.0	-13.3	-15.7	-14.4	-7.9	0.0	0.0	0.0	0.0	-4.6
1999	18	-2.6	-4.4	-5.7	-4.2	-0.2	-0.1	-13.6	-16.5	-15.5	-8.2	0.0	0.0	0.0	0.0	-4.5
2000	22	-1.7	-3.1	-5.2	-3.1	-0.1	0.0	-5.8	-7.8	-7.8	-3.3	0.0	0.0	0.0	0.0	-2.5
2001	17	-4.1	-5.4	-6.0	-3.3	0.2	-0.1	-2.7	-5.1	-6.0	-1.4	0.0	0.0	0.0	0.0	-2.4
2002	18	-2.3	-3.2	-3.9	-1.8	-0.2	-0.3	-2.5	-5.2	-5.9	-1.4	0.0	0.0	0.0	0.0	-1.8
2003	14	2.0	1.5	0.9	1.5	0.0	0.0	-2.1	-2.4	-1.9	-1.2	0.0	0.0	0.0	0.0	0.1
2004	30	1.7	1.8	1.9	1.6	0.5	0.3	1.5	2.2	2.1	0.9	0.0	0.0	0.0	0.0	1.0
2005	19	0.2	0.2	0.6	0.3	0.2	0.4	-1.2	-1.7	-1.5	-0.9	0.0	0.0	0.0	0.0	-0.1
2006	23	-0.3	0.0	0.4	0.0	-0.2	0.0	-0.6	0.8	1.5	-0.3	0.0	0.0	0.0	0.0	0.0
2007	22	-0.7	-0.5	-0.6	0.4	0.1	-0.1	-0.4	-1.9	-2.4	-0.3	0.0	0.0	0.0	0.0	-0.4
2008	15	0.5	0.3	-0.3	0.0	0.0	0.0	0.0	-0.9	-1.4	0.0	0.0	0.0	0.0	0.0	-0.1
AVERAGE		-2.1	-2.7	-3.4	-1.7	0.1	0.0	-4.3	-5.7	-5.6	-2.5	0.0	0.0	0.0	0.0	-1.9

Table H-1j-12

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE   Date: 3-JAN-89 06:55:28
Incr Study: BB415MED : PSCEIS : ALT415   Date: 14-FEB-89 16:00:08
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

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Difference Of
Dworshak Res Elev (feet)

YEAR	/ NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	-3.7	-3.7	-4.0	-2.4	0.0	0.0	-3.6	-4.0	-4.0	-1.9	0.0	0.0	0.0	0.0	-1.9
1990	19	-2.3	-2.1	-1.9	0.4	0.0	0.0	-0.4	0.4	0.5	-0.3	0.0	0.0	0.0	0.0	-0.5
1991	20	-2.4	-1.6	-1.6	-0.6	0.0	0.0	-1.0	-1.7	-1.7	-0.5	0.0	0.0	0.0	0.0	-0.8
1992	22	-2.9	-2.3	-1.3	0.8	0.0	0.0	-0.3	0.1	0.7	0.1	0.0	0.0	0.0	0.0	-0.4
1993	24	-1.3	-2.0	-2.4	-1.5	0.3	0.0	-0.7	-2.7	-3.4	-0.1	0.0	0.0	0.0	0.0	-0.9
1994	15	-0.2	-0.8	-2.4	-2.3	0.0	0.0	-0.5	-2.2	-3.0	-0.2	0.0	0.0	0.0	0.0	-0.8
1995	15	-0.6	-2.1	-3.3	-1.3	0.0	0.0	-1.6	-4.0	-5.0	-1.2	0.0	0.0	0.0	0.0	-1.3
1996	23	0.9	0.2	-1.1	-0.1	0.4	0.2	0.0	-1.1	-1.6	-0.1	0.0	0.0	0.0	0.0	-0.1
1997	16	0.2	-0.9	-1.0	0.0	0.0	-0.2	-0.5	-2.2	-3.0	-0.3	0.0	0.0	0.0	0.0	-0.5
1998	22	0.5	-0.6	-0.6	0.8	0.0	0.0	0.0	1.4	1.9	-0.1	0.0	0.0	0.0	0.0	0.2
1999	18	1.7	0.8	1.4	1.3	0.2	0.0	0.3	2.0	3.1	0.5	0.0	0.0	0.0	0.0	0.8
2000	22	-1.1	-1.4	-1.2	-0.5	-0.4	-0.1	-0.6	0.5	1.0	-0.3	0.0	0.0	0.0	0.0	-0.4
2001	17	-2.0	-1.9	-0.4	0.2	-0.3	-0.2	-0.2	1.6	2.1	0.0	0.0	0.0	0.0	0.0	-0.2
2002	18	-3.2	-4.0	-3.0	0.0	-0.2	-0.2	-0.2	0.2	0.2	-0.2	0.0	0.0	0.0	0.0	-0.9
2003	14	-0.9	-0.3	1.3	2.0	-0.1	0.0	-0.5	3.1	5.1	0.0	0.0	0.0	0.0	0.0	0.5
2004	30	1.0	1.6	2.9	1.9	0.1	0.1	1.2	4.5	5.9	0.9	0.0	0.0	0.0	0.0	1.3
2005	19	-0.8	0.0	1.4	0.5	0.2	0.3	-0.3	2.4	3.6	-0.3	0.0	0.0	0.0	0.0	0.4
2006	23	0.4	-0.2	0.9	0.1	0.0	0.0	0.0	3.3	4.8	0.2	0.0	0.0	0.0	0.0	0.5
2007	22	-1.2	-1.4	-0.4	0.3	0.0	-0.1	0.0	0.1	0.5	0.2	0.0	0.0	0.0	0.0	-0.2
2008	15	0.2	-0.4	0.0	-0.1	0.0	0.0	0.0	0.8	1.1	0.0	0.0	0.0	0.0	0.0	0.1
AVERAGE		-0.9	-1.1	-0.8	0.0	0.0	0.0	-0.4	0.2	0.6	-0.1	0.0	0.0	0.0	0.0	-0.2

Table H-1j-12

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE — Date: 3-JAN-89 06:55:28
Incr Study: BA430MED : PSCEIS : ALT43 — Date: 21-JAN-89 05:14:29
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

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Difference Of
Dworshak Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	1.1	1.1	1.3	1.6	0.0	0.0	0.0	1.5	2.3	0.0	0.0	0.0	0.0	0.0	0.6
1990	19	0.5	0.4	0.3	0.8	0.0	0.0	0.0	-0.2	-0.4	0.0	0.0	0.0	0.0	0.0	0.1
1991	20	3.4	2.8	2.7	1.1	0.0	0.0	0.3	2.4	3.3	0.3	0.0	0.0	0.0	0.0	1.2
1992	22	4.2	3.3	2.0	1.8	0.0	0.0	0.0	-0.7	-0.5	0.2	0.0	0.0	0.0	0.0	0.9
1993	24	2.8	2.0	1.3	0.7	0.1	-0.2	-0.4	-2.6	-3.5	-0.3	0.0	0.0	0.0	0.0	0.2
1994	15	1.7	1.1	-0.2	0.5	0.0	0.0	0.0	-1.9	-2.8	-0.2	0.0	0.0	0.0	0.0	0.0
1995	15	3.7	2.6	1.2	0.9	0.0	0.0	-0.2	-2.7	-4.2	-0.4	0.0	0.0	0.0	0.0	0.3
1996	23	3.7	2.7	1.6	1.6	0.6	0.2	-0.1	-1.6	-2.5	-0.2	0.0	0.0	0.0	0.0	0.6
1997	16	3.1	1.6	1.2	1.6	0.7	0.1	-0.2	-4.0	-5.7	-0.4	0.0	0.0	0.0	0.0	0.2
1998	22	1.7	0.1	-0.9	-0.3	0.0	0.0	-0.3	-2.1	-3.2	-0.4	0.0	0.0	0.0	0.0	-0.3
1999	18	4.7	2.8	1.0	1.6	0.3	0.0	-0.6	-2.5	-3.3	-0.4	0.0	0.0	0.0	0.0	0.5
2000	22	3.0	1.6	0.4	0.5	0.1	0.0	-0.5	-2.3	-3.1	-0.3	0.0	0.0	0.0	0.0	0.1
2001	17	3.2	1.7	0.3	0.3	0.0	-0.2	-0.2	-2.4	-3.8	-0.2	0.0	0.0	0.0	0.0	0.1
2002	18	1.9	1.2	-0.3	0.3	0.5	0.1	-1.5	-4.1	-4.9	-0.9	0.0	0.0	0.0	0.0	-0.3
2003	14	3.2	2.2	1.6	2.0	0.0	0.0	-2.1	-2.3	-1.7	-1.2	0.0	0.0	0.0	0.0	0.3
2004	30	5.4	5.0	4.2	2.7	0.7	0.3	1.0	1.2	1.1	0.6	0.0	0.0	0.0	0.0	1.7
2005	19	2.5	2.2	2.1	1.5	0.2	0.2	-0.8	-1.9	-2.1	-0.6	0.0	0.0	0.0	0.0	0.4
2006	23	1.9	0.9	0.7	0.3	0.1	0.0	-0.7	-1.4	-1.6	-0.4	0.0	0.0	0.0	0.0	0.1
2007	22	2.4	1.5	0.5	0.9	0.3	0.3	-0.2	-2.4	-3.3	-0.3	0.0	0.0	0.0	0.0	0.2
2008	15	2.1	1.0	0.2	0.1	0.0	0.0	0.0	-2.2	-3.2	0.0	0.0	0.0	0.0	0.0	0.0
AVERAGE		2.9	2.0	1.1	1.1	0.2	0.1	-0.3	-1.4	-2.0	-0.2	0.0	0.0	0.0	0.0	0.4

Table H-1j-12

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BPAHYSUM Summary

Base Study: BA000MED : PSCEIS : BASE CASE Date: 3-JAN-89 06:55:28
Incr Study: BC440MED : PSCEIS : ALT44 Date: 28-JAN-89 06:06:31
Difference = (Incr Study) - (Base Study)
Number of Games: 200
Average Over High Water Years (Top 10 Percent)

****

Difference Of
Dworshak Res Elev (feet)

YEAR	NUM	SEP	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUN	JUL	AG1	AG2	ANN AVG
1989	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2007	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVERAGE		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

H-1k

FREQUENCY OF CHANGE IN RESERVOIR ELEVATIONS GREATER THAN 5 FEET

Table H-1k- 1

SAS
FREQUENCY OF END OF PERIOD RESERVOIR ELEVATION
CHANGES FROM BASE CASE GREATER THAN 5 FEET (%)
(PBB.P9800.CAM.NT7.SERIES.LIBRARY(NT7ZJG1)
HUNGRY HORSE

15:04 MONDAY, JULY 24, 1989

TEST CASE	CONTRACT YEAR	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUNE	JULY	AG1	AG2
		(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)
BA000MED	1991	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	1991	3.5/ 0.5	4.0/ 0.5	4.0/ 0.5	4.5/ 0.5	6.0/ 0.5	7.0/ 0.5	6.5/ 1.5	6.5/ 1.5	6.0/ 2.0	3.5/ 1.0	4.0/ 1.0	4.0/ 0.5	4.5/ 0.5	6.5/ 0.5
BE410MED	1991	6.0/75.5	6.0/72.5	6.0/67.5	6.5/67.5	6.5/53.5	5.5/44.5	6.0/27.0	6.0/26.5	2.5/29.0	1.5/20.5	3.0/14.5	4.0/13.0	8.0/11.5	13.5/12.0
BB415MED	1991	4.5/56.5	4.5/55.5	4.0/55.0	4.5/51.0	6.0/38.0	4.5/29.0	5.5/17.0	5.0/16.0	4.0/19.5	2.5/13.0	4.0/ 8.5	4.5/ 8.5	5.0/ 9.0	7.5/ 8.5
BA430MED	1991	19.5/ 1.5	21.0/ 1.5	26.0/ 1.5	28.0/ 1.5	24.5/ 2.0	25.5/ 2.0	17.5/ 1.5	14.5/ 1.5	15.5/ 3.5	11.0/ 1.5	11.0/ 0.5	9.5/ 0.0	10.0/ 0.0	12.5/ 0.0
BC440MED	1991	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA000MED	1993	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	1993	11.0/ 0.0	12.0/ 0.0	12.0/ 0.0	13.5/ 0.0	14.5/ 0.0	10.5/ 0.0	9.5/ 0.0	9.0/ 0.0	9.0/ 0.5	6.5/ 0.0	6.5/ 0.0	6.0/ 0.0	7.0/ 0.0	7.0/ 0.0
BE410MED	1993	7.0/69.0	6.5/68.5	6.5/68.5	6.0/70.0	4.5/52.5	3.0/35.5	3.0/17.5	3.0/17.5	3.5/21.5	2.0/14.0	2.5/ 6.0	5.5/ 6.5	9.5/ 5.0	16.5/ 3.5
BB415MED	1993	5.0/27.0	5.5/28.0	5.0/31.0	4.0/31.0	3.5/24.5	3.0/15.0	4.5/ 6.0	4.0/ 5.5	5.0/ 9.0	3.0/ 4.5	4.5/ 3.0	5.5/ 2.5	5.5/ 2.0	7.0/ 2.0
BA430MED	1993	25.0/ 0.0	26.5/ 0.0	27.0/ 0.0	27.5/ 0.0	24.5/ 0.0	19.0/ 0.0	17.0/ 0.0	16.0/ 0.0	16.0/ 2.0	11.5/ 0.0	14.0/ 0.0	14.0/ 0.0	15.0/ 0.0	19.5/ 0.0
BC440MED	1993	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA000MED	1995	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	1995	13.5/ 1.0	14.0/ 1.0	14.0/ 1.0	15.0/ 1.0	14.5/ 1.0	12.0/ 1.0	12.5/ 1.0	12.0/ 1.0	12.0/ 1.0	10.0/ 1.0	10.0/ 1.0	10.0/ 0.5	9.5/ 0.5	12.0/ 1.0
BE410MED	1995	12.0/66.0	10.0/62.0	9.0/61.5	8.5/63.5	3.5/57.5	3.0/46.0	3.5/32.0	3.0/26.0	3.0/32.5	3.0/21.5	2.5/14.5	6.5/13.0	13.0/11.5	18.5/ 9.5
BB415MED	1995	15.0/13.5	14.0/15.5	14.0/16.5	13.5/16.5	10.0/17.0	11.0/10.5	13.0/ 9.5	13.0/ 9.0	11.5/ 6.5	8.5/ 5.0	9.5/ 4.5	10.0/ 4.0	11.0/ 3.5	15.0/ 4.0
BA430MED	1995	34.0/ 0.0	37.0/ 0.0	38.0/ 0.0	38.0/ 0.0	35.0/ 2.0	31.5/ 1.5	26.0/ 2.5	23.5/ 2.5	22.5/ 0.0	19.5/ 0.0	21.5/ 0.0	21.5/ 0.0	21.5/ 0.0	22.5/ 0.5
BC440MED	1995	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA000MED	1997	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	1997	9.5/ 0.5	9.0/ 0.5	9.5/ 0.5	12.0/ 0.5	14.0/ 0.5	12.5/ 0.5	10.0/ 0.5	9.5/ 0.5	8.5/ 0.5	8.0/ 0.5	8.0/ 0.0	9.0/ 0.5	7.5/ 0.0	8.5/ 0.5
BE410MED	1997	11.0/63.5	11.0/53.5	10.0/49.5	9.5/55.0	8.5/52.0	7.5/42.0	6.0/24.0	6.5/21.5	5.0/25.0	5.0/17.0	4.5/11.0	12.0/ 6.5	16.0/ 6.0	19.5/ 6.0
BB415MED	1997	11.5/ 8.0	11.5/ 8.5	11.5/ 8.0	11.0/ 8.0	11.0/ 9.0	12.0/ 6.5	10.0/ 3.5	10.0/ 4.0	11.0/ 1.5	9.5/ 1.5	10.5/ 1.0	13.5/ 1.0	14.0/ 1.0	14.0/ 1.0
BA430MED	1997	29.0/ 0.0	30.0/ 0.0	29.0/ 0.0	30.5/ 0.0	29.5/ 0.5	26.0/ 0.5	19.0/ 1.5	19.0/ 1.5	17.5/ 0.5	15.5/ 0.5	15.5/ 0.0	19.5/ 0.5	20.0/ 0.5	22.0/ 0.5
BC440MED	1997	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA000MED	2001	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	2001	14.5/ 0.0	16.0/ 0.0	17.5/ 0.0	19.0/ 0.0	18.5/ 0.0	15.0/ 0.0	13.0/ 0.0	12.0/ 0.0	11.5/ 0.0	8.0/ 0.0	7.0/ 0.0	7.0/ 0.0	6.5/ 0.0	6.5/ 0.0
BE410MED	2001	18.0/36.0	17.0/32.0	15.5/30.5	14.5/32.0	12.5/29.5	8.5/20.5	8.0/14.5	7.5/14.0	7.0/16.5	6.0/ 9.0	8.0/ 6.5	9.0/ 5.5	9.0/ 5.0	16.5/ 5.0
BB415MED	2001	15.5/14.0	14.0/15.5	14.0/16.5	15.0/16.5	14.0/16.0	8.5/13.0	7.0/12.0	5.5/12.0	4.0/12.0	2.5/11.0	4.0/10.5	3.5/10.5	4.0/10.0	3.5/15.0
BA430MED	2001	32.0/ 0.0	35.0/ 0.0	34.5/ 0.0	36.0/ 0.0	37.5/ 1.5	29.0/ 0.5	25.0/ 2.0	22.0/ 1.0	21.0/ 0.0	18.0/ 0.0	18.5/ 0.0	19.0/ 0.0	20.0/ 0.0	18.5/ 0.0
BC440MED	2001	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA000MED	2005	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	2005	10.5/ 0.0	13.0/ 0.0	13.5/ 0.0	14.0/ 0.0	17.0/ 0.0	14.5/ 0.0	15.0/ 0.0	14.0/ 0.0	12.0/ 0.0	10.0/ 0.0	9.5/ 0.0	8.5/ 0.0	8.0/ 0.5	10.0/ 0.5
BE410MED	2005	8.5/14.0	9.0/14.5	7.5/15.5	8.0/16.5	9.5/13.0	8.0/13.5	9.0/11.5	7.0/ 9.5	4.5/ 9.5	3.5/ 9.0	7.0/ 6.5	6.5/ 6.5	6.5/ 7.5	7.0/ 9.0
BB415MED	2005	10.0/12.5	10.0/13.5	9.0/12.5	9.0/11.5	11.0/ 9.5	8.5/11.0	8.0/12.5	7.5/12.0	4.5/12.0	4.5/10.0	7.0/ 9.0	6.5/ 8.5	6.5/ 9.5	6.5/14.0
BA430MED	2005	18.0/ 0.0	25.0/ 0.0	27.0/ 0.0	29.0/ 0.0	28.0/ 0.5	24.0/ 0.0	20.5/ 0.5	20.0/ 0.5	17.0/ 0.0	15.0/ 0.0	15.5/ 0.0	14.0/ 0.0	13.5/ 0.5	14.0/ 1.0
BC440MED	2005	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0

Table H-1k-2

SAS
FREQUENCY OF END OF PERIOD RESERVOIR ELEVATION
CHANGES FROM BASE CASE GREATER THAN 5 FEET (%)
(PBB.P9800.CAM.NT7.SERIES.LIBRARY(NT7ZJG1)
GRAND COULEE

TEST CASE	CONTRACT YEAR	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	AP1	AP2	MAY	JUNE	JULY	AG1	AG2
		(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)	(+/-)
BA000MED	1991	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	1991	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.5/ 0.0	0.5/ 0.5	3.0/ 2.5	1.5/ 3.0	1.0/ 0.5	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BE410MED	1991	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	2.0/10.5	0.5/22.0	5.0/20.5	4.5/14.0	3.5/ 8.0	0.5/ 6.5	0.5/ 1.5	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BB415MED	1991	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	1.5/ 1.5	0.5/11.5	5.5/13.0	4.5/ 5.5	2.0/ 3.0	1.0/ 3.5	0.5/ 0.5	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA430MED	1991	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	1.5/ 1.0	4.5/ 1.0	13.5/ 2.0	8.0/ 2.5	3.5/ 1.0	4.5/ 0.0	0.5/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BC440MED	1991	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA000MED	1993	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	1993	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	3.5/ 1.0	2.0/ 1.0	0.0/ 0.0	0.5/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BE410MED	1993	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	1.0/11.0	0.0/30.5	2.5/28.5	3.5/12.0	1.5/ 8.0	0.0/ 2.5	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BB415MED	1993	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.5/ 7.0	0.0/11.0	4.0/16.0	3.5/ 6.0	2.0/ 1.0	0.5/ 0.5	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA430MED	1993	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	1.0/ 2.0	3.5/ 0.5	6.0/ 6.0	3.0/ 6.0	3.5/ 3.5	6.0/ 0.5	0.5/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BC440MED	1993	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA000MED	1995	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	1995	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.5/ 0.0	1.5/ 0.0	1.5/ 0.0	1.5/ 0.0	1.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BE410MED	1995	0.0/ 0.5	0.0/ 0.5	0.0/ 0.5	0.0/ 0.0	0.5/34.0	0.0/41.0	0.0/29.0	0.5/22.5	0.5/15.0	0.0/ 7.5	0.0/ 1.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BB415MED	1995	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 8.5	0.5/ 8.0	1.5/10.0	1.0/ 6.5	1.0/ 3.5	0.0/ 0.5	1.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA430MED	1995	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	2.5/ 6.5	5.0/ 4.0	3.0/11.0	2.5/11.0	3.0/ 6.0	4.5/ 0.0	1.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BC440MED	1995	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA000MED	1997	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	1997	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	1.0/ 0.0	2.5/ 0.0	1.0/ 0.0	0.5/ 0.0	0.5/ 0.0	0.0/ 0.5	0.0/ 0.5	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BE410MED	1997	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	1.0/42.0	2.0/47.0	1.5/29.0	1.5/21.5	1.0/13.5	1.0/ 8.5	0.5/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BB415MED	1997	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	1.5/ 7.5	2.5/ 5.5	2.0/ 6.0	1.5/ 4.5	2.0/ 2.5	1.5/ 0.0	1.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA430MED	1997	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	4.0/ 8.0	9.5/ 3.0	4.0/12.5	2.0/11.0	2.0/ 8.5	3.0/ 0.0	0.5/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BC440MED	1997	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA000MED	2001	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	2001	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	2.0/ 0.0	0.5/ 0.5	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BE410MED	2001	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.5/18.0	3.0/23.0	1.5/22.0	1.5/11.0	0.5/ 6.5	0.5/ 3.0	0.5/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BB415MED	2001	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	2.0/ 2.5	2.5/ 3.0	5.5/ 5.0	3.5/ 1.0	2.0/ 1.0	0.5/ 3.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA430MED	2001	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.5/ 5.5	5.0/ 6.0	3.0/13.0	1.5/13.0	2.0/11.5	3.0/ 1.5	0.5/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BC440MED	2001	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA000MED	2005	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	2005	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.5/ 0.0	0.0/ 0.0	2.5/ 0.5	1.5/ 0.5	1.5/ 0.5	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BE410MED	2005	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	8.0/ 2.5	7.0/ 1.5	13.0/ 1.5	14.5/ 1.5	7.5/ 0.5	1.0/ 2.5	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BB415MED	2005	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	12.0/ 1.5	5.5/ 0.5	13.0/ 0.5	12.0/ 1.5	6.0/ 0.5	0.0/ 1.5	0.0/ 0.5	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA430MED	2005	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	2.0/ 1.5	4.0/ 1.5	4.0/ 2.0	3.5/ 2.0	2.0/ 1.5	2.0/ 1.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BC440MED	2005	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0

Table H-1k-3

SAS

15:04 MONDAY, JULY 24, 1989

FREQUENCY OF END OF PERIOD RESERVOIR ELEVATION
CHANGES FROM BASE CASE GREATER THAN 5 FEET (%)
(PDB.P9800.CAM.NT7.SERIES.LIBRARY(NT7ZJG1)
LIBBY

TEST CASE	CONTRACT YEAR	SEPT (+/-)	OCT (+/-)	NOV (+/-)	DEC (+/-)	JAN (+/-)	FEB (+/-)	MAR (+/-)	AP1 (+/-)	AP2 (+/-)	MAY (+/-)	JUNE (+/-)	JULY (+/-)	AG1 (+/-)	AG2 (+/-)
BA000MED	1991	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	1991	0.0/ 0.0	0.0/ 0.0	4.5/ 0.0	2.5/ 0.5	1.5/ 0.5	5.5/ 0.5	5.5/ 1.5	5.5/ 2.0	5.5/ 1.5	2.0/ 0.5	1.5/ 0.5	1.5/ 0.5	1.5/ 0.5	1.5/ 0.5
BE410MED	1991	0.0/ 6.5	0.0/75.5	2.5/84.0	0.0/27.0	0.5/23.5	0.5/18.5	3.5/21.5	4.0/24.5	4.5/25.5	1.0/17.0	1.0/14.0	2.0/10.0	2.5/ 8.5	4.0/ 7.5
BB415MED	1991	0.5/ 2.5	0.5/38.0	5.0/61.0	0.5/19.5	0.0/15.5	1.0/14.0	4.5/14.5	4.5/14.5	5.5/15.0	1.0/ 8.5	1.0/ 5.5	1.5/ 4.0	2.0/ 4.0	3.0/ 4.0
BA430MED	1991	4.5/ 1.0	10.0/ 0.0	16.5/ 2.5	7.5/ 0.0	7.5/ 0.0	11.5/ 0.5	12.0/ 1.5	12.0/ 0.5	12.5/ 0.5	5.5/ 0.0	2.0/ 0.5	1.5/ 0.0	3.0/ 0.0	3.5/ 0.0
BC440MED	1991	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA000MED	1993	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	1993	0.5/ 0.0	1.0/ 0.0	5.0/ 0.5	3.0/ 0.0	4.0/ 0.0	5.5/ 0.5	5.0/ 1.5	6.5/ 2.0	7.0/ 2.0	3.0/ 0.5	3.0/ 0.0	1.5/ 0.0	1.0/ 0.0	1.0/ 0.0
BE410MED	1993	0.5/12.0	0.5/80.0	1.5/89.0	0.5/16.5	0.5/14.5	1.5/14.5	2.0/18.5	2.5/17.5	3.0/19.5	1.5/11.0	0.5/11.0	0.5/ 6.5	2.5/ 6.0	4.5/ 5.0
BB415MED	1993	1.0/ 2.0	1.5/12.0	2.0/39.0	2.0/ 7.5	1.0/ 7.5	5.0/ 4.0	6.5/ 6.0	7.0/ 7.5	7.5/ 7.0	2.5/ 3.0	2.0/ 1.5	2.0/ 0.5	2.0/ 0.5	2.0/ 0.5
BA430MED	1993	3.5/ 0.0	8.5/ 0.0	12.5/ 5.5	7.5/ 0.0	6.0/ 0.0	12.5/ 0.0	11.5/ 2.0	11.5/ 3.5	11.0/ 4.0	7.0/ 0.0	5.0/ 0.0	4.0/ 0.0	3.5/ 0.0	4.5/ 0.0
BC440MED	1993	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA000MED	1995	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	1995	1.5/ 0.0	3.5/ 0.0	3.5/ 0.0	2.5/ 0.5	3.5/ 0.0	6.0/ 0.0	5.0/ 0.0	5.5/ 0.0	5.5/ 0.0	4.0/ 0.0	3.0/ 0.0	3.5/ 0.5	3.5/ 0.5	4.0/ 0.5
BE410MED	1995	3.5/ 8.0	2.0/77.0	1.0/90.0	1.0/25.0	0.5/23.0	1.5/18.0	1.0/18.5	1.0/18.5	1.0/20.0	1.0/12.5	0.5/11.5	2.5/ 9.0	6.0/ 8.0	6.0/ 7.5
BB415MED	1995	4.5/ 1.5	5.0/12.5	4.0/34.5	2.5/ 7.5	2.0/ 5.0	4.0/ 4.5	3.5/ 4.5	4.0/ 4.5	4.0/ 4.0	3.5/ 1.5	3.0/ 0.5	5.0/ 0.0	6.0/ 0.0	6.0/ 0.0
BA430MED	1995	13.0/ 0.0	14.0/ 0.0	18.0/19.5	14.0/ 0.0	9.0/ 0.0	17.0/ 0.0	14.0/ 2.0	16.0/ 4.0	16.5/ 3.5	9.5/ 0.0	6.5/ 0.0	8.0/ 0.0	9.0/ 0.0	11.0/ 0.0
BC440MED	1995	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA000MED	1997	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	1997	2.5/ 0.5	2.5/ 0.0	7.5/ 0.0	5.0/ 0.0	3.5/ 0.0	3.5/ 0.0	3.0/ 0.0	4.0/ 0.0	3.0/ 0.0	0.5/ 0.0	0.5/ 0.0	1.0/ 1.0	1.0/ 0.5	1.0/ 0.5
BE410MED	1997	2.5/ 8.0	2.5/81.0	2.5/91.0	3.0/20.5	1.5/23.5	2.5/20.0	3.0/20.5	4.0/20.0	4.0/21.5	1.5/13.5	1.0/12.5	3.0/ 9.0	4.5/ 7.0	6.0/ 5.5
BB415MED	1997	3.0/ 1.5	4.0/ 3.5	4.5/21.0	3.0/ 4.5	3.0/ 2.0	6.0/ 2.5	6.5/ 3.0	7.0/ 4.0	6.5/ 4.0	2.5/ 2.5	1.5/ 2.0	3.0/ 2.0	3.0/ 1.5	4.0/ 1.5
BA430MED	1997	9.0/ 0.0	11.0/ 0.0	19.0/21.5	16.0/ 0.0	9.5/ 0.0	11.5/ 0.5	10.5/ 3.0	11.5/ 4.0	10.5/ 4.0	5.0/ 0.0	4.5/ 0.0	4.5/ 0.5	5.5/ 0.0	5.5/ 0.0
BC440MED	1997	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA000MED	2001	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	2001	1.0/ 0.0	2.5/ 0.0	4.0/ 0.5	4.0/ 0.0	1.0/ 1.0	8.0/ 0.5	6.0/ 0.5	6.5/ 0.5	4.0/ 0.5	3.5/ 0.0	2.5/ 0.0	3.0/ 0.0	2.0/ 0.0	2.5/ 0.0
BE410MED	2001	3.5/ 4.0	3.0/37.5	2.0/66.0	4.0/14.5	1.0/13.0	3.5/13.5	3.5/14.0	3.5/15.0	2.5/14.5	1.5/ 7.5	1.0/ 6.5	1.0/ 3.5	3.0/ 2.5	3.5/ 2.5
BB415MED	2001	2.0/ 3.5	2.0/ 6.0	5.5/11.5	2.5/ 5.0	0.0/ 6.0	0.0/ 9.0	0.0/ 9.5	0.5/10.0	0.0/ 9.5	0.0/ 7.0	0.0/ 5.0	0.0/ 4.0	0.0/ 5.5	0.0/ 8.0
BA430MED	2001	8.5/ 0.0	9.0/ 0.5	17.0/21.0	14.0/ 0.0	4.5/ 0.0	12.5/ 0.0	10.5/ 2.5	10.5/ 3.5	9.5/ 3.5	7.5/ 0.5	5.5/ 0.5	5.5/ 0.0	7.5/ 0.0	7.5/ 0.0
BC440MED	2001	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA000MED	2005	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	2005	3.0/ 0.0	3.5/ 0.0	6.0/ 0.0	4.5/ 0.0	2.5/ 0.0	8.0/ 2.5	6.0/ 2.5	6.5/ 2.5	7.0/ 1.5	2.0/ 0.5	2.0/ 0.5	2.5/ 0.0	2.5/ 0.5	2.5/ 0.5
BE410MED	2005	1.5/ 2.5	1.0/ 7.5	9.0/17.0	1.0/ 7.0	0.0/ 9.0	1.0/ 9.0	1.5/ 9.5	1.5/ 9.0	1.0/ 9.5	0.5/ 6.5	0.5/ 5.0	2.0/ 1.0	2.5/ 1.0	1.0/ 2.5
BB415MED	2005	2.0/ 2.5	1.5/ 4.0	18.0/ 5.5	0.5/ 4.0	0.0/ 4.0	1.5/ 7.0	5.5/ 7.5	4.0/ 8.0	4.5/ 7.5	1.5/ 4.5	1.0/ 3.0	1.5/ 1.0	1.5/ 2.0	0.5/ 3.0
BA430MED	2005	5.5/ 0.0	9.0/ 0.0	17.5/ 5.0	8.0/ 0.0	8.0/ 0.5	12.0/ 1.5	10.5/ 1.5	10.5/ 1.5	10.0/ 1.0	5.0/ 0.5	3.5/ 0.0	3.5/ 0.0	4.0/ 0.5	3.0/ 0.5
BC440MED	2005	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0

Table H-1k-4

SAS
FREQUENCY OF END OF PERIOD RESERVOIR ELEVATION
CHANGES FROM BASE CASE GREATER THAN 5 FEET (%)
(PBB.P9800.CAM.NT7.SERIES.LIBRARY(NT7ZJGI)
DWORSHAK

15:04 MONDAY, JULY 24, 1989

TEST CASE	CONTRACT YEAR	SEPT (+/-)	OCT (+/-)	NOV (+/-)	DEC (+/-)	JAN (+/-)	FEB (+/-)	MAR (+/-)	AP1 (+/-)	AP2 (+/-)	MAY (+/-)	JUNE (+/-)	JULY (+/-)	AG1 (+/-)	AG2 (+/-)
BA000MED	1991	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	1991	2.0/ 0.0	1.5/ 0.0	1.0/ 0.0	10.5/ 0.5	9.5/ 0.5	6.0/ 0.5	7.5/ 2.5	5.5/ 1.5	4.5/ 1.0	3.5/ 0.5	3.5/ 0.0	3.5/ 0.0	3.0/ 0.0	[illegible]
BE410MED	1991	4.0/45.5	2.5/55.5	1.5/69.5	1.0/44.5	0.5/36.5	1.0/28.5	2.5/20.0	3.5/16.5	2.0/16.0	0.5/14.5	1.5/ 9.0	3.0/ 8.5	10.5/ 8.5	13.5/ 8.5
BB415MED	1991	3.0/15.5	1.5/12.5	1.5/41.0	2.0/36.0	1.0/26.5	1.5/18.5	2.5/14.0	3.5/10.5	2.0/ 9.5	1.5/ 7.0	3.0/ 6.0	3.0/ 6.5	4.5/ 6.0	9.0/ 5.0
BA430MED	1991	10.5/ 0.5	11.5/ 0.0	13.0/ 0.0	24.0/ 0.0	15.5/ 0.0	11.0/ 0.5	13.5/ 1.0	9.0/ 1.0	9.0/ 0.5	5.5/ 0.0	6.5/ 0.0	7.0/ 0.0	8.5/ 0.0	12.0/ 0.0
BC440MED	1991	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA000MED	1993	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	1993	3.5/ 0.0	2.5/ 0.0	3.5/ 0.0	15.0/ 0.0	11.5/ 0.0	8.5/ 0.0	11.0/ 0.5	6.0/ 1.0	6.0/ 1.0	4.0/ 0.5	4.5/ 0.5	3.5/ 0.0	2.5/ 0.0	4.0/ 0.0
BE410MED	1993	5.0/37.5	5.0/50.0	3.5/77.5	2.5/44.5	1.5/26.0	1.0/25.5	2.0/22.5	2.5/19.5	0.5/18.0	0.0/11.0	0.5/ 4.5	4.0/ 3.0	11.0/ 2.0	15.0/ 1.0
BB415MED	1993	2.5/ 5.0	2.5/ 6.0	2.5/23.5	4.5/24.5	2.5/16.5	2.0/11.5	4.5/11.5	3.5/ 6.5	3.0/ 6.0	2.0/ 2.0	5.0/ 0.5	6.0/ 0.5	6.0/ 0.5	6.0/ 1.0
BA430MED	1993	16.0/ 0.0	15.0/ 0.0	12.5/ 0.0	20.5/ 0.5	16.5/ 0.5	12.0/ 0.0	11.5/ 3.5	6.0/ 5.5	4.5/ 5.5	4.5/ 1.0	7.5/ 0.5	9.0/ 0.5	11.0/ 0.5	14.0/ 0.5
BC440MED	1993	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA000MED	1995	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	1995	8.5/ 0.0	6.0/ 0.0	3.0/ 0.0	11.0/ 0.0	10.5/ 0.5	[illegible]	8.5/ 0.0	8.0/ 0.0	6.0/ 0.0	5.0/ 0.0	4.5/ 0.5	3.0/ 0.5	4.0/ 0.5	6.5/ 0.5
BE410MED	1995	7.5/33.0	6.0/48.0	3.5/75.5	3.0/56.5	2.0/35.0	1.5/33.5	2.0/32.5	2.0/27.5	1.0/26.0	1.0/18.5	1.0/ 7.5	5.0/ 4.5	15.0/ 5.0	20.5/ 4.0
BB415MED	1995	8.0/ 3.0	7.5/ 3.5	4.5/10.0	4.5/17.0	5.0/13.5	5.5/ 9.5	4.0/13.0	4.5/10.5	2.5/ 9.5	2.5/ 2.5	5.0/ 1.0	6.0/ 1.5	9.5/ 1.5	10.5/ 1.0
BA430MED	1995	26.0/ 0.0	22.5/ 0.0	19.5/ 0.0	27.5/ 0.0	24.0/ 0.0	16.0/ 0.0	12.5/ 6.0	10.5/ 6.5	9.0/ 7.0	8.5/ 0.5	11.0/ 0.5	12.0/ 0.5	14.5/ 1.0	17.0/ 1.0
BC440MED	1995	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA000MED	1997	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	1997	8.5/ 0.0	8.0/ 0.0	7.0/ 0.0	17.0/ 0.0	13.5/ 0.0	8.0/ 0.0	9.5/ 0.5	6.5/ 0.5	6.0/ 0.5	4.0/ 0.5	3.0/ 0.5	1.5/ 1.0	1.5/ 2.0	4.5/ 0.5
BE410MED	1997	10.5/27.5	10.0/46.0	7.5/71.5	4.5/57.0	3.0/27.0	4.5/29.0	2.5/27.0	2.0/23.5	2.0/22.5	2.0/16.5	2.0/ 5.5	8.0/ 2.5	15.5/ 2.0	20.0/ 2.0
BB415MED	1997	9.0/ 3.0	8.5/ 3.0	6.5/ 2.5	10.5/ 7.5	6.5/ 6.0	6.0/ 3.0	6.0/ 6.5	4.0/ 7.0	4.0/ 7.0	2.5/ 1.5	6.0/ 1.5	7.5/ 2.0	8.0/ 2.0	6.0/ 4.0
BA430MED	1997	20.0/ 0.0	20.5/ 0.0	19.0/ 0.0	27.0/ 0.0	21.0/ 0.0	13.0/ 0.5	11.5/ 3.5	6.5/ 6.5	5.5/ 7.0	4.0/ 0.5	5.5/ 1.0	8.0/ 1.0	10.0/ 0.5	14.0/ 0.5
BC440MED	1997	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA000MED	2001	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	2001	4.0/ 0.0	4.0/ 0.0	3.0/ 0.5	15.0/ 0.5	13.0/ 0.5	6.0/ 0.5	7.5/ 0.5	5.0/ 0.5	6.0/ 0.5	4.5/ 0.5	2.0/ 0.5	0.5/ 0.0	1.0/ 0.0	3.5/ 0.0
BE410MED	2001	8.5/13.5	6.5/22.0	5.0/42.0	8.0/34.5	3.5/23.5	4.5/16.5	3.5/18.0	2.0/15.0	2.0/14.0	2.0/ 7.5	6.5/ 4.0	6.5/ 2.0	7.0/ 2.5	13.5/ 1.5
BB415MED	2001	2.5/ 7.0	2.0/ 7.0	2.5/ 8.0	6.0/13.0	2.0/12.0	1.5/ 9.5	3.0/ 9.5	3.0/ 7.0	3.0/ 6.0	0.5/ 6.0	4.5/ 4.5	1.5/ 5.5	1.0/ 7.5	0.0/10.5
BA430MED	2001	17.5/ 0.0	18.0/ 0.0	18.5/ 0.0	28.5/ 0.5	21.0/ 0.5	14.0/ 0.5	13.0/ 3.0	8.5/ 4.0	8.0/ 5.0	7.5/ 0.0	7.5/ 0.0	9.0/ 0.0	9.0/ 0.0	10.5/ 0.0
BC440MED	2001	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0
BA000MED	2005	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
BD120MED	2005	4.5/ 0.0	2.5/ 0.0	3.0/ 0.0	12.5/ 0.0	11.0/ 0.0	[illegible]	12.5/ 1.0	6.0/ 1.0	5.5/ 1.0	5.0/ 0.5	3.5/ 0.5	4.0/ 0.0	3.5/ 0.0	9.0/ 0.0
BE410MED	2005	0.5/ 6.0	0.5/ 8.5	1.0/10.0	3.0/12.0	3.0/ 9.5	1.5/10.5	7.0/10.0	5.5/ 9.0	5.0/ 8.0	0.5/ 7.0	4.5/ 2.0	7.5/ 0.5	4.0/ 3.5	2.5/ 8.5
BB415MED	2005	1.0/ 6.5	1.0/ 7.0	1.0/ 4.0	3.5/10.5	3.0/ 7.5	3.0/10.5	9.5/10.5	8.0/ 8.0	8.0/ 7.0	1.5/ 7.0	4.0/ 3.0	5.0/ 1.5	3.5/ 4.0	2.0/10.5
BA430MED	2005	8.0/ 0.0	8.5/ 0.0	11.5/ 0.0	19.0/ 0.0	18.0/ 1.0	12.0/ 0.5	16.5/ 2.0	9.0/ 2.0	8.5/ 2.0	7.0/ 0.5	5.5/ 0.0	6.5/ 0.5	4.0/ 0.5	6.5/ 1.0
BC440MED	2005	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0	0.0/ 0.0

H-2

Recreation

Recreation Analysis

Recreation Analysis for Albeni Falls

Recreation impacts for alternatives analyzed with the Systems Analysis Model (SAM) at Albeni Falls (Lake Pend Oreille) are analyzed in terms of the probability of the elevation of that reservoir being at an elevation of 2,054 feet or more at the end of April. That level enhances the annual Kokanee and Kamloops Fishing Derby, which occurs around May 1 each year. Table H-2-1 shows the probability of the elevation of Lake Pend Oreille exceeding 2,054 feet at the end of April. These data are given only for the same years as were used in the analysis of impacts on fish, since the data are derived from the same data set as is used for the fish impacts analysis. Also, these probability data were only developed for the alternatives with expected load sizes and gas prices, consistent with the recreation analysis for the other reservoirs described below. If there is interest in seeing data on the probability of Lake Pend Oreille being at or above 2,054 feet for other sensitivity assumptions, we will provide this data upon request.

Table H-2-1

PROBABILITY OF ALBENI FALLS ELEVATION EXCEEDING 2054 FEET AT THE END OF APRIL

(Expected Loads and Gas Prices)

Alternative	Year 91	93	95	97	01	05
No Action	.960	.935	.910	.880	.920	.920
Alt. 1.2	.965	.940	.920	.910	.925	.920
Alt. 4.1, Case A	.940	.945	.905	.890	.910	.915
Alt. 4.1, Case B	.890	.910	.845	.855	.920	.910
Alt. 4.3	.990	.950	.930	.825	.930	.925
Alt. 4.4	.960 1/	.935 1/	.910 1/	.880 1/	.920 1/	.920 1/

1/ Values for Alternative 4.4 are assumed to be the same as for No Action since there were no other differences in hydro operations between the two in the SAM results.

Development of Recreation Indices

In order to determine and compare potential impacts of Power Sales Contract alternatives which were analyzed with the Systems Analysis Model (SAM) on recreation at Federal storage reservoirs, a method of converting SAM output (reservoir elevations) to recreation impact was needed. A method was developed for the Intertie Development and Use Environmental

Impact Statement which was used for this EIS This method was based on available data relating recreation sites to reservoir elevations for the reservoirs studied. In general, this relationship was based on boat ramp elevations. In the cases of Libby and Dworshak, available information on recreation use as it relates to reservoir elevation was used.

Because of the relatively small differences in the recreation indices observed among the alternatives with expected loads and gas prices, the reacreation indices were not computed for the other (sensitivity) assumptions regarding size of Northwest and Southwest loads and gas prices. If there is interest in seeing recreation indices computed for other sensitivity assumptions, we will provide this data upon request.

Grand Coulee --

In order to compare alternatives, elevation data were converted to an overall 'recreation index' for each alternative. This was generally based upon the elevations required to utilize boat ramps and marinas. For each SAM simulation, one point was given for each usable boat ramp or marina, The points were then totalled for all 200 simulations for each alternative to provide a 'recreation index'. Recreation indices were developed for the alternatives studied with SAM using end-of-period elevations for May, June, July, August 15 and August 31.

The following facilities were given one point for being available (a reservoir elevation greater than or equal to the stated elevation).

Facility	Elevation (feet)
Evans	1287
Bradbury Beach	1285
Daisy	1285
Fort Spokane Marina	1283
North Gorge	1282
Jones Bay	1282
China Bend	1282
Marcus Island	1281
Hawk Creek	1277
Seven Bays	1262
Gifford	1249
Fort Spokane Campground	1247
Porcupine Bay	1238
Kettle Falls Campground	1237
Kettle Falls Marina	1235
Spring Canyon	1234
Hunters	1233
Enterprise	1233
Keller Ferry	1229

Hungry Horse --

Recreation indices were developed for each alternative in a manner similar to that described for Grand Coulee. One point was given for each available boat ramp and totals for 200 simulations were computed for each alternative.

The following facilities were given one point for being available (a reservoir elevation greater than or equal to the stated elevation).

Facility	Elevation (feet)
Ben Creek	3560
Emmery Bay	3558
Murray Bay	3558
Don's Point	3552
Doris Creek	3547
Graves Creek	3545
Lost Johnny Campground	3536
Lost Johnny Point Campground	3532
Devil's Corkscrew	3516
Riverside	3506
Abbot Bay	3473

Dworshak --

Impact indices were developed for Dworshak in a sightly different manner than for Grand Coulee and Hungry Horse. Drawdown impacts at Dworshak reservoir have been assessed in 5-foot increments by the U.S. Army Corps of Engineers (COE) (unpublished). The COE figures on the effects of reservoir elevation on overall recreation visitation were used in developing the recreation indices. The estimated visitation for each model simulation was summed for all 200 simulations for each alternative.

The values used, adapted from the COE data, are as follows:

Elevation	Visitation (percent of full pool usage)
Greater than 1595	100
LE 1595 and GT 1590	90
LE 1590 and GT 1585	80
LE 1585 and GT 1580	70
LE 1580 and GT 1575	60
LE 1575 and GT 1565	50
LE 1565	25

Libby --

Impact indices for Libby were developed in a manner similar to those for Dworshak. Drawdown impacts at Libby have been assessed by the COE (COE, 1985). Values for recreation use at various reservoir elevations were adapted from that document and are given below. (U.S. recreation facilities only.)

Elevation	Recreation Use (percent of full pool usage)
Greater than 2456.5	100
LE 2456.5 and GT 2454	99.3
LE 2454 and GT 2451.5	96.2
LE 2451.5 and GT 2449	92.9
LE 2449 and GT 2444	88.1
LE 2444 and GT 2439	82.4
LE 2439 and GT 2434	75.6
LE 2434 and GT 2429	73.8
LE 2429 and GT 2419	71.7
LE 2419 and GT 2409	69.0
LE 2409	67.3

The recreation indices computed as described above are shown for Grand Coulee, Hungry Horse, Dworshak, and Libby in the following tables.

Table H-2 - 1

DWORSHAK RECREATION INDEX	MAY	JUN	JUL	AG1	AG2	AVG
YEAR 1989						
NO ACTION	0.463	0.845	0.867	0.858	0.850	0.757
ALT 1.2	0.463	0.845	0.867	0.859	0.855	0.757
DIFF	0.000	0.000	0.000	0.001	0.005	0.000
ALT 4.1 (B)	0.457	0.832	0.865	0.864	0.863	0.754
DIFF	-0.006	-0.013	-0.002	0.006	0.013	-0.003
ALT 4.1 (A)	0.462	0.837	0.869	0.856	0.848	0.755
DIFF	-0.001	-0.008	0.002	-0.002	-0.002	-0.002
ALT 4.3	0.470	0.852	0.883	0.878	0.869	0.769
DIFF	0.007	0.007	0.016	0.020	0.019	0.012
ALT 4.4	0.463	0.845	0.867	0.858	0.850	0.757
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

DWORSHAK RECREATION INDEX	MAY	JUN	JUL	AG1	AG2	AVG
YEAR 1990						
NO ACTION	0.446	0.845	0.869	0.865	0.856	0.755
ALT 1.2	0.446	0.847	0.870	0.868	0.861	0.756
DIFF	0.000	0.002	0.001	0.003	0.005	0.001
ALT 4.1 (B)	0.441	0.835	0.867	0.868	0.867	0.752
DIFF	-0.005	-0.010	-0.002	0.003	0.011	-0.003
ALT 4.1 (A)	0.442	0.841	0.873	0.867	0.857	0.754
DIFF	-0.004	-0.004	0.004	0.002	0.001	-0.001
ALT 4.3	0.447	0.844	0.873	0.869	0.862	0.757
DIFF	0.001	-0.001	0.004	0.004	0.006	0.002
ALT 4.4	0.446	0.845	0.869	0.865	0.856	0.755
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

DWORSHAK RECREATION INDEX YEAR 1991

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.482	0.839	0.869	0.857	0.844	0.759
ALT 1.2	0.484	0.843	0.873	0.865	0.853	0.764
DIFF	0.002	0.004	0.004	0.008	0.009	0.005
ALT 4.1 (B)	0.477	0.821	0.853	0.853	0.849	0.750
DIFF	-0.005	-0.018	-0.016	-0.004	0.005	-0.009
ALT 4.1 (A)	0.478	0.831	0.861	0.856	0.846	0.755
DIFF	-0.004	-0.008	-0.008	-0.001	0.002	-0.004
ALT 4.3	0.488	0.851	0.882	0.873	0.862	0.772
DIFF	0.006	0.012	0.013	0.016	0.018	0.013
ALT 4.4	0.482	0.839	0.869	0.857	0.844	0.759
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

DWORSHAK RECREATION INDEX YEAR 1992

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.496	0.844	0.883	0.869	0.848	0.770
ALT 1.2	0.496	0.845	0.883	0.873	0.856	0.772
DIFF	0.000	0.001	0.000	0.004	0.008	0.002
ALT 4.1 (B)	0.493	0.842	0.880	0.876	0.866	0.771
DIFF	-0.003	-0.002	-0.003	0.007	0.018	0.001
ALT 4.1 (A)	0.496	0.846	0.884	0.869	0.851	0.771
DIFF	0.000	0.002	0.001	0.000	0.003	0.001
ALT 4.3	0.496	0.854	0.890	0.881	0.864	0.777
DIFF	0.000	0.010	0.007	0.012	0.016	0.007
ALT 4.4	0.496	0.844	0.883	0.869	0.848	0.770
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

DWORSHAK RECREATION INDEX YEAR 1993

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.481	0.846	0.879	0.867	0.851	0.765
ALT 1.2	0.482	0.850	0.882	0.872	0.860	0.769
DIFF	0.001	0.004	0.003	0.005	0.009	0.004
ALT 4.1 (B)	0.476	0.838	0.874	0.876	0.873	0.765
DIFF	-0.005	-0.008	-0.005	0.009	0.022	0.000
ALT 4.1 (A)	0.479	0.851	0.881	0.872	0.858	0.768
DIFF	-0.002	0.005	0.002	0.005	0.007	0.003
ALT 4.3	0.480	0.854	0.886	0.877	0.866	0.772
DIFF	-0.001	0.008	0.007	0.010	0.015	0.007
ALT 4.4	0.481	0.846	0.879	0.867	0.851	0.765
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

DWORSHAK RECREATION INDEX YEAR 1994

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.458	0.818	0.839	0.818	0.791	0.729
ALT 1.2	0.460	0.824	0.843	0.824	0.801	0.734
DIFF	0.002	0.006	0.004	0.006	0.010	0.005
ALT 4.1 (B)	0.452	0.809	0.833	0.831	0.821	0.729
DIFF	-0.006	-0.009	-0.006	0.013	0.030	0.000
ALT 4.1 (A)	0.458	0.817	0.838	0.821	0.797	0.730
DIFF	0.000	-0.001	-0.001	0.003	0.006	0.001
ALT 4.3	0.459	0.828	0.852	0.831	0.817	0.740
DIFF	0.001	0.010	0.013	0.013	0.026	0.011
ALT 4.4	0.458	0.818	0.839	0.818	0.791	0.729
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

DWORSHAK RECREATION INDEX YEAR 1995

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.461	0.817	0.847	0.827	0.799	0.734
ALT 1.2	0.462	0.818	0.848	0.831	0.807	0.736
DIFF	0.001	0.001	0.001	0.004	0.008	0.002
ALT 4.1 (B)	0.450	0.815	0.845	0.841	0.831	0.736
DIFF	-0.011	-0.002	-0.002	0.014	0.032	0.002
ALT 4.1 (A)	0.458	0.822	0.847	0.830	0.811	0.736
DIFF	-0.003	0.005	0.000	0.003	0.012	0.002
ALT 4.3	0.460	0.830	0.859	0.834	0.812	0.742
DIFF	-0.001	0.013	0.012	0.007	0.013	0.008
ALT 4.4	0.461	0.817	0.847	0.827	0.799	0.734
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

DWORSHAK RECREATION INDEX YEAR 1996

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.440	0.810	0.840	0.824	0.802	0.725
ALT 1.2	0.441	0.811	0.844	0.828	0.808	0.728
DIFF	0.001	0.001	0.004	0.004	0.006	0.003
ALT 4.1 (B)	0.432	0.806	0.838	0.831	0.821	0.725
DIFF	-0.008	-0.004	-0.002	0.007	0.019	0.000
ALT 4.1 (A)	0.441	0.816	0.839	0.822	0.801	0.726
DIFF	0.001	0.006	-0.001	-0.002	-0.001	0.001
ALT 4.3	0.442	0.818	0.848	0.834	0.819	0.733
DIFF	0.002	0.008	0.008	0.010	0.017	0.008
ALT 4.4	0.440	0.810	0.840	0.824	0.802	0.725
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

DWORSHAK RECREATION INDEX YEAR 1997

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.416	0.819	0.836	0.822	0.800	0.719
ALT 1.2	0.419	0.820	0.838	0.826	0.809	0.723
DIFF	0.003	0.001	0.002	0.004	0.009	0.004
ALT 4.1 (B)	0.404	0.807	0.839	0.833	0.823	0.719
DIFF	-0.012	-0.012	0.003	0.011	0.023	0.000
ALT 4.1 (A)	0.414	0.822	0.841	0.821	0.802	0.721
DIFF	-0.002	0.003	0.005	-0.001	0.002	0.002
ALT 4.3	0.419	0.820	0.845	0.830	0.816	0.726
DIFF	0.003	0.001	0.009	0.008	0.016	0.007
ALT 4.4	0.416	0.819	0.836	0.822	0.800	0.719
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

DWORSHAK RECREATION INDEX YEAR 1998

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.477	0.826	0.865	0.852	0.830	0.752
ALT 1.2	0.477	0.828	0.868	0.855	0.838	0.754
DIFF	0.000	0.002	0.003	0.003	0.008	0.002
ALT 4.1 (B)	0.454	0.825	0.864	0.857	0.846	0.748
DIFF	-0.023	-0.001	-0.001	0.005	0.016	-0.004
ALT 4.1 (A)	0.477	0.828	0.867	0.854	0.835	0.754
DIFF	0.000	0.002	0.002	0.002	0.005	0.002
ALT 4.3	0.478	0.830	0.869	0.864	0.854	0.759
DIFF	0.001	0.004	0.004	0.012	0.024	0.007
ALT 4.4	0.477	0.826	0.865	0.852	0.830	0.752
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

DWORSHAK RECREATION INDEX YEAR 1999

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.433	0.808	0.829	0.814	0.794	0.718
ALT 1.2	0.434	0.806	0.828	0.818	0.803	0.719
DIFF	0.001	-0.002	-0.001	0.004	0.009	0.001
ALT 4.1 (B)	0.421	0.814	0.840	0.821	0.811	0.722
DIFF	-0.012	0.006	0.011	0.007	0.017	0.004
ALT 4.1 (A)	0.434	0.817	0.827	0.813	0.790	0.719
DIFF	0.001	0.009	-0.002	-0.001	-0.004	0.001
ALT 4.3	0.434	0.816	0.837	0.826	0.816	0.726
DIFF	0.001	0.008	0.008	0.012	0.022	0.008
ALT 4.4	0.433	0.808	0.829	0.814	0.794	0.718
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

DWORSHAK RECREATION INDEX YEAR 2000

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.454	0.799	0.832	0.823	0.811	0.725
ALT 1.2	0.455	0.799	0.832	0.824	0.813	0.726
DIFF	0.001	0.000	0.000	0.001	0.002	0.001
ALT 4.1 (B)	0.446	0.801	0.832	0.823	0.812	0.723
DIFF	-0.008	0.002	0.000	0.000	0.001	-0.002
ALT 4.1 (A)	0.454	0.804	0.832	0.819	0.798	0.724
DIFF	0.000	0.005	0.000	-0.004	-0.013	-0.001
ALT 4.3	0.460	0.815	0.846	0.834	0.826	0.737
DIFF	0.006	0.016	0.014	0.011	0.015	0.012
ALT 4.4	0.454	0.799	0.832	0.823	0.811	0.725
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

DWORSHAK RECREATION INDEX YEAR 2001

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.454	0.811	0.846	0.831	0.809	0.732
ALT 1.2	0.454	0.812	0.846	0.834	0.817	0.734
DIFF	0.000	0.001	0.000	0.003	0.008	0.002
ALT 4.1 (B)	0.453	0.816	0.845	0.836	0.819	0.735
DIFF	-0.001	0.005	-0.001	0.005	0.010	0.003
ALT 4.1 (A)	0.454	0.816	0.846	0.824	0.795	0.731
DIFF	0.000	0.005	0.000	-0.007	-0.014	-0.001
ALT 4.3	0.454	0.817	0.851	0.837	0.822	0.737
DIFF	0.000	0.006	0.005	0.006	0.013	0.005
ALT 4.4	0.454	0.811	0.846	0.831	0.809	0.732
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

DWORSHAK RECREATION INDEX YEAR 2002

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.464	0.836	0.864	0.844	0.817	0.748
ALT 1.2	0.463	0.838	0.866	0.849	0.829	0.751
DIFF	-0.001	0.002	0.002	0.005	0.012	0.003
ALT 4.1 (B)	0.461	0.839	0.860	0.847	0.831	0.749
DIFF	-0.003	0.003	-0.004	0.003	0.014	0.001
ALT 4.1 (A)	0.462	0.833	0.860	0.842	0.813	0.745
DIFF	-0.002	-0.003	-0.004	-0.002	-0.004	-0.003
ALT 4.3	0.461	0.838	0.865	0.855	0.843	0.752
DIFF	-0.003	0.002	0.001	0.011	0.026	0.004
ALT 4.4	0.464	0.836	0.864	0.844	0.817	0.748
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

DWORSHAK RECREATION INDEX YEAR 2003

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.462	0.826	0.865	0.852	0.830	0.748
ALT 1.2	0.467	0.828	0.866	0.858	0.843	0.752
DIFF	0.005	0.002	0.001	0.006	0.013	0.004
ALT 4.1 (B)	0.465	0.834	0.865	0.851	0.832	0.751
DIFF	0.003	0.008	0.000	-0.001	0.002	0.003
ALT 4.1 (A)	0.465	0.827	0.864	0.850	0.833	0.749
DIFF	0.003	0.001	-0.001	-0.002	0.003	0.001
ALT 4.3	0.470	0.838	0.875	0.868	0.859	0.761
DIFF	0.008	0.012	0.010	0.016	0.029	0.013
ALT 4.4	0.462	0.826	0.865	0.852	0.830	0.748
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

DWORSHAK RECREATION INDEX YEAR 2004

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.508	0.842	0.879	0.870	0.856	0.773
ALT 1.2	0.508	0.843	0.882	0.876	0.864	0.775
DIFF	0.000	0.001	0.003	0.006	0.008	0.002
ALT 4.1 (B)	0.510	0.846	0.880	0.864	0.846	0.772
DIFF	0.002	0.004	0.001	-0.006	-0.010	-0.001
ALT 4.1 (A)	0.511	0.845	0.879	0.865	0.844	0.772
DIFF	0.003	0.003	0.000	-0.005	-0.012	-0.001
ALT 4.3	0.512	0.851	0.885	0.877	0.867	0.779
DIFF	0.004	0.009	0.006	0.007	0.011	0.006
ALT 4.4	0.508	0.842	0.879	0.870	0.856	0.773
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

DWORSHAK RECREATION INDEX YEAR 2005

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.469	0.834	0.866	0.852	0.833	0.752
ALT 1.2	0.469	0.835	0.868	0.858	0.844	0.755
DIFF	0.000	0.001	0.002	0.006	0.011	0.003
ALT 4.1 (B)	0.465	0.838	0.866	0.847	0.824	0.750
DIFF	-0.004	0.004	0.000	-0.005	-0.009	-0.002
ALT 4.1 (A)	0.467	0.836	0.866	0.848	0.820	0.750
DIFF	-0.002	0.002	0.000	-0.004	-0.013	-0.002
ALT 4.3	0.469	0.841	0.866	0.855	0.841	0.755
DIFF	0.000	0.007	0.000	0.003	0.008	0.003
ALT 4.4	0.469	0.834	0.866	0.852	0.833	0.752
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

DWORSHAK RECREATION INDEX YEAR 2006

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.466	0.812	0.837	0.829	0.818	0.734
ALT 1.2	0.467	0.814	0.840	0.832	0.825	0.737
DIFF	0.001	0.002	0.003	0.003	0.007	0.003
ALT 4.1 (B)	0.464	0.822	0.837	0.824	0.807	0.734
DIFF	-0.002	0.010	0.000	-0.005	-0.011	0.000
ALT 4.1 (A)	0.464	0.815	0.835	0.824	0.810	0.732
DIFF	-0.002	0.003	-0.002	-0.005	-0.008	-0.002
ALT 4.3	0.470	0.823	0.843	0.831	0.824	0.740
DIFF	0.004	0.011	0.006	0.002	0.006	0.006
ALT 4.4	0.466	0.812	0.837	0.829	0.818	0.734
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

DWORSHAK RECREATION INDEX YEAR 2007

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.437	0.835	0.859	0.849	0.834	0.742
ALT 1.2	0.438	0.836	0.860	0.852	0.840	0.745
DIFF	0.001	0.001	0.001	0.003	0.006	0.003
ALT 4.1 (B)	0.434	0.841	0.859	0.841	0.823	0.741
DIFF	-0.003	0.006	0.000	-0.008	-0.011	-0.001
ALT 4.1 (A)	0.434	0.832	0.858	0.842	0.819	0.738
DIFF	-0.003	-0.003	-0.001	-0.007	-0.015	-0.004
ALT 4.3	0.440	0.846	0.864	0.856	0.842	0.749
DIFF	0.003	0.011	0.005	0.007	0.008	0.007
ALT 4.4	0.437	0.835	0.859	0.849	0.834	0.742
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

DWORSHAK RECREATION INDEX YEAR 2008

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.422	0.825	0.849	0.840	0.830	0.732
ALT 1.2	0.423	0.828	0.853	0.846	0.840	0.736
DIFF	0.001	0.003	0.004	0.006	0.010	0.004
ALT 4.1 (B)	0.418	0.824	0.848	0.837	0.819	0.729
DIFF	-0.004	-0.001	-0.001	-0.003	-0.011	-0.003
ALT 4.1 (A)	0.422	0.825	0.850	0.840	0.824	0.731
DIFF	0.000	0.000	0.001	0.000	-0.006	-0.001
ALT 4.3	0.423	0.830	0.856	0.846	0.839	0.737
DIFF	0.001	0.005	0.007	0.006	0.009	0.005
ALT 4.4	0.422	0.825	0.849	0.840	0.830	0.732
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

Table H-2 - 2

HUNGRY HORSE RECREATION INDEX YEAR 1989	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	3.295	7.710	9.875	9.480	8.940	7.521
ALT 1.2	3.295	7.710	9.875	9.480	8.955	7.523
DIFF	0.000	0.000	0.000	0.000	0.015	0.002
ALT 4.1 (B)	2.975	7.345	9.700	9.590	9.130	7.345
DIFF	-0.320	-0.365	-0.175	0.110	0.190	-0.176
ALT 4.1 (A)	3.025	7.440	9.670	9.370	8.925	7.320
DIFF	-0.270	-0.270	-0.205	-0.110	-0.015	-0.201
ALT 4.3	3.440	8.010	10.130	9.730	9.285	7.770
DIFF	0.145	0.300	0.255	0.250	0.345	0.249
ALT 4.4	3.295	7.710	9.875	9.480	8.940	7.521
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

HUNGRY HORSE RECREATION INDEX YEAR 1990	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	3.220	7.460	9.490	9.110	8.675	7.264
ALT 1.2	3.235	7.490	9.505	9.170	8.710	7.291
DIFF	0.015	0.030	0.015	0.060	0.035	0.027
ALT 4.1 (B)	2.970	7.115	9.290	9.175	8.735	7.082
DIFF	-0.250	-0.345	-0.200	0.065	0.060	-0.182
ALT 4.1 (A)	3.095	7.255	9.340	9.030	8.590	7.124
DIFF	-0.125	-0.205	-0.150	-0.080	-0.085	-0.140
ALT 4.3	3.315	7.595	9.650	9.330	8.840	7.410
DIFF	0.095	0.135	0.160	0.220	0.165	0.146
ALT 4.4	3.220	7.460	9.490	9.110	8.675	7.264
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

HUNGRY HORSE RECREATION INDEX YEAR 1991

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	3.185	7.480	9.620	9.235	8.715	7.314
ALT 1.2	3.200	7.520	9.650	9.295	8.780	7.351
DIFF	0.015	0.040	0.030	0.060	0.065	0.037
ALT 4.1 (B)	2.800	6.925	9.235	9.080	8.725	6.966
DIFF	-0.385	-0.555	-0.385	-0.155	0.010	-0.348
ALT 4.1 (A)	2.980	7.255	9.445	9.120	8.650	7.140
DIFF	-0.205	-0.225	-0.175	-0.115	-0.065	-0.174
ALT 4.3	3.315	7.735	9.880	9.490	8.945	7.535
DIFF	0.130	0.255	0.260	0.255	0.230	0.221
ALT 4.4	3.185	7.480	9.620	9.235	8.715	7.314
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

HUNGRY HORSE RECREATION INDEX YEAR 1992

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	2.980	7.260	9.570	9.155	8.740	7.189
ALT 1.2	3.035	7.345	9.630	9.255	8.840	7.264
DIFF	0.055	0.085	0.060	0.100	0.100	0.075
ALT 4.1 (B)	2.800	7.040	9.470	9.285	8.970	7.110
DIFF	-0.180	-0.220	-0.100	0.130	0.230	-0.079
ALT 4.1 (A)	2.885	7.125	9.465	9.155	8.730	7.104
DIFF	-0.095	-0.135	-0.105	0.000	-0.010	-0.085
ALT 4.3	3.120	7.545	9.870	9.490	9.040	7.449
DIFF	0.140	0.285	0.300	0.335	0.300	0.260
ALT 4.4	2.980	7.260	9.570	9.155	8.740	7.189
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

HUNGRY HORSE RECREATION INDEX YEAR 1993

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	3.000	7.175	9.250	8.865	8.405	7.014
ALT 1.2	3.065	7.265	9.350	8.975	8.510	7.104
DIFF	0.065	0.090	0.100	0.110	0.105	0.090
ALT 4.1 (B)	2.820	7.050	9.225	9.060	8.650	6.987
DIFF	-0.180	-0.125	-0.025	0.195	0.245	-0.027
ALT 4.1 (A)	2.995	7.190	9.270	8.920	8.470	7.036
DIFF	-0.005	0.015	0.020	0.055	0.065	0.022
ALT 4.3	3.200	7.510	9.620	9.330	8.780	7.345
DIFF	0.200	0.335	0.370	0.465	0.375	0.331
ALT 4.4	3.000	7.175	9.250	8.865	8.405	7.014
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

HUNGRY HORSE RECREATION INDEX YEAR 1994

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	3.045	7.030	8.895	8.435	7.890	6.781
ALT 1.2	3.090	7.165	9.015	8.550	8.005	6.885
DIFF	0.045	0.135	0.120	0.115	0.115	0.104
ALT 4.1 (B)	2.830	6.810	8.745	8.460	8.120	6.668
DIFF	-0.215	-0.220	-0.150	0.025	0.230	-0.113
ALT 4.1 (A)	3.045	7.045	8.950	8.465	7.935	6.808
DIFF	0.000	0.015	0.055	0.030	0.045	0.027
ALT 4.3	3.185	7.340	9.235	8.815	8.270	7.073
DIFF	0.140	0.310	0.340	0.380	0.380	0.292
ALT 4.4	3.045	7.030	8.895	8.435	7.890	6.781
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

HUNGRY HORSE RECREATION INDEX YEAR 1995

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	2.925	6.750	8.615	8.220	7.705	6.562
ALT 1.2	3.045	6.920	8.790	8.350	7.875	6.715
DIFF	0.120	0.170	0.175	0.130	0.170	0.153
ALT 4.1 (B)	2.675	6.520	8.460	8.250	7.875	6.429
DIFF	-0.250	-0.230	-0.155	0.030	0.170	-0.133
ALT 4.1 (A)	2.960	6.790	8.675	8.275	7.840	6.619
DIFF	0.035	0.040	0.060	0.055	0.135	0.057
ALT 4.3	3.165	7.230	9.110	8.690	8.095	6.972
DIFF	0.240	0.480	0.495	0.470	0.390	0.410
ALT 4.4	2.925	6.750	8.615	8.220	7.705	6.562
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

HUNGRY HORSE RECREATION INDEX YEAR 1996

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	2.905	7.045	9.035	8.710	8.225	6.862
ALT 1.2	3.005	7.145	9.160	8.800	8.320	6.966
DIFF	0.100	0.100	0.125	0.090	0.095	0.104
ALT 4.1 (B)	2.680	6.805	8.945	8.660	8.335	6.731
DIFF	-0.225	-0.240	-0.090	-0.050	0.110	-0.131
ALT 4.1 (A)	2.915	7.050	9.040	8.630	8.135	6.845
DIFF	0.010	0.005	0.005	-0.080	-0.090	-0.017
ALT 4.3	3.130	7.385	9.460	9.040	8.560	7.192
DIFF	0.225	0.340	0.425	0.330	0.335	0.330
ALT 4.4	2.905	7.045	9.035	8.710	8.225	6.862
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

HUNGRY HORSE RECREATION INDEX YEAR 1997

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	2.885	6.930	8.825	8.455	7.950	6.709
ALT 1.2	2.920	7.025	8.965	8.595	8.050	6.806
DIFF	0.035	0.095	0.140	0.140	0.100	0.097
ALT 4.1 (B)	2.635	6.725	8.845	8.540	8.175	6.640
DIFF	-0.250	-0.205	0.020	0.085	0.225	-0.069
ALT 4.1 (A)	2.925	7.045	8.945	8.580	8.030	6.803
DIFF	0.040	0.115	0.120	0.125	0.080	0.094
ALT 4.3	3.045	7.245	9.290	8.905	8.365	7.052
DIFF	0.160	0.315	0.465	0.450	0.415	0.343
ALT 4.4	2.885	6.930	8.825	8.455	7.950	6.709
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

HUNGRY HORSE RECREATION INDEX YEAR 1998

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	2.810	6.810	9.035	8.710	8.240	6.782
ALT 1.2	2.850	6.875	9.080	8.780	8.320	6.838
DIFF	0.040	0.065	0.045	0.070	0.080	0.056
ALT 4.1 (B)	2.690	6.700	8.995	8.825	8.425	6.753
DIFF	-0.120	-0.110	-0.040	0.115	0.185	-0.029
ALT 4.1 (A)	2.845	6.880	9.095	8.795	8.280	6.839
DIFF	0.035	0.070	0.060	0.085	0.040	0.057
ALT 4.3	2.945	7.030	9.270	9.040	8.555	7.010
DIFF	0.135	0.220	0.235	0.330	0.315	0.228
ALT 4.4	2.810	6.810	9.035	8.710	8.240	6.782
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

HUNGRY HORSE RECREATION INDEX YEAR 1999

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	2.875	6.830	8.650	8.185	7.770	6.581
ALT 1.2	2.970	6.895	8.715	8.320	7.860	6.666
DIFF	0.095	0.065	0.065	0.135	0.090	0.085
ALT 4.1 (B)	2.825	6.835	8.695	8.320	7.935	6.619
DIFF	-0.050	0.005	0.045	0.135	0.165	0.038
ALT 4.1 (A)	2.970	6.940	8.715	8.255	7.700	6.648
DIFF	0.095	0.110	0.065	0.070	-0.070	0.067
ALT 4.3	3.085	7.215	9.080	8.705	8.245	6.962
DIFF	0.210	0.385	0.430	0.520	0.475	0.381
ALT 4.4	2.875	6.830	8.650	8.185	7.770	6.581
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

HUNGRY HORSE RECREATION INDEX YEAR 2000

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	2.845	6.810	8.770	8.560	8.180	6.698
ALT 1.2	2.885	6.860	8.800	8.600	8.235	6.740
DIFF	0.040	0.050	0.030	0.040	0.055	0.042
ALT 4.1 (B)	2.850	6.870	8.860	8.600	8.250	6.750
DIFF	0.005	0.060	0.090	0.040	0.070	0.052
ALT 4.1 (A)	2.850	6.875	8.815	8.455	8.055	6.697
DIFF	0.005	0.065	0.045	-0.105	-0.125	-0.001
ALT 4.3	3.070	7.215	9.225	8.980	8.585	7.072
DIFF	0.225	0.405	0.455	0.420	0.405	0.374
ALT 4.4	2.845	6.810	8.770	8.560	8.180	6.698
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

HUNGRY HORSE RECREATION INDEX YEAR 2001

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	2.855	6.785	8.830	8.435	7.935	6.663
ALT 1.2	2.880	6.845	8.920	8.500	8.045	6.728
DIFF	0.025	0.060	0.090	0.065	0.110	0.065
ALT 4.1 (B)	2.805	6.785	8.840	8.425	7.990	6.658
DIFF	-0.050	0.000	0.010	-0.010	0.055	-0.005
ALT 4.1 (A)	2.755	6.650	8.715	8.155	7.625	6.501
DIFF	-0.100	-0.135	-0.115	-0.280	-0.310	-0.162
ALT 4.3	3.035	7.155	9.315	8.870	8.340	7.026
DIFF	0.180	0.370	0.485	0.435	0.405	0.363
ALT 4.4	2.855	6.785	8.830	8.435	7.935	6.663
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

HUNGRY HORSE RECREATION INDEX YEAR 2002

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	2.975	6.865	8.745	8.315	7.770	6.655
ALT 1.2	3.070	7.030	8.890	8.445	7.910	6.790
DIFF	0.095	0.165	0.145	0.130	0.140	0.135
ALT 4.1 (B)	3.030	7.045	8.860	8.450	7.925	6.778
DIFF	0.055	0.180	0.115	0.135	0.155	0.123
ALT 4.1 (A)	2.925	6.780	8.650	8.055	7.500	6.531
DIFF	-0.050	-0.085	-0.095	-0.260	-0.270	-0.124
ALT 4.3	3.135	7.180	9.145	8.815	8.290	7.002
DIFF	0.160	0.315	0.400	0.500	0.520	0.347
ALT 4.4	2.975	6.865	8.745	8.315	7.770	6.655
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

HUNGRY HORSE RECREATION INDEX YEAR 2003

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	2.890	6.945	9.115	8.745	8.245	6.861
ALT 1.2	2.960	7.070	9.210	8.850	8.350	6.959
DIFF	0.070	0.125	0.095	0.105	0.105	0.098
ALT 4.1 (B)	3.020	7.165	9.320	8.835	8.265	7.013
DIFF	0.130	0.220	0.205	0.090	0.020	0.152
ALT 4.1 (A)	2.995	7.120	9.255	8.810	8.240	6.973
DIFF	0.105	0.175	0.140	0.065	-0.005	0.112
ALT 4.3	3.155	7.420	9.570	9.240	8.750	7.284
DIFF	0.265	0.475	0.455	0.495	0.505	0.423
ALT 4.4	2.890	6.945	9.115	8.745	8.245	6.861
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

HUNGRY HORSE RECREATION INDEX YEAR 2004

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	2.985	7.145	9.335	8.970	8.520	7.052
ALT 1.2	3.040	7.195	9.430	9.050	8.625	7.125
DIFF	0.055	0.050	0.095	0.080	0.105	0.073
ALT 4.1 (B)	3.010	7.275	9.445	8.870	8.465	7.098
DIFF	0.025	0.130	0.110	-0.100	-0.055	0.046
ALT 4.1 (A)	2.995	7.205	9.395	8.855	8.360	7.049
DIFF	0.010	0.060	0.060	-0.115	-0.160	-0.003
ALT 4.3	3.135	7.475	9.690	9.285	8.835	7.339
DIFF	0.150	0.330	0.355	0.315	0.315	0.287
ALT 4.4	2.985	7.145	9.335	8.970	8.520	7.052
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

HUNGRY HORSE RECREATION INDEX YEAR 2005

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	2.905	6.915	8.930	8.565	8.135	6.774
ALT 1.2	2.985	7.080	9.080	8.735	8.260	6.909
DIFF	0.080	0.165	0.150	0.170	0.125	0.135
ALT 4.1 (B)	2.860	6.990	8.945	8.385	7.925	6.735
DIFF	-0.045	0.075	0.015	-0.180	-0.210	-0.039
ALT 4.1 (A)	2.825	6.875	8.890	8.330	7.835	6.666
DIFF	-0.080	-0.040	-0.040	-0.235	-0.300	-0.108
ALT 4.3	3.030	7.225	9.225	8.805	8.335	7.011
DIFF	0.125	0.310	0.295	0.240	0.200	0.237
ALT 4.4	2.905	6.915	8.930	8.565	8.135	6.774
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

HUNGRY HORSE RECREATION INDEX YEAR 2006

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	3.160	7.020	8.850	8.610	8.150	6.851
ALT 1.2	3.225	7.140	8.990	8.720	8.285	6.963
DIFF	0.065	0.120	0.140	0.110	0.135	0.112
ALT 4.1 (B)	3.125	7.085	8.875	8.360	7.855	6.796
DIFF	-0.035	0.065	0.025	-0.250	-0.295	-0.055
ALT 4.1 (A)	3.145	6.985	8.785	8.365	7.920	6.763
DIFF	-0.015	-0.035	-0.065	-0.245	-0.230	-0.088
ALT 4.3	3.235	7.285	9.145	8.835	8.345	7.062
DIFF	0.075	0.265	0.295	0.225	0.195	0.211
ALT 4.4	3.160	7.020	8.850	8.610	8.150	6.851
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

HUNGRY HORSE RECREATION INDEX YEAR 2007

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	2.935	6.980	8.895	8.610	8.115	6.792
ALT 1.2	3.015	7.065	9.055	8.780	8.310	6.919
DIFF	0.080	0.085	0.160	0.170	0.195	0.127
ALT 4.1 (B)	2.870	6.965	8.930	8.410	7.870	6.724
DIFF	-0.065	-0.015	0.035	-0.200	-0.245	-0.068
ALT 4.1 (A)	2.895	6.940	8.905	8.450	7.940	6.732
DIFF	-0.040	-0.040	0.010	-0.160	-0.175	-0.060
ALT 4.3	3.065	7.310	9.185	8.905	8.385	7.049
DIFF	0.130	0.330	0.290	0.295	0.270	0.257
ALT 4.4	2.935	6.980	8.895	8.610	8.115	6.792
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

HUNGRY HORSE RECREATION INDEX YEAR 2008

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	2.940	7.145	9.070	8.775	8.320	6.924
ALT 1.2	3.000	7.305	9.210	8.885	8.435	7.042
DIFF	0.060	0.160	0.140	0.110	0.115	0.118
ALT 4.1 (B)	2.905	7.215	9.125	8.610	8.160	6.905
DIFF	-0.035	0.070	0.055	-0.165	-0.160	-0.019
ALT 4.1 (A)	2.915	7.215	9.125	8.705	8.195	6.924
DIFF	-0.025	0.070	0.055	-0.070	-0.125	0.000
ALT 4.3	3.065	7.470	9.385	9.080	8.635	7.192
DIFF	0.125	0.325	0.315	0.305	0.315	0.268
ALT 4.4	2.940	7.145	9.070	8.775	8.320	6.924
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

Table H-2 - 3

LIBBY RECREATION INDEX			YEAR 1989			
	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.687	0.908	0.983	0.983	0.985	0.890
ALT 1.2	0.687	0.908	0.983	0.983	0.986	0.890
DIFF	0.000	0.000	0.000	0.000	0.001	0.000
ALT 4.1 (B)	0.684	0.894	0.976	0.977	0.977	0.882
DIFF	-0.003	-0.014	-0.007	-0.006	-0.008	-0.008
ALT 4.1 (A)	0.685	0.898	0.980	0.980	0.980	0.886
DIFF	-0.002	-0.010	-0.003	-0.003	-0.005	-0.004
ALT 4.3	0.687	0.911	0.985	0.986	0.988	0.892
DIFF	0.000	0.003	0.002	0.003	0.003	0.002
ALT 4.4	0.687	0.908	0.983	0.983	0.985	0.890
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

LIBBY RECREATION INDEX			YEAR 1990			
	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.689	0.904	0.983	0.982	0.985	0.890
ALT 1.2	0.689	0.904	0.983	0.983	0.986	0.890
DIFF	0.000	0.000	0.000	0.001	0.001	0.000
ALT 4.1 (B)	0.683	0.889	0.973	0.974	0.975	0.880
DIFF	-0.006	-0.015	-0.010	-0.008	-0.010	-0.010
ALT 4.1 (A)	0.685	0.896	0.978	0.979	0.980	0.885
DIFF	-0.004	-0.008	-0.005	-0.003	-0.005	-0.005
ALT 4.3	0.690	0.906	0.983	0.984	0.987	0.891
DIFF	0.001	0.002	0.000	0.002	0.002	0.001
ALT 4.4	0.689	0.904	0.983	0.982	0.985	0.890
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

LIBBY RECREATION INDEX YEAR 1991

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.688	0.902	0.981	0.981	0.981	0.888
ALT 1.2	0.688	0.903	0.981	0.982	0.983	0.889
DIFF	0.000	0.001	0.000	0.001	0.002	0.001
ALT 4.1 (B)	0.681	0.887	0.970	0.972	0.973	0.878
DIFF	-0.007	-0.015	-0.011	-0.009	-0.008	-0.010
ALT 4.1 (A)	0.684	0.897	0.977	0.977	0.978	0.884
DIFF	-0.004	-0.005	-0.004	-0.004	-0.003	-0.004
ALT 4.3	0.689	0.904	0.982	0.983	0.984	0.889
DIFF	0.001	0.002	0.001	0.002	0.003	0.001
ALT 4.4	0.688	0.902	0.981	0.981	0.981	0.888
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

LIBBY RECREATION INDEX YEAR 1992

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.686	0.906	0.982	0.981	0.980	0.888
ALT 1.2	0.687	0.908	0.982	0.981	0.981	0.889
DIFF	0.001	0.002	0.000	0.000	0.001	0.001
ALT 4.1 (B)	0.682	0.897	0.975	0.976	0.976	0.883
DIFF	-0.004	-0.009	-0.007	-0.005	-0.004	-0.005
ALT 4.1 (A)	0.685	0.902	0.980	0.979	0.979	0.886
DIFF	-0.001	-0.004	-0.002	-0.002	-0.001	-0.002
ALT 4.3	0.688	0.909	0.983	0.983	0.983	0.891
DIFF	0.002	0.003	0.001	0.002	0.003	0.003
ALT 4.4	0.686	0.906	0.982	0.981	0.980	0.888
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

LIBBY RECREATION INDEX YEAR 1993

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.688	0.898	0.982	0.979	0.978	0.887
ALT 1.2	0.690	0.900	0.982	0.981	0.980	0.888
DIFF	0.002	0.002	0.000	0.002	0.002	0.001
ALT 4.1 (B)	0.684	0.888	0.974	0.975	0.977	0.880
DIFF	-0.004	-0.010	-0.008	-0.004	-0.001	-0.007
ALT 4.1 (A)	0.687	0.897	0.982	0.981	0.981	0.887
DIFF	-0.001	-0.001	0.000	0.002	0.003	0.000
ALT 4.3	0.691	0.901	0.984	0.984	0.984	0.890
DIFF	0.003	0.003	0.002	0.005	0.006	0.003
ALT 4.4	0.688	0.898	0.982	0.979	0.978	0.887
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

LIBBY RECREATION INDEX YEAR 1994

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.689	0.885	0.970	0.967	0.965	0.877
ALT 1.2	0.689	0.886	0.971	0.970	0.969	0.879
DIFF	0.000	0.001	0.001	0.003	0.004	0.002
ALT 4.1 (B)	0.683	0.872	0.963	0.965	0.965	0.871
DIFF	-0.006	-0.013	-0.007	-0.002	0.000	-0.006
ALT 4.1 (A)	0.687	0.884	0.971	0.970	0.969	0.878
DIFF	-0.002	-0.001	0.001	0.003	0.004	0.001
ALT 4.3	0.689	0.891	0.975	0.976	0.976	0.883
DIFF	0.000	0.006	0.005	0.009	0.011	0.006
ALT 4.4	0.689	0.885	0.970	0.967	0.965	0.877
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

LIBBY RECREATION INDEX YEAR 1995

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.688	0.890	0.971	0.967	0.966	0.879
ALT 1.2	0.689	0.891	0.972	0.970	0.969	0.880
DIFF	0.001	0.001	0.001	0.003	0.003	0.001
ALT 4.1 (B)	0.686	0.880	0.963	0.964	0.965	0.873
DIFF	-0.002	-0.010	-0.008	-0.003	-0.001	-0.006
ALT 4.1 (A)	0.688	0.890	0.973	0.971	0.970	0.880
DIFF	0.000	0.000	0.002	0.004	0.004	0.001
ALT 4.3	0.691	0.895	0.976	0.976	0.976	0.884
DIFF	0.003	0.005	0.005	0.009	0.010	0.005
ALT 4.4	0.688	0.890	0.971	0.967	0.966	0.879
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

LIBBY RECREATION INDEX YEAR 1996

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.686	0.890	0.971	0.969	0.968	0.879
ALT 1.2	0.686	0.891	0.973	0.972	0.971	0.880
DIFF	0.000	0.001	0.002	0.003	0.003	0.001
ALT 4.1 (B)	0.681	0.879	0.964	0.965	0.966	0.872
DIFF	-0.005	-0.011	-0.007	-0.004	-0.002	-0.007
ALT 4.1 (A)	0.685	0.890	0.972	0.971	0.971	0.879
DIFF	-0.001	0.000	0.001	0.002	0.003	0.000
ALT 4.3	0.687	0.895	0.976	0.975	0.976	0.883
DIFF	0.001	0.005	0.005	0.006	0.008	0.004
ALT 4.4	0.686	0.890	0.971	0.969	0.968	0.879
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

LIBBY RECREATION INDEX YEAR 1997

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.686	0.891	0.975	0.971	0.969	0.880
ALT 1.2	0.686	0.891	0.975	0.973	0.972	0.881
DIFF	0.000	0.000	0.000	0.002	0.003	0.001
ALT 4.1 (B)	0.681	0.879	0.965	0.965	0.967	0.873
DIFF	-0.005	-0.012	-0.010	-0.006	-0.002	-0.007
ALT 4.1 (A)	0.685	0.890	0.975	0.974	0.973	0.881
DIFF	-0.001	-0.001	0.000	0.003	0.004	0.001
ALT 4.3	0.687	0.895	0.979	0.978	0.977	0.884
DIFF	0.001	0.004	0.004	0.007	0.008	0.004
ALT 4.4	0.686	0.891	0.975	0.971	0.969	0.880
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

LIBBY RECREATION INDEX YEAR 1998

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.685	0.888	0.973	0.969	0.968	0.879
ALT 1.2	0.685	0.890	0.974	0.970	0.969	0.880
DIFF	0.000	0.002	0.001	0.001	0.001	0.001
ALT 4.1 (B)	0.683	0.885	0.970	0.971	0.971	0.877
DIFF	-0.002	-0.003	-0.003	0.002	0.003	-0.002
ALT 4.1 (A)	0.684	0.889	0.974	0.971	0.969	0.879
DIFF	-0.001	0.001	0.001	0.002	0.001	0.000
ALT 4.3	0.687	0.893	0.975	0.975	0.975	0.883
DIFF	0.002	0.005	0.002	0.006	0.007	0.004
ALT 4.4	0.685	0.888	0.973	0.969	0.968	0.879
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

LIBBY RECREATION INDEX YEAR 1999

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.685	0.888	0.971	0.968	0.966	0.878
ALT 1.2	0.685	0.889	0.971	0.968	0.965	0.878
DIFF	0.000	0.001	0.000	0.000	-0.001	0.000
ALT 4.1 (B)	0.684	0.887	0.970	0.971	0.973	0.878
DIFF	-0.001	-0.001	-0.001	0.003	0.007	0.000
ALT 4.1 (A)	0.685	0.889	0.971	0.967	0.963	0.877
DIFF	0.000	0.001	0.000	-0.001	-0.003	-0.001
ALT 4.3	0.686	0.896	0.975	0.975	0.976	0.883
DIFF	0.001	0.008	0.004	0.007	0.010	0.005
ALT 4.4	0.685	0.888	0.971	0.968	0.966	0.878
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

LIBBY RECREATION INDEX YEAR 2000

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.688	0.903	0.972	0.970	0.969	0.883
ALT 1.2	0.689	0.904	0.974	0.971	0.971	0.884
DIFF	0.001	0.001	0.002	0.001	0.002	0.001
ALT 4.1 (B)	0.685	0.897	0.969	0.969	0.969	0.880
DIFF	-0.003	-0.006	-0.003	-0.001	0.000	-0.003
ALT 4.1 (A)	0.686	0.901	0.971	0.967	0.965	0.881
DIFF	-0.002	-0.002	-0.001	-0.003	-0.004	-0.002
ALT 4.3	0.689	0.906	0.977	0.975	0.976	0.887
DIFF	0.001	0.003	0.005	0.005	0.007	0.004
ALT 4.4	0.688	0.903	0.972	0.970	0.969	0.883
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

LIBBY RECREATION INDEX — YEAR 2001

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.688	0.891	0.968	0.966	0.964	0.878
ALT 1.2	0.688	0.892	0.970	0.968	0.966	0.879
DIFF	0.000	0.001	0.002	0.002	0.002	0.001
ALT 4.1 (B)	0.685	0.889	0.967	0.966	0.966	0.876
DIFF	-0.003	-0.002	-0.001	0.000	0.002	-0.002
ALT 4.1 (A)	0.685	0.889	0.967	0.961	0.959	0.875
DIFF	-0.003	-0.002	-0.001	-0.005	-0.005	-0.003
ALT 4.3	0.688	0.894	0.972	0.971	0.970	0.881
DIFF	0.000	0.003	0.004	0.005	0.006	0.003
ALT 4.4	0.688	0.891	0.968	0.966	0.964	0.878
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

LIBBY RECREATION INDEX — YEAR 2002

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.687	0.894	0.976	0.972	0.968	0.882
ALT 1.2	0.688	0.896	0.977	0.974	0.972	0.883
DIFF	0.001	0.002	0.001	0.002	0.004	0.001
ALT 4.1 (B)	0.688	0.895	0.975	0.975	0.974	0.883
DIFF	0.001	0.001	-0.001	0.003	0.006	0.001
ALT 4.1 (A)	0.685	0.888	0.972	0.967	0.965	0.878
DIFF	-0.002	-0.006	-0.004	-0.005	-0.003	-0.004
ALT 4.3	0.688	0.897	0.978	0.977	0.977	0.885
DIFF	0.001	0.003	0.002	0.005	0.009	0.003
ALT 4.4	0.687	0.894	0.976	0.972	0.968	0.882
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

LIBBY RECREATION INDEX YEAR 2003

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.685	0.893	0.977	0.974	0.974	0.882
ALT 1.2	0.686	0.895	0.979	0.977	0.976	0.884
DIFF	0.001	0.002	0.002	0.003	0.002	0.002
ALT 4.1 (B)	0.687	0.897	0.979	0.978	0.976	0.885
DIFF	0.002	0.004	0.002	0.004	0.002	0.003
ALT 4.1 (A)	0.686	0.896	0.979	0.977	0.976	0.884
DIFF	0.001	0.003	0.002	0.003	0.002	0.002
ALT 4.3	0.690	0.903	0.984	0.984	0.984	0.890
DIFF	0.005	0.010	0.007	0.010	0.010	0.008
ALT 4.4	0.685	0.893	0.977	0.974	0.974	0.882
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

LIBBY RECREATION INDEX YEAR 2004

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.688	0.905	0.978	0.976	0.975	0.886
ALT 1.2	0.689	0.906	0.979	0.978	0.978	0.888
DIFF	0.001	0.001	0.001	0.002	0.003	0.002
ALT 4.1 (B)	0.685	0.902	0.978	0.977	0.975	0.885
DIFF	-0.003	-0.003	0.000	0.001	0.000	-0.001
ALT 4.1 (A)	0.686	0.903	0.979	0.976	0.974	0.886
DIFF	-0.002	-0.002	0.001	0.000	-0.001	0.000
ALT 4.3	0.691	0.908	0.981	0.981	0.981	0.890
DIFF	0.003	0.003	0.003	0.005	0.006	0.004
ALT 4.4	0.688	0.905	0.978	0.976	0.975	0.886
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

LIBBY RECREATION INDEX — YEAR 2005

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.687	0.898	0.972	0.968	0.967	0.881
ALT 1.2	0.687	0.898	0.973	0.970	0.970	0.882
DIFF	0.000	0.000	0.001	0.002	0.003	0.001
ALT 4.1 (B)	0.684	0.893	0.972	0.970	0.967	0.880
DIFF	-0.003	-0.005	0.000	0.002	0.000	-0.001
ALT 4.1 (A)	0.685	0.895	0.973	0.967	0.964	0.880
DIFF	-0.002	-0.003	0.001	-0.001	-0.003	-0.001
ALT 4.3	0.688	0.899	0.974	0.971	0.970	0.883
DIFF	0.001	0.001	0.002	0.003	0.003	0.002
ALT 4.4	0.687	0.898	0.972	0.968	0.967	0.881
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

LIBBY RECREATION INDEX — YEAR 2006

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.692	0.904	0.974	0.972	0.971	0.885
ALT 1.2	0.693	0.906	0.977	0.974	0.974	0.887
DIFF	0.001	0.002	0.003	0.002	0.003	0.002
ALT 4.1 (B)	0.689	0.899	0.972	0.971	0.970	0.882
DIFF	-0.003	-0.005	-0.002	-0.001	-0.001	-0.003
ALT 4.1 (A)	0.690	0.900	0.974	0.973	0.971	0.884
DIFF	-0.002	-0.004	0.000	0.001	0.000	-0.001
ALT 4.3	0.692	0.906	0.977	0.979	0.979	0.888
DIFF	0.000	0.002	0.003	0.007	0.008	0.003
ALT 4.4	0.692	0.904	0.974	0.972	0.971	0.885
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

LIBBY RECREATION INDEX — YEAR 2007

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.685	0.899	0.975	0.973	0.972	0.883
ALT 1.2	0.685	0.900	0.975	0.974	0.974	0.884
DIFF	0.000	0.001	0.000	0.001	0.002	0.001
ALT 4.1 (B)	0.684	0.897	0.973	0.972	0.970	0.881
DIFF	-0.001	-0.002	-0.002	-0.001	-0.002	-0.002
ALT 4.1 (A)	0.685	0.897	0.974	0.973	0.970	0.882
DIFF	0.000	-0.002	-0.001	0.000	-0.002	-0.001
ALT 4.3	0.687	0.901	0.977	0.977	0.977	0.885
DIFF	0.002	0.002	0.002	0.004	0.005	0.002
ALT 4.4	0.685	0.899	0.975	0.973	0.972	0.883
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

LIBBY RECREATION INDEX — YEAR 2008

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	0.685	0.887	0.975	0.974	0.973	0.880
ALT 1.2	0.685	0.887	0.976	0.975	0.975	0.881
DIFF	0.000	0.000	0.001	0.001	0.002	0.001
ALT 4.1 (B)	0.684	0.884	0.975	0.974	0.972	0.879
DIFF	-0.001	-0.003	0.000	0.000	-0.001	-0.001
ALT 4.1 (A)	0.684	0.884	0.976	0.973	0.972	0.879
DIFF	-0.001	-0.003	0.001	-0.001	-0.001	-0.001
ALT 4.3	0.686	0.888	0.979	0.978	0.979	0.883
DIFF	0.001	0.001	0.004	0.004	0.006	0.003
ALT 4.4	0.685	0.887	0.975	0.974	0.973	0.880
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

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GRAND COULEE RECREATION INDEX YEAR 1989

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	7.815	17.590	18.995	19.000	19.000	15.836
ALT 1.2	7.815	17.590	18.995	19.000	19.000	15.836
DIFF	0.000	0.000	0.000	0.000	0.000	0.000
ALT 4.1 (B)	7.680	17.390	19.000	19.000	19.000	15.754
DIFF	-0.135	-0.200	0.005	0.000	0.000	-0.082
ALT 4.1 (A)	7.700	17.500	19.000	19.000	19.000	15.786
DIFF	-0.115	-0.090	0.005	0.000	0.000	-0.050
ALT 4.3	8.100	17.615	19.000	19.000	19.000	15.915
DIFF	0.285	0.025	0.005	0.000	0.000	0.079
ALT 4.4	7.815	17.590	18.995	19.000	19.000	15.836
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

GRAND COULEE RECREATION INDEX YEAR 1990

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	7.645	17.305	19.000	19.000	19.000	15.725
ALT 1.2	7.690	17.310	19.000	19.000	19.000	15.737
DIFF	0.045	0.005	0.000	0.000	0.000	0.012
ALT 4.1 (B)	7.565	17.185	18.995	19.000	19.000	15.674
DIFF	-0.080	-0.120	-0.005	0.000	0.000	-0.051
ALT 4.1 (A)	7.610	17.250	19.000	19.000	19.000	15.703
DIFF	-0.035	-0.055	0.000	0.000	0.000	-0.022
ALT 4.3	7.830	17.260	19.000	19.000	19.000	15.760
DIFF	0.185	-0.045	0.000	0.000	0.000	0.035
ALT 4.4	7.645	17.305	19.000	19.000	19.000	15.725
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

GRAND COULEE RECREATION INDEX YEAR 1991

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	7.270	17.175	19.000	19.000	19.000	15.599
ALT 1.2	7.280	17.200	19.000	19.000	19.000	15.607
DIFF	0.010	0.025	0.000	0.000	0.000	0.008
ALT 4.1 (B)	7.195	17.070	19.000	19.000	19.000	15.554
DIFF	-0.075	-0.105	0.000	0.000	0.000	-0.045
ALT 4.1 (A)	7.250	17.125	19.000	19.000	19.000	15.581
DIFF	-0.020	-0.050	0.000	0.000	0.000	-0.018
ALT 4.3	7.515	17.215	19.000	19.000	19.000	15.670
DIFF	0.245	0.040	0.000	0.000	0.000	0.071
ALT 4.4	7.270	17.175	19.000	19.000	19.000	15.599
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

GRAND COULEE RECREATION INDEX YEAR 1992

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	7.465	17.255	19.000	19.000	19.000	15.667
ALT 1.2	7.480	17.315	19.000	19.000	19.000	15.686
DIFF	0.015	0.060	0.000	0.000	0.000	0.019
ALT 4.1 (B)	7.430	17.205	18.995	19.000	19.000	15.645
DIFF	-0.035	-0.050	-0.005	0.000	0.000	-0.022
ALT 4.1 (A)	7.450	17.305	19.000	19.000	19.000	15.676
DIFF	-0.015	0.050	0.000	0.000	0.000	0.009
ALT 4.3	7.600	17.340	19.000	19.000	19.000	15.722
DIFF	0.135	0.085	0.000	0.000	0.000	0.055
ALT 4.4	7.465	17.255	19.000	19.000	19.000	15.667
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

GRAND COULEE RECREATION INDEX YEAR 1993

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	7.410	17.165	19.000	19.000	19.000	15.631
ALT 1.2	7.440	17.195	19.000	19.000	19.000	15.646
DIFF	0.030	0.030	0.000	0.000	0.000	0.015
ALT 4.1 (B)	7.390	17.135	19.000	19.000	19.000	15.619
DIFF	-0.020	-0.030	0.000	0.000	0.000	-0.012
ALT 4.1 (A)	7.410	17.215	19.000	19.000	19.000	15.644
DIFF	0.000	0.050	0.000	0.000	0.000	0.013
ALT 4.3	7.640	17.255	19.000	19.000	19.000	15.711
DIFF	0.230	0.090	0.000	0.000	0.000	0.080
ALT 4.4	7.410	17.165	19.000	19.000	19.000	15.631
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

GRAND COULEE RECREATION INDEX YEAR 1994

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	7.620	17.390	19.000	19.000	19.000	15.739
ALT 1.2	7.705	17.450	19.000	19.000	19.000	15.775
DIFF	0.085	0.060	0.000	0.000	0.000	0.036
ALT 4.1 (B)	7.555	17.360	18.985	18.985	18.995	15.709
DIFF	-0.065	-0.030	-0.015	-0.015	-0.005	-0.030
ALT 4.1 (A)	7.635	17.440	19.000	19.000	19.000	15.755
DIFF	0.015	0.050	0.000	0.000	0.000	0.016
ALT 4.3	7.890	17.525	19.000	19.000	19.000	15.840
DIFF	0.270	0.135	0.000	0.000	0.000	0.101
ALT 4.4	7.620	17.390	19.000	19.000	19.000	15.739
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

GRAND COULEE RECREATION INDEX YEAR 1995

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	7.595	17.565	19.000	19.000	19.000	15.776
ALT 1.2	7.600	17.635	19.000	19.000	19.000	15.794
DIFF	0.005	0.070	0.000	0.000	0.000	0.018
ALT 4.1 (B)	7.550	17.510	19.000	19.000	19.000	15.751
DIFF	-0.045	-0.055	0.000	0.000	0.000	-0.025
ALT 4.1 (A)	7.610	17.690	19.000	19.000	19.000	15.810
DIFF	0.015	0.125	0.000	0.000	0.000	0.034
ALT 4.3	7.905	17.730	19.000	19.000	19.000	15.894
DIFF	0.310	0.165	0.000	0.000	0.000	0.118
ALT 4.4	7.595	17.565	19.000	19.000	19.000	15.776
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

GRAND COULEE RECREATION INDEX YEAR 1996

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	7.755	17.315	19.000	19.000	19.000	15.755
ALT 1.2	7.750	17.365	19.000	19.000	19.000	15.766
DIFF	-0.005	0.050	0.000	0.000	0.000	0.011
ALT 4.1 (B)	7.680	17.335	19.000	19.000	19.000	15.741
DIFF	-0.075	0.020	0.000	0.000	0.000	-0.014
ALT 4.1 (A)	7.715	17.365	19.000	19.000	19.000	15.757
DIFF	-0.040	0.050	0.000	0.000	0.000	0.002
ALT 4.3	7.875	17.495	19.000	19.000	19.000	15.829
DIFF	0.120	0.180	0.000	0.000	0.000	0.074
ALT 4.4	7.755	17.315	19.000	19.000	19.000	15.755
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

GRAND COULEE RECREATION INDEX YEAR 1997

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	7.315	17.530	19.000	19.000	19.000	15.696
ALT 1.2	7.330	17.560	19.000	19.000	19.000	15.708
DIFF	0.015	0.030	0.000	0.000	0.000	0.012
ALT 4.1 (B)	7.330	17.555	19.000	19.000	19.000	15.706
DIFF	0.015	0.025	0.000	0.000	0.000	0.010
ALT 4.1 (A)	7.375	17.595	19.000	19.000	19.000	15.727
DIFF	0.060	0.065	0.000	0.000	0.000	0.031
ALT 4.3	7.560	17.590	19.000	19.000	19.000	15.773
DIFF	0.245	0.060	0.000	0.000	0.000	0.077
ALT 4.4	7.315	17.530	19.000	19.000	19.000	15.696
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

GRAND COULEE RECREATION INDEX YEAR 1998

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	6.955	16.845	19.000	19.000	19.000	15.439
ALT 1.2	6.950	16.860	19.000	19.000	19.000	15.441
DIFF	-0.005	0.015	0.000	0.000	0.000	0.002
ALT 4.1 (B)	6.965	16.850	19.000	19.000	19.000	15.442
DIFF	0.010	0.005	0.000	0.000	0.000	0.003
ALT 4.1 (A)	6.970	16.890	19.000	18.995	19.000	15.453
DIFF	0.015	0.045	0.000	-0.005	0.000	0.014
ALT 4.3	7.015	16.950	19.000	19.000	19.000	15.479
DIFF	0.060	0.105	0.000	0.000	0.000	0.040
ALT 4.4	6.955	16.845	19.000	19.000	19.000	15.439
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

GRAND COULEE RECREATION INDEX YEAR 1999

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	7.480	17.320	19.000	19.000	19.000	15.687
ALT 1.2	7.475	17.325	19.000	19.000	19.000	15.687
DIFF	-0.005	0.005	0.000	0.000	0.000	0.000
ALT 4.1 (B)	7.455	17.375	19.000	19.000	19.000	15.694
DIFF	-0.025	0.055	0.000	0.000	0.000	0.007
ALT 4.1 (A)	7.475	17.385	19.000	19.000	19.000	15.701
DIFF	-0.005	0.065	0.000	0.000	0.000	0.014
ALT 4.3	7.910	17.440	19.000	19.000	19.000	15.824
DIFF	0.430	0.120	0.000	0.000	0.000	0.137
ALT 4.4	7.480	17.320	19.000	19.000	19.000	15.687
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

GRAND COULEE RECREATION INDEX YEAR 2000

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	7.555	17.480	19.000	19.000	19.000	15.745
ALT 1.2	7.565	17.535	19.000	19.000	19.000	15.761
DIFF	0.010	0.055	0.000	0.000	0.000	0.016
ALT 4.1 (B)	7.505	17.575	19.000	19.000	19.000	15.755
DIFF	-0.050	0.095	0.000	0.000	0.000	0.010
ALT 4.1 (A)	7.525	17.535	19.000	19.000	19.000	15.751
DIFF	-0.030	0.055	0.000	0.000	0.000	0.006
ALT 4.3	7.920	17.590	19.000	19.000	19.000	15.864
DIFF	0.365	0.110	0.000	0.000	0.000	0.119
ALT 4.4	7.555	17.480	19.000	19.000	19.000	15.745
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

GRAND COULEE RECREATION INDEX YEAR 2001

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	7.210	16.890	19.000	19.000	19.000	15.514
ALT 1.2	7.215	16.935	19.000	19.000	19.000	15.526
DIFF	0.005	0.045	0.000	0.000	0.000	0.012
ALT 4.1 (B)	7.115	16.960	18.995	18.995	19.000	15.505
DIFF	-0.095	0.070	-0.005	-0.005	0.000	-0.009
ALT 4.1 (A)	7.140	16.880	18.995	18.985	18.985	15.489
DIFF	-0.070	-0.010	-0.005	-0.015	-0.015	-0.025
ALT 4.3	7.385	16.950	19.000	19.000	19.000	15.573
DIFF	0.175	0.060	0.000	0.000	0.000	0.059
ALT 4.4	7.210	16.890	19.000	19.000	19.000	15.514
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

GRAND COULEE RECREATION INDEX YEAR 2002

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	7.770	17.470	19.000	19.000	19.000	15.797
ALT 1.2	7.800	17.470	19.000	19.000	19.000	15.804
DIFF	0.030	0.000	0.000	0.000	0.000	0.007
ALT 4.1 (B)	7.710	17.575	19.000	19.000	19.000	15.807
DIFF	-0.060	0.105	0.000	0.000	0.000	0.010
ALT 4.1 (A)	7.670	17.450	19.000	19.000	19.000	15.766
DIFF	-0.100	-0.020	0.000	0.000	0.000	-0.031
ALT 4.3	7.880	17.505	19.000	19.000	19.000	15.833
DIFF	0.110	0.035	0.000	0.000	0.000	0.036
ALT 4.4	7.770	17.470	19.000	19.000	19.000	15.797
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

GRAND COULEE RECREATION INDEX YEAR 2003

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	7.110	17.070	19.000	19.000	19.000	15.533
ALT 1.2	7.140	17.105	19.000	19.000	19.000	15.549
DIFF	0.030	0.035	0.000	0.000	0.000	0.016
ALT 4.1 (B)	7.150	17.210	19.000	19.000	19.000	15.577
DIFF	0.040	0.140	0.000	0.000	0.000	0.044
ALT 4.1 (A)	7.145	17.160	19.000	19.000	19.000	15.563
DIFF	0.035	0.090	0.000	0.000	0.000	0.030
ALT 4.3	7.480	17.235	19.000	19.000	19.000	15.666
DIFF	0.370	0.165	0.000	0.000	0.000	0.133
ALT 4.4	7.110	17.070	19.000	19.000	19.000	15.533
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

GRAND COULEE RECREATION INDEX YEAR 2004

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	7.325	17.190	19.000	19.000	19.000	15.616
ALT 1.2	7.365	17.265	19.000	19.000	19.000	15.644
DIFF	0.040	0.075	0.000	0.000	0.000	0.028
ALT 4.1 (B)	7.265	17.230	18.995	18.985	18.995	15.607
DIFF	-0.060	0.040	-0.005	-0.015	-0.005	-0.009
ALT 4.1 (A)	7.305	17.225	19.000	19.000	19.000	15.620
DIFF	-0.020	0.035	0.000	0.000	0.000	0.004
ALT 4.3	7.655	17.295	19.000	19.000	19.000	15.725
DIFF	0.330	0.105	0.000	0.000	0.000	0.109
ALT 4.4	7.325	17.190	19.000	19.000	19.000	15.616
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

GRAND COULEE RECREATION INDEX YEAR 2005

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	7.825	17.365	19.000	19.000	19.000	15.785
ALT 1.2	7.875	17.410	19.000	19.000	19.000	15.808
DIFF	0.050	0.045	0.000	0.000	0.000	0.023
ALT 4.1 (B)	7.785	17.385	19.000	19.000	19.000	15.780
DIFF	-0.040	0.020	0.000	0.000	0.000	-0.005
ALT 4.1 (A)	7.760	17.285	19.000	19.000	19.000	15.749
DIFF	-0.065	-0.080	0.000	0.000	0.000	-0.036
ALT 4.3	8.055	17.405	19.000	19.000	19.000	15.852
DIFF	0.230	0.040	0.000	0.000	0.000	0.067
ALT 4.4	7.825	17.365	19.000	19.000	19.000	15.785
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

GRAND COULEE RECREATION INDEX YEAR 2006

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	7.710	17.170	19.000	19.000	19.000	15.708
ALT 1.2	7.755	17.210	19.000	19.000	19.000	15.729
DIFF	0.045	0.040	0.000	0.000	0.000	0.021
ALT 4.1 (B)	7.625	17.290	19.000	18.995	19.000	15.715
DIFF	-0.085	0.120	0.000	-0.005	0.000	0.007
ALT 4.1 (A)	7.580	17.190	19.000	19.000	19.000	15.680
DIFF	-0.130	0.020	0.000	0.000	0.000	-0.028
ALT 4.3	8.055	17.280	19.000	19.000	19.000	15.822
DIFF	0.345	0.110	0.000	0.000	0.000	0.114
ALT 4.4	7.710	17.170	19.000	19.000	19.000	15.708
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

GRAND COULEE RECREATION INDEX YEAR 2007

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	7.965	17.565	19.000	19.000	19.000	15.869
ALT 1.2	8.015	17.580	19.000	19.000	19.000	15.885
DIFF	0.050	0.015	0.000	0.000	0.000	0.016
ALT 4.1 (B)	7.930	17.565	19.000	19.000	19.000	15.860
DIFF	-0.035	0.000	0.000	0.000	0.000	-0.009
ALT 4.1 (A)	7.885	17.520	19.000	19.000	19.000	15.838
DIFF	-0.080	-0.045	0.000	0.000	0.000	-0.031
ALT 4.3	8.245	17.630	19.000	19.000	19.000	15.955
DIFF	0.280	0.065	0.000	0.000	0.000	0.086
ALT 4.4	7.965	17.565	19.000	19.000	19.000	15.869
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

GRAND COULEE RECREATION INDEX YEAR 2008

	MAY	JUN	JUL	AG1	AG2	AVG
NO ACTION	6.995	17.155	18.935	18.935	18.935	15.492
ALT 1.2	7.020	17.170	18.945	18.945	18.950	15.507
DIFF	0.025	0.015	0.010	0.010	0.015	0.015
ALT 4.1 (B)	6.910	17.265	18.950	18.950	18.955	15.505
DIFF	-0.085	0.110	0.015	0.015	0.020	0.013
ALT 4.1 (A)	6.870	17.240	18.955	18.950	18.950	15.490
DIFF	-0.125	0.085	0.020	0.015	0.015	-0.002
ALT 4.3	7.215	17.275	18.985	18.985	18.985	15.602
DIFF	0.220	0.120	0.050	0.050	0.050	0.110
ALT 4.4	6.995	17.155	18.935	18.935	18.935	15.492
DIFF	0.000	0.000	0.000	0.000	0.000	0.000

H-3

Irrigation

Irrigation

Irrigation impacts were assessed on the basis of the probability of the elevation at Grand Coulee (Lake Roosevelt). Pumps for the Columbia Basin Project are located at Grand Coulee. As the level of Lake Roosevelt drops, pumping becomes more difficult; at some levels, pumps will not operate or may be damaged if run. There is currently a requirement for Lake Roosevelt to be at or above 1,240 feet at the end of May for irrigation. If that constraint is not met, there would be some potential for drawdown of Banks Lake, which would have an adverse effect on the fishery therein and recreation thereon. Table H-3-1 shows the probabilities of the elevation at Grand Coulee being at or above 1240 feet at the end of May for all alternatives.

TABLE H-3-1
PROBABILITY OF ELEVATION AT GRAND COULEE BEING AT OR ABOVE 1240 FEET AT THE END OF MAY

YEAR	PROBABILITY (percent)	YEAR	PROBABILITY (percent)
1989	83	1999	85
1990	83	2000	79.5
1991	79	2001	77.5
1992	82.5	2002	83.5
1993	81	2003	80
1994	81.5	2004	80
1995	81	2005	84.5
1996	84	2006	82
1997	81.5	2007	88.5
1998	78.5	2008	75.5

1/ Probabilities were the same for all alternatives. Failure to be above elevation 1240 at the end of May is the result of an end of May flood control elevation of less than 1240.0 feet.

H-4

Probability of July Refill

Probability of July Refill

One of the parameters computed by the Systems Analysis Model (SAM) is the probability of refill of the Northwest hydrosystem reservoirs by the end of July. Refill by that time has some implications for reservoir elevation related impacts such as recreation, but, more importantly, it is a criteria in coordinated system operations which affects how the system is operated in subsequent operating years. Tables H-4-1 and H-4-2 show the probabilities of refill for all the alternatives analyzed with SAM for the assumptions of expected loads and gas price and high Northwest loads. Probabilities of refill for the other sensitivity assumptions (low Northwest loads, high Southwest loads, low Southwest loads, high gas price, and low gas price) are available upon request.

TABLE H-4-1
PROBABILITY OF JULY REFILL
(EXPECTED LOADS AND GAS PRICE)

			ALTERNATIVES			
YEAR	NO ACTION	1.2	4.1 CASE A	4.1 CASE B	4.3	4.4
1989	0.905	0.905	0.875	0.875	0.920	0.905
1990	0.885	0.885	0.865	0.850	0.900	0.885
1991	0.900	0.910	0.880	0.860	0.920	0.900
1992	0.900	0.905	0.895	0.890	0.905	0.900
1993	0.890	0.880	0.880	0.865	0.895	0.890
1994	0.855	0.860	0.850	0.830	0.865	0.855
1995	0.845	0.845	0.835	0.800	0.870	0.845
1996	0.855	0.855	0.840	0.830	0.870	0.855
1997	0.835	0.830	0.830	0.810	0.855	0.835
1998	0.870	0.870	0.870	0.850	0.875	0.870
1999	0.810	0.815	0.815	0.795	0.855	0.810
2000	0.840	0.835	0.835	0.840	0.860	0.840
2001	0.855	0.855	0.835	0.845	0.860	0.855
2002	0.845	0.845	0.840	0.840	0.855	0.845
2003	0.865	0.865	0.875	0.875	0.905	0.865
2004	0.880	0.875	0.875	0.860	0.895	0.880
2005	0.860	0.860	0.845	0.855	0.860	0.860
2006	0.825	0.825	0.840	0.825	0.835	0.825
2007	0.845	0.845	0.855	0.845	0.860	0.845
2008	0.875	0.880	0.875	0.865	0.885	0.875

TABLE H-4-2
PROBABILITY OF JULY REFILL
(HIGH NORTHWEST LOADS)

		ALTERNATIVES				
YEAR	NO ACTION	1.2	4.1 CASE A	4.1 CASE B	4.3	4.4
1989	0.905	0.910	0.905	0.870	0.905	0.905
1990	0.870	0.870	0.870	0.865	0.870	0.870
1991	0.880	0.885	0.880	0.885	0.880	0.880
1992	0.885	0.880	0.890	0.890	0.880	0.885
1993	0.890	0.885	0.885	0.880	0.880	0.890
1994	0.830	0.840	0.825	0.845	0.830	0.830
1995	0.845	0.830	0.835	0.840	0.835	0.845
1996	0.840	0.840	0.845	0.840	0.835	0.840
1997	0.835	0.830	0.845	0.820	0.820	0.835
1998	0.855	0.860	0.855	0.875	0.860	0.855
1999	0.825	0.820	0.825	0.820	0.845	0.825
2000	0.840	0.835	0.840	0.830	0.865	0.840
2001	0.845	0.845	0.840	0.835	0.860	0.845
2002	0.845	0.855	0.860	0.840	0.890	0.845
2003	0.885	0.895	0.880	0.875	0.900	0.885
2004	0.895	0.880	0.890	0.875	0.900	0.895
2005	0.850	0.855	0.860	0.860	0.860	0.850
2006	0.845	0.840	0.845	0.835	0.840	0.845
2007	0.865	0.855	0.860	0.865	0.880	0.865
2008	0.870	0.865	0.885	0.890	0.875	0.870

H-5

Changes in Thermal Plant Operations

Operation of Resources, Summarized by Type

The analyses performed with the System Analysis Model (See Appendix G-1) produced projections of future operation of the region's generating resources. These projections, shown in Tables H-5-1 and H-5-2, are summarized by resource type. Table H-5-1 contains results for the medium loads and gas prices scenario, while Table H-5-2 contains results under high Northwest loads. Similar tables showing projected resource operations for other sensitivity assumptions (high and low Southwest loads, high and low gas prices, and low Northwest loads) are available upon request.

In Tables H-5-1 and H-5-2, the values given for the No Action Alternative are actual projected values from SAM. Values given for all other alternatives, however, are incremental relative to the No Action Alternative (i.e., value = alternative result - No Action result). The following information is given by column:

- (1) the year being summarized;
- (2) the alternative;
- (3) total hydro generation;
- (4) total nuclear generation (including any new resources);
- (5) total coal generation (including any new resources);
- (6) total combustion turbine generation;
- (7) energy resulting from the release of water covered under the current non-treaty storage agreement;
- (8) the total of exchange energy and use of storage outside the region;
- (9) use of short-term energy purchases which were reserved by the LCMM;
- (10) purchases from B.C. Hyrdo;
- (11) total generation occurring in SAM (Note: This does not include use of conservation, firm impacts, or miscellaneous small resources since SAM treats these as reductions to load).

TABLE H-5-1

OPERATION OF RESOURCES BY TYPE
(AVERAGE ANNUAL MW)
Medium Loads and Gas Prices

YEAR	ALTERNATIVE	HYDRO	NUCLEAR	COAL	CT	NTRTY	OTHER*	PURC**	BC/NW	TOTAL***
1989	NOACTION	16387.4	1530.9	1680.0	30.4	217.6	0.0	0.0	246.3	20092.6
1989	1.2	-1.3	0.0	-0.2	-0.6	0.0	0.0	0.0	-0.1	-2.2
1989	4.1, B	32.1	0.0	-62.6	0.0	-1.5	0.0	0.0	-72.5	-104.5
1989	4.1, A	34.0	0.0	-63.6	5.1	-7.0	0.0	0.0	-67.8	-99.3
1989	4.3	-35.1	0.0	37.7	1.9	2.8	0.0	0.0	29.7	37.0
1989	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	NOACTION	16343.2	1530.4	2179.4	44.4	48.8	0.0	0.0	314.9	20461.1
1990	1.2	-5.1	0.0	2.6	-0.5	-0.2	0.0	0.0	3.9	0.7
1990	4.1, B	-5.9	0.0	22.0	-7.2	-9.6	0.0	0.0	-94.5	-95.2
1990	4.1, A	-8.2	0.0	23.6	-3.2	-6.1	0.0	0.0	-78.3	-72.2
1990	4.3	2.3	0.0	-21.7	1.4	0.6	5.8	0.6	-18.4	-29.4
1990	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	NOACTION	16309.9	1529.3	2301.9	55.7	53.4	0.0	0.0	302.7	20552.9
1991	1.2	-12.5	0.0	-2.8	2.4	-0.5	0.0	0.0	4.7	-8.7
1991	4.1, B	13.8	0.0	-19.5	-32.4	-10.4	0.0	0.0	-67.6	-116.1
1991	4.1, A	3.6	0.0	-16.3	-16.8	-7.0	0.0	0.0	-43.8	-80.3
1991	4.3	-64.1	0.0	-122.6	-5.1	-0.8	8.6	0.0	-50.3	-234.3
1991	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	NOACTION	16570.7	1526.5	2272.3	13.6	39.9	1.1	0.0	271.7	20695.8
1992	1.2	-8.6	0.0	-4.5	-2.3	0.4	0.0	0.0	10.4	-4.6
1992	4.1, B	-8.6	0.0	7.8	-9.7	-5.9	-1.1	0.0	-71.1	-88.6
1992	4.1, A	-6.6	0.0	5.8	-2.9	-3.3	-1.1	0.0	-49.7	-57.8
1992	4.3	-43.4	0.0	-71.9	0.5	6.0	3.5	0.0	-51.9	-157.2
1992	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	NOACTION	16531.8	1542.5	2482.0	17.0	40.4	1.6	0.0	209.2	20824.5
1993	1.2	-5.3	0.0	-5.0	-0.7	0.1	0.0	0.0	14.0	3.1
1993	4.1, B	19.3	0.0	8.4	-7.7	0.7	-1.6	0.0	-74.4	-55.3
1993	4.1, A	3.9	0.0	8.3	1.4	0.8	-1.0	0.0	-40.2	-26.8
1993	4.3	-5.6	0.0	-110.3	2.0	6.9	2.6	0.0	-54.8	-159.2
1993	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	NOACTION	16298.1	1531.6	2808.0	24.1	0.0	4.5	0.0	252.6	20918.9
1994	1.2	-7.8	0.0	-0.1	1.7	0.0	-1.1	0.0	14.2	6.9
1994	4.1, B	37.1	0.0	-9.7	-15.5	0.0	-4.5	0.0	-106.2	-98.8
1994	4.1, A	16.6	0.0	-10.2	-8.2	0.0	-4.4	0.0	-23.7	-29.9
1994	4.3	-23.4	0.0	-126.7	-3.7	0.0	1.7	0.0	-59.0	-211.1
1994	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

*OTHER INCLUDES OUTSIDE STORAGE AND EXCHANGE ENERGY
**PURC REPRESENTS USE OF SHORT-TERM PURCHASES RESERVED BY THE LEAST COST MIX MODEL
***TOTAL DOES NOT INCLUDE RESOURCES NOT DISPATCHED BY SAM (CONSERVATION, RENEWABLES, FIRM IMPORTS, ETC.)

TABLE H-5-1

OPERATION OF RESOURCES BY TYPE
(AVERAGE ANNUAL MW)
Medium Loads and Gas Prices

YEAR	ALTERNATIVE	HYDRO	NUCLEAR	COAL	CT	NTRTY	OTHER*	PURC**	BC/NW	TOTAL***
1995	NOACTION	16318.7	1537.9	2927.0	29.1	0.0	10.7	0.0	301.2	21124.6
1995	1.2	-6.9	0.0	-6.6	1.6	0.0	-1.0	0.0	11.4	-1.5
1995	4.1, B	39.9	0.0	-25.9	-11.9	0.0	-10.7	0.0	-98.8	-107.4
1995	4.1, A	11.6	0.0	-14.6	-4.8	0.0	-10.7	0.0	-16.7	-35.2
1995	4.3	-19.5	0.0	-82.8	-0.2	0.0	2.4	0.2	-69.3	-169.2
1995	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	NOACTION	16430.2	1534.8	2852.4	33.3	0.0	21.3	0.0	269.9	21141.9
1996	1.2	4.6	0.0	0.3	1.5	0.0	-3.3	0.0	10.5	13.6
1996	4.1, B	49.3	0.0	-2.8	-19.8	0.0	-21.3	0.0	-79.9	-74.5
1996	4.1, A	30.9	0.0	4.4	-6.2	0.0	-20.5	0.0	-1.0	7.6
1996	4.3	-8.0	0.0	-69.5	-1.3	0.0	-0.9	2.9	-59.7	-136.5
1996	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	NOACTION	16462.6	1535.1	3064.2	33.8	0.0	14.5	0.0	264.0	21374.2
1997	1.2	-3.3	0.0	0.2	1.1	0.0	-2.3	0.0	13.6	9.3
1997	4.1, B	28.5	0.0	-1.1	-19.9	0.0	-14.3	0.0	-82.1	-88.9
1997	4.1, A	6.7	0.0	4.4	-7.1	0.0	-13.8	0.0	11.2	1.4
1997	4.3	-15.6	0.0	-109.0	-5.1	0.0	0.8	0.0	-65.1	-194.0
1997	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	NOACTION	16670.6	1531.4	2908.4	24.6	0.0	16.8	0.0	224.1	21375.9
1998	1.2	-7.2	0.0	0.1	1.8	0.0	-1.8	0.0	7.0	-0.1
1998	4.1, B	77.4	0.0	42.3	-12.0	0.0	-16.8	0.0	-41.3	49.6
1998	4.1, A	29.0	0.0	54.0	25.9	0.0	-15.4	0.0	37.8	131.3
1998	4.3	-28.4	47.2	-130.5	-3.5	0.0	-3.2	0.0	-72.1	-190.5
1998	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	NOACTION	16454.8	1577.4	3103.9	46.2	0.0	17.1	0.0	232.7	21432.1
1999	1.2	-0.8	0.0	-3.5	2.4	0.0	-2.0	0.0	7.9	4.0
1999	4.1, B	41.4	-45.3	64.1	-21.9	0.0	-17.1	0.0	0.5	21.7
1999	4.1, A	23.5	-45.3	75.4	52.3	0.0	-11.7	0.0	66.4	160.6
1999	4.3	-43.0	725.1	-159.5	-16.8	0.0	-12.1	0.0	-72.3	421.4
1999	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	NOACTION	16719.7	2308.1	3034.2	27.8	0.0	12.5	0.0	221.6	22323.9
2000	1.2	-5.6	0.0	1.1	-1.3	0.0	-1.1	0.0	6.4	-0.5
2000	4.1, B	73.4	-769.8	148.0	-7.9	0.0	-9.0	0.0	47.4	-517.9
2000	4.1, A	15.8	-769.8	109.8	67.4	0.0	6.6	0.0	77.4	-492.8
2000	4.3	-11.8	36.7	-82.7	0.3	0.0	-3.2	0.0	-49.4	-110.1
2000	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

*OTHER INCLUDES OUTSIDE STORAGE AND EXCHANGE ENERGY
**PURC REPRESENTS USE OF SHORT-TERM PURCHASES RESERVED BY THE LEAST COST MIX MODEL
***TOTAL DOES NOT INCLUDE RESOURCES NOT DISPATCHED BY SAM (CONSERVATION, RENEWABLES, FIRM IMPORTS, ETC.)

TABLE H-5-1

OPERATION OF RESOURCES BY TYPE
(AVERAGE ANNUAL MW)
Medium Loads and Gas Prices

YEAR	ALTERNATIVE	HYDRO	NUCLEAR	COAL	CT	NTRTY	OTHER*	PURC**	BC/NW	TOTAL***
2001	NOACTION	16542.5	2341.0	3112.1	27.4	0.0	9.9	0.0	201.8	22234.7
2001	1.2	-8.6	0.0	-4.5	1.8	0.0	-1.2	0.0	7.7	-4.8
2001	4.1, B	43.1	-801.5	145.7	-6.4	0.0	-6.6	0.0	43.6	-582.1
2001	4.1, A	23.3	-801.5	103.9	75.8	0.0	13.7	0.0	55.5	-529.3
2001	4.3	-0.8	0.0	-82.8	3.7	0.0	9.0	0.0	-60.2	-131.1
2001	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	NOACTION	16348.1	2342.9	3116.4	49.0	0.0	15.9	0.0	170.2	22042.5
2002	1.2	-4.8	0.0	-1.4	2.8	0.0	-1.0	0.0	3.3	-1.1
2002	4.1, B	35.6	-802.1	141.0	-23.6	0.0	-12.0	0.0	44.2	-616.9
2002	4.1, A	1.6	-756.4	68.7	47.6	0.0	4.1	0.0	25.4	-609.0
2002	4.3	-21.0	45.2	-86.4	-12.8	0.0	-1.6	0.0	-67.1	-143.7
2002	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	NOACTION	16599.0	2392.4	3190.3	33.1	0.0	21.7	0.0	167.2	22403.7
2003	1.2	-3.8	0.0	-3.1	-0.1	0.0	-1.5	0.0	12.7	4.2
2003	4.1, B	40.6	-854.0	156.9	-7.0	0.0	-17.0	0.0	115.0	-565.5
2003	4.1, A	-22.6	-83.5	36.1	31.0	0.0	-10.5	0.0	34.6	-14.9
2003	4.3	-44.2	732.9	-142.7	-13.7	0.0	-17.4	0.0	-56.2	458.7
2003	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	NOACTION	16733.5	3121.1	3043.5	18.6	0.0	4.8	0.0	135.5	23057.0
2004	1.2	-6.6	0.0	-4.4	-0.2	0.0	-0.3	0.0	10.0	-1.5
2004	4.1, B	39.5	-1579.5	210.7	3.7	0.0	0.4	0.0	204.7	-1120.5
2004	4.1, A	11.4	-773.7	99.4	54.5	0.0	5.4	0.0	116.0	-487.0
2004	4.3	-8.5	39.0	-62.6	4.5	0.0	1.8	0.0	-13.3	-39.1
2004	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	NOACTION	16580.7	3153.0	3083.8	29.0	0.0	1.9	0.0	142.7	22991.1
2005	1.2	-7.0	0.0	-6.6	0.8	0.0	0.5	0.0	12.2	-0.1
2005	4.1, B	20.0	-1616.4	198.4	14.7	0.0	5.0	0.0	167.8	-1210.5
2005	4.1, A	7.9	-817.8	94.7	73.0	0.0	18.6	0.0	92.3	-531.3
2005	4.3	-10.1	0.0	-58.3	7.6	0.0	13.4	0.0	-15.6	-63.0
2005	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	NOACTION	16447.9	3159.9	3105.6	27.6	0.0	4.4	0.0	138.6	22884.0
2006	1.2	-2.9	0.0	-6.7	-0.3	0.0	-0.1	0.0	9.0	-1.0
2006	4.1, B	30.4	-1619.8	204.9	17.6	0.0	9.7	0.0	187.0	-1170.2
2006	4.1, A	-10.9	-808.6	78.8	64.1	0.0	19.3	0.0	77.0	-580.3
2006	4.3	-26.7	0.0	-71.7	7.9	0.0	12.9	0.0	-26.5	-104.1
2006	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

*OTHER INCLUDES OUTSIDE STORAGE AND EXCHANGE ENERGY
**PURC REPRESENTS USE OF SHORT-TERM PURCHASES RESERVED BY THE LEAST COST MIX MODEL
***TOTAL DOES NOT INCLUDE RESOURCES NOT DISPATCHED BY SAM (CONSERVATION, RENEWABLES, FIRM IMPORTS, ETC.)

TABLE H-5-1

OPERATION OF RESOURCES BY TYPE
(AVERAGE ANNUAL MW)
Medium Loads and Gas Prices

YEAR	ALTERNATIVE	HYDRO	NUCLEAR	COAL	CT	NTRTY	OTHER*	PURC**	BC/NW	TOTAL***
2007	NOACTION	16525.6	3143.3	3156.1	29.6	0.0	5.1	0.0	159.5	23019.2
2007	1.2	-4.7	0.0	-1.1	0.1	0.0	0.2	0.0	7.1	1.6
2007	4.1, B	22.3	-1602.6	175.8	16.0	0.0	14.8	0.0	199.3	-1174.4
2007	4.1, A	3.2	-807.9	46.0	65.1	0.0	16.9	0.0	72.9	-602.8
2007	4.3	-10.8	0.0	9.2	1.3	0.0	9.6	0.0	-42.6	-33.3
2007	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	NOACTION	16517.4	3159.3	3227.1	30.5	0.0	13.9	0.0	148.7	23096.9
2008	1.2	-3.9	0.0	-6.6	0.4	0.0	0.4	0.0	12.4	2.7
2008	4.1, B	18.5	-1625.3	160.2	19.1	0.0	6.2	0.0	171.8	-1249.5
2008	4.1, A	-11.0	-812.9	38.2	53.7	0.0	9.5	0.0	52.5	-670.0
2008	4.3	-20.8	0.0	81.5	-1.4	0.0	1.9	0.0	-41.0	20.2
2008	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

*OTHER INCLUDES OUTSIDE STORAGE AND EXCHANGE ENERGY
**PURC REPRESENTS USE OF SHORT-TERM PURCHASES RESERVED BY THE LEAST COST MIX MODEL
***TOTAL DOES NOT INCLUDE RESOURCES NOT DISPATCHED BY SAM (CONSERVATION, RENEWABLES, FIRM IMPORTS, ETC.)

TABLE H-5-2

OPERATION OF RESOURCES BY TYPE
(AVERAGE ANNUAL MW)
High Northwest Loads

YEAR	ALTERNATIVE	HYDRO	NUCLEAR	COAL	CT	NTRTY	OTHER*	PURC**	BC/NW	TOTAL***
1989	NOACTION	16497.8	1530.9	1992.0	67.8	228.4	0.0	5.8	455.9	20778.6
1989	1.2	-16.4	0.0	18.5	7.5	0.4	0.0	0.3	3.5	13.8
1989	4.1, B	18.5	0.0	-107.0	-14.9	-4.7	0.1	-5.8	-134.1	-247.9
1989	4.1, A	2.9	0.0	-2.5	-7.9	-0.8	0.0	-5.8	-2.8	-16.9
1989	4.3	-13.5	0.0	19.9	6.0	0.3	0.0	28.8	3.3	44.8
1989	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	NOACTION	16468.1	1530.4	2532.9	115.6	24.5	15.9	54.4	453.9	21195.7
1990	1.2	-6.7	0.0	-6.1	3.5	-1.6	-3.4	2.3	10.8	-1.2
1990	4.1, B	-1.5	0.0	16.1	-39.2	-8.9	-15.7	-54.4	-45.2	-148.8
1990	4.1, A	16.7	0.0	24.2	1.6	-2.6	-12.7	-50.4	32.0	8.8
1990	4.3	2.2	0.0	-5.3	-3.1	-1.3	-3.6	69.9	12.1	70.9
1990	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	NOACTION	16401.1	1529.3	2644.4	138.0	22.0	15.9	76.7	417.7	21245.1
1991	1.2	-7.0	0.0	-3.2	-0.6	-1.2	-1.3	0.1	2.1	-11.1
1991	4.1, B	18.2	0.0	139.3	-36.0	-4.3	-15.5	-76.7	-0.5	24.5
1991	4.1, A	-8.3	0.0	62.8	4.8	-2.6	3.6	-62.8	-7.1	-9.6
1991	4.3	-6.9	0.0	4.4	-3.1	-1.6	-1.8	93.1	2.6	86.7
1991	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	NOACTION	16648.9	1526.5	2700.5	135.3	13.5	14.0	160.1	435.0	21633.8
1992	1.2	-7.1	0.0	-8.1	1.5	0.1	-1.4	3.9	0.3	-10.8
1992	4.1, B	35.8	0.0	105.5	-119.9	-5.3	-13.7	-160.1	7.4	-150.3
1992	4.1, A	1.0	0.0	14.4	12.0	1.6	0.2	-78.6	2.2	-47.2
1992	4.3	-13.3	0.0	-7.0	-3.4	0.7	-1.3	107.8	2.2	85.7
1992	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	NOACTION	16606.9	1542.5	2872.3	148.9	12.4	17.8	176.4	354.9	21732.1
1993	1.2	-4.5	0.0	-11.7	-0.8	1.0	-1.8	3.8	3.0	-11.0
1993	4.1, B	3.8	0.0	163.2	-126.3	-2.0	-16.0	-176.4	53.8	-99.9
1993	4.1, A	-5.9	0.0	42.8	9.7	2.3	0.8	-92.7	16.3	-26.7
1993	4.3	-4.4	0.0	-9.4	-8.5	0.2	-2.7	117.8	-0.2	92.8
1993	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	NOACTION	16345.5	1531.6	3206.2	193.8	0.0	17.1	312.6	386.0	21992.8
1994	1.2	-5.8	0.0	-8.9	-3.3	0.0	-1.6	-1.8	10.3	-11.1
1994	4.1, B	12.7	0.0	107.7	-142.6	0.0	-7.9	-312.6	49.4	-293.3
1994	4.1, A	4.3	0.0	1.9	17.8	0.0	2.3	-113.2	21.7	-65.2
1994	4.3	-10.1	0.0	-9.1	-12.2	0.0	-3.7	145.6	7.6	118.1
1994	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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**PURC REPRESENTS USE OF SHORT-TERM PURCHASES RESERVED BY THE LEAST COST MIX MODEL
***TOTAL DOES NOT INCLUDE RESOURCES NOT DISPATCHED BY SAM (CONSERVATION, RENEWABLES, FIRM IMPORTS, ETC.)

TABLE H-5-2

OPERATION OF RESOURCES BY TYPE
(AVERAGE ANNUAL MW)
High Northwest Loads

YEAR	ALTERNATIVE	HYDRO	NUCLEAR	COAL	CT	NTRTY	OTHER*	PURC**	BC/NW	TOTAL***
1995	NOACTION	16359.4	1537.9	3287.9	193.9	0.0	20.8	380.7	461.3	22241.9
1995	1.2	-5.0	0.0	-3.0	-2.6	0.0	-3.2	2.2	3.4	-8.2
1995	4.1, B	-7.5	0.0	59.5	-132.1	0.0	-0.7	-380.7	42.5	-419.0
1995	4.1, A	-3.7	0.0	5.4	25.8	0.0	0.9	-115.1	10.3	-76.4
1995	4.3	-6.1	0.0	-3.0	-10.5	0.0	-4.9	137.9	8.2	121.6
1995	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	NOACTION	16496.3	1534.8	3246.1	208.9	0.0	19.5	507.6	473.1	22486.3
1996	1.2	-8.4	0.0	-3.6	-1.0	0.0	-1.8	-1.1	3.6	-12.3
1996	4.1, B	38.6	0.0	37.4	-138.8	0.0	-0.2	-496.5	27.0	-532.5
1996	4.1, A	4.6	0.0	3.5	10.3	0.0	1.8	-179.3	-3.0	-162.1
1996	4.3	-1.5	0.0	0.8	-15.3	0.0	-2.2	136.7	6.6	125.1
1996	4.4	0.5	0.0	0.0	1.0	0.0	0.0	2.7	0.1	4.3
1997	NOACTION	16480.2	3158.2	3280.9	132.5	0.0	16.3	111.6	340.3	23520.0
1997	1.2	-6.6	0.0	-2.6	5.5	0.0	-1.6	6.4	8.4	9.5
1997	4.1, B	-27.3	-810.0	144.1	-88.7	0.0	-12.7	-111.6	108.4	-797.8
1997	4.1, A	-7.6	0.0	4.9	-12.4	0.0	0.0	-110.1	12.1	-113.1
1997	4.3	-5.8	0.0	-2.7	5.0	0.0	-1.7	124.9	5.3	125.0
1997	4.4	0.6	0.0	-0.1	0.9	0.0	0.0	0.2	-0.2	1.4
1998	NOACTION	16729.8	3148.3	3186.3	162.7	0.0	17.2	254.9	330.2	23829.4
1998	1.2	-6.6	0.0	-0.5	0.6	0.0	-2.0	2.4	7.0	0.9
1998	4.1, B	26.5	-821.5	84.2	-121.6	0.0	-7.3	-254.9	48.3	-1046.3
1998	4.1, A	6.2	0.0	3.3	-4.2	0.0	1.9	-148.3	6.2	-134.9
1998	4.3	-3.1	0.0	4.8	-11.4	0.0	-3.1	123.5	5.5	116.2
1998	4.4	-1.2	0.0	0.3	0.2	0.0	0.0	0.3	-0.1	-0.5
1999	NOACTION	16463.3	3159.3	5028.8	48.5	0.0	18.2	0.0	234.0	24952.1
1999	1.2	-7.4	0.0	-8.3	5.6	0.0	-0.7	0.0	10.1	-0.7
1999	4.1, B	33.1	0.0	-1568.2	21.2	0.0	3.5	0.0	170.8	-1339.6
1999	4.1, A	10.2	0.0	-603.9	84.9	0.0	-0.2	0.0	72.5	-436.5
1999	4.3	-48.0	0.0	583.3	-4.1	0.0	-1.4	0.0	-66.4	463.4
1999	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	NOACTION	16751.1	3148.0	5602.0	37.6	0.0	18.5	0.0	214.7	25771.9
2000	1.2	-3.9	0.0	-5.6	4.7	0.0	-0.2	0.0	12.7	7.7
2000	4.1, B	10.4	0.0	-1544.1	15.6	0.0	2.0	0.0	176.5	-1339.6
2000	4.1, A	3.6	0.0	-603.6	76.1	0.0	2.9	0.0	69.6	-451.4
2000	4.3	-8.8	0.0	575.0	-1.4	0.0	-2.8	0.0	-69.3	492.7
2000	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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**PURC REPRESENTS USE OF SHORT-TERM PURCHASES RESERVED BY THE LEAST COST MIX MODEL
***TOTAL DOES NOT INCLUDE RESOURCES NOT DISPATCHED BY SAM (CONSERVATION, RENEWABLES, FIRM IMPORTS, ETC.)

TABLE H-5-2

OPERATION OF RESOURCES BY TYPE
(AVERAGE ANNUAL MW)
High Northwest Loads

YEAR	ALTERNATIVE	HYDRO	NUCLEAR	COAL	CT	NTRTY	OTHER*	PURC**	BC/NW	TOTAL***
2001	NOACTION	16581.3	3151.0	6130.3	34.8	0.0	22.0	0.0	188.8	26108.2
2001	1.2	-6.1	0.0	-7.0	4.8	0.0	-0.6	0.0	1.6	-7.3
2001	4.1, B	-6.9	0.0	-1555.4	11.9	0.0	0.4	0.0	125.5	-1424.5
2001	4.1, A	-6.5	0.0	-593.1	88.4	0.0	1.0	0.0	49.3	-460.9
2001	4.3	-3.7	0.0	586.2	1.3	0.0	-3.8	0.0	-58.4	521.6
2001	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	NOACTION	16389.2	3158.9	6775.7	56.7	0.0	18.9	0.0	152.3	26551.7
2002	1.2	-5.3	0.0	-8.6	2.2	0.0	1.2	0.0	-3.9	-14.4
2002	4.1, B	-17.7	0.0	-1643.3	9.0	0.0	-0.6	0.0	119.3	-1533.3
2002	4.1, A	-2.9	0.0	-648.8	82.2	0.0	3.1	0.0	40.7	-525.7
2002	4.3	-5.1	0.0	622.0	-9.9	0.0	-1.9	0.0	-50.6	554.5
2002	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	NOACTION	16618.4	3164.3	7295.9	44.0	0.0	18.6	0.0	204.7	27345.9
2003	1.2	-1.2	0.0	-8.9	0.5	0.0	-0.4	0.0	-0.5	-10.5
2003	4.1, B	3.6	0.0	-1688.3	19.5	0.0	-0.6	0.0	148.2	-1517.6
2003	4.1, A	5.7	0.0	-638.3	77.7	0.0	4.1	0.0	52.5	-498.3
2003	4.3	3.7	0.0	606.0	-6.9	0.0	-2.4	0.0	-66.2	534.2
2003	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	NOACTION	16767.4	3160.1	7866.3	28.9	0.0	17.1	0.0	210.5	28050.3
2004	1.2	-4.3	0.0	-3.7	0.8	0.0	0.0	0.0	3.3	-3.9
2004	4.1, B	-10.0	0.0	-1790.4	15.3	0.0	2.4	0.0	187.6	-1595.1
2004	4.1, A	-11.4	0.0	-632.0	76.5	0.0	6.1	0.0	63.2	-497.6
2004	4.3	-8.5	0.0	619.3	-0.9	0.0	0.3	0.0	-76.1	534.1
2004	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	NOACTION	16605.0	3153.0	8381.1	44.8	0.0	16.7	0.0	196.3	28396.9
2005	1.2	-5.3	0.0	-7.8	1.3	0.0	-0.4	0.0	3.5	-8.7
2005	4.1, B	-16.2	0.0	-1809.9	12.7	0.0	0.4	0.0	163.5	-1649.5
2005	4.1, A	-9.6	0.0	-634.2	73.7	0.0	4.3	0.0	61.1	-504.7
2005	4.3	-6.6	0.0	616.9	-2.1	0.0	-1.8	0.0	-63.7	542.7
2005	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	NOACTION	16460.3	3159.9	8888.0	39.7	0.0	15.8	0.0	178.4	28742.1
2006	1.2	-2.1	0.0	-5.3	1.1	0.0	0.1	0.0	0.6	-5.6
2006	4.1, B	-2.4	0.0	-1800.8	12.2	0.0	0.8	0.0	190.2	-1600.0
2006	4.1, A	0.6	0.0	-641.5	60.8	0.0	5.1	0.0	71.2	-503.8
2006	4.3	-10.3	0.0	640.0	-1.6	0.0	-0.3	0.0	-54.9	572.9
2006	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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***TOTAL DOES NOT INCLUDE RESOURCES NOT DISPATCHED BY SAM (CONSERVATION, RENEWABLES, FIRM IMPORTS, ETC.)

TABLE H-5-2

OPERATION OF RESOURCES BY TYPE
(AVERAGE ANNUAL MW)
High Northwest Loads

YEAR	ALTERNATIVE	HYDRO	NUCLEAR	COAL	CT	NTRTY	OTHER*	PURC**	BC/NW	TOTAL***
2007	NOACTION	16551.8	3143.3	9361.0	35.2	0.0	11.9	0.0	211.1	29314.3
2007	1.2	-5.9	0.0	-3.6	1.3	0.0	0.0	0.0	0.3	-7.9
2007	4.1, B	-1.7	0.0	-1815.5	11.7	0.0	0.4	0.0	198.1	-1607.0
2007	4.1, A	-5.3	0.0	-639.5	77.8	0.0	5.6	0.0	60.2	-501.2
2007	4.3	-5.2	0.0	636.5	-4.0	0.0	0.1	0.0	-56.5	570.9
2007	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	NOACTION	16527.4	3159.3	9868.3	34.3	0.0	11.1	0.0	200.3	29800.7
2008	1.2	-5.2	0.0	-5.5	1.4	0.0	0.2	0.0	2.4	-6.7
2008	4.1, B	-0.4	0.0	-1822.3	10.7	0.0	2.1	0.0	179.9	-1630.0
2008	4.1, A	1.3	0.0	-646.6	63.7	0.0	7.2	0.0	55.1	-519.3
2008	4.3	-1.6	0.0	632.1	-5.2	0.0	0.1	0.0	-44.8	580.6
2008	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

*OTHER INCLUDES OUTSIDE STORAGE AND EXCHANGE ENERGY
**PURC REPRESENTS USE OF SHORT-TERM PURCHASES RESERVED BY THE LEAST COST MIX MODEL
***TOTAL DOES NOT INCLUDE RESOURCES NOT DISPATCHED BY SAM (CONSERVATION, RENEWABLES, FIRM IMPORTS, ETC.)

H-6

Operation of Existing Coal Plants

Operation of Existing Coal Plants

The analyses performed with the Systems Analysis Model (See Appendix G-1) produced projections of future operation of existing coal-fired generating plants which serve the region. These projections are provided in Tables H-6-1 and H-6-2 for the assumptions of expected loads and gas prices and high Northwest Loads. Similar Tables showing projected coal plant operations for other sensitivity assumptions (Low Northwest Loads, High Southwest Loads, Low Southwest Loads, High Gas Price, and Low Gas Price) are available upon request. In Tables H-6-1 and H-6-2, the values given for "No Action" for each plant are actual projected values from SAM. Values given for each other alternative by plant are differences for that alternative from the value given above it by plant for "No Action". The last column of each Table shows generation and generation changes from No Action for "generic coal plants which are added in some cases by the LCMM to meet load firm load growth.

TABLE H-6-1

COAL PLANT GENERATION
(AVG ANNUAL MW)
Medium Loads and Gas Prices

YEAR	ALTERNATIVE	VALMY	COLSTP	CORETTE	BRDMAN	CENTR	BRIDGER	GENCOAL
1989	NOACTION	14.5	945.3	16.3	21.4	201.0	481.5	0.0
1989	1.2	-0.1	0.0	0.0	-0.1	0.0	0.0	0.0
1989	4.1, B	1.3	8.6	0.6	1.4	-2.4	-72.1	0.0
1989	4.1, A	1.5	6.2	0.9	1.9	-5.5	-68.6	0.0
1989	4.3	3.1	-3.4	-0.9	2.2	33.9	2.8	0.0
1989	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	NOACTION	28.2	955.9	19.8	49.6	383.1	742.8	0.0
1990	1.2	0.4	-1.7	0.0	1.3	5.4	-2.8	0.0
1990	4.1, B	-7.0	1.4	0.8	-12.7	2.9	36.6	0.0
1990	4.1, A	-4.7	0.8	0.6	-8.6	6.2	29.3	0.0
1990	4.3	-0.9	-4.9	-0.1	-0.7	8.3	-23.4	0.0
1990	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	NOACTION	34.9	953.3	20.9	63.6	421.7	807.5	0.0
1991	1.2	1.8	-1.7	-0.1	4.3	1.3	-8.4	0.0
1991	4.1, B	-10.4	4.0	0.4	-22.4	-21.8	30.7	0.0
1991	4.1, A	-7.1	1.6	0.3	-15.3	-19.0	23.2	0.0
1991	4.3	-5.3	-12.5	-0.8	-9.2	-13.9	-80.9	0.0
1991	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	NOACTION	30.5	959.8	21.4	64.3	432.6	763.7	0.0
1992	1.2	0.5	-4.5	-0.3	2.2	3.2	-5.6	0.0
1992	4.1, B	-7.9	4.9	0.4	-22.0	0.8	31.6	0.0
1992	4.1, A	-5.6	3.9	0.2	-16.7	4.8	19.2	0.0
1992	4.3	-6.2	-15.5	-0.7	-13.6	-17.5	-18.4	0.0
1992	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	NOACTION	33.7	1012.8	22.0	63.0	542.1	808.4	0.0
1993	1.2	1.7	-0.1	-0.2	5.3	-4.2	-7.5	0.0
1993	4.1, B	-10.5	8.2	0.5	-21.2	-1.7	33.1	0.0
1993	4.1, A	-5.5	3.6	0.3	-11.7	1.2	20.4	0.0
1993	4.3	-6.8	-10.6	-1.7	-13.0	-33.3	-44.9	0.0
1993	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	NOACTION	48.9	1032.7	24.9	91.7	651.2	958.6	0.0
1994	1.2	1.5	-0.4	0.1	4.3	-3.3	-2.3	0.0
1994	4.1, B	-16.4	6.4	0.2	-36.9	4.0	33.0	0.0
1994	4.1, A	-7.0	4.9	0.2	-20.3	-2.3	14.3	0.0
1994	4.3	-9.9	-15.9	-0.5	-20.2	-36.6	-43.6	0.0
1994	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	NOACTION	49.0	1049.8	25.6	94.0	716.8	991.8	0.0
1995	1.2	0.9	0.5	0.0	2.3	-6.0	-4.3	0.0
1995	4.1, B	-14.6	6.5	0.3	-32.7	-5.1	19.7	0.0
1995	4.1, A	-5.4	3.7	0.1	-14.6	-6.4	8.0	0.0
1995	4.3	-10.6	-7.8	-0.3	-19.4	-18.6	-26.1	0.0
1995	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TABLE H-6-1

COAL PLANT GENERATION
(AVG ANNUAL MW)
Medium Loads and Gas Prices

YEAR	ALTERNATIVE	VALMY	COLSTP	CORETTE	BRDMAN	CENTR	BRIDGER	GENCOAL
1996	NOACTION	49.2	1025.9	25.2	93.2	710.5	948.4	0.0
1996	1.2	1.1	0.6	0.1	3.0	-1.8	-2.7	0.0
1996	4.1, B	-13.6	12.7	0.6	-33.4	10.1	20.8	0.0
1996	4.1, A	-4.1	6.2	0.3	-12.7	0.4	14.3	0.0
1996	4.3	-9.1	-8.5	-0.3	-17.4	-12.5	-21.7	0.0
1996	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	NOACTION	42.6	1103.3	31.6	96.4	802.7	987.6	0.0
1997	1.2	1.3	-0.7	0.0	4.2	-5.0	0.4	0.0
1997	4.1, B	-10.5	7.2	0.5	-36.8	11.1	27.4	0.0
1997	4.1, A	-0.6	3.8	0.2	-6.5	0.0	7.5	0.0
1997	4.3	-8.3	-9.4	-0.3	-19.5	-47.2	-24.3	0.0
1997	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	NOACTION	46.0	1060.8	32.9	91.2	780.5	897.0	0.0
1998	1.2	0.0	-0.2	-0.1	2.9	-3.3	0.8	0.0
1998	4.1, B	-9.5	15.7	0.6	-23.5	26.1	32.9	0.0
1998	4.1, A	3.7	7.6	0.3	6.4	15.8	20.2	0.0
1998	4.3	-13.3	-13.0	-0.6	-26.4	-60.1	-17.1	0.0
1998	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	NOACTION	54.4	1114.7	33.3	103.1	851.9	946.5	0.0
1999	1.2	0.4	-2.0	-0.1	1.1	-1.4	-1.5	0.0
1999	4.1, B	-0.9	20.9	0.8	-10.0	24.8	28.5	0.0
1999	4.1, A	9.0	14.4	0.5	17.4	16.0	18.1	0.0
1999	4.3	-16.5	-26.6	-1.3	-30.8	-56.3	-28.0	0.0
1999	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	NOACTION	60.5	1079.6	33.0	91.6	827.0	942.5	0.0
2000	1.2	0.8	0.3	0.1	5.3	-4.8	-0.6	0.0
2000	4.1, B	13.3	24.9	1.4	18.2	45.5	44.7	0.0
2000	4.1, A	13.2	16.4	0.9	31.7	21.9	25.7	0.0
2000	4.3	-6.1	-8.5	0.0	-16.6	-34.3	-17.2	0.0
2000	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	NOACTION	83.9	1117.6	32.3	104.9	855.2	918.2	0.0
2001	1.2	-0.4	0.3	0.1	1.7	-5.7	-0.5	0.0
2001	4.1, B	14.6	18.9	0.8	24.0	44.1	43.3	0.0
2001	4.1, A	11.7	10.3	0.5	28.6	29.7	23.1	0.0
2001	4.3	-8.0	-10.9	-0.4	-18.7	-35.2	-9.6	0.0
2001	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	NOACTION	99.5	1081.4	31.8	126.2	858.3	919.2	0.0
2002	1.2	-0.6	-0.9	-0.1	2.1	-0.9	-1.0	0.0
2002	4.1, B	24.0	22.5	0.8	36.9	28.3	28.5	0.0
2002	4.1, A	13.0	9.2	0.3	17.8	14.9	13.5	0.0
2002	4.3	-9.6	-12.2	-0.6	-36.1	-15.7	-12.2	0.0
2002	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TABLE H-6-1

COAL PLANT GENERATION
(AVG ANNUAL MW)
Medium Loads and Gas Prices

YEAR	ALTERNATIVE	VALMY	COLSTP	CORETTE	BRDMAN	CENTR	BRIDGER	GENCOAL
2003	NOACTION	113.4	1113.8	33.2	113.0	884.1	932.8	0.0
2003	1.2	-0.9	0.2	-0.1	2.1	-2.2	-2.2	0.0
2003	4.1, B	19.0	25.7	1.0	41.9	32.3	37.0	0.0
2003	4.1, A	3.5	5.1	0.2	18.2	1.5	7.6	0.0
2003	4.3	-12.5	-26.0	-1.0	-30.4	-43.9	-28.9	0.0
2003	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	NOACTION	121.3	1099.0	32.3	96.6	839.9	854.4	0.0
2004	1.2	-0.7	-1.6	-0.1	0.8	-2.7	-0.1	0.0
2004	4.1, B	28.3	28.7	1.3	64.5	38.5	49.4	0.0
2004	4.1, A	13.7	13.2	0.7	31.5	18.4	21.9	0.0
2004	4.3	-9.4	-13.1	-0.5	-4.7	-21.2	-13.7	0.0
2004	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	NOACTION	129.2	1101.9	32.9	115.4	850.5	853.9	0.0
2005	1.2	-1.1	-1.2	-0.1	1.4	-5.0	-0.6	0.0
2005	4.1, B	26.3	29.4	1.2	65.4	33.8	42.3	0.0
2005	4.1, A	14.9	8.9	0.6	36.4	16.3	17.6	0.0
2005	4.3	-7.6	-12.7	-0.4	-5.1	-21.3	-11.2	0.0
2005	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	NOACTION	136.2	1104.3	32.7	124.8	850.4	857.2	0.0
2006	1.2	-1.2	-0.7	0.0	1.5	-6.1	-0.2	0.0
2006	4.1, B	22.5	29.1	1.2	64.3	44.2	43.6	0.0
2006	4.1, A	10.3	6.9	0.3	31.8	14.2	15.3	0.0
2006	4.3	-7.9	-19.7	-0.7	-10.6	-16.3	-16.5	0.0
2006	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2007	NOACTION	134.5	1116.5	33.4	178.3	860.5	832.9	0.0
2007	1.2	-1.9	-1.4	0.0	3.1	-0.1	-0.8	0.0
2007	4.1, B	15.5	19.2	0.8	72.3	35.0	33.0	0.0
2007	4.1, A	4.8	1.0	0.1	25.1	4.7	10.3	0.0
2007	4.3	-9.8	-13.9	-0.6	-13.3	-10.1	-12.6	69.5
2007	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	NOACTION	143.8	1113.4	32.9	229.7	858.5	848.8	0.0
2008	1.2	-2.1	-0.1	0.0	0.0	-3.5	-0.9	0.0
2008	4.1, B	14.1	21.1	0.9	63.1	34.4	26.6	0.0
2008	4.1, A	7.1	1.6	0.1	20.7	4.6	4.1	0.0
2008	4.3	-13.4	-15.5	-0.4	-22.9	-9.6	-10.0	153.3
2008	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TABLE H-6-2

COAL PLANT GENERATION
(AVG ANNUAL MW)
High Northwest Loads

YEAR	ALTERNATIVE	VALMY	COLSTP	CORETTE	BRDMAN	CENTR	BRIDGER	GENCOAL
1989	NOACTION	31.0	979.9	19.5	44.5	309.1	608.0	0.0
1989	1.2	3.5	-0.8	-0.1	4.7	17.0	-5.8	0.0
1989	4.1, B	-7.1	11.7	1.4	-5.2	-77.2	-30.6	0.0
1989	4.1, A	-0.5	2.2	0.5	-2.6	4.2	-6.3	0.0
1989	4.3	3.6	-0.8	-0.1	4.8	17.9	-5.5	0.0
1989	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	NOACTION	50.5	1009.8	23.6	97.8	446.3	904.9	0.0
1990	1.2	1.4	-2.6	-0.2	3.4	0.1	-8.2	0.0
1990	4.1, B	-6.4	1.1	0.2	-17.7	-10.4	49.3	0.0
1990	4.1, A	4.5	-1.5	0.0	7.8	11.7	1.7	0.0
1990	4.3	1.5	-2.2	-0.2	3.7	-0.2	-7.9	0.0
1990	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	NOACTION	58.1	1003.7	24.3	117.6	482.8	957.9	0.0
1991	1.2	0.9	-1.2	0.0	3.0	3.1	-9.0	0.0
1991	4.1, B	7.1	15.4	0.3	11.1	38.4	67.0	0.0
1991	4.1, A	6.0	0.7	-0.1	11.8	22.6	21.8	0.0
1991	4.3	1.4	-1.3	0.0	4.0	8.5	-8.2	0.0
1991	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	NOACTION	52.5	1044.0	24.7	123.2	491.8	964.3	0.0
1992	1.2	0.3	-1.4	-0.1	2.4	-4.8	-4.5	0.0
1992	4.1, B	8.7	14.3	0.5	24.3	41.2	16.5	0.0
1992	4.1, A	3.9	-1.6	0.0	11.0	12.7	-11.6	0.0
1992	4.3	0.7	-2.3	-0.1	3.6	-4.4	-4.5	0.0
1992	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	NOACTION	61.7	1066.8	24.1	127.0	625.3	967.4	0.0
1993	1.2	0.1	-1.3	-0.1	0.2	-2.1	-8.5	0.0
1993	4.1, B	13.4	12.3	0.8	33.6	32.8	70.3	0.0
1993	4.1, A	4.8	-0.7	0.3	8.4	12.2	17.8	0.0
1993	4.3	0.6	-1.1	0.0	2.0	-4.2	-6.7	0.0
1993	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	NOACTION	78.8	1082.1	26.8	159.9	788.3	1070.3	0.0
1994	1.2	0.2	-0.8	0.0	0.6	-8.2	-0.7	0.0
1994	4.1, B	11.5	8.9	0.7	27.3	28.7	30.6	0.0
1994	4.1, A	2.8	1.9	-0.1	6.9	-17.4	7.8	0.0
1994	4.3	0.5	-0.6	-0.1	0.7	-8.3	-1.3	0.0
1994	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	NOACTION	79.9	1089.5	27.3	163.6	850.1	1077.5	0.0
1995	1.2	0.1	0.2	-0.1	1.0	-3.2	-1.0	0.0
1995	4.1, B	7.7	6.7	0.0	17.6	23.0	4.5	0.0
1995	4.1, A	2.9	1.7	0.0	6.1	3.2	-8.5	0.0
1995	4.3	0.6	0.9	0.0	1.3	-5.8	0.0	0.0
1995	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TABLE H-6-2

COAL PLANT GENERATION
(AVG ANNUAL MW)
High Northwest Loads

YEAR	ALTERNATIVE	VALMY	COLSTP	CORETTE	BRDMAN	CENTR	BRIDGER	GENCOAL
1996	NOACTION	82.7	1081.3	27.7	167.7	844.6	1042.1	0.0
1996	1.2	0.4	-0.4	0.0	1.0	-1.5	-3.1	0.0
1996	4.1, B	5.4	2.8	0.2	11.5	2.8	14.7	0.0
1996	4.1, A	0.9	-0.2	-0.1	1.2	-0.7	2.4	0.0
1996	4.3	0.8	-0.2	0.0	1.9	1.6	-3.3	0.0
1996	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	NOACTION	56.0	1149.3	33.3	127.2	868.6	1046.5	0.0
1997	1.2	0.5	0.1	0.0	1.7	-4.4	-0.5	0.0
1997	4.1, B	17.0	7.0	0.6	43.1	40.8	35.6	0.0
1997	4.1, A	1.1	1.9	0.0	3.4	-3.0	1.5	0.0
1997	4.3	0.4	0.7	0.0	2.8	-6.7	0.1	0.0
1997	4.4	0.0	0.0	0.0	-0.1	0.0	0.0	0.0
1998	NOACTION	65.0	1113.4	34.8	133.6	855.7	983.8	0.0
1998	1.2	0.7	-0.6	0.0	1.4	-0.2	-1.8	0.0
1998	4.1, B	14.1	4.4	0.5	33.0	14.4	17.8	0.0
1998	4.1, A	1.0	-0.2	0.0	2.5	1.4	-1.4	0.0
1998	4.3	1.2	-1.0	0.0	3.3	1.7	-0.4	0.0
1998	4.4	0.1	0.0	0.0	0.2	0.0	0.0	0.0
1999	NOACTION	58.4	1172.6	35.9	111.4	947.0	1040.6	1662.9
1999	1.2	-0.1	0.0	0.0	1.9	-1.9	-0.6	-7.6
1999	4.1, B	29.8	0.9	0.1	66.1	-8.4	6.2	-1662.9
1999	4.1, A	11.4	-0.5	-0.1	25.0	-0.1	0.0	-639.6
1999	4.3	-14.2	-0.1	0.0	-26.4	-0.5	-0.2	624.7
1999	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	NOACTION	68.2	1135.8	36.3	101.9	940.4	1049.5	2269.9
2000	1.2	0.4	0.0	0.0	2.7	-0.7	-0.1	-7.9
2000	4.1, B	32.6	0.0	-0.1	69.1	4.6	9.9	-1660.2
2000	4.1, A	12.8	0.1	0.0	27.3	-0.4	-0.2	-643.2
2000	4.3	-15.4	0.0	0.0	-30.7	0.8	1.1	619.2
2000	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	NOACTION	91.2	1175.0	34.7	118.1	975.1	1024.2	2712.0
2001	1.2	-0.8	0.0	0.0	0.2	0.5	0.0	-6.9
2001	4.1, B	31.2	0.1	-0.1	61.0	9.6	3.6	-1660.8
2001	4.1, A	12.5	0.0	0.0	23.8	0.3	0.4	-630.1
2001	4.3	-16.1	0.0	0.0	-34.1	1.1	0.4	634.9
2001	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	NOACTION	107.5	1129.4	33.7	132.0	947.1	996.6	3429.4
2002	1.2	-0.8	0.0	0.0	-1.5	-0.4	0.0	-5.9
2002	4.1, B	34.3	0.0	0.0	65.0	4.4	0.1	-1747.1
2002	4.1, A	12.8	0.0	0.0	24.6	0.9	-0.6	-686.5
2002	4.3	-16.4	0.0	0.0	-37.5	0.2	-0.3	676.0
2002	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TABLE H-6-2

COAL PLANT GENERATION
(AVG ANNUAL MW)
High Northwest Loads

YEAR	ALTERNATIVE	VALMY	COLSTP	CORETTE	BRDMAN	CENTR	BRIDGER	GENCOAL
2003	NOACTION	124.4	1165.2	35.3	123.2	1002.8	1019.5	3825.5
2003	1.2	-0.9	0.0	0.0	0.0	-0.4	0.0	-7.6
2003	4.1, B	28.8	0.0	0.0	63.3	3.1	0.0	-1783.5
2003	4.1, A	11.5	0.0	0.0	24.7	0.0	0.0	-674.5
2003	4.3	-14.2	0.0	0.0	-32.6	0.1	0.0	652.7
2003	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	NOACTION	132.1	1167.9	35.0	116.5	956.8	957.9	4500.1
2004	1.2	-0.5	0.0	0.0	0.5	-0.2	0.0	-3.5
2004	4.1, B	33.4	0.0	0.0	64.5	1.3	0.0	-1889.6
2004	4.1, A	13.1	0.0	0.0	22.8	-0.1	0.0	-667.8
2004	4.3	-14.8	0.0	0.0	-22.6	-0.2	0.0	656.9
2004	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	NOACTION	138.9	1159.9	35.3	136.5	960.4	943.7	5006.4
2005	1.2	-1.1	0.0	0.0	-1.9	0.0	0.0	-4.8
2005	4.1, B	30.8	0.0	0.0	62.9	0.4	0.0	-1904.0
2005	4.1, A	11.3	0.0	0.0	24.5	-0.3	0.0	-669.7
2005	4.3	-13.5	0.0	0.0	-27.2	0.0	0.0	657.6
2005	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	NOACTION	145.5	1161.5	35.0	136.0	964.3	949.2	5496.5
2006	1.2	-0.4	0.0	0.0	-1.1	0.0	0.0	-3.8
2006	4.1, B	25.5	0.0	0.0	63.3	0.3	0.0	-1889.9
2006	4.1, A	10.4	0.0	0.0	25.4	0.0	0.0	-677.3
2006	4.3	-14.1	0.0	0.0	-25.1	0.0	0.0	679.2
2006	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2007	NOACTION	140.5	1160.0	35.1	198.7	954.9	898.5	5973.3
2007	1.2	-0.3	0.0	0.0	-0.2	0.0	0.0	-3.1
2007	4.1, B	23.3	0.0	0.0	76.4	0.0	0.0	-1915.2
2007	4.1, A	8.6	0.0	0.0	29.0	0.0	0.1	-677.2
2007	4.3	-14.8	0.0	0.0	-26.2	0.0	0.1	677.4
2007	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	NOACTION	145.2	1164.2	35.0	249.7	958.2	917.5	6398.5
2008	1.2	0.0	0.0	0.0	-1.5	0.0	0.0	-4.0
2008	4.1, B	21.9	0.0	0.0	74.5	0.0	0.0	-1918.7
2008	4.1, A	8.0	0.0	0.0	26.3	0.0	0.0	-680.9
2008	4.3	-14.3	0.0	0.0	-29.0	0.0	0.0	675.4
2008	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0

H-7

Air Quality Analysis--Coal and Combustion Turbine Plants

Combustion Turbine Air Quality Analysis

A methodology for analyzing air quality impacts from changes in generation from existing combustion turbine facilities included in the SAM had not been developed for the Intertie Development and Use Environmental Impact Statement. Changes in generation at existing combustion turbines were generally projected by SAM to be small and only the Beaver facility tended to be affected substantially.

An analysis of the Frederickson Combustion Turbine facility (Final Report: Economic Analysis of the Environmental Effects of the Fredrickson Combustion Turbine Electric Generator, ECO Northwest, 4/84, P. III-8) used a Gaussian plume model to project maximum impacts of air pollutants from the plant. These impacts when firing natural gas were maximum nitrogen oxide concentrations of 0.016 $\mu g/m^3$ and maximum particulate concentrations of 0.0014 $\mu g/m^3$. When firing distillate fuel oil, maximum ambient concentrations were 0.014 $\mu g/m^3$ for nitrogen oxides, 0.0014 $\mu g/m^3$ for particulates, and 0.021 $\mu g/m^3$ for sulfur dioxide. Average ground level concentrations were projected to be about one tenth of these values. Average concentrations were based on 1500 hours of operation per year, a plant factor of about 17 percent. All these concentrations were negligible when compared to ambient air quality standards.

A field measurement program using sulfur hexaflouride (SF_6) as a tracer showed that ambient air concentrations of nitrogen oxides and sulfur dioxide from the Beaver combustion turbine facility, when operated in combined cycle mode, are far below the air quality regulatory standards (Air Quality Impact Study of Combined Cycle Operation at the Beaver Combustion Turbine Plant, Phase I: Summary of Field Measurement Programs, Portland General Electric, 12/80).

Since the above studies indicate that ambient concentrations of air pollutants from combustion turbine facilities are very small in comparison with air quality standards, it is unlikely that any but an extremely large change in annual generation would make any substantial difference in annual average concentrations of air pollutants. Maximum air quality impacts from each plant would not be affected by any of the alternatives since these could occur at any time any of the plants is operated at capacity coincident with adverse dispersion conditions. The combustion turbine plants are sufficiently physically distanced from each other that cumulative effects from operating more than one plant simultaneously are not a concern.

Because of (1) the generally small changes in generation at the existing combustion turbine facilities; (2) the low levels of ambient air pollutant concentrations seemingly associated with these kinds of facilities; and (3) the fact that the only substantial changes occurred at the Beaver plant where there was documentation of the low air quality impacts, a methodology such as was used to compute ambient air quality changes for coal plants was not developed for the existing combustion turbine facilities. It was felt that computation of air quality changes, considering the inevitable compromises in computing such values, was not going to enable any better conclusions than those drawn directly, but more qualitatively, from the information above.

Coal Plant Air Quality Analysis

The analysis to determine the effects on air quality resulting from differences in existing coal plant generation betweem alternatives for which the Systems Analysis Model (SAM) was run used the methodology developed under contract to BPA by the Office of Applied Energy Studies, Washington State University (1987) for the Intertie Development and Use Environmental Impact Statement. The following describes the derivation of this methodology as it applies to the existing coal-fired generating plants addressed by the analysis for the Power Sales Contract EIS.

Plume calculations were performed by the contractor using the PTDIS Gaussian plume model to determine maximum hourly SO_2 and total suspended particulate (TSP) concentrations downwind of each source for a range of atmospheric stability classes. Seasonal and annual average SO_2 and particulate concentrations were calculated using the CDMQC climatological Gaussian plume dispersion model along with the STAR data obtained from the National Climatic Center. All changes in concentration are presented as functions of annual average generation by each plant.

PTDIS HOURLY CALCULATIONS

PTDIS is a simple Gaussian plume model that calculates plume rise using Brigg's formulations, and estimates ground-level concentrations of nonreactive species at specified distances downwind of a single source for a specified wind speed, mixing height, and atmospheric stability class.

PTDIS was used in a flat-terrain mode for all power plants to screen impacts and determine which are potentially significant.

Flat-terrain calculations were performed for six atmospheric stability classes ranging from unstable to stable, covering downwind distances out to 50 km from each power plant. Preliminary calculations were used to identify best receptor spacing in order to bracket closely the location of maximum impact for each stability condition. Model runs yielded six maximum concentrations. The results of this work were maximum hourly concentrations of SO_2 and TSP for each power plant.

ANNUAL AVERAGE CDMQC CALCULATIONS

CDMQC employs a sector-averaged Gaussian plume algorithm to calculate long-term concentrations at specific receptors caused by single or multiple point and area sources. For each source-receptor pair, the model determines the concentration associated with each possible combination of six wind speed classes, six stability classes, and 16 wind direction sectors. These concentrations are then weighted and summed by the joint meteorological frequency distribution contained in the STAR data to give a single long-term average concentration. The impacts of multiple sources are summed to give the total impact at a receptor.

In applying CDMQC to specific power plants, results for each source were obtained at an array of receptors covering all wind directions at several downwind distances.

The primary indicator of annual air quality is the maximum annual average concentration predicted within the array of receptors. Sulfate concentrations were estimated using CDMQC, assuming a first-order sulfur dioxide-to-sulfate (SO_2 to SO_4) conversion rate of 1 percent per hour. The conversion rate was derived from current literature reporting field and laboratory measurements of sulfur dioxide-sulfate chemistry in atmospheric plumes.

MODEL INPUT

Stack parameters, emission loadings per unit of thermal output, and other source data have been obtained from EPA regional offices, local air pollution control districts, and utility companies for each of the selected power plants. Thermal loadings were combined with the operational levels predicted for various alternatives and assumptions concerning size of loads and gas prices to yield pollutant emission rates for each plant and for each combination of alternative and assumptions. Model input data are shown in Table H-7-1.

Table H-7-1
MODEL INPUT DATA

Power Plant	Stack Height (m)	Stack Diameter (m)	Exhaust Temp. (K)	Exit Velocity (m/s)	Emission Factor (lb./MMBTU) SO2	TSP	Star Data Location
Centralia	152	4.3	388	33	1.695	0.0 0	Olympia, WA
	152	4.3	388	33	1.695	0.030	
Boardman	200	6.8	422	37	0.780	0.060	Spokane, WA
Valmy	152	5.8	405	19	0.630	0.010	Lovelock, NV
	139	5.2	359	23	0.120	0.010	
Colstrip	152	5.0	366	32	0.120	0.040	Custer, MT
	152	5.0	366	32	0.290	0.040	
	211	7.3	372	32	0.070	0.050	
Bridger	152	7.3	325	22	0.300	0.100	Rock Springs, WY
	152	7.3	325	22	0.300	0.100	
	152	7.3	325	22	0.300	0.100	
	152	9.4	325	17	0.200	0.100	

Sources: Private communications with plant personnel and CFM-VI reports.

MODEL OUTPUT

The primary model output is impact coefficients defined in terms of SO_2 and TSP concentrations per unit pollutant emission rate. The coefficients derived from the model are shown in Table H-7-2. Because ambient pollutant concentration is a linear function of emission rate, these impact coefficients can then be used to determine changes in ambient pollutant concentration related to each alternative and set of assumptions. The results of the analysis of air quality impacts, developed through applying the coefficients from the model to generation levels or changes in generation, for each alternative are shown in a comparative manner for the assumptions of expected loads and gas prices and high Northwest loads in Tables H-7-3 and 4. (Each page of each of these Tables is for a different year of the analysis. The values given for "No Action" for each plant are actual projected ambient air pollutant concentration values derived using the methodology described above. Values given for each other alternative by plant are differences for that alternative from the ambient air pollutant concentration given above it by plant for "No Action".)

Air quality impacts were similarly determined for other assumptions (sensitivities) for each alternative analyzed with SAM. These other sensitivity assumptions were: (1) low Northwest loads; (2) high Southwest loads; (3) low Southwest loads; (4) high gas price; and (5) low gas price. Air quality data like that in Tables H-7-3 and 4 for these other assumptions will be provided upon request.

Table H-7-2
PACIFIC NORTHWEST
AIR QUALITY CALCULATION FORMULAS

Centralia
SO2MAX = MWs * 1.0940
TSPMAX = MWs * 0.0179
SO2 = MWs * 0.005714
SO4 = MWs * 0.0000136
TSP = MWs * 0.00009529 + SO4

Boardman
SO2MAX = MWs * 0.2825
TSPMAX = MWs * 0.0215
SO2 = MWs * 0.0005882
SO4 = MWs * 0.00000159
TSP = MWs * 0.00005348 + SO4

Colstrip
SO2MAX = MWs * 0.0963
TSPMAX = MWs * 0.0259
SO2 = MWs * 0.0004401
SO4 = MWs * 0.00000094
TSP = MWs * 0.00009243 + SO4

Bridger
SO2MAX = MWs * 0.2065
TSPMAX = MWs * 0.0745
SO2 = MWs * 0.001819
SO4 = MWs * 0.00000416
TSP = MWs * 0.0006391 + SO4

Valmy
SO2MAX = MWs * 0.2186
TSPMAX = MWs * 0.0057
SO2 = MWs * 0.001696
SO4 = MWs * 0.00000522
TSP = MWs * 0.00005221 + SO4

LIMITS OF UNCERTAINTY IN AIR QUALITY ANALYSES

Gaussian Plume Calculations

Both the maximum 1-hour average concentrations and the maximum annual average concentrations for SO_2, SO_4, and TSP were calculated using Gaussian plume models for point sources. As a result, both sets of calculations are restricted by the inherent uncertainties associated with using a Gaussian plume model of atmospheric transport and diffusion. These uncertainties arise from the assumptions of homogeneous, stationary turbulence; steady-state conditions; and constant wind speed in the model and from the use of empirical but nonsite specific diffusion coefficients. It is generally assumed that these uncertainties, under the best of conditions, limit the accuracy of a Gaussian plume calculation to approximately a factor of two.

Additional limitations to the accuracy of the results are introduced in both short-term and long-term calculations for power plants located in rough terrain. Neither PTDIS (short-term) nor CDM (long-term) account for the effects of complex terrain. These effects generally imply that during stable conditions high surface concentrations may result from impingement of a plume upon a terrain obstacle, while during unstable or neutral conditions, the plume may pass closer to the surface than predicted for a similar flat terrain case. The Complex Terrain Dispersion Model (CTDM) now under development by EPA is designed to address the stable and neutral cases, but it was not available to the contractor in developing this methodology. Unfortunately, it is not possible to assign a level of uncertainty for the effects of complex terrain since the results are extremely site dependent.

Other factors which affect the accuracy of the calculations include possible errors in emission data; the use of STAR meteorological data from National Weather Service sites located too far from the power plants of concern; the assumption of a 1 percent per hour first order conversion rate of SO_2 to SO_4; and the assumption that wet and dry deposition are negligible within the transport distance to the maximum receptor. The end result of all of these uncertainties is that the air quality impact cannot be estimated to be more accurate than a factor of two in the best circumstances and in cases with complicating features the uncertainty probably increases substantially.

Table H-7-3

AIR QUALITY IN PACIFIC NORTHWEST
(MICROGRAMS/CUBIC METER OF AIR)
Medium Loads and Gas Prices

	GENERATION (AVG MW)	1 HOUR MAX. CONCENTRATION SO2	1 HOUR MAX. CONCENTRATION TSP	ANNUAL AVERAGE CONCENTRATION SO2	ANNUAL AVERAGE CONCENTRATION SO4	ANNUAL AVERAGE CONCENTRATION TSP
NOACTION 1991						
VALMY	34.9	7.63	0.20	0.06	0.0002	0.002
COLSTRIP	953.3	91.80	24.69	0.42	0.0009	0.089
BOARDMAN	63.6	17.97	1.37	0.04	0.0001	0.004
CENTRALIA	421.7	461.34	7.55	2.41	0.0057	0.046
BRIDGER	807.5	166.75	60.16	1.47	0.0034	0.519
1.2 1991						
VALMY	1.8	0.39	0.01	0.00	0.0000	0.000
COLSTRIP	-1.7	-0.16	-0.04	0.00	0.0000	0.000
BOARDMAN	4.3	1.21	0.09	0.00	0.0000	0.000
CENTRALIA	1.3	1.42	0.02	0.01	0.0000	0.000
BRIDGER	-8.4	-1.73	-0.63	-0.02	0.0000	-0.005
4.1, B 1991						
VALMY	-10.4	-2.27	-0.06	-0.02	-0.0001	-0.001
COLSTRIP	4.0	0.39	0.10	0.00	0.0000	0.000
BOARDMAN	-22.4	-6.33	-0.48	-0.01	0.0000	-0.001
CENTRALIA	-21.8	-23.85	-0.39	-0.12	-0.0003	-0.002
BRIDGER	30.7	6.34	2.29	0.06	0.0001	0.020
4.1, A 1991						
VALMY	-7.1	-1.55	-0.04	-0.01	0.0000	0.000
COLSTRIP	1.6	0.15	0.04	0.00	0.0000	0.000
BOARDMAN	-15.3	-4.32	-0.33	-0.01	0.0000	-0.001
CENTRALIA	-19.0	-20.79	-0.34	-0.11	-0.0003	-0.002
BRIDGER	23.2	4.79	1.73	0.04	0.0001	0.015
4.3 1991						
VALMY	-5.3	-1.16	-0.03	-0.01	0.0000	0.000
COLSTRIP	-12.5	-1.20	-0.32	-0.01	0.0000	-0.001
BOARDMAN	-9.2	-2.60	-0.20	-0.01	0.0000	-0.001
CENTRALIA	-13.9	-15.21	-0.25	-0.08	-0.0002	-0.002
BRIDGER	-80.9	-16.71	-6.03	-0.15	-0.0003	-0.052
4.4 1991						
VALMY	0.0	0.00	0.00	0.00	0.0000	0.000
COLSTRIP	0.0	0.00	0.00	0.00	0.0000	0.000
BOARDMAN	0.0	0.00	0.00	0.00	0.0000	0.000
CENTRALIA	0.0	0.00	0.00	0.00	0.0000	0.000
BRIDGER	0.0	0.00	0.00	0.00	0.0000	0.000

Table H-7-3

AIR QUALITY IN PACIFIC NORTHWEST
(MICROGRAMS/CUBIC METER OF AIR)
Medium Loads and Gas Prices

	GENERATION (AVG MW)	1 HOUR MAX. CONCENTRATION SO2	1 HOUR MAX. CONCENTRATION TSP	ANNUAL AVERAGE CONCENTRATION SO2	ANNUAL AVERAGE CONCENTRATION SO4	ANNUAL AVERAGE CONCENTRATION TSP
NOACTION 1993						
VALMY	33.7	7.37	0.19	0.06	0.0002	0.002
COLSTRIP	1012.8	97.53	26.23	0.45	0.0010	0.095
BOARDMAN	63.0	17.80	1.35	0.04	0.0001	0.003
CENTRALIA	542.1	593.06	9.70	3.10	0.0074	0.059
BRIDGER	808.4	166.93	60.23	1.47	0.0034	0.520
1.2 1993						
VALMY	1.7	0.37	0.01	0.00	0.0000	0.000
COLSTRIP	-0.1	-0.01	0.00	0.00	0.0000	0.000
BOARDMAN	5.3	1.50	0.11	0.00	0.0000	0.000
CENTRALIA	-4.2	-4.59	-0.08	-0.02	-0.0001	0.000
BRIDGER	-7.5	-1.55	-0.56	-0.01	0.0000	-0.005
4.1, B 1993						
VALMY	-10.5	-2.30	-0.06	-0.02	-0.0001	-0.001
COLSTRIP	8.2	0.79	0.21	0.00	0.0000	0.001
BOARDMAN	-21.2	-5.99	-0.46	-0.01	0.0000	-0.001
CENTRALIA	-1.7	-1.86	-0.03	-0.01	0.0000	0.000
BRIDGER	33.1	6.84	2.47	0.06	0.0001	0.021
4.1, A 1993						
VALMY	-5.5	-1.20	-0.03	-0.01	0.0000	0.000
COLSTRIP	3.6	0.35	0.09	0.00	0.0000	0.000
BOARDMAN	-11.7	-3.31	-0.25	-0.01	0.0000	-0.001
CENTRALIA	1.2	1.31	0.02	0.01	0.0000	0.000
BRIDGER	20.4	4.21	1.52	0.04	0.0001	0.013
4.3 1993						
VALMY	-6.8	-1.49	-0.04	-0.01	0.0000	0.000
COLSTRIP	-10.6	-1.02	-0.27	0.00	0.0000	-0.001
BOARDMAN	-13.0	-3.67	-0.28	-0.01	0.0000	-0.001
CENTRALIA	-33.3	-36.43	-0.60	-0.19	-0.0005	-0.004
BRIDGER	-44.9	-9.27	-3.35	-0.08	-0.0002	-0.029
4.4 1993						
VALMY	0.0	0.00	0.00	0.00	0.0000	0.000
COLSTRIP	0.0	0.00	0.00	0.00	0.0000	0.000
BOARDMAN	0.0	0.00	0.00	0.00	0.0000	0.000
CENTRALIA	0.0	0.00	0.00	0.00	0.0000	0.000
BRIDGER	0.0	0.00	0.00	0.00	0.0000	0.000

Table H-7-3

AIR QUALITY IN PACIFIC NORTHWEST
(MICROGRAMS/CUBIC METER OF AIR)
Medium Loads and Gas Prices

	GENERATION (AVG MW)	1 HOUR MAX. CONCENTRATION SO2	1 HOUR MAX. CONCENTRATION TSP	ANNUAL AVERAGE CONCENTRATION SO2	ANNUAL AVERAGE CONCENTRATION SO4	ANNUAL AVERAGE CONCENTRATION TSP
NOACTION 1995						
VALMY	49.0	10.71	0.28	0.08	0.0003	0.003
COLSTRIP	1049.8	101.10	27.19	0.46	0.0010	0.098
BOARDMAN	94.0	26.56	2.02	0.06	0.0001	0.005
CENTRALIA	716.8	784.18	12.83	4.10	0.0097	0.078
BRIDGER	991.8	204.81	73.89	1.80	0.0041	0.638
1.2 1995						
VALMY	0.9	0.20	0.01	0.00	0.0000	0.000
COLSTRIP	0.5	0.05	0.01	0.00	0.0000	0.000
BOARDMAN	2.3	0.65	0.05	0.00	0.0000	0.000
CENTRALIA	-6.0	-6.56	-0.11	-0.03	-0.0001	-0.001
BRIDGER	-4.3	-0.89	-0.32	-0.01	0.0000	-0.003
4.1, B 1995						
VALMY	-14.6	-3.19	-0.08	-0.02	-0.0001	-0.001
COLSTRIP	6.5	0.63	0.17	0.00	0.0000	0.001
BOARDMAN	-32.7	-9.24	-0.70	-0.02	-0.0001	-0.002
CENTRALIA	-5.1	-5.58	-0.09	-0.03	-0.0001	-0.001
BRIDGER	19.7	4.07	1.47	0.04	0.0001	0.013
4.1, A 1995						
VALMY	-5.4	-1.18	-0.03	-0.01	0.0000	0.000
COLSTRIP	3.7	0.36	0.10	0.00	0.0000	0.000
BOARDMAN	-14.6	-4.12	-0.31	-0.01	0.0000	-0.001
CENTRALIA	-6.4	-7.00	-0.11	-0.04	-0.0001	-0.001
BRIDGER	8.0	1.65	0.60	0.01	0.0000	0.005
4.3 1995						
VALMY	-10.6	-2.32	-0.06	-0.02	-0.0001	-0.001
COLSTRIP	-7.8	-0.75	-0.20	0.00	0.0000	-0.001
BOARDMAN	-19.4	-5.48	-0.42	-0.01	0.0000	-0.001
CENTRALIA	-18.6	-20.35	-0.33	-0.11	-0.0003	-0.002
BRIDGER	-26.1	-5.39	-1.94	-0.05	-0.0001	-0.017
4.4 1995						
VALMY	0.0	0.00	0.00	0.00	0.0000	0.000
COLSTRIP	0.0	0.00	0.00	0.00	0.0000	0.000
BOARDMAN	0.0	0.00	0.00	0.00	0.0000	0.000
CENTRALIA	0.0	0.00	0.00	0.00	0.0000	0.000
BRIDGER	0.0	0.00	0.00	0.00	0.0000	0.000

Table H-7-3

AIR QUALITY IN PACIFIC NORTHWEST
(MICROGRAMS/CUBIC METER OF AIR)
Medium Loads and Gas Prices

	GENERATION (AVG MW)	1 HOUR MAX. CONCENTRATION SO2	1 HOUR MAX. CONCENTRATION TSP	ANNUAL AVERAGE CONCENTRATION SO2	ANNUAL AVERAGE CONCENTRATION SO4	ANNUAL AVERAGE CONCENTRATION TSP
NOACTION 1997						
VALMY	42.6	9.31	0.24	0.07	0.0002	0.002
COLSTRIP	1103.3	106.25	28.58	0.49	0.0010	0.103
BOARDMAN	96.4	27.23	2.07	0.06	0.0002	0.005
CENTRALIA	802.7	878.15	14.37	4.59	0.0109	0.087
BRIDGER	987.6	203.94	73.58	1.80	0.0041	0.635
1.2 1997						
VALMY	1.3	0.28	0.01	0.00	0.0000	0.000
COLSTRIP	-0.7	-0.07	-0.02	0.00	0.0000	0.000
BOARDMAN	4.2	1.19	0.09	0.00	0.0000	0.000
CENTRALIA	-5.0	-5.47	-0.09	-0.03	-0.0001	-0.001
BRIDGER	0.4	0.08	0.03	0.00	0.0000	0.000
4.1, B 1997						
VALMY	-10.5	-2.30	-0.06	-0.02	-0.0001	-0.001
COLSTRIP	7.2	0.69	0.19	0.00	0.0000	0.001
BOARDMAN	-36.8	-10.40	-0.79	-0.02	-0.0001	-0.002
CENTRALIA	11.1	12.14	0.20	0.06	0.0002	0.001
BRIDGER	27.4	5.66	2.04	0.05	0.0001	0.018
4.1, A 1997						
VALMY	-0.6	-0.13	0.00	0.00	0.0000	0.000
COLSTRIP	3.8	0.37	0.10	0.00	0.0000	0.000
BOARDMAN	-6.5	-1.84	-0.14	0.00	0.0000	0.000
CENTRALIA	0.0	0.00	0.00	0.00	0.0000	0.000
BRIDGER	7.5	1.55	0.56	0.01	0.0000	0.005
4.3 1997						
VALMY	-8.3	-1.81	-0.05	-0.01	0.0000	0.000
COLSTRIP	-9.4	-0.91	-0.24	0.00	0.0000	-0.001
BOARDMAN	-19.5	-5.51	-0.42	-0.01	0.0000	-0.001
CENTRALIA	-47.2	-51.64	-0.84	-0.27	-0.0006	-0.005
BRIDGER	-24.3	-5.02	-1.81	-0.04	-0.0001	-0.016
4.4 1997						
VALMY	0.0	0.00	0.00	0.00	0.0000	0.000
COLSTRIP	0.0	0.00	0.00	0.00	0.0000	0.000
BOARDMAN	0.0	0.00	0.00	0.00	0.0000	0.000
CENTRALIA	0.0	0.00	0.00	0.00	0.0000	0.000
BRIDGER	0.0	0.00	0.00	0.00	0.0000	0.000

Table H-7-3

AIR QUALITY IN PACIFIC NORTHWEST
(MICROGRAMS/CUBIC METER OF AIR)
Medium Loads and Gas Prices

	GENERATION (AVG MW)	1 HOUR MAX. CONCENTRATION SO2	1 HOUR MAX. CONCENTRATION TSP	ANNUAL AVERAGE CONCENTRATION SO2	ANNUAL AVERAGE CONCENTRATION SO4	ANNUAL AVERAGE CONCENTRATION TSP
NOACTION 2001						
VALMY	83.9	18.34	0.48	0.14	0.0004	0.005
COLSTRIP	1117.6	107.62	28.95	0.49	0.0011	0.104
BOARDMAN	104.9	29.63	2.26	0.06	0.0002	0.006
CENTRALIA	855.2	935.59	15.31	4.89	0.0116	0.093
BRIDGER	918.2	189.61	68.41	1.67	0.0038	0.591
1.2 2001						
VALMY	-0.4	-0.09	0.00	0.00	0.0000	0.000
COLSTRIP	0.3	0.03	0.01	0.00	0.0000	0.000
BOARDMAN	1.7	0.48	0.04	0.00	0.0000	0.000
CENTRALIA	-5.7	-6.24	-0.10	-0.03	-0.0001	-0.001
BRIDGER	-0.5	-0.10	-0.04	0.00	0.0000	0.000
4.1, B 2001						
VALMY	14.6	3.19	0.08	0.02	0.0001	0.001
COLSTRIP	18.9	1.82	0.49	0.01	0.0000	0.002
BOARDMAN	24.0	6.78	0.52	0.01	0.0000	0.001
CENTRALIA	44.1	48.25	0.79	0.25	0.0006	0.005
BRIDGER	43.3	8.94	3.23	0.08	0.0002	0.028
4.1, A 2001						
VALMY	11.7	2.56	0.07	0.02	0.0001	0.001
COLSTRIP	10.3	0.99	0.27	0.00	0.0000	0.001
BOARDMAN	28.6	8.08	0.61	0.02	0.0000	0.002
CENTRALIA	29.7	32.49	0.53	0.17	0.0004	0.003
BRIDGER	23.1	4.77	1.72	0.04	0.0001	0.015
4.3 2001						
VALMY	-8.0	-1.75	-0.05	-0.01	0.0000	0.000
COLSTRIP	-10.9	-1.05	-0.28	0.00	0.0000	-0.001
BOARDMAN	-18.7	-5.28	-0.40	-0.01	0.0000	-0.001
CENTRALIA	-35.2	-38.51	-0.63	-0.20	-0.0005	-0.004
BRIDGER	-9.6	-1.98	-0.72	-0.02	0.0000	-0.006
4.4 2001						
VALMY	0.0	0.00	0.00	0.00	0.0000	0.000
COLSTRIP	0.0	0.00	0.00	0.00	0.0000	0.000
BOARDMAN	0.0	0.00	0.00	0.00	0.0000	0.000
CENTRALIA	0.0	0.00	0.00	0.00	0.0000	0.000
BRIDGER	0.0	0.00	0.00	0.00	0.0000	0.000

Table H-7-3
AIR QUALITY IN PACIFIC NORTHWEST
(MICROGRAMS/CUBIC METER OF AIR)
Medium Loads and Gas Prices

		GENERATION (AVG MW)	1 HOUR MAX. CONCENTRATION SO2	TSP	ANNUAL AVERAGE CONCENTRATION SO2	SO4	TSP
NOACTION 2005							
	VALMY	129.2	28.24	0.74	0.22	0.0007	0.007
	COLSTRIP	1101.9	106.11	28.54	0.48	0.0010	0.103
	BOARDMAN	115.4	32.60	2.48	0.07	0.0002	0.006
	CENTRALIA	850.5	930.45	15.22	4.86	0.0116	0.093
	BRIDGER	853.9	176.33	63.62	1.55	0.0036	0.549
1.2 2005							
	VALMY	-1.1	-0.24	-0.01	0.00	0.0000	0.000
	COLSTRIP	-1.2	-0.12	-0.03	0.00	0.0000	0.000
	BOARDMAN	1.4	0.40	0.03	0.00	0.0000	0.000
	CENTRALIA	-5.0	-5.47	-0.09	-0.03	-0.0001	-0.001
	BRIDGER	-0.6	-0.12	-0.04	0.00	0.0000	0.000
4.1, B 2005							
	VALMY	26.3	5.75	0.15	0.04	0.0001	0.002
	COLSTRIP	29.4	2.83	0.76	0.01	0.0000	0.003
	BOARDMAN	65.4	18.48	1.41	0.04	0.0001	0.004
	CENTRALIA	33.8	36.98	0.61	0.19	0.0005	0.004
	BRIDGER	42.3	8.73	3.15	0.08	0.0002	0.027
4.1, A 2005							
	VALMY	14.9	3.26	0.08	0.03	0.0001	0.001
	COLSTRIP	8.9	0.86	0.23	0.00	0.0000	0.001
	BOARDMAN	36.4	10.28	0.78	0.02	0.0001	0.002
	CENTRALIA	16.3	17.83	0.29	0.09	0.0002	0.002
	BRIDGER	17.6	3.63	1.31	0.03	0.0001	0.011
4.3 2005							
	VALMY	-7.6	-1.66	-0.04	-0.01	0.0000	0.000
	COLSTRIP	-12.7	-1.22	-0.33	-0.01	0.0000	-0.001
	BOARDMAN	-5.1	-1.44	-0.11	0.00	0.0000	0.000
	CENTRALIA	-21.3	-23.30	-0.38	-0.12	-0.0003	-0.002
	BRIDGER	-11.2	-2.31	-0.83	-0.02	0.0000	-0.007
4.4 2005							
	VALMY	0.0	0.00	0.00	0.00	0.0000	0.000
	COLSTRIP	0.0	0.00	0.00	0.00	0.0000	0.000
	BOARDMAN	0.0	0.00	0.00	0.00	0.0000	0.000
	CENTRALIA	0.0	0.00	0.00	0.00	0.0000	0.000
	BRIDGER	0.0	0.00	0.00	0.00	0.0000	0.000

Table H-7-4

AIR QUALITY IN PACIFIC NORTHWEST
(MICROGRAMS/CUBIC METER OF AIR)
High Northwest Loads

	GENERATION (AVG MW)	1 HOUR MAX. CONCENTRATION SO2	1 HOUR MAX. CONCENTRATION TSP	ANNUAL AVERAGE CONCENTRATION SO2	ANNUAL AVERAGE CONCENTRATION SO4	ANNUAL AVERAGE CONCENTRATION TSP
NOACTION 1991						
VALMY	58.1	12.70	0.33	0.10	0.0003	0.003
COLSTRIP	1003.7	96.66	26.00	0.44	0.0009	0.094
BOARDMAN	117.6	33.22	2.53	0.07	0.0002	0.006
CENTRALIA	482.8	528.18	8.64	2.76	0.0066	0.053
BRIDGER	957.9	197.81	71.36	1.74	0.0040	0.616
1.2 1991						
VALMY	0.9	0.20	0.01	0.00	0.0000	0.000
COLSTRIP	-1.2	-0.12	-0.03	0.00	0.0000	0.000
BOARDMAN	3.0	0.85	0.06	0.00	0.0000	0.000
CENTRALIA	3.1	3.39	0.06	0.02	0.0000	0.000
BRIDGER	-9.0	-1.86	-0.67	-0.02	0.0000	-0.006
4.1, B 1991						
VALMY	7.1	1.55	0.04	0.01	0.0000	0.000
COLSTRIP	15.4	1.48	0.40	0.01	0.0000	0.001
BOARDMAN	11.1	3.14	0.24	0.01	0.0000	0.001
CENTRALIA	38.4	42.01	0.69	0.22	0.0005	0.004
BRIDGER	67.0	13.84	4.99	0.12	0.0003	0.043
4.1, A 1991						
VALMY	6.0	1.31	0.03	0.01	0.0000	0.000
COLSTRIP	0.7	0.07	0.02	0.00	0.0000	0.000
BOARDMAN	11.8	3.33	0.25	0.01	0.0000	0.001
CENTRALIA	22.6	24.72	0.40	0.13	0.0003	0.002
BRIDGER	21.8	4.50	1.62	0.04	0.0001	0.014
4.3 1991						
VALMY	1.4	0.31	0.01	0.00	0.0000	0.000
COLSTRIP	-1.3	-0.13	-0.03	0.00	0.0000	0.000
BOARDMAN	4.0	1.13	0.09	0.00	0.0000	0.000
CENTRALIA	8.5	9.30	0.15	0.05	0.0001	0.001
BRIDGER	-8.2	-1.69	-0.61	-0.01	0.0000	-0.005
4.4 1991						
VALMY	0.0	0.00	0.00	0.00	0.0000	0.000
COLSTRIP	0.0	0.00	0.00	0.00	0.0000	0.000
BOARDMAN	0.0	0.00	0.00	0.00	0.0000	0.000
CENTRALIA	0.0	0.00	0.00	0.00	0.0000	0.000
BRIDGER	0.0	0.00	0.00	0.00	0.0000	0.000

Table H-7-4

AIR QUALITY IN PACIFIC NORTHWEST
(MICROGRAMS/CUBIC METER OF AIR)
High Northwest Loads

	GENERATION (AVG MW)	1 HOUR MAX. CONCENTRATION SO2	TSP	ANNUAL AVERAGE CONCENTRATION SO2	SO4	TSP
NOACTION 1993						
VALMY	61.7	13.49	0.35	0.10	0.0003	0.004
COLSTRIP	1066.8	102.73	27.63	0.47	0.0010	0.100
BOARDMAN	127.0	35.88	2.73	0.07	0.0002	0.007
CENTRALIA	625.3	684.08	11.19	3.57	0.0085	0.068
BRIDGER	967.4	199.77	72.07	1.76	0.0040	0.622
1.2 1993						
VALMY	0.1	0.02	0.00	0.00	0.0000	0.000
COLSTRIP	-1.3	-0.13	-0.03	0.00	0.0000	0.000
BOARDMAN	0.2	0.06	0.00	0.00	0.0000	0.000
CENTRALIA	-2.1	-2.30	-0.04	-0.01	0.0000	0.000
BRIDGER	-8.5	-1.76	-0.63	-0.02	0.0000	-0.005
4.1, B 1993						
VALMY	13.4	2.93	0.08	0.02	0.0001	0.001
COLSTRIP	12.3	1.18	0.32	0.01	0.0000	0.001
BOARDMAN	33.6	9.49	0.72	0.02	0.0001	0.002
CENTRALIA	32.8	35.88	0.59	0.19	0.0004	0.004
BRIDGER	70.3	14.52	5.24	0.13	0.0003	0.045
4.1, A 1993						
VALMY	4.8	1.05	0.03	0.01	0.0000	0.000
COLSTRIP	-0.7	-0.07	-0.02	0.00	0.0000	0.000
BOARDMAN	8.4	2.37	0.18	0.00	0.0000	0.000
CENTRALIA	12.2	13.35	0.22	0.07	0.0002	0.001
BRIDGER	17.8	3.68	1.33	0.03	0.0001	0.011
4.3 1993						
VALMY	0.6	0.13	0.00	0.00	0.0000	0.000
COLSTRIP	-1.1	-0.11	-0.03	0.00	0.0000	0.000
BOARDMAN	2.0	0.56	0.04	0.00	0.0000	0.000
CENTRALIA	-4.2	-4.59	-0.08	-0.02	-0.0001	0.000
BRIDGER	-6.7	-1.38	-0.50	-0.01	0.0000	-0.004
4.4 1993						
VALMY	0.0	0.00	0.00	0.00	0.0000	0.000
COLSTRIP	0.0	0.00	0.00	0.00	0.0000	0.000
BOARDMAN	0.0	0.00	0.00	0.00	0.0000	0.000
CENTRALIA	0.0	0.00	0.00	0.00	0.0000	0.000
BRIDGER	0.0	0.00	0.00	0.00	0.0000	0.000

Table H-7-4

AIR QUALITY IN PACIFIC NORTHWEST
(MICROGRAMS/CUBIC METER OF AIR)
High Northwest Loads

	GENERATION (AVG MW)	1 HOUR MAX. CONCENTRATION SO2	1 HOUR MAX. CONCENTRATION TSP	ANNUAL AVERAGE CONCENTRATION SO2	ANNUAL AVERAGE CONCENTRATION SO4	ANNUAL AVERAGE CONCENTRATION TSP
NOACTION 1995						
VALMY	79.9	17.47	0.46	0.14	0.0004	0.005
COLSTRIP	1089.5	104.92	28.22	0.48	0.0010	0.102
BOARDMAN	163.6	46.22	3.52	0.10	0.0003	0.009
CENTRALIA	850.1	930.01	15.22	4.86	0.0116	0.093
BRIDGER	1077.5	222.50	80.27	1.96	0.0045	0.693
1.2 1995						
VALMY	0.1	0.02	0.00	0.00	0.0000	0.000
COLSTRIP	0.2	0.02	0.01	0.00	0.0000	0.000
BOARDMAN	1.0	0.28	0.02	0.00	0.0000	0.000
CENTRALIA	-3.2	-3.50	-0.06	-0.02	0.0000	0.000
BRIDGER	-1.0	-0.21	-0.07	0.00	0.0000	-0.001
4.1, B 1995						
VALMY	7.7	1.68	0.04	0.01	0.0000	0.000
COLSTRIP	6.7	0.65	0.17	0.00	0.0000	0.001
BOARDMAN	17.6	4.97	0.38	0.01	0.0000	0.001
CENTRALIA	23.0	25.16	0.41	0.13	0.0003	0.003
BRIDGER	4.5	0.93	0.34	0.01	0.0000	0.003
4.1, A 1995						
VALMY	2.9	0.63	0.02	0.00	0.0000	0.000
COLSTRIP	1.7	0.16	0.04	0.00	0.0000	0.000
BOARDMAN	6.1	1.72	0.13	0.00	0.0000	0.000
CENTRALIA	3.2	3.50	0.06	0.02	0.0000	0.000
BRIDGER	-8.5	-1.76	-0.63	-0.02	0.0000	-0.005
4.3 1995						
VALMY	0.6	0.13	0.00	0.00	0.0000	0.000
COLSTRIP	0.9	0.09	0.02	0.00	0.0000	0.000
BOARDMAN	1.3	0.37	0.03	0.00	0.0000	0.000
CENTRALIA	-5.8	-6.35	-0.10	-0.03	-0.0001	-0.001
BRIDGER	0.0	0.00	0.00	0.00	0.0000	0.000
4.4 1995						
VALMY	0.0	0.00	0.00	0.00	0.0000	0.000
COLSTRIP	0.0	0.00	0.00	0.00	0.0000	0.000
BOARDMAN	0.0	0.00	0.00	0.00	0.0000	0.000
CENTRALIA	0.0	0.00	0.00	0.00	0.0000	0.000
BRIDGER	0.0	0.00	0.00	0.00	0.0000	0.000

Table H-7-4

AIR QUALITY IN PACIFIC NORTHWEST
(MICROGRAMS/CUBIC METER OF AIR)
High Northwest Loads

	GENERATION (AVG MW)	1 HOUR MAX. CONCENTRATION SO2	TSP	ANNUAL AVERAGE CONCENTRATION SO2	SO4	TSP
NOACTION 1997						
VALMY	56.0	12.24	0.32	0.09	0.0003	0.003
COLSTRIP	1149.3	110.68	29.77	0.51	0.0011	0.107
BOARDMAN	127.2	35.93	2.73	0.07	0.0002	0.007
CENTRALIA	868.6	950.25	15.55	4.96	0.0118	0.095
BRIDGER	1046.5	216.10	77.96	1.90	0.0044	0.673
1.2 1997						
VALMY	0.5	0.11	0.00	0.00	0.0000	0.000
COLSTRIP	0.1	0.01	0.00	0.00	0.0000	0.000
BOARDMAN	1.7	0.48	0.04	0.00	0.0000	0.000
CENTRALIA	-4.4	-4.81	-0.08	-0.03	-0.0001	0.000
BRIDGER	-0.5	-0.10	-0.04	0.00	0.0000	0.000
4.1, B 1997						
VALMY	17.0	3.72	0.10	0.03	0.0001	0.001
COLSTRIP	7.0	0.67	0.18	0.00	0.0000	0.001
BOARDMAN	43.1	12.18	0.93	0.03	0.0001	0.002
CENTRALIA	40.8	44.64	0.73	0.23	0.0006	0.004
BRIDGER	35.6	7.35	2.65	0.06	0.0001	0.023
4.1, A 1997						
VALMY	1.1	0.24	0.01	0.00	0.0000	0.000
COLSTRIP	1.9	0.18	0.05	0.00	0.0000	0.000
BOARDMAN	3.4	0.96	0.07	0.00	0.0000	0.000
CENTRALIA	-3.0	-3.28	-0.05	-0.02	0.0000	0.000
BRIDGER	1.5	0.31	0.11	0.00	0.0000	0.001
4.3 1997						
VALMY	0.4	0.09	0.00	0.00	0.0000	0.000
COLSTRIP	0.7	0.07	0.02	0.00	0.0000	0.000
BOARDMAN	2.8	0.79	0.06	0.00	0.0000	0.000
CENTRALIA	-6.7	-7.33	-0.12	-0.04	-0.0001	-0.001
BRIDGER	0.1	0.02	0.01	0.00	0.0000	0.000
4.4 1997						
VALMY	0.0	0.00	0.00	0.00	0.0000	0.000
COLSTRIP	0.0	0.00	0.00	0.00	0.0000	0.000
BOARDMAN	-0.1	-0.03	0.00	0.00	0.0000	0.000
CENTRALIA	0.0	0.00	0.00	0.00	0.0000	0.000
BRIDGER	0.0	0.00	0.00	0.00	0.0000	0.000

Table H-7-4

AIR QUALITY IN PACIFIC NORTHWEST
(MICROGRAMS/CUBIC METER OF AIR)
High Northwest Loads

	GENERATION (AVG MW)	1 HOUR MAX. CONCENTRATION SO2	1 HOUR MAX. CONCENTRATION TSP	ANNUAL AVERAGE CONCENTRATION SO2	ANNUAL AVERAGE CONCENTRATION SO4	ANNUAL AVERAGE CONCENTRATION TSP
NOACTION 2001						
VALMY	91.2	19.94	0.52	0.15	0.0005	0.005
COLSTRIP	1175.0	113.15	30.43	0.52	0.0011	0.110
BOARDMAN	118.1	33.36	2.54	0.07	0.0002	0.007
CENTRALIA	975.1	1066.76	17.45	5.57	0.0133	0.106
BRIDGER	1024.2	211.50	76.30	1.86	0.0043	0.659
1.2 2001						
VALMY	-0.8	-0.17	0.00	0.00	0.0000	0.000
COLSTRIP	0.0	0.00	0.00	0.00	0.0000	0.000
BOARDMAN	0.2	0.06	0.00	0.00	0.0000	0.000
CENTRALIA	0.5	0.55	0.01	0.00	0.0000	0.000
BRIDGER	0.0	0.00	0.00	0.00	0.0000	0.000
4.1, B 2001						
VALMY	31.2	6.82	0.18	0.05	0.0002	0.002
COLSTRIP	0.1	0.01	0.00	0.00	0.0000	0.000
BOARDMAN	61.0	17.23	1.31	0.04	0.0001	0.003
CENTRALIA	9.6	10.50	0.17	0.05	0.0001	0.001
BRIDGER	3.6	0.74	0.27	0.01	0.0000	0.002
4.1, A 2001						
VALMY	12.5	2.73	0.07	0.02	0.0001	0.001
COLSTRIP	0.0	0.00	0.00	0.00	0.0000	0.000
BOARDMAN	23.8	6.72	0.51	0.01	0.0000	0.001
CENTRALIA	0.3	0.33	0.01	0.00	0.0000	0.000
BRIDGER	0.4	0.08	0.03	0.00	0.0000	0.000
4.3 2001						
VALMY	-16.1	-3.52	-0.09	-0.03	-0.0001	-0.001
COLSTRIP	0.0	0.00	0.00	0.00	0.0000	0.000
BOARDMAN	-34.1	-9.63	-0.73	-0.02	-0.0001	-0.002
CENTRALIA	1.1	1.20	0.02	0.01	0.0000	0.000
BRIDGER	0.4	0.08	0.03	0.00	0.0000	0.000
4.4 2001						
VALMY	0.0	0.00	0.00	0.00	0.0000	0.000
COLSTRIP	0.0	0.00	0.00	0.00	0.0000	0.000
BOARDMAN	0.0	0.00	0.00	0.00	0.0000	0.000
CENTRALIA	0.0	0.00	0.00	0.00	0.0000	0.000
BRIDGER	0.0	0.00	0.00	0.00	0.0000	0.000

Table H-7-4
AIR QUALITY IN PACIFIC NORTHWEST
(MICROGRAMS/CUBIC METER OF AIR)
High Northwest Loads

	GENERATION (AVG MW)	1 HOUR MAX. CONCENTRATION SO2	1 HOUR MAX. CONCENTRATION TSP	ANNUAL AVERAGE CONCENTRATION SO2	ANNUAL AVERAGE CONCENTRATION SO4	ANNUAL AVERAGE CONCENTRATION TSP
NOACTION 2005						
VALMY	138.9	30.36	0.79	0.24	0.0007	0.008
COLSTRIP	1159.9	111.70	30.04	0.51	0.0011	0.108
BOARDMAN	136.5	38.56	2.93	0.08	0.0002	0.008
CENTRALIA	960.4	1050.68	17.19	5.49	0.0131	0.105
BRIDGER	943.7	194.87	70.31	1.72	0.0039	0.607
1.2 2005						
VALMY	-1.1	-0.24	-0.01	0.00	0.0000	0.000
COLSTRIP	0.0	0.00	0.00	0.00	0.0000	0.000
BOARDMAN	-1.9	-0.54	-0.04	0.00	0.0000	0.000
CENTRALIA	0.0	0.00	0.00	0.00	0.0000	0.000
BRIDGER	0.0	0.00	0.00	0.00	0.0000	0.000
4.1, B 2005						
VALMY	30.8	6.73	0.18	0.05	0.0002	0.002
COLSTRIP	0.0	0.00	0.00	0.00	0.0000	0.000
BOARDMAN	62.9	17.77	1.35	0.04	0.0001	0.003
CENTRALIA	0.4	0.44	0.01	0.00	0.0000	0.000
BRIDGER	0.0	0.00	0.00	0.00	0.0000	0.000
4.1, A 2005						
VALMY	11.3	2.47	0.06	0.02	0.0001	0.001
COLSTRIP	0.0	0.00	0.00	0.00	0.0000	0.000
BOARDMAN	24.5	6.92	0.53	0.01	0.0000	0.001
CENTRALIA	-0.3	-0.33	-0.01	0.00	0.0000	0.000
BRIDGER	0.0	0.00	0.00	0.00	0.0000	0.000
4.3 2005						
VALMY	-13.5	-2.95	-0.08	-0.02	-0.0001	-0.001
COLSTRIP	0.0	0.00	0.00	0.00	0.0000	0.000
BOARDMAN	-27.2	-7.68	-0.58	-0.02	0.0000	-0.001
CENTRALIA	0.0	0.00	0.00	0.00	0.0000	0.000
BRIDGER	0.0	0.00	0.00	0.00	0.0000	0.000
4.4 2005						
VALMY	0.0	0.00	0.00	0.00	0.0000	0.000
COLSTRIP	0.0	0.00	0.00	0.00	0.0000	0.000
BOARDMAN	0.0	0.00	0.00	0.00	0.0000	0.000
CENTRALIA	0.0	0.00	0.00	0.00	0.0000	0.000
BRIDGER	0.0	0.00	0.00	0.00	0.0000	0.000

H-8

Coal Consumption, Land Use, and Water Consumption Impacts Related to Operation of Existing Coal-Fired Generating Plants

Coal Mining and Coal-Fired Generation

Impacts of coal mining, processing and transportation, as well as impacts of the construction and operation of coal-fired generating plants in general are described in Appendices F and H-1b. This discussion is intended to present information pertinent to the specific, existing coal-fired generating plants addressed in the analyses of alternatives performed with the Systems Analysis Model (SAM). Since the changes in generation among alternatives for the Corette plant were small and the plant itself is quite small, an analysis of coal use, land use, and water consumption impacts was not performed for this plant.

Over half the nation's demonstrated coal reserves lies west of the Mississippi River, mostly in the northern Great Plains and Rocky Mountain provinces (Table H-8-1). Coal resources in these areas have several common characteristics: the Federal government owns most of the coal lands; competition for surface land use is relatively low; much of the coal is near the surface and can be easily strip-mined; the coal has a low energy value and a low sulfur content; and water resources in mining areas are scarce. In Wyoming and Montana, conditions for surface mining approach the ideal, with coal seams 50-75 feet thick and overburdens 30-50 feet thick. Over 90 percent of Western coal is mined at the surface (Office of Technology Assessment, 1979), and the majority of Western strip-mines have been open since the late 1960s.

Table H-8-1

DEMONSTRATED COAL RESERVE BASE FOR SELECTED WESTERN STATES (Millions of Short Tons)

State	Mining Method	Bituminous	Subbituminous	Lignite	Total Tonnage
Arizona	Surface	281	0	0	281
Montana	Surface	0	33,625	15,765	49,390
New Mexico	Surface	815	1,758	0	2,573
Washington	Surface	0	129	9	138
Wyoming	Surface	548	26,564	0	27,112

Sources: National Coal Association, "1983 Facts About Coal" (Washington, D.C.: National Coal Association, 1983).
Office of Coal/Nuclear Electric Power and Alternative Fuels, Energy Information Administration, U.S. Department of Energy.

Table H-8-2 shows 1980-1984 coal receipts for PNW power plants. Although plants usually stockpile coal for future use, these receipts provide a relatively accurate measure of annual amounts of coal burned per individual power plant. Receipts represent coal use for all units currently operating at a generating station.

Table H-8-2

COAL RECEIPTS AT PACIFIC NORTHWEST POWER PLANTS
(tons)

Power Plant	Year 1980	1981	1982	1983	1984
Boardman	1,075,000	1,164,000	1,135,000	0	352,000
Centralia	4,00,000	4,400,000	4,400,000	3,600,000	3,600,000
Colstrip	2,542,000	2,692,000	2,103,000	1,499,000	4,552,000
Bridger	5,839,000	6,449,000	6,025,000	4,317,000	4,462,000
Valmy	0	337,000	716,000	822,000	635,000

Sources: Energy Information Administration, U.S. Dept. of Energy, "Cost and Quality of Fuels for Electric Utility Plants," U.S. Department of Energy, Washington, D.C., 1981-1985.

Table H-8-3 identifies surface coal mines serving coal-fired power plants addressed in the EIS. Several of these mines provide coal to more than one power plant; therefore, tonnage figures for individual mines do not necessarily indicate production dedicated to a single station. For example, mines in Campbell County, Wyoming, supply coal to local plants as well as to the Boardman unit in Oregon. In contrast, the Centralia mine, in Washington State, supplies only the Centralia units.

Table H-8-3

COAL MINING ACTIVITIES RELATED TO PACIFIC NORTHWEST POWER PLANTS

Power Plant	Location of Fuel Source	Mine	Over-burden (feet)	Ratio (Cover/ Coal)	Tons Mined 1982	1983	1984
Boardman	Campbell, WY	Belle Ayre	98	1.3:1	15,161,298	13,825,242	13,417,442
Centralia	Lewis, WA	Centralia	250	8:1	4,200,00	4,120,000	3,690,000
Colstrip	Rosebud, MT	Rosebud	150	4:1	9,446,905	9,564,905	11,907,099
Jim Bridger	Sweetwater, WY	Bridger	120	6:1	6,100,00	4,300,000	4,300,000
Valmy	Humbolt, UT	Underground	---	---	---	---	---

Source: Keystone Coal Industry Manual, 1983-1985.
Note: Underground mines are shown by name and location for completeness but they do not contribute to land disturbance to the extent that surface mines do.

Table H-8-4 shows past and present reclamation efforts associated with coal plants in the PNW. The values shown for land disturbed represent only those acres affected by direct coal removal, and do not include other land-use activities such as roads and power line corridors. The ratio of tons extracted to total land disrupted is a function of coal seam thickness and mining methods used.

Table H-8-4

COAL SURFACE MINING LAND RECLAMATION ACTIVITIES RELATED TO PACIFIC NORTHWEST POWER PLANTS

Power Plant	Mine	Coal Mined BY Oct 86 1/ (tons)	Total Land Disturbed 2/ (acres)	Total Land Reclaimed 3/ (acres)
Boardman	Belle Ayre	136,013,303	2,316	451
Centralia	Centralia	54,453,000	3,200	900
Colstrip	Rosebud	118,456,701	2,087	1,946
Jim Bridger	Bridger	57,236,000	3,800	1,166

Sources: Personal communication with Office of Surface Mining staff, U.S. Dept of the Interior, Denver, Colorado, December 1985-January 1986.

Personal communication with Land Quality staff, Wyoming Dept. of Environmental Quality, December 1985-January 1986.

Personal communication with Mining and Minerals Division staff, New Mexico Dept. of Energy and Minerals, January 1986.

Personal communication with Manager of Permitting, Washington Irrigation and Development Company, January 1986.

1/ Tonnage mined to date is an approximate figure based on available references. None of the figures provided include tonnage mined prior to 1972. Figures for Belle Ayre and Bridger extend through 1985; for Centralia and Rosebud through 1984.
2/ Does not include land used for facilities, road, or power line corridor.
3/ Includes land in all reclamation phases.

Analysis of Coal, Land, and Water Use for Existing Coal Plants Included in SAM

For BPA's Intertie Development and Use Environmental Impact Statement (EIS), the Office of Applied Energy Studies at Washington State University (1987) developed coefficients under contract to BPA for use in relating electrical generation at coal-fired power plants to requirements for fuel, cooling water, and to land disturbance by strip mining operations. These same coefficients were used in this EIS to assess coal consumption, water use, and land use impacts related to coal plants.

Coal Use Coefficients: The steps followed to derive the coal use coefficient (amount of coal used per unit of electricity generated, e.g., tons of coal/MWh) at each power plant were: (1) relate MWh generation to heat requirements using plant heat rates and then; (2) relate heat requirements to fuel requirements using heating values of the coal in use at the plant. The sources used to obtain these data included publications of the U.S. Energy Information Administration ("Cost and Quality of Fuels for Electric Utility Plants" and "Historical Plant Cost and Annual Production Expenses for Selected Electric Plants" various years). Formulae for determining changes in fuel use using the coefficients so derived are reported in Table H-8-5.

Table H-8-5

FORMULAE FOR CALCULATING COAL USE CHANGES ASSOCIATED WTIH CHANGES IN ANNUAL GENERATION FOR PACIFIC NORTHWEST COAL PLANTS (Results in units of 1,000's of tons of coal)

Valmy	MWs * 4.36
Colstrip	MWs * 5.716
Boardman	MWs * 5.882
Centralia	MWs * 5.948
Bridger	MWs * 5.251

Land Disturbance Coefficients: These coefficients were used to determine land disturbance associated with surface coal mining to supply coal-fired power plants serving the Pacific Northwest. The units are acres/MWh. The assumption is made that the disturbed acreage increases at the rate at which the amount of coal mined increases. Mining from thin coal seams will produce more disturbance per MWh than mining from thick seams. The data used to derive these coefficients came from various sources. Some were obtained from the mine operators, some from a proprietary data collection of the contractor, and some from the Keystone Coal Industry Manual published annually by McGraw-Hill. The tons per acre of coal mined was obtained directly in some cases, but in others it was derived from the overburden thickness and overburden ratio together with the density of the coal. Formulae for the calculation of changes in land disturbance at surface coal mines are shown in Table H-8-6.

Table H-8-6

FORMULAE FOR DETERMINING LAND DISTURBANCE CHANGES AT COAL MINES ASSOCIATED WITH CHANGES IN ANNUAL GENERATION FOR PACIFIC NORTHWEST PLANTS (Results in acres per year; coal use values derived using the formulae in Table H-8-5)

Valmy	Underground Mine - Not Applicable
Colstrip	Coal Use **E** 53.592
Boardman	Coal Use **E** 58.722
Centralia	Coal Use **E** 17.017
Bridger	Coal Use **E** 15.062

Water Use Coefficients: The coefficients used are presented in Table H-8-7. They were derived from data in Thomas, J. L., 1975, Water Requirements and Wastewater Potential of Coal-Energy Facilities (in Montana Academy of Sciences (ed.), Proceedings of the Fort Union Coal Field Symposium, Vol. 2, Aquatic Ecosystems, Hagen Printing Company, Billings, MT, Pp. 179-190). Thomas gave data for water requirements of alternate cooling systems for a 1000 MWe plant operating at 70 percent capacity. The assumption is made that water use is proportional to generation level and can be expressed in units of acre-feet per average annual MW using Thomas' data. The assumption is generally valid although the coefficients used probably result in a slight overestimation of changes in water use. However, this is strictly true only if plants are equipped with variable speed pumps. In practice, pumps may be left running during nongenerating periods to enable fast startup on demand.

Table H-8-7

FORMULAE FOR DETERMINING WATER USE FROM ANNUAL GENERATION FOR PACIFIC NORTHWEST PLANTS (Results in units of acre-feet of water)

Valmy	MWs*14.35
Colstrip	MWs*21.6
Boardman	MWs*24.4
Centralia	MWs*21.6
Bridger	MWs*21.6

All comparisons of water use by plants and discharge to surface waters were based on discharge conditions in the early 1980s. Actual stream flows in the future may be different, but no attempt was made to forecast actual stream flows for future years.

For most plants using water from surface streams, change in water use was compared to the minimum daily stream discharge for the period of record of the source water. This is a very conservative analysis and represents an extreme worst case scenario.

Measurements of stream discharge reported by the U.S. Geological survey (USGS) are estimates made with varying precision. This precision is generally known and is reported for most USGS gauge stations. Records rated as "excellent" signify that 95 percent of measured daily discharges are within 5 percent of the true value, "good" ratings are within 10 percent, "fair" within 15 percent, and "poor" have less than fair accuracy (John Bader, pers. comm., May 1987). Levels of change within the error range would be unmeasureable. In addition, surface runoff in any area varies from year to year depending largely on meteorological conditions. This variation is usually much greater than the measurement error.

For the Valmy Plant which uses groundwater for cooling, a similar approach was used, but changes in water use were related to acquifer recharge rather than a streamflow. Groundwater resources are less accurately measured than surface water resources. Aquifer recharge is the volume of water which enters a groundwater basin, usually measured on an annual basis. It comes from precipitation in the basin, seepage from surface water, and inflow of groundwater. Often, recharge is only roughly estimated from water budgets, or is not known at all.

Results of Coal Use, Land Disturbance, and Water Use Impact Analysis

The results of the coal use analysis are shown in Table H-8-8 and 9. The results of the land disturbance analysis are shown in Table H-8-10 and 11. Only results for expected loads and gas prices and for high Northwest loads are provided. Results for the other sensitivity assumptions (Low Northwest loads, High Southwest Loads, Low Southwest Loads, High Gas Price, and Low Gas Price) are available upon request. In Tables H-8-8 through H-8-11, the values given for "No Action" for each plant are actual projected values derived using the respective coefficients described above. Values given for each other alternative by plant are differences for that alternative from the value given above it by plant for "No Action." Results of the water use analysis are provided in Chapter 4 of the main body of this EIS.

Table H-8-8

FUEL USE CHANGES

(1,000s OF TONS OF COAL)

Medium Loads and Gas Prices

YEAR	ALTERNATIVE	VALMY	COLSTRIP	BOARDMAN	CENTRALIA	BRIDGER
1989	NOACTION	63.220	5403.335	125.875	1195.548	2528.356
1989	1.2	-0.436	0.000	-0.588	0.000	0.000
1989	4.1, B	5.668	49.158	8.235	-14.275	-378.597
1989	4.1, A	6.540	35.439	11.176	-32.714	-360.219
1989	4.3	13.516	-19.434	12.940	201.637	14.703
1989	4.4	0.000	0.000	0.000	0.000	0.000
1990	NOACTION	122.952	5463.925	291.747	2278.679	3900.443
1990	1.2	1.744	-9.717	7.647	32.119	-14.703
1990	4.1, B	-30.520	8.002	-74.701	17.249	192.187
1990	4.1, A	-20.492	4.573	-50.585	36.877	153.854
1990	4.3	-3.924	-28.009	-4.117	49.368	-122.873
1990	4.4	0.000	0.000	0.000	0.000	0.000
1991	NOACTION	152.164	5449.063	374.095	2508.272	4240.183
1991	1.2	7.848	-9.717	25.293	7.732	-44.109
1991	4.1, B	-45.344	22.864	-131.757	-129.667	161.206
1991	4.1, A	-30.956	9.146	-89.995	-113.012	121.823
1991	4.3	-23.108	-71.450	-54.114	-82.677	-424.806
1991	4.4	0.000	0.000	0.000	0.000	0.000
1992	NOACTION	132.980	5486.217	378.213	2573.105	4010.189
1992	1.2	2.180	-25.722	12.940	19.033	-29.406
1992	4.1, B	-34.444	28.009	-129.404	4.758	165.931
1992	4.1, A	-24.416	22.293	-98.229	28.550	100.819
1992	4.3	-27.032	-88.598	-79.995	-104.090	-96.619
1992	4.4	0.000	0.000	0.000	0.000	0.000
1993	NOACTION	146.932	5789.165	370.566	3224.411	4244.909
1993	1.2	7.412	-0.571	31.175	-24.981	-39.382
1993	4.1, B	-45.780	46.871	-124.698	-10.111	173.808
1993	4.1, A	-23.980	20.578	-68.819	7.138	107.120
1993	4.3	-29.648	-60.589	-76.466	-198.068	-235.770
1993	4.4	0.000	0.000	0.000	0.000	0.000
1994	NOACTION	213.204	5902.913	539.379	3873.338	5033.608
1994	1.2	6.540	-2.286	25.293	-19.628	-12.077
1994	4.1, B	-71.504	36.583	-217.046	23.792	173.283
1994	4.1, A	-30.520	28.009	-119.405	-13.680	75.090
1994	4.3	-43.164	-90.884	-118.816	-217.697	-228.943
1994	4.4	0.000	0.000	0.000	0.000	0.000
1995	NOACTION	213.640	6000.657	552.908	4263.526	5207.942
1995	1.2	3.924	2.858	13.529	-35.688	-22.579
1995	4.1, B	-63.656	37.154	-192.341	-30.335	103.445
1995	4.1, A	-23.544	21.149	-85.877	-38.067	42.008
1995	4.3	-46.216	-44.585	-114.111	-110.633	-137.051
1995	4.4	0.000	0.000	0.000	0.000	0.000

Table H-8-8
FUEL USE CHANGES
(1,000s OF TONS OF COAL)
Medium Loads and Gas Prices

YEAR	ALTERNATIVE	VALMY	COLSTRIP	BOARDMAN	CENTRALIA	BRIDGER
1996	NOACTION	214.512	5864.044	548.202	4226.054	4980.048
1996	1.2	4.796	3.429	17.646	-10.706	-14.178
1996	4.1, B	-59.296	72.593	-196.459	60.075	109.221
1996	4.1, A	-17.876	35.439	-74.701	2.379	75.089
1996	4.3	-39.676	-48.586	-102.347	-74.350	-113.947
1996	4.4	0.000	0.000	0.000	0.000	0.000
1997	NOACTION	185.736	6306.463	567.025	4774.459	5185.887
1997	1.2	5.668	-4.002	24.704	-29.740	2.101
1997	4.1, B	-45.780	41.155	-216.458	66.023	143.878
1997	4.1, A	-2.616	21.720	-38.233	0.000	39.382
1997	4.3	-36.188	-53.731	-114.699	-280.746	-127.599
1997	4.4	0.000	0.000	0.000	0.000	0.000
1998	NOACTION	200.560	6063.533	536.438	4642.414	4710.147
1998	1.2	0.000	-1.144	17.058	-19.628	4.201
1998	4.1, B	-41.420	89.741	-138.227	155.243	172.758
1998	4.1, A	16.132	43.441	37.645	93.978	106.070
1998	4.3	-57.988	-74.308	-155.285	-357.475	-89.792
1998	4.4	0.000	0.000	0.000	0.000	0.000
1999	NOACTION	237.184	6371.625	606.434	5067.101	4970.071
1999	1.2	1.744	-11.432	6.470	-8.327	-7.877
1999	4.1, B	-3.924	119.465	-58.820	147.510	149.654
1999	4.1, A	39.240	82.311	102.347	95.168	95.043
1999	4.3	-71.940	-152.045	-181.166	-334.873	-147.028
1999	4.4	0.000	0.000	0.000	0.000	0.000
2000	NOACTION	263.780	6170.994	538.791	4918.996	4949.067
2000	1.2	3.488	1.715	31.175	-28.550	-3.150
2000	4.1, B	57.988	142.329	107.052	270.634	234.720
2000	4.1, A	57.552	93.743	186.459	130.261	134.951
2000	4.3	-26.596	-48.586	-97.641	-204.016	-90.317
2000	4.4	0.000	0.000	0.000	0.000	0.000
2001	NOACTION	365.804	6388.202	617.022	5086.729	4821.468
2001	1.2	-1.744	1.715	9.999	-33.904	-2.625
2001	4.1, B	63.656	108.033	141.168	262.307	227.368
2001	4.1, A	51.012	58.875	168.225	176.656	121.298
2001	4.3	-34.880	-62.305	-109.993	-209.370	-50.410
2001	4.4	0.000	0.000	0.000	0.000	0.000
2002	NOACTION	433.820	6181.283	742.308	5105.168	4826.719
2002	1.2	-2.616	-5.145	12.352	-5.353	-5.251
2002	4.1, B	104.640	128.610	217.046	168.328	149.654
2002	4.1, A	56.680	52.587	104.700	88.625	70.888
2002	4.3	-41.856	-69.736	-212.340	-93.384	-64.062
2002	4.4	0.000	0.000	0.000	0.000	0.000

Table H-8-8
FUEL USE CHANGES
(1,000s OF TONS OF COAL)
Medium Loads and Gas Prices

YEAR	ALTERNATIVE	VALMY	COLSTRIP	BOARDMAN	CENTRALIA	BRIDGER
2003	NOACTION	494.424	6366.481	664.666	5258.626	4898.133
2003	1.2	-3.924	1.143	12.352	-13.085	-11.552
2003	4.1, B	82.840	146.901	246.456	192.121	194.287
2003	4.1, A	15.260	29.151	107.052	8.922	39.908
2003	4.3	-54.500	-148.616	-178.813	-261.117	-151.754
2003	4.4	0.000	0.000	0.000	0.000	0.000
2004	NOACTION	528.868	6281.884	568.201	4995.725	4486.455
2004	1.2	-3.052	-9.145	4.706	-16.060	-0.525
2004	4.1, B	123.388	164.049	379.389	228.998	259.399
2004	4.1, A	59.732	75.451	185.283	109.443	114.997
2004	4.3	-40.984	-74.879	-27.645	-126.098	-71.939
2004	4.4	0.000	0.000	0.000	0.000	0.000
2005	NOACTION	563.312	6298.460	678.783	5058.774	4483.829
2005	1.2	-4.796	-6.860	8.235	-29.740	-3.151
2005	4.1, B	114.668	168.051	384.683	201.042	222.117
2005	4.1, A	64.964	50.873	214.105	96.952	92.417
2005	4.3	-33.136	-72.594	-29.998	-126.692	-58.811
2005	4.4	0.000	0.000	0.000	0.000	0.000
2006	NOACTION	593.832	6312.179	734.074	5058.179	4501.157
2006	1.2	-5.232	-4.002	8.823	-36.283	-1.050
2006	4.1, B	98.100	166.335	378.213	262.901	228.943
2006	4.1, A	44.908	39.440	187.048	84.461	80.340
2006	4.3	-34.444	-112.606	-62.349	-96.953	-86.642
2006	4.4	0.000	0.000	0.000	0.000	0.000
2007	NOACTION	586.420	6381.914	1048.761	5118.254	4373.558
2007	1.2	-8.284	-8.003	18.234	-0.595	-4.201
2007	4.1, B	67.580	109.747	425.269	208.180	173.283
2007	4.1, A	20.928	5.716	147.638	27.956	54.085
2007	4.3	-42.728	-79.453	-78.231	-60.075	-66.163
2007	4.4	0.000	0.000	0.000	0.000	0.000
2008	NOACTION	626.968	6364.195	1351.095	5106.358	4457.049
2008	1.2	-9.156	-0.571	0.000	-20.818	-4.726
2008	4.1, B	61.476	120.607	371.154	204.611	139.677
2008	4.1, A	30.956	9.145	121.757	27.361	21.529
2008	4.3	-58.424	-88.598	-134.698	-57.101	-52.510
2008	4.4	0.000	0.000	0.000	0.000	0.000

Table H-8-9
FUEL USE CHANGES
(1,000s OF TONS OF COAL)
High Northwest Loads

YEAR	ALTERNATIVE	VALMY	COLSTRIP	BOARDMAN	CENTRALIA	BRIDGER
1989	NOACTION	135.160	5601.108	261.749	1838.527	3192.608
1989	1.2	15.260	-4.573	27.645	101.116	-30.456
1989	4.1, B	-30.956	66.877	-30.586	-459.186	-160.680
1989	4.1, A	-2.180	12.575	-15.293	24.981	-33.081
1989	4.3	15.696	-4.573	28.234	106.469	-28.880
1989	4.4	0.000	0.000	0.000	0.000	0.000
1990	NOACTION	220.180	5772.017	575.260	2654.592	4751.630
1990	1.2	6.104	-14.861	19.999	0.595	-43.058
1990	4.1, B	-27.904	6.288	-104.111	-61.859	258.874
1990	4.1, A	19.620	-8.574	45.880	69.592	8.926
1990	4.3	6.540	-12.575	21.763	-1.189	-41.483
1990	4.4	0.000	0.000	0.000	0.000	0.000
1991	NOACTION	253.316	5737.149	691.723	2871.694	5029.933
1991	1.2	3.924	-6.859	17.646	18.439	-47.259
1991	4.1, B	30.956	88.026	65.290	228.403	351.817
1991	4.1, A	26.160	4.001	69.408	134.425	114.472
1991	4.3	6.104	-7.431	23.528	50.558	-43.058
1991	4.4	0.000	0.000	0.000	0.000	0.000
1992	NOACTION	228.900	5967.504	724.662	2925.226	5063.539
1992	1.2	1.308	-8.003	14.117	-28.550	-23.629
1992	4.1, B	37.932	81.739	142.933	245.058	86.642
1992	4.1, A	17.004	-9.145	64.702	75.540	-60.911
1992	4.3	3.052	-13.147	21.175	-26.171	-23.629
1992	4.4	0.000	0.000	0.000	0.000	0.000
1993	NOACTION	269.012	6097.829	747.014	3719.284	5079.817
1993	1.2	0.436	-7.431	1.176	-12.491	-44.633
1993	4.1, B	58.424	70.306	197.635	195.094	369.145
1993	4.1, A	20.928	-4.002	49.409	72.566	93.468
1993	4.3	2.616	-6.288	11.764	-24.982	-35.182
1993	4.4	0.000	0.000	0.000	0.000	0.000
1994	NOACTION	343.568	6185.284	940.532	4688.808	5620.146
1994	1.2	0.872	-4.572	3.529	-48.774	-3.676
1994	4.1, B	50.140	50.873	160.579	170.708	160.680
1994	4.1, A	12.208	10.861	40.586	-103.495	40.957
1994	4.3	2.180	-3.429	4.117	-49.368	-6.827
1994	4.4	0.000	0.000	0.000	0.000	0.000
1995	NOACTION	348.364	6227.582	962.295	5056.395	5657.953
1995	1.2	0.436	1.143	5.882	-19.033	-5.251
1995	4.1, B	33.572	38.297	103.523	136.804	23.629
1995	4.1, A	12.644	9.717	35.880	19.034	-44.633
1995	4.3	2.616	5.145	7.647	-34.498	0.000
1995	4.4	0.000	0.000	0.000	0.000	0.000

Table H-8-9

FUEL USE CHANGES
(1,000s OF TONS OF COAL)
High Northwest Loads

YEAR	ALTERNATIVE	VALMY	COLSTRIP	BOARDMAN	CENTRALIA	BRIDGER
1996	NOACTION	360.572	6180.711	986.411	5023.681	5472.067
1996	1.2	1.744	-2.287	5.882	-8.922	-16.278
1996	4.1, B	23.544	16.004	67.643	16.655	77.190
1996	4.1, A	3.924	-1.144	7.058	-4.163	12.603
1996	4.3	3.488	-1.144	11.176	9.517	-17.328
1996	4.4	0.000	0.000	0.000	0.000	0.000
1997	NOACTION	244.160	6569.399	748.190	5166.433	5495.171
1997	1.2	2.180	0.571	9.999	-26.171	-2.625
1997	4.1, B	74.120	40.012	253.514	242.679	186.935
1997	4.1, A	4.796	10.860	19.999	-17.844	7.877
1997	4.3	1.744	4.001	16.470	-39.851	0.525
1997	4.4	0.000	0.000	-0.588	0.000	0.000
1998	NOACTION	283.400	6364.195	785.835	5089.704	5165.934
1998	1.2	3.052	-3.429	8.235	-1.190	-9.452
1998	4.1, B	61.476	25.151	194.106	85.651	93.468
1998	4.1, A	4.360	-1.144	14.705	8.327	-7.351
1998	4.3	5.232	-5.716	19.411	10.112	-2.100
1998	4.4	0.436	0.000	1.176	0.000	0.000
1999	NOACTION	254.624	6702.582	655.255	5632.756	5464.190
1999	1.2	-0.436	0.000	11.176	-11.301	-3.150
1999	4.1, B	129.928	5.145	388.800	-49.963	32.557
1999	4.1, A	49.704	-2.858	147.050	-0.595	0.000
1999	4.3	-61.912	-0.571	-155.285	-2.974	-1.050
1999	4.4	0.000	0.000	0.000	0.000	0.000
2000	NOACTION	297.352	6492.233	599.376	5593.500	5510.924
2000	1.2	1.744	0.000	15.881	-4.164	-0.525
2000	4.1, B	142.136	0.000	406.446	27.361	51.985
2000	4.1, A	55.808	0.571	160.579	-2.379	-1.050
2000	4.3	-67.144	0.000	-180.577	4.758	5.776
2000	4.4	0.000	0.000	0.000	0.000	0.000
2001	NOACTION	397.632	6716.300	694.664	5799.895	5378.074
2001	1.2	-3.488	0.000	1.176	2.974	0.000
2001	4.1, B	136.032	0.571	358.802	57.101	18.904
2001	4.1, A	54.500	0.000	139.992	1.785	2.101
2001	4.3	-70.196	0.000	-200.576	6.543	2.101
2001	4.4	0.000	0.000	0.000	0.000	0.000
2002	NOACTION	468.700	6455.650	776.424	5633.351	5233.146
2002	1.2	-3.488	0.000	-8.823	-2.379	0.000
2002	4.1, B	149.548	0.000	382.330	26.171	0.525
2002	4.1, A	55.808	0.000	144.697	5.353	-3.150
2002	4.3	-71.504	0.000	-220.575	1.190	-1.575
2002	4.4	0.000	0.000	0.000	0.000	0.000

Table H-8-9

FUEL USE CHANGES
(1,000s OF TONS OF COAL)
High Northwest Loads

YEAR	ALTERNATIVE	VALMY	COLSTRIP	BOARDMAN	CENTRALIA	BRIDGER
2003	NOACTION	542.384	6660.283	724.662	5964.654	5353.395
2003	1.2	-3.924	0.000	0.000	-2.379	0.000
2003	4.1, B	125.568	0.000	372.331	18.439	0.000
2003	4.1, A	50.140	0.000	145.285	0.000	0.000
2003	4.3	-61.912	0.000	-191.753	0.595	0.000
2003	4.4	0.000	0.000	0.000	0.000	0.000
2004	NOACTION	575.956	6675.717	685.253	5691.046	5029.933
2004	1.2	-2.180	0.000	2.941	-1.190	0.000
2004	4.1, B	145.624	0.000	379.389	7.732	0.000
2004	4.1, A	57.116	0.000	134.110	-0.595	0.000
2004	4.3	-64.528	0.000	-132.933	-1.190	0.000
2004	4.4	0.000	0.000	0.000	0.000	0.000
2005	NOACTION	605.604	6629.989	802.893	5712.459	4955.369
2005	1.2	-4.796	0.000	-11.176	0.000	0.000
2005	4.1, B	134.288	0.000	369.978	2.379	0.000
2005	4.1, A	49.268	0.000	144.109	-1.785	0.000
2005	4.3	-58.860	0.000	-159.990	0.000	0.000
2005	4.4	0.000	0.000	0.000	0.000	0.000
2006	NOACTION	634.380	6639.134	799.952	5735.656	4984.249
2006	1.2	-1.744	0.000	-6.470	0.000	0.000
2006	4.1, B	111.180	0.000	372.331	1.784	0.000
2006	4.1, A	45.344	0.000	149.403	0.000	0.000
2006	4.3	-61.476	0.000	-147.638	0.000	0.000
2006	4.4	0.000	0.000	0.000	0.000	0.000
2007	NOACTION	612.580	6630.560	1168.753	5679.745	4718.023
2007	1.2	-1.308	0.000	-1.176	0.000	0.000
2007	4.1, B	101.588	0.000	449.385	0.000	0.000
2007	4.1, A	37.496	0.000	170.578	0.000	0.525
2007	4.3	-64.528	0.000	-154.108	0.000	0.525
2007	4.4	0.000	0.000	0.000	0.000	0.000
2008	NOACTION	633.072	6654.567	1468.735	5699.374	4817.792
2008	1.2	0.000	0.000	-8.823	0.000	0.000
2008	4.1, B	95.484	0.000	438.209	0.000	0.000
2008	4.1, A	34.880	0.000	154.697	0.000	0.000
2008	4.3	-62.348	0.000	-170.578	0.000	0.000
2008	4.4	0.000	0.000	0.000	0.000	0.000

Table H-8-10
LAND DISTURBANCE AT COAL MINES
(ACRES PER YEAR)
Medium Loads and Gas Prices

YEAR	ALTERNATIVE	COLSTRIP	BOARDMAN	CENTRALIA	BRIDGER
1989	NOACTION	100.824	2.144	70.256	167.863
1989	1.2	0.000	-0.010	0.000	0.000
1989	4.1, B	0.917	0.140	-0.839	-25.136
1989	4.1, A	0.661	0.190	-1.922	-23.916
1989	4.3	-0.363	0.220	11.849	0.976
1989	4.4	0.000	0.000	0.000	0.000
1990	NOACTION	101.954	4.968	133.906	258.959
1990	1.2	-0.181	0.130	1.887	-0.976
1990	4.1, B	0.149	-1.272	1.014	12.760
1990	4.1, A	0.085	-0.861	2.167	10.215
1990	4.3	-0.523	-0.070	2.901	-8.158
1990	4.4	0.000	0.000	0.000	0.000
1991	NOACTION	101.677	6.371	147.398	281.515
1991	1.2	-0.181	0.431	0.454	-2.928
1991	4.1, B	0.427	-2.244	-7.620	10.703
1991	4.1, A	0.171	-1.533	-6.641	8.088
1991	4.3	-1.333	-0.922	-4.859	-28.204
1991	4.4	0.000	0.000	0.000	0.000
1992	NOACTION	102.370	6.441	151.208	266.245
1992	1.2	-0.480	0.220	1.118	-1.952
1992	4.1, B	0.523	-2.204	0.280	11.017
1992	4.1, A	0.416	-1.673	1.678	6.694
1992	4.3	-1.653	-1.362	-6.117	-6.415
1992	4.4	0.000	0.000	0.000	0.000
1993	NOACTION	108.023	6.311	189.482	281.829
1993	1.2	-0.011	0.531	-1.468	-2.615
1993	4.1, B	0.875	-2.124	-0.594	11.540
1993	4.1, A	0.384	-1.172	0.419	7.112
1993	4.3	-1.131	-1.302	-11.639	-15.653
1993	4.4	0.000	0.000	0.000	0.000
1994	NOACTION	110.145	9.185	227.616	334.193
1994	1.2	-0.043	0.431	-1.153	-0.802
1994	4.1, B	0.683	-3.696	1.398	11.505
1994	4.1, A	0.523	-2.033	-0.804	4.985
1994	4.3	-1.696	-2.023	-12.793	-15.200
1994	4.4	0.000	0.000	0.000	0.000
1995	NOACTION	111.969	9.416	250.545	345.767
1995	1.2	0.053	0.230	-2.097	-1.499
1995	4.1, B	0.693	-3.275	-1.783	6.868
1995	4.1, A	0.395	-1.462	-2.237	2.789
1995	4.3	-0.832	-1.943	-6.501	-9.099
1995	4.4	0.000	0.000	0.000	0.000

Table H-8-10

LAND DISTURBANCE AT COAL MINES
(ACRES PER YEAR)
Medium Loads and Gas Prices

YEAR	ALTERNATIVE	COLSTRIP	BOARDMAN	CENTRALIA	BRIDGER
1996	NOACTION	109.420	9.336	248.343	330.637
1996	1.2	0.064	0.301	-0.629	-0.941
1996	4.1, B	1.355	-3.346	3.530	7.251
1996	4.1, A	0.661	-1.272	0.140	4.985
1996	4.3	-0.907	-1.743	-4.369	-7.565
1996	4.4	0.000	0.000	0.000	0.000
1997	NOACTION	117.675	9.656	280.570	344.303
1997	1.2	-0.075	0.421	-1.748	0.139
1997	4.1, B	0.768	-3.686	3.880	9.552
1997	4.1, A	0.405	-0.651	0.000	2.615
1997	4.3	-1.003	-1.953	-16.498	-8.472
1997	4.4	0.000	0.000	0.000	0.000
1998	NOACTION	113.143	9.135	272.810	312.717
1998	1.2	-0.021	0.290	-1.153	0.279
1998	4.1, B	1.675	-2.354	9.123	11.470
1998	4.1, A	0.811	0.641	5.523	7.042
1998	4.3	-1.387	-2.644	-21.007	-5.961
1998	4.4	0.000	0.000	0.000	0.000
1999	NOACTION	118.891	10.327	297.767	329.974
1999	1.2	-0.213	0.110	-0.489	-0.523
1999	4.1, B	2.229	-1.002	8.668	9.936
1999	4.1, A	1.536	1.743	5.593	6.310
1999	4.3	-2.837	-3.085	-19.679	-9.762
1999	4.4	0.000	0.000	0.000	0.000
2000	NOACTION	115.148	9.175	289.064	328.580
2000	1.2	0.032	0.531	-1.678	-0.209
2000	4.1, B	2.656	1.823	15.904	15.584
2000	4.1, A	1.749	3.175	7.655	8.960
2000	4.3	-0.907	-1.663	-11.989	-5.996
2000	4.4	0.000	0.000	0.000	0.000
2001	NOACTION	119.201	10.508	298.920	320.108
2001	1.2	0.032	0.170	-1.992	-0.174
2001	4.1, B	2.016	2.404	15.414	15.095
2001	4.1, A	1.099	2.865	10.381	8.053
2001	4.3	-1.163	-1.873	-12.304	-3.347
2001	4.4	0.000	0.000	0.000	0.000
2002	NOACTION	115.340	12.641	300.004	320.457
2002	1.2	-0.096	0.210	-0.315	-0.349
2002	4.1, B	2.400	3.696	9.892	9.936
2002	4.1, A	0.981	1.783	5.208	4.706
2002	4.3	-1.301	-3.616	-5.488	-4.253
2002	4.4	0.000	0.000	0.000	0.000

Table H-8-10

LAND DISTURBANCE AT COAL MINES
(ACRES PER YEAR)
Medium Loads and Gas Prices

YEAR	ALTERNATIVE	COLSTRIP	BOARDMAN	CENTRALIA	BRIDGER
2003	NOACTION	118.795	11.319	309.022	325.198
2003	1.2	0.021	0.210	-0.769	-0.767
2003	4.1, B	2.741	4.197	11.290	12.899
2003	4.1, A	0.544	1.823	0.524	2.650
2003	4.3	-2.773	-3.045	-15.344	-10.075
2003	4.4	0.000	0.000	0.000	0.000
2004	NOACTION	117.217	9.676	293.573	297.866
2004	1.2	-0.171	0.080	-0.944	-0.035
2004	4.1, B	3.061	6.461	13.457	17.222
2004	4.1, A	1.408	3.155	6.431	7.635
2004	4.3	-1.397	-0.471	-7.410	-4.776
2004	4.4	0.000	0.000	0.000	0.000
2005	NOACTION	117.526	11.559	297.278	297.691
2005	1.2	-0.128	0.140	-1.748	-0.209
2005	4.1, B	3.136	6.551	11.814	14.747
2005	4.1, A	0.949	3.646	5.697	6.136
2005	4.3	-1.355	-0.511	-7.445	-3.905
2005	4.4	0.000	0.000	0.000	0.000
2006	NOACTION	117.782	12.501	297.243	298.842
2006	1.2	-0.075	0.150	-2.132	-0.070
2006	4.1, B	3.104	6.441	15.449	15.200
2006	4.1, A	0.736	3.185	4.963	5.334
2006	4.3	-2.101	-1.062	-5.697	-5.752
2006	4.4	0.000	0.000	0.000	0.000
2007	NOACTION	119.083	17.860	300.773	290.370
2007	1.2	-0.149	0.311	-0.035	-0.279
2007	4.1, B	2.048	7.242	12.234	11.505
2007	4.1, A	0.107	2.514	1.643	3.591
2007	4.3	-1.483	-1.332	-3.530	-4.393
2007	4.4	0.000	0.000	0.000	0.000
2008	NOACTION	118.753	23.008	300.074	295.913
2008	1.2	-0.011	0.000	-1.223	-0.314
2008	4.1, B	2.250	6.321	12.024	9.273
2008	4.1, A	0.171	2.073	1.608	1.429
2008	4.3	-1.653	-2.294	-3.356	-3.486
2008	4.4	0.000	0.000	0.000	0.000

Table H-8-11

LAND DISTURBANCE AT COAL MINES
(ACRES PER YEAR)
High Northwest Loads

YEAR	ALTERNATIVE	COLSTRIP	BOARDMAN	CENTRALIA	BRIDGER
1989	NOACTION	104.514	4.457	108.041	211.964
1989	1.2	-0.085	0.471	5.942	-2.022
1989	4.1, B	1.248	-0.521	-26.984	-10.668
1989	4.1, A	0.235	-0.260	1.468	-2.196
1989	4.3	-0.085	0.481	6.257	-1.917
1989	4.4	0.000	0.000	0.000	0.000
1990	NOACTION	107.703	9.796	155.996	315.471
1990	1.2	-0.277	0.341	0.035	-2.859
1990	4.1, B	0.117	-1.773	-3.635	17.187
1990	4.1, A	-0.160	0.781	4.090	0.593
1990	4.3	-0.235	0.371	-0.070	-2.754
1990	4.4	0.000	0.000	0.000	0.000
1991	NOACTION	107.052	11.780	168.754	333.949
1991	1.2	-0.128	0.301	1.084	-3.138
1991	4.1, B	1.643	1.112	13.422	23.358
1991	4.1, A	0.075	1.182	7.899	7.600
1991	4.3	-0.139	0.401	2.971	-2.859
1991	4.4	0.000	0.000	0.000	0.000
1992	NOACTION	111.351	12.341	171.900	336.180
1992	1.2	-0.149	0.240	-1.678	-1.569
1992	4.1, B	1.525	2.434	14.401	5.752
1992	4.1, A	-0.171	1.102	4.439	-4.044
1992	4.3	-0.245	0.361	-1.538	-1.569
1992	4.4	0.000	0.000	0.000	0.000
1993	NOACTION	113.782	12.721	218.563	337.260
1993	1.2	-0.139	0.020	-0.734	-2.963
1993	4.1, B	1.312	3.366	11.465	24.508
1993	4.1, A	-0.075	0.841	4.264	6.206
1993	4.3	-0.117	0.200	-1.468	-2.336
1993	4.4	0.000	0.000	0.000	0.000
1994	NOACTION	115.414	16.017	275.537	373.134
1994	1.2	-0.085	0.060	-2.866	-0.244
1994	4.1, B	0.949	2.735	10.032	10.668
1994	4.1, A	0.203	0.691	-6.082	2.719
1994	4.3	-0.064	0.070	-2.901	-0.453
1994	4.4	0.000	0.000	0.000	0.000
1995	NOACTION	116.204	16.387	297.138	375.644
1995	1.2	0.021	0.100	-1.118	-0.349
1995	4.1, B	0.715	1.763	8.039	1.569
1995	4.1, A	0.181	0.611	1.119	-2.963
1995	4.3	0.096	0.130	-2.027	0.000
1995	4.4	0.000	0.000	0.000	0.000

Table H-8-11

LAND DISTURBANCE AT COAL MINES
(ACRES PER YEAR)
High Northwest Loads

YEAR	ALTERNATIVE	COLSTRIP	BOARDMAN	CENTRALIA	BRIDGER
1996	NOACTION	115.328	16.798	295.215	363.303
1996	1.2	-0.043	0.100	-0.524	-1.081
1996	4.1, B	0.299	1.152	0.979	5.125
1996	4.1, A	-0.021	0.120	-0.245	0.837
1996	4.3	-0.021	0.190	0.559	-1.150
1996	4.4	0.000	0.000	0.000	0.000
1997	NOACTION	122.582	12.741	303.604	364.837
1997	1.2	0.011	0.170	-1.538	-0.174
1997	4.1, B	0.747	4.317	14.261	12.411
1997	4.1, A	0.203	0.341	-1.049	0.523
1997	4.3	0.075	0.280	-2.342	0.035
1997	4.4	0.000	-0.010	0.000	0.000
1998	NOACTION	118.753	13.382	299.095	342.978
1998	1.2	-0.064	0.140	-0.070	-0.628
1998	4.1, B	0.469	3.306	5.033	6.206
1998	4.1, A	-0.021	0.250	0.489	-0.488
1998	4.3	-0.107	0.331	0.594	-0.139
1998	4.4	0.000	0.020	0.000	0.000
1999	NOACTION	125.067	11.159	331.008	362.780
1999	1.2	0.000	0.190	-0.664	-0.209
1999	4.1, B	0.096	6.621	-2.936	2.162
1999	4.1, A	-0.053	2.504	-0.035	0.000
1999	4.3	-0.011	-2.644	-0.175	-0.070
1999	4.4	0.000	0.000	0.000	0.000
2000	NOACTION	121.142	10.207	328.701	365.883
2000	1.2	0.000	0.270	-0.245	-0.035
2000	4.1, B	0.000	6.922	1.608	3.451
2000	4.1, A	0.011	2.735	-0.140	-0.070
2000	4.3	0.000	-3.075	0.280	0.383
2000	4.4	0.000	0.000	0.000	0.000
2001	NOACTION	125.323	11.830	340.829	357.062
2001	1.2	0.000	0.020	0.175	0.000
2001	4.1, B	0.011	6.110	3.356	1.255
2001	4.1, A	0.000	2.384	0.105	0.139
2001	4.3	0.000	-3.416	0.384	0.139
2001	4.4	0.000	0.000	0.000	0.000
2002	NOACTION	120.459	13.222	331.043	347.440
2002	1.2	0.000	-0.150	-0.140	0.000
2002	4.1, B	0.000	6.511	1.538	0.035
2002	4.1, A	0.000	2.464	0.315	-0.209
2002	4.3	0.000	-3.756	0.070	-0.105
2002	4.4	0.000	0.000	0.000	0.000

Table H-8-11

LAND DISTURBANCE AT COAL MINES
(ACRES PER YEAR)
High Northwest Loads

YEAR	ALTERNATIVE	COLSTRIP	BOARDMAN	CENTRALIA	BRIDGER
2003	NOACTION	124.278	12.341	350.512	355.424
2003	1.2	0.000	0.000	-0.140	0.000
2003	4.1, B	0.000	6.341	1.084	0.000
2003	4.1, A	0.000	2.474	0.000	0.000
2003	4.3	0.000	-3.265	0.035	0.000
2003	4.4	0.000	0.000	0.000	0.000
2004	NOACTION	124.566	11.669	334.433	333.949
2004	1.2	0.000	0.050	-0.070	0.000
2004	4.1, B	0.000	6.461	0.454	0.000
2004	4.1, A	0.000	2.284	-0.035	0.000
2004	4.3	0.000	-2.264	-0.070	0.000
2004	4.4	0.000	0.000	0.000	0.000
2005	NOACTION	123.712	13.673	335.691	328.998
2005	1.2	0.000	-0.190	0.000	0.000
2005	4.1, B	0.000	6.300	0.140	0.000
2005	4.1, A	0.000	2.454	-0.105	0.000
2005	4.3	0.000	-2.725	0.000	0.000
2005	4.4	0.000	0.000	0.000	0.000
2006	NOACTION	123.883	13.623	337.054	330.915
2006	1.2	0.000	-0.110	0.000	0.000
2006	4.1, B	0.000	6.341	0.105	0.000
2006	4.1, A	0.000	2.544	0.000	0.000
2006	4.3	0.000	-2.514	0.000	0.000
2006	4.4	0.000	0.000	0.000	0.000
2007	NOACTION	123.723	19.903	333.769	313.240
2007	1.2	0.000	-0.020	0.000	0.000
2007	4.1, B	0.000	7.653	0.000	0.000
2007	4.1, A	0.000	2.905	0.000	0.035
2007	4.3	0.000	-2.624	0.000	0.035
2007	4.4	0.000	0.000	0.000	0.000
2008	NOACTION	124.171	25.012	334.922	319.864
2008	1.2	0.000	-0.150	0.000	0.000
2008	4.1, B	0.000	7.462	0.000	0.000
2008	4.1, A	0.000	2.634	0.000	0.000
2008	4.3	0.000	-2.905	0.000	0.000
2008	4.4	0.000	0.000	0.000	0.000

H-9

Resource Additions

Resource Additions

The Least Cost Mix Model (LCMM) was used to determine future resource development needs within the region. These results are then input to the System Analysis Model (SAM). Tables H-9-1 and H-9-2 show the resource additions used for each of the alternatives analyzed with SAM. Results are shown for only the expected loads and gas prices and high Northwest load scenarios. No resource additions were necessary under the low Northwest load case. Since the other sensitivity assumptions (high and low Southwest loads and high and low gas prices) do not affect Northwest resource needs, the results from the expected load scenario were used for these cases. Results from the No Action Alternative were used for Alternatives 1.2 and 4.4, since these cases did not involve changes in the amount of firm load.

Values given for the No Action Alternative represent cumulative average annual MWs of resource additions (e.g., values for 1998 include all additions which occurred from 1989 through 1997). Values for the other alternatives are incremental to those given for the No Action Alternative. Small resources include small hydro, cogeneration, and other renewable resources. As with conservation, SAM treats these as nonschedulable resources, so they are reflected as reductions in the amount of firm load which must be served. Certain scenarios, primarily those with high Northwest loads, have resource needs in the near-term before major resources can be built. As a result, short-term purchases are reserved in order to maintain regional load/resource balance. These were then modeled in SAM in a manner similar to combustion turbines. Actual usage of these reserved purchases can be found in Appendix H-5.

Table H-9-3 shows the amount of firm surplus available in SAM, given the above resource additions. Values are given for both the expected loads and gas price and high Northwest load scenarios. As with Tables H-9-1 and H-9-2, results for Alternatives 1.2 and 4.4 are identical to the No Action Alternative, and results for the sensitivities involving gas prices and Southwest loads are identical to the medium Northwest load scenario.

An additional "resource" available to meet load is the "conversion" of existing power sales contracts to California utilities to exchanges or to capacity sales. At the time of the SAM analysis, there were two such convertible contracts, Southern California Edison's and another with Burbank, Glendale, and Pasadena, which were converted at different times as needed for different alternatives. The timing of these conversions is shown on Table H-9-9. Since the analysis was performed, both these contracts have been converted.

Table H-9-1
Cumulative Resource Additions (aMW)
Medium Loads and Gas Prices

Year	Alternative	Conservation	Small Resources	Nuclear	Coal	Reserved Purchases
1989	No Action	5	0	0	0	0
	4.1, Case B	0	0	0	0	0
	4.1, Case A	0	0	0	0	0
	4.3	+2	0	0	0	0
1990	No Action	5	0	0	0	0
	4.1, Case B	0	0	0	0	0
	4.1, Case A	0	0	0	0	0
	4.3	+2	0	0	0	+41
1991	No Action	5	0	0	0	0
	4.1, Case B	0	0	0	0	0
	4.1, Case A	0	0	0	0	0
	4.3	+2	+317	0	0	0
1992	No Action	42	0	0	0	0
	4.1, Case B	-4	0	0	0	0
	4.1, Case A	0	0	0	0	0
	4.3	+8	+317	0	0	0
1993	No Action	74	47	0	0	0
	4.1, Case B	-8	0	0	0	0
	4.1, Case A	0	0	0	0	0
	4.3	+20	+378	0	0	0
1994	No Action	115	61	0	0	0
	4.1, Case B	-11	0	0	0	0
	4.1, Case A	0	0	0	0	0
	4.3	+33	+391	0	0	0
1995	No Action	155	77	0	0	0
	4.1, Case B	-14	0	0	0	0
	4.1, Case A	0	0	0	0	0
	4.3	+86	+404	0	0	+6
1996	No Action	201	168	0	0	0
	4.1, Case B	-18	-75	0	0	0
	4.1, Case A	-2	-75	0	0	0
	4.3	+57	+334	0	0	+97
1997	No Action	244	183	0	0	0
	4.1, Case B	-23	-108	0	0	0
	4.1, Case A	-5	-75	0	0	0
	4.3	+66	+333	0	0	0
1998	No Action	287	324	0	0	0
	4.1, Case B	-27	-208	0	0	0
	4.1, Case A	-8	-200	0	0	0
	4.3	+75	+209	0	0	0

Table H-9-1
Cumulative Resource Additions (aMW)
Medium Loads and Gas Prices
(Continued)

Year	Alternative	Conservation	Small Resources	Nuclear	Coal	Reserved Purchases
1999	No Action	333	324	0	0	0
	4.1, Case B	-32	-208	0	0	0
	4.1, Case A	-9	-200	0	0	0
	4.3	+84	+209	+806	0	0
2000	No Action	379	324	806	0	0
	4.1, Case B	-38	-208	-806	0	0
	4.1, Case A	-10	0	-806	0	0
	4.3	+93	+209	0	0	0
2001	No Action	428	324	806	0	0
	4.1, Case B	-46	-208	-806	0	0
	4.1, Case A	-11	0	-806	0	0
	4.3	+100	+209	0	0	0
2002	No Action	476	324	806	0	0
	4.1, Case B	-53	-208	-806	0	0
	4.1, Case A	-11	0	-806	0	0
	4.3	+109	+209	0	0	0
2003	No Action	525	324	806	0	0
	4.1, Case B	-61	-208	-806	0	0
	4.1, Case A	-13	0	0	0	0
	4.3	+117	+209	+815	0	0
2004	No Action	576	324	1621	0	0
	4.1, Case B	-71	-208	-1621	0	0
	4.1, Case A	-14	0	-815	0	0
	4.3	+122	+209	0	0	0
2005	No Action	630	324	1621	0	0
	4.1, Case B	-84	-208	-1621	0	0
	4.1, Case A	-15	0	-815	0	0
	4.3	+124	+240	0	0	0
2006	No Action	683	324	1621	0	0
	4.1, Case B	-100	-208	-1621	0	0
	4.1, Case A	-15	0	-815	0	0
	4.3	+123	+240	0	0	0
2007	No Action	735	324	1621	0	0
	4.1, Case B	-115	-208	-1621	0	0
	4.1, Case A	-16	0	-815	0	0
	4.3	+121	+240	0	+87	0
2008	No Action	781	324	1621	0	0
	4.1, Case B	-130	-208	-1621	0	0
	4.1, Case A	-16	0	-815	0	0
	4.3	+118	+240	0	+190	0

Table H-9-2
Cumulative Resource Additions (aMW)
High Northwest Loads

Year	Alternative	Conservation	Small Resources	Nuclear	Coal	Reserved Purchases
1989	No Action	8	0	0	0	190
	4.1, Case B	-1	0	0	0	-190
	4.1, Case A	0	0	0	0	-190
	4.3	0	0	0	0	+852
1990	No Action	8	0	0	0	665
	4.1, Case B	-1	0	0	0	-665
	4.1, Case A	0	0	0	0	-600
	4.3	0	0	0	0	+852
1991	No Action	8	411	0	0	742
	4.1, Case B	-1	-411	0	0	-742
	4.1, Case A	0	0	0	0	-603
	4.3	0	0	0	0	+878
1992	No Action	87	415	0	0	1165
	4.1, Case B	-40	-415	0	0	-1165
	4.1, Case A	0	0	0	0	-613
	4.3	0	0	0	0	+885
1993	No Action	133	699	0	0	1127
	4.1, Case B	-42	-652	0	0	-1127
	4.1, Case A	0	0	0	0	-613
	4.3	0	0	00	0	+863
1994	No Action	188	790	0	0	1490
	4.1, Case B	-43	-729	0	0	-1490
	4.1, Case A	0	-18	0	0	-596
	4.3	0	0	0	0	+885
1995	No Action	242	840	0	0	1807
	4.1, Case B	-44	-409	0	0	-1807
	4.1, Case A	0	-18	0	0	-656
	4.3	0	0	0	0	+885
1996	No Action	299	879	0	0	2205
	4.1, Case B	-43	-194	0	0	-2042
	4.1, Case A	0	-17	0	0	-813
	4.3	0	0	0	0	+884
1997	No Action	352	917	1621	0	827
	4.1, Case B	-44	-212	-815	0	-827
	4.1, Case A	0	-18	0	0	-814
	4.3	0	0	0	0	+885
1998	No Action	404	957	1621	0	1480
	4.1, Case B	-43	-222	-815	0	-1480
	4.1, Case A	0	-18	0	0	-813
	4.3	0	0	0	0	+885

Table H-9-2
Cumulative Resource Additions (aMW)
High Northwest Loads
(Continued)

Year	Alternative	Conservation	Small Resources	Nuclear	Coal	Reserved Purchases
1999	No Action	460	957	1621	2040	0
	4.1, Case B	-44	-205	0	-2040	0
	4.1, Case A	0	-18	0	-812	0
	4.3	0	0	0	+886	0
2000	No Action	516	957	1621	2721	0
	4.1, Case B	-46	-205	0	-2034	0
	4.1, Case A	0	-18	0	-811	0
	4.3	0	0	0	+886	0
2001	No Action	574	957	1621	3164	0
	4.1, Case B	-47	-205	0	-2034	0
	4.1, Case A	0	-18	0	-811	0
	4.3	0	0	0	+886	0
2002	No Action	631	957	1621	3807	0
	4.1, Case B	-47	-205	0	-2637	0
	4.1, Case A	0	-18	0	-813	0
	4.3	0	0	0	+886	0
2003	No Action	688	957	1621	4271	0
	4.1, Case B	-48	-205	0	-2097	0
	4.1, Case A	0	-18	0	-814	0
	4.3	0	0	0	+886	0
2004	No Action	745	957	1621	4999	0
	4.1, Case B	-49	-205	0	-2243	0
	4.1, Case A	0	-18	0	-814	0
	4.3	0	0	0	+886	0
2005	No Action	802	957	1621	5497	0
	4.1, Case B	-50	-205	0	-2241	0
	4.1, Case A	0	-18	0	-813	0
	4.3	0	0	0	+886	0
2006	No Action	855	957	1621	6021	0
	4.1, Case B	-51	-205	0	-2241	0
	4.1, Case A	0	-18	0	-814	0
	4.3	0	0	0	+886	0
2007	No Action	906	957	1621	6447	0
	4.1, Case B	-51	-205	0	-2241	0
	4.1, Case A	0	-18	0	-816	0
	4.3	0	0	0	+886	0
2008	No Action	949	957	1621	6928	0
	4.1, Case B	-50	-205	0	-2241	0
	4.1, Case A	0	-18	0	-815	0
	4.3	0	0	0	+886	0

Table H-9-3
Amount of Firm Surplus Availble in the SAM Analyses
(aMW)

	Medium Northwest Loads				High Northwest Loads			
Year	No Action	Alt. 4.1, A	Alt. 4.1, B	Alt. 4.3	No Action	Alt. 4.1, A	Alt. 4.1, B	Alt. 4.3
1989	940	1689	3185	156	0	560	2194	1
1990	571	1286	2716	0	1	0	1574	0
1991	447	1139	2523	161	0	0	1091	1
1992	317	983	2312	92	1	0	650	2
1993	349	1002	2301	231	0	0	454	0
1994	181	835	2134	109	-1	0	15	0
1995	40	696	1993	0	1	0	18	2
1996	10	590	1886	0	0	0	0	0
1997	42	625	1933	0	1	0	383	2
1998	0	312	1589	0	0	0	0	1
1999	0	153	1417	321	2	3	0	3
2000	132	0	1028	0	1	3	1	3
2001	127	0	987	0	1	4	2	3
2002	0	0	713	0	5	5	2	6
2003	0	420	647	435	7	6	3	8
2004	443	95	330	96	7	7	4	9
2005	353	0	194	8	6	7	5	8
2006	244	0	45	0	8	8	6	10
2007	159	0	0	0	10	9	7	12
2008	0	0	0	1	10	9	7	12

TABLE H-9-4

CONVERSION OF CALIFORNIA CONTRACTS

Alternative	Southern California Edison (Time of Conversion)	Burbank, Glendale, and Pasadena (Time of Conversion)
Expected Loads & Gas Price		
No Action	June 2003	July 2004
1.2	June 2003	July 2004
4.1, Case A	No conversion	No conversion
4.1, Case B	No conversion	No conversion
4.3	At start of study	At start of study
4.4	June 2003	July 2004
High Northwest Loads		
No Action	At start of study	At start of study
1.2	At start of study	At start of study
4.1, Case A	June 1995	June 1995
4.1, Case B	June 2003	June 2003
4.3	At start of study	At start of study
4.4	At start of study	At start of study

Appendix H-10

Programmatic Agreement for Compliance with the National Historic Preservation Act

PROGRAMMATIC AGREEMENT
FOR COMPLIANCE WITH THE
NATIONAL HISTORIC PRESERVATION ACT

Among

- **Bonneville Power Administration**
- **Bureau of Reclamation, Pacific Northwest Region**
- **U.S. Army Corps of Engineers, North Pacific Division**
- **National Park Service, Pacific Northwest Region**
- **U.S. Forest Service, Region 1**
- **Confederated Tribes of the Colville Reservation**
- **Spokane Tribe of Indians**
- **Idaho, Montana, and Washington State Historic Preservation Officers**
- **Advisory Council on Historic Preservation**

Regarding

FEDERAL COLUMBIA RIVER POWER SYSTEM HYDROELECTRIC OPERATIONS

WHEREAS, hydroelectric project operations of the Federal Columbia River Power System, including power marketing policies and programs under the direct and/or indirect jurisdiction of the Bonneville Power Administration (BPA), the Bureau of Reclamation (Bureau), and the U.S. Army Corps of Engineers (Corps), may have an effect upon properties included in, eligible for inclusion in, or potentially eligible for inclusion in the National Register of Historic Places (Register); and

WHEREAS, BPA has requested the comments of the Advisory Council on Historic Preservation (Council) pursuant to Section 106 of the National Historic Preservation Act (16 U.S.C. 470 f) and its implementing regulations, "Protection of Historic Properties: (36 CFR Part 800); and

WHEREAS, the historic properties potentially affected are within or immediately adjacent to the reservoir drawdown zones (hereinafter affected area) in the project areas of Grand Coulee (Lake Roosevelt) and Hungry Horse Dams, owned and operated by the Bureau, and the Dworshak, Libby (Lake Koocanusa), and Albeni Falls (Lake Pend Oreille) Dams, owned and operated by the Corps; and

WHEREAS, the National Historic Preservation Act requires Federal agencies having direct or indirect jurisdiction over an undertaking to take into account the effect of the undertaking on historic properties; and

WHEREAS, BPA power marketing policy and program undertakings, as power system management actions, are under the direct and/or indirect jurisdiction of BPA, the Bureau, and the Corps; and

WHEREAS, the BPA, the Bureau, and the Corps, in exercising their independent power system management authorities and in fulfilling their responsibilities for historic properties, intend to meet this shared responsibility for historic properties in a timely manner; and

WHEREAS, the operation of the Grand Coulee Project affects land within the boundaries of the Colville Indian Reservation and the Spokane Indian Reservation, and lands administered by the National Park Service (NPS); and

WHEREAS, the Bureau, the NPS, the Confederated Tribes of the Colville Reservation (Colville Tribes), the Spokane Tribe of Indians (Spokane Tribe), and other parties have ratified the Lake Roosevelt Cooperative Management Agreement; and

WHEREAS, Dworshak Reservoir, Hungry Horse Reservoir, Lake Koocanusa, and Lake Pend Oreille are partially within National Forests administered by the U.S. Forest Service, Region 1;

NOW THEREFORE, it is mutually agreed that BPA, the NPS, the Bureau, and the Corps will identify and manage historic properties in accordance with the following stipulations:

STIPULATIONS

BPA, the Bureau, the NPS, and the Corps will ensure that the following measures are carried out:

1. Survey and Evaluation

BPA will participate with the Bureau, the NPS, the Corps, the Colville Tribes, and the Spokane Tribe, as appropriate in accordance with their respective jurisdictions, to complete intensive surveys[1] of historic properties and properties possessing traditional cultural value to Native Americans, at the project reservoirs listed above. (Exhibit A shows the present status of historic preservation activities.) The Bureau, the NPS, the Corps, the Colville Tribe, and the Spokane Tribe will ensure that surveys are performed in accordance with accepted archaeological practices as defined in 36 CFR Part 800, Section 110 Guidelines, and the Secretary of the Interior's Standards and Guidelines. Site evaluations will be done in accordance with 36 CFR Part 63 and the above-referenced guidelines. Surveys and evaluations will be done in consultation with the appropriate SHPO and appropriate Native American tribes in accordance with 36 CFR Part 63.

Intensive surveys will be initiated at all affected areas within two years from execution of this Agreement, and proceed as quickly as possible thereafter. The Bureau, the NPS, the Corps, the Colville Tribes, and the Spokane Tribe, as appropriate, shall provide copies of completed survey reports to BPA, interested Native American tribes, the U.S. Forest Service, and the appropriate SHPO.

2. Action Plans

Once intensive surveys are completed for each affected area, the Bureau, the NPS, the Corps, the Colville Tribes, or the Spokane Tribe, as appropriate, will consult with BPA and the appropriate SHPO to develop a draft Action Plan for that area.

Action Plans will identify:

- Research design (including criteria for determining which properties may be likely to yield information important in prehistory and history);
- Determinations of Register eligibility; and
- Methods of mitigating adverse effects on Register and Register-eligible properties (including *in situ* preservation and law enforcement), monitoring, and curation.

Appropriate Native American tribes and traditional spiritual leaders will be consulted about properties possessing traditional cultural value to Native Americans, and provided a reasonable opportunity to comment on each draft

[1] Intensive survey describes the distribution of properties in an area; determines the number, location, and condition of the properties; determines the types of properties actually present within the area; permits classification of individual properties; and records the physical extent of the specific properties. 48 Fed. Reg. 44716, 44722 (1983).

Action Plan, and the Forest Service will be afforded a reasonable opportunity to comment on the draft Action Plans for Dworshak Reservoir, Hungry Horse Reservoir, Lake Koocanusa, and Lake Pend Oreille. Upon completion of the coordinated draft Action Plan for each affected area (within 18 months of completion of the intensive survey for the subject project), the draft Action Plan will be submitted to the Council for review and comment.

Each final Action Plan will be implemented when mutually accepted by the managing agency or tribe, the appropriate SHPO, the Forest Service if the affected area is on Forest Service lands, and the Council. In consultation with other involved jurisdictions and affected Tribes, the lead agency for each Action Plan will prepare an annual report of activities performed during the year. The lead agency will provide copies to BPA, the Council, the appropriate SHPOs, other interested agencies, and appropriate Native American Tribes.

3. Interim Management

Interim management of historic properties at these project reservoirs will be conducted in accordance with the steps in the Council's regulations, 36 CFR Part 800. Until such time as the approved Action Plan is implemented, and prior to any change in operating constraints, the appropriate agency or tribe will implement the steps detailed in the regulations for identification, evaluation, and management of historic properties.

4. Professional Qualifications

Supervisory personnel managing the implementation of each Action Plan shall, at a minimum, meet the professional qualifications detailed in the Secretary of the Interior's "Standards and Guidelines for Archeology and Historic Preservation," 48 Fed.Reg. 44716, 44738 (1983).

5. Other Historic Properties Management Considerations

a. If human skeletal material is discovered during the intensive survey or during implementation of the Action Plan, the Bureau, the NPS, the Corps, the Colville Tribes, or the Spokane Tribe, as appropriate, will consult with local law enforcement authorities and the appropriate SHPO; or, if the skeletal material appears to be of Native American origin, will consult with the affected tribe and appropriate SHPO to prepare and implement a burial disposition plan in accordance with the North American Graves Protection and Repatriation Act

(P.L. 101-601). BPA will participate in implementing the approved/agreed upon burial disposition plan.

b. The Bureau, the NPS, the Corps, the Colville Tribes, and the Spokane Tribe shall curate archaeological data, artifacts, field notes, photographs, and other records in accordance with the standards, guidelines, and principles in 36 CFR 79, "Curation of Federally-Owned or Administered Archeological Collections: Final Rule" (55 Fed. Reg. 37839); the Council's "Treatment of Archaeological Properties: A Handbook;" and in "Archeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines," 48 Fed. Reg. 44716 (1983).

c. The Bureau, the NPS, the Corps, the Colville Tribes, or the Spokane Tribe shall prepare and distribute final reports to interested parties for each project listed above, for the affected area within their respective jurisdiction, within two years after full implementation of the Action Plan. Final reports will include the results of survey, evaluation, and mitigation.

6. Existing or new Memorandum of Agreement (MOA), or an existing Programmatic Agreement for the operation and management of individual project reservoirs included in this Agreement, may be substituted for this Agreement. In the absence of a substitute MOA or Programmatic Agreement, the terms of this Agreement shall be implemented for each project reservoir.

7. Any party to this Agreement may request its amendment, whereupon the parties will consult in accordance with 36 CFR 800.13 to consider such amendment.

8. If a signatory to this Agreement determines that the terms of the Agreement cannot be met, or that a change is necessary to meet the requirements of the law, that signatory will immediately request the consulting parties to consider an amendment or addendum. Any necessary amendment or addendum will be executed as defined in 36 CFR Part 800. If a dispute arises regarding implementation of the Agreement, BPA will consult with the objecting party(ies) to resolve the dispute. If the dispute cannot be resolved, further comments will be requested from the Advisory Council, as defined in 36 CFR Part 800.

9. Any party to this Agreement may suspend it by providing 30 days written notice to the other consulting parties. Additional consultations will then occur in an effort to resolve any issues, and to reimplement the Agreement in amended form.

10. Execution and implementation of this Programmatic Agreement evidences that BPA, the Corps, Bureau and the NPS have satisfied their Section 106 responsibilities for hydroelectric project operations (including BPA power marketing policies and programs) affecting the reservoir drawdown areas of Grand Coulee, Hungry Horse, Dworshak, Libby, and Albeni Falls Dams.

11. All activities set forth in this Agreement are subject to availability of funds. If lack of funds results in failure to carry out the terms of this Agreement, BPA, NPS, the Bureau, and the Corps will again request the Council's comments in accordance with 36 CFR Part 800.

EXHIBIT A

STATUS OF HISTORIC PRESERVATION ACTIVITIES BY PROJECT

Project	Survey	Action Plan/ Mitigation Plan	Mitigation
Dworshak[1]	Required	Required	Required
Albeni Falls[2]	Partially Completed[3]	Required	Required
Libby	Mostly Completed[4]	Completed[5]	Required
Grand Coulee	Partially Completed	Required	Required
Hungry Horse	Partially Completed	Required	Required

NOTES:

1/ The Dworshak project is presently covered under a Programmatic Agreement that addresses historic preservation activities on all operating reservoir projects within the U.S. Army Corps of Engineers Walla Walla District.

2/ The majority of lands are privately owned. Historic property investigations will require acquisition of real estate interests for site access and excavation, which will increase overall costs.

3/ Site locations have been identified, but no subsurface testing or evaluation has occurred.

4/ The U.S. Forest Service has identified additional cultural resource sites within the affected area. These sites have not been subjected to subsurface testing or evaluation.

5/ An existing Action Plan/Mitigation Plan may need to be modified as a result of subsurface testing and evaluation of recently discovered sites (see preceding footnote).

BONNEVILLE POWER ADMINISTRATION

By:____________________ **Date:**____________

James J. Jura, Administrator

BUREAU OF RECLAMATION, PACIFIC NORTHWEST REGION

By:____________________ **Date:**____________

John W. Keys, III, Regional Director

U.S. ARMY CORPS OF ENGINEERS, NORTH PACIFIC DIVISION

By:____________________ **Date:**____________

MG Ernest J. Harrell, Division Engineer

NATIONAL PARK SERVICE, PACIFIC NORTHWEST REGION

By:____________________ **Date:**____________

Charles H. Odegaard, Regional Director

U.S. FOREST SERVICE, REGION 1

By:____________________ **Date:**____________

John W. Mumma, Regional Forester

CONFEDERATED TRIBES OF THE COLVILLE RESERVATION

By:____________________ **Date:**____________

Jude C. Stensgar, Business Council Chairperson

SPOKANE TRIBE OF INDIANS

By:____________________ **Date:**____________

Bruce Wynne, Business Council Chairperson

IDAHO STATE HISTORIC PRESERVATION OFFICE

By:____________________ **Date:**____________

David Crowder, Ph.D., State Historic Preservation Officer

MONTANA STATE HISTORIC PRESERVATION OFFICE

By:____________________ **Date:**____________

Marcella Sherfy, State Historic Preservation Officer

WASHINGTON STATE HISTORIC PRESERVATION OFFICE

By:____________________ **Date:**____________

Jacob E. Thomas, State Historic Preservation Officer

ADVISORY COUNCIL ON HISTORIC PRESERVATION

By:____________________ **Date:**____________

John F.W. Rogers, Chairman

Concur:

KOOTENAI TRIBE OF IDAHO

By:____________________ **Date:**____________

Velma Bahe, Business Council Chairperson

APPENDIX I

Appendix I

Public Involvement Activities

APPENDIX I

Public Involvement Activities

Public involvement activities for the Initial Northwest Power Sales Contracts Environmental Impact Statement (EIS) have been carried out to fulfill the intent of the Council on Environmental Quality in prescribing a scoping of the project and to encourage and integrate public information and interests into the analysis of the power sales contact alternatives and the EIS process. A description and chronology of the principal public involvement activities is presented below.

3/5/85	BPA published Notice of Intent to prepared an EIS on the long-term sales contracts. Individual notices were sent to 2500 Federal, State, and local agencies, BPA customers, the Northwest Power Planning Council, interest groups and others. Comments on the Notice of Intent were received from 16 entities.
9/19/85	BPA sent out notice of scoping meetings and solicition of comment. The notice requested interested parties to return a postcard to develop a mailing list of parties who wanted to be kept informed about the EIS process. It also offered additional documents to help the public understand the power sales contracts and the issues involved. Five scoping meetings were held in October in Seattle amd Richland, Washington; Portland, Oregon; Burley, Idaho; and Missoula, Montana. Sixty-eight persons attended these meetings. By the end of this phase of the scoping process, 60 comment letters had been received.
10/21/85	A list of issues and alternatives raised by commenters in the scoping meetings was distributed to aid the public in formulating written comments.
12/4/85	A summary of the scoping comments, both written and orally presented at the scoping meetings, and copies of all comment letters received were sent to interested entities. A Cross Comment Process was undertaken, i.e., comments were requested both as to the accuracy of the summary and an opportunity was provided for parties to judge others comments and reconsider their own. An additional public meeting was held during this process. Fifteen additional comment letters were received.
1/23/86	At the request of interested parties, a list of prior BPA environmental documents was distributed to facilitate an understanding of the relationship of the Power Sales Contract EIS to previous environmental analysis.
4/2/86	A Power Sales Contracts EIS Update was distributed to interested parties. This included a summary of the comments received during the Cross Comment period and copies of the Cross Comment letters.

9/19/86	A Power Sales Contract EIS Update was sent to interested parties to inform them of progress on the EIS.
2/9/87	A draft Implementation Plan for the EIS was distributed for comment by interested parties. A public meeting was held on 3/24/87 to discuss and take comment on the draft implementation plan.
5/26/87	A letter was sent to interested parties offering copies of comments on the draft Implementation Plan and a summary of them. In addition, this letter announced the formation of the Review Panel, consisting of representatives of customers and other interested parties, to act as a sounding board on the scope of the EIS, identification of issues to be dealt with, and the methods of analysis. The first meeting of the Review Panel was scheduled for June 8 and 9, 1987. From this time forward, meetings with the Review Panel were held as needed to discuss issues.
7/10/87	A letter was sent to the Review Panel distributing a new draft of the Implementation Plan for review and comment, with comments due July 24, 1989.
9/9/87	A letter was sent to Review Panel members distributing all comments received from them on the draft Implementation Plan of July 10, 1987, and announcing the decision to prepare a Study Plan prior to finalizing the Implementation Plan. The Study Plan was to lay out the assumptions and analytical methods in greater detail than required for the Implementation Plan.
9/24/87	A Power Sales Contract EIS Update was sent to interested parties describing the Review Panel's review of the draft Implementation Plan, and explaining that the Implementation Plan would be slightly delayed in order to assure that issues are accurately defined and that the proposed analysis is reasonable. Copies were offered of all Review Panel comments on the Draft Implementation Plan and a summary of these comments organized by issue and how they will be incorporated into the Implementation Plan.
2/11/88	A letter was sent to the Review Panel providing (1) a summary of changes in the alternatives proposed to be analyzed in the EIS; (2) a summary of changes to the text of the Implementation Plan; (3) a February 5, 1988, draft of the Implemenation Plan; and (4) study plans for analysis of the alternatives. Comments were requested by March 4, 1988.
7/6/88	A meeting with the Review Panel was held to provide information regarding the SAM base (i.e., No Action) case.

8/1/88	A Power Sales Contract EIS update was sent to interested parties. This Update offered copies of the Final Implementation Plan, which had been approved by the Department of Energy on June 24, 1988, upon request.
8/16/88	Copies of the Final Implementation Plan, a summary of comments on the February 11, 1988, transmittal of a draft Implementation Plan and a Study Plan, a Study Plan summary, and a summary of assumptions to be used in SAM in modeling the No Action Alternative were provided to the Review Panel.
10/18/88	A letter was sent to Review Panel members describing the status of the analysis, informing them of what the partial Draft EIS they were to review would consist of and when they could expect, and providing a list of categories of data which would be collected from SAM.
11/18/88	A letter was sent to Review Panel members which provided an update of the EIS schedule and provided a document stating assumptions which were used in the SAM analyses.
12/23/88	A partial Draft EIS, consisting of Chapters 1 through 3, Appendix B, and Appendix C, was sent to the Review Panel for review and comment. Comments were due February 3, 1989.
3/8/89	Copies of all five comment letters from review panel members on the Partial Draft Power Sales Contract EIS were sent to each review panel member.
5/5/89	A draft report on Direct Service Industry-related analysis prepared by BPA staff for the Power Sales Contract EIS was provided to the Review Panel for review and comment with comments due May 19, 1989.
4/11/89 - 5/23/89	BPA Responded to several requests from individual Review Panel members for data from the SAM analyses from Review Panel members so they could check our analyses, perform other types of analysis, and generally critique BPA's SAM analyses.
8/8-10/89	Updates were sent to the Review Panel and other interested parties providing new information on the EIS schedule.
9/8/89	Copies of significant portions of a preliminary Draft Power Sales Contract EIS were provided to the Review Panel for review and comment. Comments were due September 29, 1989.
9/18/89	Technical Appendix material related to the analysis of impacts on fish was provided to the Review Panel for review and comment.

9/25/89	A meeting with the Review Panel was held to discuss the Preliminary Draft EIS.
11/1/89	A letter and copies of the six comment letter received on the preliminary Draft EIS were sent to the Review Panel members.
12/21/89	A letter was sent to Review Panel members informing them that the Draft EIS was sent to DOE for formal approval.
1/23/90	A letter was sent to the Review Panel members updating them on status of DOE review of Draft EIS.
3/5/90	Letter was sent to Review Panel members describing the status of the Draft EIS. The document had to undergo a more thorough review process that included the Office of the Secretary which caused a delay in the schedule. The letter also informed the Review Panel that BPA is required to offer a public meeting on the Draft EIS and members would be contacted with possible meeting dates.
10/1/90	The draft EIS was distributed for public reveiw and comment through 12/10/90.
11/8/90	The Review Panel met to discuss the draft EIS.
11/15/90	A public meeting was held to receive comments on the draft EIS.
12/10/90	Close of comments on the draft EIS.
12/20/90	A letter was sent to the Review Panel distributing written comment letters on the Draft EIS for their information.

APPENDIX J

APPENDIX J

Bibliography

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APPENDIX K

Appendix K

Pacific Northwest Electric Power Planning and Conservation Act
P.L. 96-501

(Northwest Power Act)

94 STAT 2697

An Act

To assist the electrical consumers of the Pacific Northwest through use of the Federal Columbia River Power System to achieve cost-effective energy conservation, to encourage the development of renewable energy resources, to establish a representative regional power planning process, to assure the region of an efficient and adequate power supply, and for other purposes.

Dec 5, 1980
[S. 885]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

Pacific Northwest Electric Power Planning and Conservation Act
16 USC 839 note

SHORT TITLE AND TABLE OF CONTENTS

Section 1. This Act, together with the following table of contents, may be cited as the "Pacific Northwest Electric Power Planning and Conservation Act".

TABLE OF CONTENTS

PURPOSES

Section 2. The purposes of this Act, together with the provisions of other laws applicable to the Federal Columbia River Power System, are all intended to be construed in a consistent manner. Such purposes are also intended to be construed in a manner consistent with applicable environmental laws. Such purposes are: 16 USC 839

2.(1) to encourage, through the unique opportunity provided by the Federal Columbia River Power System—

2.(1)(A) conservation and efficiency in the use of electric power, and

2.(1)(B) the development of renewable resources within the Pacific Northwest;

2.(2) to assure the Pacific Northwest of an adequate, efficient, economical, and reliable power supply;

2.(3) to provide for the participation and consultation of the Pacific Northwest States, local governments, consumers, customers, users of the Columbia River System (including Federal and State fish and wildlife agencies and appropriate Indian tribes), and the public at large within the region in—

2.(3)(A) the development of regional plans and programs related to energy conservation, renewable resources, other resources, and protecting, mitigating, and enhancing fish and wildlife resources,

2.(3)(B) facilitating the orderly planning of the region's power system, and

2.(3)(C) providing environmental quality;

2.(4) to provide that the customers of the Bonneville Power Administration and their consumers continue to pay all costs necessary to produce, transmit, and conserve resources to meet the region's electric power requirements, including the amortization on a current basis of the Federal investment in the Federal Columbia River Power System;

2.(5) to insure, subject to the provisions of this Act—

2.(5)(A) that the authorities and responsibilities of State and local governments, electric utility systems, water management agencies, and other non-Federal entities for the regulation, planning, conservation, supply, distribution, and use of electric power shall be construed to be maintained, and

2.(5)(B) that Congress intends that this Act not be construed to limit or restrict the ability of customers to take actions in accordance with other applicable provisions of Federal or State law, including, but not limited to, actions to plan, develop, and operate resources and to achieve conservation, without regard to this Act; and

2.(6) to protect, mitigate and enhance the fish and wildlife, including related spawning grounds and habitat, of the Columbia River and its tributaries, particularly anadromous fish which are of significant importance to the social and economic well-being of the Pacific Northwest and the Nation and which are dependent on suitable environmental conditions substantially obtainable from the management and operation of the Federal Columbia River Power System and other power generating facilities on the Columbia River and its tributaries.

DEFINITIONS

16 USC 839 a

Section 3. As used in this Act, the term—

3.(1) "Acquire" and "acquisition" shall not be construed as authorizing the Administrator to construct, or have ownership of, under this Act or any other law, any electric generating facility.

3.(2) "Administrator" means the Administrator of the Bonneville Power Administration.

3.(3) "Conservation" means any reduction in electric power consumption as a result of increases in the efficiency of energy use, production, or distribution.

3.(4)(A) "Cost-effective", when applied to any measure or resource referred to in this Act, means that such measure or resource must be forecast—

3.(4)(A)(i) to be reliable and available within the time it is needed, and

3.(4)(A)(ii) to meet or reduce the electric power demand, as determined by the Council or the Administrator, as appropriate, of the consumers of the customers at an estimated incremental system cost no greater than that of the least-cost similarly reliable and available alternative measure or resource, or any combination thereof.

3.(4)(B) For purposes of this paragraph, the term "system cost" means an estimate of all direct costs of a measure or resource over its effective life, including, if applicable, the cost of distribution and transmission to the consumer and, among other factors, waste disposal costs, end-of-cycle costs, and fuel costs (including projected increases), and such quantifiable environmental costs and benefits as the Administrator determines, on the basis of a methodology developed by the Council as part of the plan, or in the absence of the plan by the Administrator, are directly attributable to such measure or resource.

3.(4)(C) In determining the amount of power that a conservation measure or other resource may be expected to save or to produce, the Council or the Administrator, as the case may be, shall take into account projected realization factors and plant factors, including appropriate historical experience with similar measures or resources.

3.(4)(D) For purposes of this paragraph, the "estimated incremental system cost" of any conservation measure or resource shall not be treated as greater than that of any nonconservation measure or resource unless the incremental system cost of such conservation measure or resource is in excess of 110 per centum of the incremental system cost of the nonconservation measure or resource.

3.(5) "Consumer" means any end user of electric power.

3.(6) "Council" means, unless otherwise specifically provided, the members appointed to the Pacific Northwest Electric Power and Conservation Planning Council established pursuant to section 4.

3.(7) "Customer" means anyone who contracts for the purchase of power from the Administrator pursuant to this Act.

3.(8) "Direct service industrial customer" means an industrial customer that contracts for the purchase of power from the Administrator for direct consumption.

3.(9) "Electric power" means electric peaking capacity, or electric energy, or both.

3.(10) "Federal base system resources" means—

3.(10)(A) the Federal Columbia River Power System hydroelectric projects;

3.(10)(B) resources acquired by the Administrator under long-term contracts in force on the effective date of this Act; and

3.(10)(C) resources acquired by the Administrator in an amount necessary to replace reductions in capability of the resources referred to in subparagraphs (A) and (B) of this paragraph.

3.(11) "Indian tribe" means any Indian tribe or band which is located in whole or in part in the region and which has a governing body which is recognized by the Secretary of the Interior.

3.(12) "Major resource" means any resource that—

3.(12)(A) has a planned capability greater than fifty average megawatts, and

3.(12)(B) if acquired by the Administrator, is acquired for a period of more than five years.

3.(12) Such term does not include any resource acquired pursuant to section 11(b)(6) of the Federal Columbia River Transmission System Act. 16 USC 838i

3.(13) "New large single load" means any load associated with a new facility, an existing facility, or an expansion of an existing facility—

3.(13)(A) which is not contracted for, or committed to, as determined by the Administrator, by a public body, cooperative, investor-owned utility, or Federal agency customer prior to September 1, 1979, and

3.(13)(B) which will result in an increase in power requirements of such customer of ten average megawatts or more in any consecutive twelve-month period.

3.(14) "Pacific Northwest", "region", or "regional" means—

3.(14)(A) the area consisting of the States of Oregon, Washington, and Idaho, the portion of the State of Montana west of the Continental Divide, and such portions of the States of Nevada, Utah, and Wyoming as are within the Columbia River drainage basin; and

3.(14)(B) any contiguous areas, not in excess of seventy-five air miles from the area referred to in subparagraph (A), which are a part of the service area of a rural electric cooperative customer served by the Administrator on the effective date of this Act which has a distribution system from which it serves both within and without such region.

3.(15) "Plan" means the Regional Electric Power and Conservation plan (including any amendments thereto) adopted pursuant to this Act and such plan shall apply to actions of the Administrator as specified in this Act.

3.(16) "Renewable resource" means a resource which utilizes solar, wind, hydro, geothermal, biomass, or similar sources of energy and which either is used for electric power generation or will reduce the electric power requirements of a consumer, including by direct application.

3.(17) "Reserves" means the electric power needed to avert particular planning or operating shortages for the benefit of firm power customers of the Administrator and available to the Administrator (A) from resources or (B) from rights to interrupt, curtail, or otherwise withdraw, as provided by specific contract provisions, portions of the electric power supplied to customers.

3.(18) "Residential use" or "residential load" means all usual residential, apartment, seasonal dwelling and farm electrical loads or uses, but only the first four hundred horsepower during any monthly billing period of farm irrigation and pumping for any farm.

3.(19) "Resource" means—

3.(19)(A) electric power, including the actual or planned electric power capability of generating facilities, or

3.(19)(B) actual or planned load reduction resulting from direct application of a renewable energy resource by a consumer, or from a conservation measure.

3.(20) "Secretary" means the Secretary of Energy.

REGIONAL PLANNING AND PARTICIPATION

Section 4.

Pacific Northwest Electric Power and Conservation Planning Council, establishment. 16 USC 839b

4.(a)(1) The purposes of this section are to provide for the prompt establishment and effective operation of the Pacific Northwest Electric Power and Conservation Planning Council, to further the purposes of this Act by the Council promptly preparing and adopting (A) a regional conservation and electric power plan and (B) a program to protect, mitigate, and enhance fish and wildlife, and to otherwise expeditiously and effectively carry out the Council's responsibilities and functions under this Act.

4.(a)(2) To achieve such purposes and facilitate cooperation among the States of Idaho, Montana, Oregon, and Washington, and with the Bonneville Power Administration, the consent of Congress is given for an agreement described in this paragraph and not in conflict with this Act, pursuant to which—

4.(a)(2)(A) there shall be established a regional agency known as the "Pacific Northwest Electric Power and Conservation Planning Council" which (i) shall have its offices in the Pacific Northwest, (ii) shall carry out its functions and responsibilities in accordance with the provisions of this Act, (iii) shall continue in force and effect in accordance with the provisions of this Act, and (iv) except as otherwise provided in this Act, shall not be considered an agency or instrumentality of the United States for the purpose of any Federal law; and

4.(a)(2)(B) two persons from each State may be appointed, subject to the applicable laws of each such State, to undertake the functions and duties of members of the Council.

4.(a)(2) The State may fill any vacancy occurring prior to the expiration of the term of any member. The appointment of six initial members, subject to applicable State law, by June 30, 1981, by at least three of such States shall constitute an agreement by the States establishing the Council and such agreement is hereby consented to by the Congress. Upon request of the Governors of two of the States, the Secretary shall extend the June 30, 1981, date for six additional months to provide more time for the States to make such appointments.

Members. appointment

Time extension

4.(a)(3) Except as otherwise provided by State law, each member appointed to the Council shall serve for a term of three years, except that, with respect to members initially appointed, each Governor shall designate one member to serve a term of two years and one member to serve a term of three years. The members of the Council shall select from among themselves a chairman. The members and officers and employees of the Council shall not be deemed to be officers or employees of the United States for any purpose. The Council shall appoint, fix compensation, and assign and delegate duties to such executive and additional personnel as the Council deems necessary to fulfill its functions under this Act, taking into account such information and analyses as are, or are likely to be, available from other sources pursuant to provisions of this Act. The compensation of the members shall be fixed by State law. The compensation of the members and officers shall not exceed the rate prescribed for Federal officers and positions at step 1 of level GS-18 of the General Schedule.

Terms of office

Compensation

45 FR 69201

4.(a)(4) For the purpose of providing a uniform system of laws, in addition to this Act, applicable to the Council relating to the making of contracts, conflicts-of-interest, financial disclosure, open meetings of the Council, advisory committees, disclosure of information, judicial review of Council functions and actions under this Act, and related matters, the Federal laws applicable to such matters in the case of the Bonneville Power Administration shall apply to the Council to the extent appropriate, except that with respect to open meetings, the Federal laws applicable to open meetings in the case of the Federal Energy Regulatory Commission shall apply to the Council to the extent appropriate. In applying the Federal laws applicable to financial disclosure under the preceding sentence, such laws shall be applied to members of the Council without regard to the duration of their service on the Council or the amount of compensation received for such service. No contract, obligation, or other action of the Council shall be construed as an obligation of the United States or an obligation secured by the full faith and credit of the United States. For the purpose of judicial review of any action of the Council or challenging any provision of this Act relating to functions and responsibilities of the Council, notwithstanding any other provision of law, the courts of the United States shall have exclusive jurisdiction of any such review.

4.(b)(1) If the Council is not established and its members are not timely appointed in accordance with subsection (a) of this section, or if, at any time after such Council is established and its members are appointed in accordance with subsection (a)—

4.(b)(1)(A) any provision of this Act relating to the establishment of the Council or to any substantial function or responsibility of the Council (including any function or responsibility under subsection (d) or (h) of this section or under section 6(c) of this Act) is held to be unlawful by a final determination of any Federal court, or

4.(b)(1)(B) the plan or any program adopted by such Council under this section is held by a final determination of such a court to be ineffective by reason of subsection (a)(2)(B),

4.(b)(1) the Secretary shall establish the Council pursuant to this subsection as a Federal agency. The Secretary shall promptly publish a notice thereof in the Federal Register and notify the Governors of each of the States referred to in subsection (a) of this section.

Notice, publication in Federal Register.

4.(b)(2) As soon as practicable, but not more than thirty days after the publication of the notice referred to in paragraph (1) of this subsection, and thereafter within forty-five days after a vacancy occurs, the Governors of the States of Washington, Oregon, Idaho, and Montana may each (under applicable State laws, if any) provide to the Secretary a list of nominations from such State for each of the State's positions to be selected for such Council. The Secretary may extend this time an additional thirty days. The list shall include at least two persons for each such position. The list shall include such information about such nominees as the Secretary may request. The Secretary shall appoint the Council members from each Governor's list of nominations for each State's positions, except that the Secretary may decline to appoint for any reason any of a Governor's nominees for a position and shall so notify the Governor. The Governor may thereafter make successive nominations within forty-five days of receipt of such notice until nominees acceptable to the Secretary are appointed for each position. In the event the Governor of any such State fails to make the required nominations for any State position on such Council within the time specified for such nominations, the Secretary shall select from such State and appoint the Council member or members for such position. The members of the Council shall select from among themselves one member of the Council as Chairman.

Compensation.

45 FR 69201.

4.(b)(3) The members of the Council established by this subsection who are not employed by the United States or a State shall receive compensation at a rate equal to the rate prescribed for offices and positions at level GS-18 of the General Schedule for each day such members are engaged in the actual performance of duties as members of such Council, except that no such member may be paid more in any calendar year than an officer or employee at step 1 of level GS-18 is paid during such year. Members of such Council shall be considered officers or employees of the United States for purposes of title II of the Ethics in Government Act of 1978 (5 U.S.C. app.) and shall also be allowed travel expenses, including per diem in lieu of subsistence, in the same manner as persons employed intermittently in Government service are allowed expenses under section 5703 of title 5 of the United States Code. Such Council may appoint, and assign duties to, an executive director who shall serve at the pleasure of such Council and who shall be compensated at the rate established for GS-18 of the General Schedule. The executive director shall exercise the powers and duties delegated to such director by such Council,

Compensation.

including the power to appoint and fix compensation of additional personnel in accordance with applicable Federal law to carry out the functions and responsibilities of such Council.

4.(b)(4) When a Council is established under this subsection after a Council was established pursuant to subsection (a) of this section, the Secretary shall provide, to the greatest extent feasible, for the transfer to the Council established by this subsection of all funds, books, papers, documents, equipment, and other matters in order to facilitate the Council's capability to achieve the requirements of subsections (d) and (h) of this section. In order to carry out its functions and responsibilities under this Act expeditiously, the Council shall take into consideration any actions of the Council under subsection (a) and may review, modify, or confirm such actions without further proceedings.

Funds, books, papers, documents and equipment, transfer

4.(b)(5)(A) At any time beginning one year after the plan referred to in such subsection (d) and the program referred to in such subsection (h) of this section are both finally adopted in accordance with this Act, the Council established pursuant to this subsection shall be terminated by the Secretary 90 days after the Governors of three of the States referred to in this subsection jointly provide for any reason to the Secretary a written request for such termination. Except as provided in subparagraph (B), upon such termination all functions and responsibilities of the Council under this Act shall also terminate.

Termination

4.(b)(5)(B) Upon such termination of the Council, the functions and responsibilities of the Council set forth in subsection (h) of this section shall be transferred to, and continue to be funded and carried out, jointly, by the Administrator, the Secretary of the Interior, and the Administrator of the National Marine Fisheries Service, in the same manner and to the same extent as required by such subsection and in cooperation with the Federal and the region's State fish and wildlife agencies and Indian tribes referred to in subsection (h) of this section and the Secretary shall provide for the transfer to them of all records, books, documents, funds, and personnel of such Council that relate to subsection (h) matters. In order to carry out such functions and responsibilities expeditiously, the Administrator, the Secretary of the Interior, and the Administrator of the National Marine Fisheries Service shall take into consideration any actions of the Council under this subsection, and may review, modify, or confirm such actions without further proceedings. In the event the Council is terminated pursuant to this paragraph, whenever any action of the Administrator requires any approval or other action by the Council, the Administrator may take such action without such approval or action, except that the Administrator may not implement any proposal to acquire a major generating resource or to grant billing credits involving a major generating resource until the expenditure of funds for that purpose is specifically authorized by Act of Congress enacted after such termination.

Transfer of functions

4.(c)(1) The provisions of this subsection shall, except as specifically provided in this subsection, apply to the Council established pursuant to either subsection (a) or (b) of this section.

4.(c)(2) A majority of the members of the Council shall constitute a quorum. Except as otherwise provided specifically in this Act, all actions and decisions of the Council shall be by majority vote of the members present and voting. The plan or any part thereof and any amendment thereto shall not be approved unless such plan or amendment receives the votes of—

Quorum

4.(c)(2)(A) a majority of the members appointed to the Council, including the vote of at least one member from each State with members on the Council; or

4.(c)(2)(B) at least six members of the Council.

Council meeting.

4.(c)(3) The Council shall meet at the call of the Chairman or upon the request of any three members of the Council. If any member of the Council disagrees with respect to any matter transmitted to any Federal or State official or any other person or wishes to express additional views concerning such matter, such member may submit a statement to accompany such matter setting forth the reasons for such disagreement or views.

Annual work program budget, availability.

4.(c)(4) The Council shall determine its organization and prescribe its practices and procedures for carrying out its functions and responsibilities under this Act. The Council shall make available to the public a statement of its organization, practices, and procedures, and make available to the public its annual work program budget at the time the President submits his annual budget to Congress.

Personnel detail.

4.(c)(5) Upon request of the Council established pursuant to subsection (b) of this section, the head of any Federal agency is authorized to detail or assign to the Council, on a reimbursable basis, any of the personnel of such agency to assist the Council in the performance of its functions under this Act.

Offices, equipment and supplies.

4.(c)(6) At the Council's request, the Administrator of the General Services Administration shall furnish the Council established pursuant to subsection (b) of this section with such offices, equipment, supplies, and services in the same manner and to the same extent as such Administrator is authorized to furnish to any other Federal agency or instrumentality such offices, supplies, equipment, and services.

Information to Congress.

4.(c)(7) Upon the request of the Congress or any committee thereof, the Council shall promptly provide to the Congress, or to such committee, any record, report, document, material, and other information which is in the possession of the Council.

4.(c)(8) To obtain such information and advice as the Council determines to be necessary or appropriate to carry out its functions and responsibilities pursuant to this Act, the Council shall, to the greatest extent practicable, solicit engineering, economic, social, environmental, and other technical studies from customers of the Administrator and from other bodies or organizations in the region with particular expertise.

4.(c)(9) The Administrator and other Federal agencies, to the extent authorized by other provisions of law, shall furnish the Council all information requested by the Council as necessary for performance of its functions, subject to such requirements of law concerning trade secrets and proprietary data as may be applicable.

Compensation and other expenses, payment.

4.(c)(10)(A) At the request of the Council, the Administrator shall pay from funds available to the Administrator the compensation and other expenses of the Council as are authorized by this Act, including the reimbursement of those States with members on the Council for services and personnel to assist in preparing a plan pursuant to subsection (d) and a program pursuant to subsection (h) of this section, as the Council determines are necessary or appropriate for the performance of its functions and responsibilities. Such payments shall be included by the Administrator in his annual budgets submitted to Congress pursuant to the Federal Columbia River Transmission System Act and shall be subject to the requirements of that Act, including the audit requirements of section 11(d) of such Act. The records, reports, and other documents of the Council shall be available to

16 USC 838 note.
16 USC 838i.
Records, reports, review.

the Comptroller General for review in connection with such audit or other review and examination by the Comptroller General pursuant to other provisions of law applicable to the Comptroller General. Funds provided by the Administrator for such payments shall not exceed annually an amount equal to 0.02 mill multiplied by the kilowatt hours of firm power forecast to be sold by the Administrator during the year to be funded. In order to assist the Council's initial organization, the Administrator after the enactment of this Act shall promptly prepare and propose an amended annual budget to expedite payment for Council activities.

4.(c)(10)(B) Notwithstanding the limitation contained in the fourth sentence of subparagraph (A) of this paragraph, upon an annual showing by the Council that such limitation will not permit the Council to carry out its functions and responsibilities under this Act the Administrator may raise such limit up to any amount not in excess of 0.10 mill multiplied by the kilowatt hours of firm power forecast to be sold by the Administrator during the year to be funded.

4.(c)(11) The Council shall establish a voluntary scientific and statistical advisory committee to assist in the development, collection, and evaluation of such statistical, biological, economic, social, environmental, and other scientific information as is relevant to the Council's development and amendment of a regional conservation and electric power plan.

Voluntary scientific and advisory committee, establishment.

4.(c)(12) The Council may establish such other voluntary advisory committees as it determines are necessary or appropriate to assist it in carrying out its functions and responsibilities under this Act.

4.(c)(13) The Council shall ensure that the membership for any advisory committee established or formed pursuant to this section shall, to the extent feasible, include representatives of, and seek the advice of, the Federal, and the various regional, State, local, and Indian Tribal Governments, consumer groups, and customers.

4.(d)(1) Within two years after the Council is established and the members are appointed pursuant to subsection (a) or (b) of this section, the Council shall prepare, adopt, and promptly transmit to the Administrator a regional conservation and electric power plan. The adopted plan, or any portion thereof, may be amended from time to time, and shall be reviewed by the Council not less frequently than once every five years. Prior to such adoption, public hearings shall be held in each Council member's State on the plan or substantial, nontechnical amendments to the plan proposed by the Council for adoption. A public hearing shall also be held in any other State of the region on the plan or amendments thereto, if the Council determines that the plan or amendments would likely have a substantial impact on that State in terms of major resources which may be developed in that State and which the Administrator may seek to acquire. Action of the Council under this subsection concerning such hearings shall be subject to section 553 of title 5, United States Code and such procedure as the Council shall adopt.

Electric power plan, transmittal to Administrator.

Hearings.

4.(d)(2) Following adoption of the plan and any amendment thereto, all actions of the Administrator pursuant to section 6 of this Act shall be consistent with the plan and any amendment thereto, except as otherwise specifically provided in this Act.

4.(e)(1) The plan shall, as provided in this paragraph, give priority to resources which the Council determines to be cost-effective. Priority shall be given: first, to conservation; second, to renewable resources; third, to generating resources utilizing waste heat or generating resources of high fuel conversion efficiency; and fourth, to all other resources.

4.(e)(2) The plan shall set forth a general scheme for implementing conservation measures and developing resources pursuant to section 6 of this Act to reduce or meet the Administrator's obligations with due consideration by the Council for (A) environmental quality, (B) compatibility with the existing regional power system, (C) protection, mitigation, and enhancement of fish and wildlife and related spawning grounds and habitat, including sufficient quantities and qualities of flows for successful migration, survival, and propagation of anadromous fish, and (D) other criteria which may be set forth in the plan.

4.(e)(3) To accomplish the priorities established by this subsection, the plan shall include the following elements which shall be set forth in such detail as the Council determines to be appropriate:

4.(e)(3)(A) an energy conservation program to be implemented under this Act, including, but not limited to, model conservation standards;

4.(e)(3)(B) recommendation for research and development;

4.(e)(3)(C) a methodology for determining quantifiable environmental costs and benefits under section 3(4);

4.(e)(3)(D) a demand forecast of at least twenty years (developed in consultation with the Administrator, the customers, the States, including State agencies with ratemaking authority over electric utilities, and the public, in such manner as the Council deems appropriate) and a forecast of power resources estimated by the Council to be required to meet the Administrator's obligations and the portion of such obligations the Council determines can be met by resources in each of the priority categories referred to in paragraph (1) of this subsection which forecast (i) shall include regional reliability and reserve requirements, (ii) shall take into account the effect, if any, of the requirements of subsection (h) on the availability of resources to the Administrator, and (iii) shall include the approximate amounts of power the Council recommends should be acquired by the Administrator on a long-term basis and may include, to the extent practicable, an estimate of the types of resources from which such power should be acquired;

4.(e)(3)(E) an analysis of reserve and reliability requirements and cost-effective methods of providing reserves designed to insure adequate electric power at the lowest probable cost;

4.(e)(3)(F) the program adopted pursuant to subsection (h); and

4.(e)(3)(G) if the Council recommends surcharges pursuant to subsection (f) of this section, a methodology for calculating such surcharges.

Studies.

4.(e)(4) The Council, taking into consideration the requirement that it devote its principal efforts to carrying out its responsibilities under subsections (d) and (h) of this section, shall undertake studies of conservation measures reasonably available to direct service industrial customers and other major consumers of electric power within the region and make an analysis of the estimated reduction in energy use which would result from the implementation of such measures as rapidly as possible, consistent with sound business practices. The Council shall consult with such customers and consumers in the conduct of such studies.

Model conservation standards.

4.(f)(1) Model conservation standards to be included in the plan shall include, but not be limited to, standards applicable to (A) new and existing structures, (B) utility, customer, and governmental conservation programs, and (C) other consumer actions for achieving conservation. Model conservation standards shall reflect geographic and climatic differences within the region and other appropriate considerations, and shall be designed to produce all power savings that are cost-effective for the region and economically feasible for consumers, taking into account financial assistance made available to consumers under section 6(a) of this Act. These model conservation standards shall be adopted by the Council and included in the plan after consultation, in such manner as the Council deems appropriate, with the Administrator, States, and political subdivisions, customers of the Administrator, and the public.

4.(f)(2) The Council by a majority vote of the members of the Council is authorized to recommend to the Administrator a surcharge and the Administrator may thereafter impose such a surcharge, in accordance with the methodology provided in the plan, on customers for those portions of their loads within the region that are within States or political subdivisions which have not, or on the Administrator's customers which have not, implemented conservation measures that achieve energy savings which the Administrator determines are comparable to those which would be obtained under such standards. Such surcharges shall be established to recover such additional costs as the Administrator determines will be incurred because such projected energy savings attributable to such conservation measures have not been achieved, but in no case may such surcharges be less than 10 per centum or more than 50 per centum of the Administrator's applicable rates for such load or portion thereof. Surcharge.

4.(g)(1) To insure widespread public involvement in the formulation of regional power policies, the Council and Administrator shall maintain comprehensive programs to—

4.(g)(1)(A) inform the Pacific Northwest public of major regional power issues,

4.(g)(1)(B) obtain public views concerning major regional power issues, and

4.(g)(1)(C) secure advice and consultation from the Administrator's customers and others.

4.(g)(2) In carrying out the provisions of this section, the Council and the Administrator shall—

4.(g)(2)(A) consult with the Administrator's customers;

4.(g)(2)(B) include the comments of such customers in the record of the Council's proceedings; and

4.(g)(2)(C) recognize and not abridge the authorities of State and local governments, electric utility systems, and other non-Federal entities responsible to the people of the Pacific Northwest for the planning, conservation, supply, distribution, and use of electric power and the operation of electric generating facilities.

4.(g)(3) In the preparation, adoption, and implementation of the plan, the Council and the Administrator shall encourage the cooperation, participation, and assistance of appropriate Federal agencies, State entities, State political subdivisions, and Indian tribes. The Council and the Administrator are authorized to contract, in accordance with applicable law, with such agencies, entities, tribes, and subdivisions individually, in groups, or through associations thereof to (A) investigate possible measures to be included in the plan, (B) provide public involvement and information regarding a proposed plan or amendment thereto, and (C) provide services which will assist in the implementation of the plan. In order to assist in the implementation of the plan, particularly conservation, renewable resource, and fish and wildlife activities, the Administrator, when requested and subject to available funds, may provide technical assistance in establishing conservation, renewable resource, and fish and wildlife objectives by individual States or subdivisions thereof or Indian tribes. Such objectives, if adopted by a State or subdivision

Contracts.

Technical assistance

thereof or Indian tribes, may be submitted to the Council and the Administrator for review, and upon approval by the Council, may be incorporated as part of the plan.

4.(h)(1)(A) The Council shall promptly develop and adopt, pursuant to this subsection, a program to protect, mitigate, and enhance fish and wildlife, including related spawning grounds and habitat, on the Columbia River and its tributaries. Because of the unique history, problems, and opportunities presented by the development and operation of hydroelectric facilities on the Columbia River and its tributaries, the program, to the greatest extent possible, shall be designed to deal with that river and its tributaries as a system.

4.(h)(1)(B) This subsection shall be applicable solely to fish and wildlife, including related spawning grounds and habitat, located on the Columbia River and its tributaries. Nothing in this subsection shall alter, modify, or affect in any way the laws applicable to rivers or river systems, including electric power facilities related thereto, other than the Columbia River and its tributaries, or affect the rights and obligations of any agency, entity, or person under such laws.

4.(h)(2) The Council shall request, in writing, promptly after the Council is established under either section 4(a) or 4(b) of this Act and prior to the development or review of the plan, or any major revision thereto, from the Federal and the region's State fish and wildlife agencies[1] and from the region's appropriate Indian tribes, recommendations for—

4.(h)(2)(A) measures which can be expected to be implemented by the Administrator, using authorities under this Act and other laws, and other Federal agencies to protect, mitigate, and enhance fish and wildlife, including related spawning grounds and habitat, affected by the development and operation of any hydroelectric project on the Columbia River and its tributaries;

4.(h)(2)(B) establishing objectives for the development and operation of such projects on the Columbia River and its tributaries in a manner designed to protect, mitigate, and enhance fish and wildlife; and

4.(h)(2)(C) fish and wildlife management coordination and research and development (including funding) which, among other things, will assist protection, mitigation, and enhancement of anadromous fish at, and between, the region's hydroelectric dams.

4.(h)(3) Such agencies and tribes shall have 90 days to respond to such request, unless the Council extends the time for making such recommendations. The Federal and the region's water management agencies,[2] and the region's electric power producing agencies, customers, and public may submit recommendations of the type referred to in paragraph (2) of this subsection. All recommendations shall be accompanied by detailed information and data in support of the recommendations.

4.(h)(4)(A) The Council shall give notice of all recommendations and shall make the recommendations and supporting documents available to the Administrator, to the Federal and the region's State fish and wildlife agencies,[3] to the appropriate Indian tribes, to Federal agencies responsible for managing, operating, or regulating hydroelectric facilities located on the Columbia River or its tributaries, and to any customer or other electric utility which owns or operates any such facility. Notice shall also be given to the public. Copies of such recommendations and supporting documents shall be made available for review at the offices of the Council and shall be available for reproduction at reasonable cost.

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[1] Reads thus in the Public Law as enacted and printed: "from the Federal, and the region's State, fish and wildlife agencies," cf §§4(h)(6)(A) & (7).

[2] Reads thus in the Public Law as enacted and printed: "from the Federal, and the region's, water management agencies," cf. §§4(h)(6)(A) & (7).

[3] Reads thus in the Public Law as enacted and printed: "from the Federal, and the region's, State fish and wildlife agencies," cf. §§4(h)(6)(A) & (7).

4.(h)(4)(B) The Council shall provide for public participation and comment regarding the recommendations and supporting documents, including an opportunity for written and oral comments, within such reasonable time as the Council deems appropriate.

Written and oral comments

4.(h)(5) The Council shall develop a program on the basis of such recommendations, supporting documents, and views and information obtained through public comment and participation, and consultation with the agencies, tribes, and customers referred to in subparagraph (A) of paragraph (4). The program shall consist of measures to protect, mitigate, and enhance fish and wildlife affected by the development, operation, and management of such facilities while assuring the Pacific Northwest an adequate, efficient, economical, and reliable power supply. Enhancement measures shall be included in the program to the extent such measures are designed to achieve improved protection and mitigation.

Fish and wildlife protection.

4.(h)(6) The Council shall include in the program measures which it determines, on the basis set forth in paragraph (5), will—

4.(h)(6)(A) complement the existing and future activities of the Federal and the region's State fish and wildlife agencies and appropriate Indian tribes;

4.(h)(6)(B) be based on, and supported by, the best available scientific knowledge;

4.(h)(6)(C) utilize, where equally effective alternative means of achieving the same sound biological objective exist, the alternative with the minimum economic cost;

4.(h)(6)(D) be consistent with the legal rights of appropriate Indian tribes in the region; and

4.(h)(6)(E) in the case of anadromous fish—

4.(h)(6)(E)(i) provide for improved survival of such fish at hydroelectric facilities located on the Columbia River system; and

4.(h)(6)(E)(ii) provide flows of sufficient quality and quantity between such facilities to improve production, migration, and survival of such fish as necessary to meet sound biological objectives.

4.(h)(7) The Council shall determine whether each recommendation received is consistent with the purposes of this Act. In the event such recommendations are inconsistent with each other, the Council, in consultation with appropriate entities, shall resolve such inconsistency in the program giving due weight to the recommendations, expertise, and legal rights and responsibilities of the Federal and the region's State fish and wildlife agencies and appropriate Indian tribes. If the Council does not adopt any recommendation of the fish and wildlife agencies and Indian tribes as part of the program or any other recommendation, it shall explain in writing, as part of the program, the basis for its finding that the adoption of such recommendation would be—

4.(h)(7)(A) inconsistent with paragraph (5) of this subsection;

4.(h)(7)(B) inconsistent with paragraph (6) of this subsection; or

4.(h)(7)(C) less effective than the adopted recommendations for the protection, mitigation, and enhancement of fish and wildlife.

4.(h)(8) The Council shall consider, in developing and adopting a program pursuant to this subsection, the following principles:

4.(h)(8)(A) Enhancement measures may be used, in appropriate circumstances, as a means of achieving offsite protection and mitigation with respect to compensation for losses arising from the development and operation of the hydroelectric facilities of the Columbia River and its tributaries as a system.

4.(h)(8)(B) Consumers of electric power shall bear the cost of measures designed to deal with adverse impacts caused by the development and operation of electric power facilities and programs only.

4.(h)(8)(C) To the extent the program provides for coordination of its measures with additional measures (including additional enhancement measures to deal with impacts caused by factors other than the development and operation of electric power facilities and programs), such additional measures are to be implemented in accordance with agreements among the appropriate parties providing for the administration and funding of such additional measures.

4.(h)(8)(D) Monetary costs and electric power losses resulting from the implementation of the program shall be allocated by the Administrator consistent with individual project impacts and system-wide objectives of this subsection.

4.(h)(9) The Council shall adopt such program or amendments thereto within one year after the time provided for receipt of the recommendations. Such program shall also be included in the plan adopted by the Council under subsection (d).

Fish and wildlife, protection.

4.(h)(10)(A) The Administrator shall use the Bonneville Power Administration fund and the authorities available to the Administrator under this Act and other laws administered by the Administrator to protect, mitigate, and enhance fish and wildlife to the extent affected by the development and operation of any hydroelectric project of the Columbia River and its tributaries in a manner consistent with the plan, if in existence, the program adopted by the Council under this subsection, and the purposes of this Act. Expenditures of the Administrator pursuant to this paragraph shall be in addition to, not in lieu of, other expenditures authorized or required from other entities under other agreements or provisions of law.

4.(h)(10)(B) The Administrator may make expenditures from such fund which shall be included in the annual or supplementary budgets submitted to the Congress pursuant to the Federal Columbia River Transmission System Act. Any amounts included in such budget for the construction of capital facilities with an estimated life of greater than 15 years and an estimated cost of at least $1,000,000 shall be funded in the same manner and in accordance with the same procedures as major transmission facilities under the Federal Columbia River Transmission System Act.

16 USC 838 note.

Allocation of funds.

4.(h)(10)(C) The amounts expended by the Administrator for each activity pursuant to this subsection shall be allocated as appropriate by the Administrator, in consultation with the Corps of Engineers and the Water and Power Resources Service, among the various hydroelectric projects of the Federal Columbia River Power System. Amounts so allocated shall be allocated to the various project purposes in accordance with existing accounting procedures for the Federal Columbia River Power System.

4.(h)(11)(A) The Administrator and other Federal agencies responsible for managing, operating, or regulating Federal or non-Federal hydroelectric facilities located on the Columbia River or its tributaries shall—

4.(h)(11)(A)(i) exercise such responsibilities consistent with the purposes of this Act and other applicable laws, to adequately protect, mitigate, and enhance fish and wildlife, including related spawning grounds and habitat, affected by such projects or facilities in a manner that provides equitable treatment for such fish and wildlife with the other purposes for which such system and facilities are managed and operated;

4.(h)(11)(A)(ii) exercise such responsibilities, taking into account at each relevant stage of decisionmaking processes to the fullest extent practicable, the program adopted by the Council under this subsection. If, and to the extent that, such other Federal agencies as a result of such consideration impose upon any non-Federal electric power project measures to protect, mitigate, and enhance fish and wildlife which are not attributable to the development and operation of such project, then the resulting monetary costs and power losses (if any) shall be borne by the Administrator in accordance with this subsection.

4.(h)(11)(B) The Administrator and such Federal agencies shall consult with the Secretary of the Interior, the Administrator of the National Marine Fisheries Service, and the State fish and wildlife agencies of the region, appropriate Indian tribes, and affected project operators in carrying out the provisions of this paragraph and shall, to the greatest extent practicable, coordinate their actions.

4.(h)(12)(A) Beginning on October 1 of the first fiscal year after all members to the Council are appointed initially, the Council shall submit annually a detailed report to the Committee on Energy and Natural Resources of the Senate and to the Committees on Interstate and Foreign Commerce and on Interior and Insular Affairs of the House of Representatives. The report shall describe the actions taken and to be taken by the Council under this Act, including this subsection, the effectiveness of the fish and wildlife program, and potential revisions or modifications to the program to be included in the plan when adopted. At least ninety days prior to its submission of such report, the Council shall make available to such fish and wildlife agencies, and tribes, the Administrator and the customers a draft of such report. The Council shall establish procedures for timely comments thereon. The Council shall include as an appendix to such report such comments or a summary thereof.

Report to congressional committees.

4.(h)(12)(B) The Administrator shall keep such committees fully and currently informed of the actions taken and to be taken by the Administrator under this Act, including this subsection.

4.(i) The Council may from time to time review the actions of the Administrator pursuant to sections 4 and 6 of this Act to determine whether such actions are consistent with the plan and programs, the extent to which the plan and programs is being implemented, and to assist the Council in preparing amendments to the plan and programs.

Review.

4.(j)(1) The Council may request the Administrator to take an action under section 6 to carry out the Administrator's responsibilities under the plan.

4.(j)(2) To the greatest extent practicable within ninety days after the Council's request, the Administrator shall respond to the Council in writing specifying—

4.(j)(2)(A) the means by which the Administrator will undertake the action or any modification thereof requested by the Council, or

4.(j)(2)(B) the reasons why such action would not be consistent with the plan, or with the Administrator's legal obligations under this Act, or other provisions of law, which the Administrator shall specifically identify.

4.(j)(3) If the Administrator determines not to undertake the requested action, the Council, within sixty days after notice of the Administrator's determination, may request the Administrator to hold an informal hearing and make a final decision.

Hearing.

4.(k)(1) Not later than October 1, 1987, or six years after the Council is established under this Act, whichever is later, the Council shall complete a thorough analysis of conservation measures and conservation resources implemented pursuant to this Act during the five-year period beginning on the date the Council is established under this Act to determine if such measures or resources:

Conservation measures and resources, analysis

4.(k)(1)(A) have resulted or are likely to result in costs to consumers in the region greater than the costs of additional generating resources or additional fuel which the Council determines would be necessary in the absence of such measures or resources;

4.(k)(1)(B) have not been or are likely not to be generally equitable to all consumers in the region; or

4.(k)(1)(C) have impaired or are likely to impair the ability of the Administrator to carry out his obligations under this Act and other laws, consistent with sound business practices.

4.(k)(2) The Administrator may determine that section 3(4)(D) shall not apply to any proposed conservation measure or resource if the Administrator finds after receipt of such analysis from the Council that such measure or resource would have any result or effect described in subparagraph (A), (B) or (C) of paragraph (1).

SALE OF POWER

Section 5.

16 USC 839c.

5.(a) All power sales under this Act shall be subject at all times to the preference and priority provisions of the Bonneville Project Act of 1937 (16 U.S.C. 832 and following) and, in particular, sections 4 and 5 thereof. Such sales shall be at rates established pursuant to section 7.

16 USC 832c, 832d.
16 USC 832f.

5.(b)(1) Whenever requested, the Administrator shall offer to sell to each requesting public body and cooperative entitled to preference and priority under the Bonneville Project Act of 1937 and to each requesting investor-owned utility electric power to meet the firm power load of such public body, cooperative or investor-owned utility in the Region to the extent that such firm power load exceeds—

5.(b)(1)(A) the capability of such entity's firm peaking and energy resources used in the year prior to the enactment of this Act to serve its firm load in the region, and

5.(b)(1)(B) such other resources as such entity determines, pursuant to contracts under this Act, will be used to serve its firm load in the region.

5.(b)(1) In determining the resources which are used to serve a firm load, for purposes of subparagraphs (A) and (B), any resources used to serve a firm load under such subparagraphs shall be treated as continuing to be so used, unless such use is discontinued with the consent of the Administrator, or unless such use is discontinued because of obsolescence, retirement, loss of resource, or loss of contract rights.

5.(b)(2) Contracts with investor-owned utilities shall provide that the Administrator may reduce his obligations under such contracts in accordance with section 5(a) of the Bonneville Project Act of 1937.

5.(b)(3) In addition to his authorities to sell electric power under paragraph (1), the Administrator is also authorized to sell electric power to Federal agencies in the region

5.(b)(4) Sales under this subsection shall be made only if the public body, cooperative, Federal agency or investor-owned utility complies with the Administrator's standards for service in effect on the effective date of this Act or as subsequently revised.

5.(b)(5) The Administrator shall include in contracts executed in accordance with this subsection provisions that enable the Administrator to restrict his contractual obligations to meet the loads referred to in this subsection in the future if the Administrator determines, after a reasonable period of experience under this Act. that the Administrator cannot be assured on a planning basis of acquiring sufficient resources to meet such loads during a specified period of insufficiency. Any such contract with a public body, cooperative, or Federal agency shall specify a reasonable minimum period between a notice of restriction and the earliest date such restriction may be imposed.

5.(b)(6) Contracts executed in accordance with this subsection with public body, cooperative, and Federal agency customers shall—

5.(b)(6)(A) provide that the restriction referred to in paragraph (5) shall not be applicable to any such customers until the operating year in which the total of such customers' firm loads to be served by the Administrator equals or exceeds the firm capability of the Federal base system resources;

5.(b)(6)(B) not permit restrictions which would reduce the total contractual entitlement of such customers to an amount less than the firm capability of the Federal base system resources; and

5.(b)(6)(C) contain a formula for determining annually, on a uniform basis, each such customer's contractual entitlement to firm power during such a period of restriction, which formula shall not consider customer resources other than those the customer has determined, as of the effective date of this Act, to be used to serve its own firm loads.

5.(b)(6) The formula referred to in subparagraph (C) shall obligate the Administrator to provide on an annual basis only firm power needed to serve the portion of such customer's firm load in excess of the capability of such customer's own firm resources determined by such customer under paragraph (1) of this subsection to be used to serve its firm load.

5.(c)(1) Whenever a Pacific Northwest electric utility offers to sell electric power to the Administrator at the average system cost of that utility's resources in each year, the Administrator shall acquire by purchase such power and shall offer, in exchange, to sell an equivalent amount of electric power to such utility for resale to that utility's residential users within the region.

Purchase and exchange sale.

5.(c)(2) The purchase and exchange sale referred to in paragraph (1) of this subsection with any electric utility shall be limited to an amount not in excess of 50 per centum of such utility's Regional residential load in the year beginning July 1, 1980, such 50 per centum limit increasing in equal annual increments to 100 per centum of such load in the year beginning July 1, 1985, and each year thereafter.

Limitation.

5.(c)(3) The cost benefits, as specified in contracts with the Administrator, of any purchase and exchange sale referred to in paragraph (1) of this subsection which are attributable to any electric utility's residential load within a State shall be passed through directly to such utility's residential loads within such State, except that a State which lies partially within and partially without the region may require that such cost benefits be distributed among all of the utility's residential loads in that State.

Cost benefits.

5.(c)(4) An electric utility may terminate, upon reasonable terms and conditions agreed to by the Administrator and such utility prior to such termination, its purchase and sale under this subsection if the supplemental rate charge provided for in section 7(b)(3) is applied and the cost of electric power sold to such utility under this subsection exceeds, after application of such rate charge, the average system cost of power sold by such utility to the Administrator under this subsection.

Termination.

5.(c)(5) Subject to the provisions of sections 4 and 6, in lieu of purchasing any amount of electric power offered by a utility under paragraph (1) of this subsection, the Administrator may acquire an equivalent amount of electric power from other sources to replace power sold to such utility as part of an exchange sale if the cost of such acquisition is less than the cost of purchasing the electric power offered by such utility.

5.(c)(6) Exchange sales to a utility pursuant to this subsection shall not be restricted below the amounts of electric power acquired by the Administrator from, or on behalf of, such utility pursuant to this subsection.

"Average system cost."

5.(c)(7) The "average system cost" for electric power sold to the Administrator under this subsection shall be determined by the Administrator on the basis of a methodology developed for this purpose in consultation with the Council, the Administrator's customers, and appropriate State regulatory bodies in the region. Such methodology shall be subject to review and approval by the Federal Energy Regulatory Commission. Such average system cost shall not include—

5.(c)(7)(A) the cost of additional resources in an amount sufficient to serve any new large single load of the utility;

5.(c)(7)(B) the cost of additional resources in an amount sufficient to meet any additional load outside the region occurring after the effective date of this Act; and

5.(c)(7)(C) any costs of any generating facility which is terminated prior to initial commercial operation.

5.(d)(1)(A) The Administrator is authorized to sell in accordance with this subsection electric power to existing direct service industrial customers. Such sales shall provide a portion of the Administrator's reserves for firm power loads within the region.

Industrial firm power.

5.(d)(1)(B) After the effective date of this Act, the Administrator shall offer in accordance with subsection (g) of this section to each existing direct service industrial customer an initial long term contract that provides such customer an amount of power equivalent to that to which such customer is entitled under its contract dated January or April 1975 providing for the sale of "industrial firm power."

5.(d)(2) The Administrator shall not sell electric power, including reserves, directly to new direct service industrial customers.

5.(d)(3) The Administrator shall not sell amounts of electric power, including reserves, to existing direct service industrial customers in excess of the amount permitted under paragraph (1) unless the Administrator determines, after a plan has been adopted pursuant to section 4 of this Act, that such proposed sale is consistent with the plan and that—

5.(d)(3)(A) additional power system reserves are required for the region's firm loads,

5.(d)(3)(B) the proposed sale would provide a cost-effective method of supplying such reserves,

5.(d)(3)(C) such loads or loads of similar character cannot provide equivalent operating or planning benefits to the region if served by an electric utility under contractual arrangements providing reserves, and

5.(d)(3)(D) the Administrator has or can acquire sufficient electric power to serve such loads, and

5.(d)(3) unless the Council has determined such sale is consistent with the plan. After such determination by the Administrator and by the Council, the Administrator is authorized to offer to existing direct service industrial customers power in such amounts in excess of the amount permitted under paragraph (1) of this subsection as the Administrator determines to be necessary to provide additional power system reserves to meet the region's firm loads.

Definitions.

5.(d)(4)(A) As used in this section, the term "existing direct service industrial customer" means any direct service industrial customer of the Administrator which has a contract for the purchase of electric power from the Administrator on the effective date of this Act.

5.(d)(4)(B) The term "new direct service industrial customer" means any industrial entity other than an existing direct service industrial customer.

New contract

5.(d)(4)(C)(i) Where a new contract is offered in accordance with subsection (g) to any existing direct service industrial customer which has not received electric power prior to the effective date of this Act from the Administrator pursuant to a contract with the Administrator existing on the date of the enactment of this Act, electric power delivered under such new contract shall be conditioned on the Administrator reasonably acquiring, in accordance with this Act and within such estimated period of time (as specified in the contract) as he deems reasonable, sufficient resources to meet, on a planning basis, the load requirement of such customer. Such contract shall also provide that the obligation of the Administrator to acquire such resources to meet such load requirement shall, except as provided in clause (ii) of this subparagraph, apply only to such customer and shall not be sold or exchanged by such customer to any other person.

Contract rights, transfer.

5.(d)(4)(C)(ii) Rights under a contract described in clause (i) of this subparagraph may be transferred by an existing direct service industrial customer referred to in clause (i) to a successor in interest in connection with a reorganization or other transfer of all major assets of such customer. Following such a transfer, such successor in interest (or any other subsequent successor in interest) may also transfer rights under such a contract only in connection with a reorganization or other transfer of all assets of such successor in interest.

5.(d)(4)(C)(iii) The limitations of clause (i) of this subparagraph shall not apply to any customer referred to in clause (i) whenever the Administrator determines that such customer is receiving electric power pursuant to a contract referred to in such clause (ii).

5.(e)(1) The contractual entitlement to firm power of any customer from whom, or on whose behalf, the Administrator has acquired electric power pursuant to section 6 may not be restricted below the amount of electric power so acquired from, or on behalf of, such customer. If in any year such customer's requirements are less than such entitlement, any excess of such entitlement shall be first made available to increase the entitlement of other customers of the same class before being available for the entitlement of other customers. For purposes of this paragraph, the following entities shall each constitute a class:

5.(e)(1)(A) public bodies and cooperatives;
5.(e)(1)(B) Federal agencies;
5.(e)(1)(C) direct service industrial; and
5.(e)(1)(D) investor owned utilities.

5.(e)(2) Any contractual entitlement to firm power which is based on electric power acquired from, or on behalf of, a customer pursuant to section 6 shall be in addition to any other contractual entitlement to firm power not subject to restriction that such customer may have under this section. For the purposes of this subsection, references to amounts of power required by the Administrator pursuant to section 6 shall be deemed to mean the amounts specified in the resource acquisition contracts exclusive of any amounts recognized in such contracts as replacement for Federal base system resources.

5.(e)(3) The Administrator shall, consistent with the provisions of this Act, insure that any restrictions upon any particular customer class made pursuant to this subsection and subsection (b) of this section are distributed equitably throughout the region.

5.(f) The Administrator is authorized to sell, or otherwise dispose of, electric power, including power acquired pursuant to this and other Acts, that is surplus to his obligations incurred pursuant to subsections (b), (c), and (d) of this section in accordance with this and other Acts applicable to the Administrator, including the Bonneville Project Act of 1937 (16 U.S.C. 832 and following), the Federal Columbia River Transmission System Act (16 U.S.C. 838 and following), and the Act of August 31, 1964 (16 U.S.C. 837-837h).

Long-term contracts.

16 USC 838d.

5.(g)(1) As soon as practicable within nine months after the effective date of this Act, the Administrator shall commence necessary negotiations for, and offer, initial long-term contracts (within the limitations of the third sentence of section 5(a) of the Bonneville Project Act) simultaneously to—

5.(g)(1)(A) existing public body and cooperative customers and investor-owned utility customers under subsection (b) of this section;

5.(g)(1)(B) Federal agency customers under subsection (b) of this section;

5.(g)(1)(C) electric utility customers under subsection (c) of this section; and

5.(g)(1)(D) direct service industrial customers under subsection (d)(1).

5.(g)(2) Each customer offered a contract pursuant to this subsection shall have one year from the date of such offer to accept such contract. Such contract shall be effective as provided in this subsection.

5.(g)(3) An initial contract with a public body, cooperative or investor-owned electric utility customer or a Federal agency customer pursuant to subsection (b) of this section shall be effective on the date executed by such customer, unless another effective date is otherwise agreed to by the Administrator and the customer.

5.(g)(4) An initial contract with an electric utility customer pursuant to subsection (c) of this section shall be effective on the date executed by such customer, but no earlier than the first day of the tenth month after the effective date of this Act.

5.(g)(5) An initial contract with a direct service industrial customer pursuant to subsection (d)(1), shall be effective on the date agreed upon by the Administrator and such customer, but no later than the first day of the tenth month after the effective date of this Act. When such contract is executed, it may for rate purposes be given retroactive effect to such first day.

5.(g)(6) Initial contracts offered public body, cooperative and Federal agency customers in accordance with this subsection shall provide that during a period of insufficiency declared in accordance with subsection (b) of this section each customer's contractual entitlement shall, to the extent of its requirements on the Administrator, be no less than the amount of firm power received from the Administrator in the year immediately preceding the period of insufficiency.

5.(g)(7) The Administrator shall be deemed to have sufficient resources for the purpose of entering into the initial contracts specified in paragraph (1)(A) through (D).

CONSERVATION AND RESOURCE ACQUISITION

Section 6.

6.(a)(1) The Administrator shall acquire such resources through conservation, implement all such conservation measures, and acquire such renewable resources which are installed by a residential or small commercial consumer to reduce load, as the Administrator determines are consistent with the plan, or if no plan is in effect with the criteria of section 4(e)(1) and the considerations of section 4(e)(2) and, in the case of major resources, in accordance with subsection (c) of this section. Such conservation measures and such resources may include, but are not limited to— 16 USC 838d.

6.(a)(1)(A) loans and grants to consumers for insulation or weatherization, increased system efficiency, and waste energy recovery by direct application,

6.(a)(1)(B) technical and financial assistance to, and other cooperation with, the Administrator's customer and governmental authorities to encourage maximum cost-effective voluntary conservation and the attainment of any cost-effective conservation objectives adopted by individual States or subdivisions thereof,

6.(a)(1)(C) aiding the Administrator's customers and governmental authorities in implementing model conservation standards adopted pursuant to section 4(f), and

6.(a)(1)(D) conducting demonstration projects to determine the cost effectiveness of conservation measures and direct application of renewable energy resources.

6.(a)(2) In addition to acquiring electric power pursuant to section 5(c), or on a short-term basis pursuant to section 11(b)(6)(i) of the Federal Columbia River Transmission System Act, the Administrator shall acquire, in accordance with this section, sufficient resources— 16 USC 838i.

6.(a)(2)(A) to meet his contractual obligations that remain after taking into account planned savings from measures provided for in paragraph (1) of this subsection, and

6.(a)(2)(B) to assist in meeting the requirements of section 4(h) of this Act.

6.(a)(2) The Administrator shall acquire such resources without considering restrictions which may apply pursuant to section 5(b) of this Act.

6.(b)(1) Except as specifically provided in this section, acquisition of resources under this Act shall be consistent with the plan, as determined by the Administrator.

6.(b)(2) The Administrator may acquire resources (other than major resources) under this Act which are not consistent with the plan, but which are determined by the Administrator to be consistent with the criteria of section 4(e)(1) and the considerations of section 4(e)(2) of this Act.

6.(b)(3) If no plan is in effect, the Administrator may acquire resources under this Act which are determined by the Administrator to be consistent with the criteria of section 4(e)(1) and the considerations of section 4(e)(2) of this Act.

6.(b)(4) The Administrator shall acquire any non-Federal resources to replace Federal base system resources only in accordance with the provisions of this section. The Administrator shall include in the contracts for the acquisition of any such non-Federal replacement resources provisions which will enable him to ensure that such non-Federal replacement resources are developed and operated in a manner consistent with the considerations specified in section 4(e)(2) of this Act.

6.(b)(5) Notwithstanding any acquisition of resources pursuant to this section, the Administrator shall not reduce his efforts to achieve conservation and to acquire renewable resources installed by a residential or small commercial consumer to reduce load, pursuant to subsection (a)(1) of this section.

6.(c)(1) For each proposal under subsection (a), (b), (f), (h) or (l) of this section to acquire a major resource, to implement a conservation measure which will conserve an amount of electric power equivalent to that of a major resource, to pay or reimburse investigation and preconstruction expenses of the sponsors of a major resource, or to grant billing credits or services involving a major resource, the Administrator shall—

Publication in Federal Register

6.(c)(1)(A) publish notice of the proposed action in the Federal Register and provide a copy of such notice to the Council, the Governor of each State in which facilities would be constructed or a conservation measure implemented, and the Administrator's customers;

Public hearings

6.(c)(1)(B) not less than sixty days following publication of such notice, conduct one or more public hearings, presided over by a hearing officers, at which testimony and evidence shall be received, with opportunity for such rebuttal and cross-examination as the hearing officer deems appropriate in the development of an adequate hearing record;

6.(c)(1)(C) develop a record to assist in evaluating the proposal which shall include the transcript of the public hearings, together with exhibits, and such other materials and information as may have been submitted to, or developed by, the Administrator; and

6.(c)(1)(D) following completion of such hearings, promptly provide to the Council and make public a written decision that includes, in addition to a determination respecting the requirements of subsection (a), (b), (f), (h), (l), or (m) of this section, as appropriate—

6.(c)(1)(D)(i) if a plan is in effect, a finding that the proposal is either consistent or inconsistent with the plan or, notwithstanding its inconsistency with the plan, a finding that it is needed to meet the Administrator's obligations under this Act, or

6.(c)(1)(D)(ii) if no plan is in effect, a finding that the proposal is either consistent or inconsistent with the criteria of section 4(e)(1) and the considerations of section 4(e)(2) of this Act or notwithstanding its inconsistency, a finding that it is needed to meet the Administrator's obligations under this Act.

6.(c)(1)(D) In the case of subsection (f) of this section, such decision shall be treated as satisfying the applicable requirements of this subsection and of subsection (f) of this section, if it includes a finding of probable consistency, based upon the Administrator's evaluation of information available at the time of completion of the hearing under this paragraph. Such decision shall include the reasons for such finding.

6.(c)(2) Within sixty days of the receipt of the Administrator's decision pursuant to paragraph (1)(D) of this subsection, the Council may determine by a majority vote of all members of the Council, and notify the Administrator—

6.(c)(2)(A) that the proposal is either consistent or inconsistent with the plan, or

6.(c)(2)(B) if no plan is in effect, that the proposal is either consistent or inconsistent with the criteria of section 4(e)(1) and the considerations of section 4(e)(2).

6.(c)(3) The Administrator may not implement any proposal referred to in paragraph (1) that is determined pursuant to paragraph (1) or (2) by either the Administrator or the Council to be inconsistent with the plan or, if no plan is in effect, with the criteria of section 4(e)(1) and the considerations of section 4(e)(2)—

6.(c)(3)(A) unless the Administrator finds that, notwithstanding such inconsistency, such resource is needed to meet the Administrator's obligations under this Act, and

6.(c)(3)(B) until the expenditure of funds for that purpose has been specifically authorized by Act of Congress enacted after the date of the enactment of this Act.

6.(c)(4) Before the Administrator implements any proposal referred to in paragraph (1) of this subsection, the Administrator shall— 42 USC 4321 note. Publication in Federal Register

6.(c)(4)(A) submit to the appropriate committees of the Congress the administrative record of the decision (including any determination by the Council under paragraph (2)) and a statement of the procedures followed or to be followed for compliance with the National Environmental Policy Act of 1969,

6.(c)(4)(B) publish notice of the decision in the Federal Register, and

6.(c)(4)(C) note the proposal in the Administrator's annual or supplementary budget submittal made pursuant to the Federal Columbia River Transmission System Act (16 U.S.C. 838 and following).

6.(c)(4) The Administrator may not implement any such proposal until ninety days after the date on which such proposal has been noted in such budget or after the date on which such decision has been published in the Federal Register, whichever is later.

6.(c)(5) The authority of the Council to make a determination under paragraph (2)(B) if no plan is in effect shall expire on the date two years after the establishment of the Council.

6.(d) The Administrator is authorized to acquire a resource, other than a major resource, whether or not such resource meets the criteria of section 4(e)(1) and the considerations of section 4(e)(2) but which he determines is an experimental, developmental, demonstration, or pilot project of a type with a potential for providing cost-effective service to the region. The Administrator shall make no obligation for the acquisition of such resource until it is included in the annual budgets submitted to the Congress pursuant to the Federal Columbia River Transmission System Act.

6.(e)(1) In order to effectuate the priority given to conservation measures and renewable resources under this Act, the Administrator shall, to the maximum extent practicable, make use of his authorities under this Act to acquire conservation measures and renewable resources, to implement conservation measures, and to provide credits and technical and financial assistance for the development and implementation of such resources and measures (including the funding of, and the securing of debt for, expenses incurred during the investigation and preconstruction of resources, as authorized in subsection (f) of this section).

6.(e)(2) To the extent conservation measures or acquisition of resources require direct arrangements with consumers, the Administrator shall make maximum practicable use of customers and local entities capable of administering and carrying out such arrangements.

6.(f)(1) For resources which the Administrator determines may be eligible for acquisition under this section and satisfy the criteria of section 4(e)(1) and the considerations of section 4(e)(2) of this Act or, if a plan is in effect, to be consistent with the plan, the Administrator is authorized to enter into agreements with sponsors of—

6.(f)(1)(A) a renewable resource, other than a major resource, to fund or secure debt incurred in the investigation and initial development of such resource, or

6.(f)(1)(B) any other resource to provide for the reimbursement of the sponsor's investigation and preconstruction expenses concerning such resource (which expenses shall not include procurement of capital equipment or construction material for such resource).

6.(f)(1) In the case of any resource referred to in subparagraph (B) of this paragraph, such reimbursement is authorized only if—

6.(f)(1)(B)(i) such resource is subsequently denied State siting approval or other necessary Federal or State permits, or approvals,

6.(f)(1)(B)(ii) such investigation subsequently demonstrates, as determined by the Administrator, that such resource does not meet the criteria of section 4(e)(1) and the considerations of section 4(e)(2) of this Act or is not acceptable because of environmental impacts, or

6.(f)(1)(B)(iii) after such investigation the Administrator determines not to acquire the resource and the sponsor determines not to construct the resource.

6.(f)(2) The Administrator may exercise the authority of this subsection only after he determines that the failure to do so would result in inequitable hardship to the consumers of such sponsors. The Administrator may provide reimbursement under this subsection only for expenses incurred after the date of the enactment of this Act.

6.(f)(3) Any agreement under paragraph (1) of this subsection shall provide the Administrator an option to acquire any such resource, including a renewable resource, and shall include such other provisions, as the Administrator deems appropriate, for the Administrator's recovery from such sponsors or any assignee of the sponsors, if such sponsor or assignee continues development of the resource, of any advances made by the Administrator pursuant to such agreement.

6.(f)(4) The Administrator shall not reimburse any expense incurred by the sponsors (except necessary expenses involved in the liquidation of the resource) after the date of a final denial of application for State siting approval or after the date the Administrator determines that the resource to be inconsistent with the plan or the criteria of section 4(e)(1) and the considerations of section 4(e)(2).

6.(g) At the request of the appropriate State, any environmental impact statement which may be required with respect to a resource, to the extent determined possible by the Administrator in accordance with applicable law and regulations, may be prepared jointly and in coordination with any required environmental impact statement of the State or any other statement which serves the purpose of an environmental impact statement which is required by State law.

Billing credits.

6.(h)(1) If a customer so requests, the Administrator shall grant billing credits to such customer, and provide services to such customer at rates established for such services, for—

6.(h)(1)(A) conservation activities independently undertaken or continued after the effective date of this Act by such customer or political subdivision served by such customer which reduce the obligation of the Administrator that would otherwise have existed to acquire other resources under this Act, or

6.(h)(1)(B) resources constructed, completed, or acquired after the effective date of this Act by a customer, an entity acting on behalf of such customer, or political subdivision served by the customer which reduce the obligation of the Administrator to acquire resources under this Act. Such resources shall be renewable resources or multipurpose projects or other resources which are not inconsistent with the plan or, in the absence of a plan, not inconsistent with the criteria of section 4(e)(1) and the considerations of section 4(e)(2) of this Act.

6.(h)(2) The energy and capacity on which a credit under this subsection to a customer is based shall be the amount by which a conservation activity or resource actually changes the customer's net requirement for supply of electric power or reserves from the Administrator.

6.(h)(3) The amount of credits for conservation under this subsection shall be set to credit the customer implementing or continuing the conservation activity for which the credit is granted for the savings resulting from such activity. The rate impact on the Administrator's other customers of granting the credit shall be equal to the rate impact such customers would have experienced had the Administrator been obligated to acquire resources in an amount equal to that actually saved by the activity for which the credit is granted.

6.(h)(4) For resources other than conservation, the customer shall be credited for net costs actually incurred by such customer, an entity acting on behalf of such customer, or political subdivision served by such customer, in acquiring, constructing, or operating the resource for which the credit is granted. The rate impact to the Administrator's other customers of granting the credit shall be no greater than the rate impact such customers would have experienced had the Administrator been obligated to acquire resources in an amount equal to that actually produced by the resource for which the credit is granted.

6.(h)(5) Retail rate structures which are voluntarily implemented by the Administrator's customers and which induce conservation or installation of consumer-owned renewable resources shall be considered, for purposes of this subsection, to be (A) conservation activities independently undertaken or carried on by such customers, or (B) customer-owned renewable resources, and shall qualify for billing credits upon the same showing as that required for other conservation or renewable resource activities.

6.(h)(6) Prior to granting any credit or providing services pursuant to this subsection, the Administrator shall—

6.(h)(6)(A) comply with the notice provisions of subsection (c) of this section, and include in such notice the methodology the Administrator proposes to use in determining the amount of any such credit;

6.(h)(6)(B) include the cost of such credit in the Administrator's annual or amended budget submittal to the Congress made pursuant to the Federal Columbia River Transmission System Act (16 U.S.C. 838(j));

6.(h)(6)(C) require that resources in excess of customer's reasonable load growth shall have been offered to others for ownership, participation or other sponsorship pursuant to subsection (m) of this section, except in the case of conservation, multi-purpose projects uniquely suitable for development by the customer, or renewable resources; and

6.(h)(6)(D) require that the operators of any generating resource for which a billing credit is to be granted agree to operate such resource in a manner compatible with the planning and operation of the region's power system.

6.(i) Contracts for the acquisition of resources and for billing credits for major resources, including conservation activities, entered into pursuant to this section shall contain such terms and conditions, applicable after the contract is entered into, as will—

6(i)(1) insure timely construction, scheduling, completion, and operation of resources.

6.(i)(2) insure that the costs of any acquisition are as low as reasonably possible, consistent (A) with sound engineering, operating, and safety practices, and (B) the protection, mitigation, and enhancement of fish and wildlife, including related spawning grounds and habitat affected by the development of such resources, and

6.(i)(3) insure that the Administrator exercises effective oversight, inspection, audit, and review of all aspects of such construction and operation.

6.(i) Such contracts shall contain provisions assuring that the Administrator has the authority to approve all costs of, and proposals for, major modifications in construction, scheduling or operations and to assure that the Administrator is provided with such current information as he deems necessary to evaluate such construction and operation.

6.(j)(1) All contractual and other obligations required to be carried out by the Administrator pursuant to this Act shall be secured solely by the Administrator's revenues received from the sale of electric power and other services. Such obligations are not, nor shall they be construed to be, general obligations of the United States, nor are such obligations intended to be or are they secured by the full faith and credit of the United States.

6.(j)(2) All contracts entered into by the Administrator for the acquisition of resources pursuant to this Act shall require that, in the sale of any obligations, all offerings and promotional material for the sale of such obligations shall include the language contained in the second sentence of paragraph (1) of this subsection. The Administrator shall monitor and enforce such requirement.

6.(k) In the exercise of his authorities pursuant to this section, the Administrator shall, consistent with the provisions of this Act and the Administrator's obligations to particular customer classes, insure that benefits under this section, including financial and technical assistance, conduct of conservation demonstrations, and experimental projects, services, and billing credits, are distributed equitably throughout the region.

Investigations

6.(l)(1) The Administrator is authorized and directed to investigate opportunities for adding to the region's resources or reducing the region's power costs through the accelerated or cooperative development of resources located outside the States of Idaho, Montana, Oregon, and Washington if such resources are renewable resources, and are now or in the future planned or considered for eventual development by nonregional agencies or authorities that will or would own, sponsor, or otherwise develop them. The Administrator shall keep the Council fully and currently informed of such investigations, and seek the Council's advice as to the desirability of pursuing such investigations.

6.(l)(2) The Administrator is authorized and directed to investigate periodically opportunities for mutually beneficial interregional exchanges of electric power that reduce the need for additional generation or generating capacity in the Pacific Northwest and the regions with which such exchanges may occur. The Council shall take into consideration in formulating a plan such investigations.

6.(l)(3) After the Administrator submits a report to Congress pursuant to paragraph (5) of this subsection, the Administrator is authorized to acquire resources consistent with such investigations and consistent with the plan or, if no plan is in effect, with the priorities of section 4(e)(1) and the considerations of section 4(e)(2). Such acquisitions shall be in accordance with the provisions of this subsection.

6.(l)(4) The Administrator shall conduct the investigations and the acquisitions, if any, authorized under this subsection with the assistance of other Federal agencies as may be appropriate.

6.(l)(5) No later than July 1, 1981, the Administrator shall submit to the Congress a report of the results of the investigations undertaken pursuant to this subsection, together with the prospects for obtaining additional resources under the authority granted by this subsection and for reductions in generation or generating capacity through exchanges. Report to Congress.

6.(m) Except as to resources under construction on the effective date of this Act, the Administrator shall determine in each case of a major resource acquisition that a reasonable share of the particular resource, or a reasonable equivalent, has been offered to each Pacific Northwest electric utility for ownership, participation, or other sponsorship, but not in excess of the amounts needed to meet such utility's Regional load.

RATES

Section 7.

7.(a)(1) The Administrator shall establish, and periodically review and revise, rates for the sale and disposition of electric energy and capacity and for the transmission of non-Federal power. Such rates shall be established and, as appropriate, revised to recover, in accordance with sound business principles, the costs associated with the acquisition, conservation, and transmission of electric power, including the amortization of the Federal investment in the Federal Columbia River Power System (including irrigation costs required to be repaid out of power revenues) over a reasonable period of years and the other costs and expenses incurred by the Administrator pursuant to this Act and other provisions of law. Such rates shall be established in accordance with sections 9 and 10 of the Federal Columbia River Transmission System Act (16 U.S.C. 838), section 5 of the Flood Control Act of 1944, and the provisions of this Act. 16 USC 839e. 16 USC 838g, 838h. 16 USC 825s.

7.(a)(2) Rates established under this section shall become effective only, except in the case of interim rules as provided in subsection (i)(6), upon confirmation and approval by the Federal Energy Regulatory Commission upon a finding by the Commission, that such rates—

7.(a)(2)(A) are sufficient to assure repayment of the Federal investment in the Federal Columbia River Power System over a reasonable number of years after first meeting the Administrator's other costs,

7.(a)(2)(B) are based upon the Administrator's total system costs, and

7.(a)(2)(C) insofar as transmission rates are concerned, equitably allocate the costs of the Federal transmission system between Federal and non-Federal power utilizing such system.

7.(b)(1) The Administrator shall establish a rate or rates of general application for electric power sold to meet the general requirements of public body, cooperative, and Federal agency customers within the Pacific Northwest, and loads of electric utilities under section 5(c). Such rate or rates shall recover the costs of that portion of the Federal base system resources needed to supply such loads until such sales exceed the Federal base system resources. Thereafter, such rate or rates shall recover the cost of additional electric power as needed to supply such loads, first from the electric power acquired by the Administrator under section 5(c) and then from other resources.

7.(b)(2) After July 1, 1985, the projected amounts to be charged for firm power for the combined general requirements of public body, cooperative and Federal agency customers, exclusive of amounts charged such customers under subsection (g) for the costs of conservation, resource and conservation credits, experimental resources and uncontrollable events, may not exceed in total, as determined by the Administrator, during any year after July 1, 1985, plus the ensuing four years, an amount equal to the power costs for general requirements of such customers if, the Administrator assumes that—

7.(b)(2)(A) the public body and cooperative customers' general requirements had included during such five-year period the direct service industrial customer loads which are—

7.(b)(2)(A)(i) served by the Administrator, and

7.(b)(2)(A)(ii) located within or adjacent to the geographic service boundaries of such public bodies and cooperatives;

7.(b)(2)(B) public body, cooperative, and Federal agency customers were served, during such five-year period, with Federal base system resources not obligated to other entities under contracts existing as of the effective date of this Act (during the remaining term of such contracts) excluding obligations to direct service industrial customer loads included in subparagraph (A) of this paragraph;

7.(b)(2)(C) no purchases or sales by the Administrator as provided in section 5(c) were made during such five-year period;

7.(b)(2)(D) all resources that would have been required, during such five-year period, to meet remaining general requirements of the public body, cooperative and Federal agency customers (other than requirements met by the available Federal base system resources determined under subparagraph (B) of this paragraph) were—

7.(b)(2)(D)(i) purchased from such customers by the Administrator pursuant to section 6, or

7.(b)(2)(D)(ii) not committed to load pursuant to section 5(b),

7.(b)(2)(D) and were the least expensive resources owned or purchased by public bodies or cooperatives; and any additional needed resources were obtained at the average cost of all other new resources acquired by the Administrator; and

7.(b)(2)(E) the quantifiable monetary savings, during such five-year period, to public body, cooperative and Federal agency customers resulting from—

7.(b)(2)(E)(i) reduced public body and cooperative financing costs as applied to the total amount of resources, other than Federal base system resources, identified under subparagraph (D) of this paragraph, and

7.(b)(2)(E)(ii) reserve benefits as a result of the Administrator's actions under this Act

7.(b)(2)(E) were not achieved.

7.(b)(3) Any amounts not charged to public body, cooperative, and Federal agency customers by reason of paragraph (2) of this subsection shall be recovered through supplemental rate charges for all other power sold by the Administrator to all customers. Rates charged public body, cooperative, or Federal agency customers pursuant to this subsection shall not include any costs or benefits of a net revenue surplus or deficiency occurring for the period ending June 30, 1985, to the extent such surplus or deficiency is caused by—

7.(b)(3)(A) a difference between actual power deliveries and power deliveries projected for the purpose of establishing rates to direct service industrial customers under subsection (c)(1) of this subsection, and

7.(b)(3)(B) an overrecovery or underrecovery of the net costs incurred by the Administrator under section 5(c) as a result of such difference.

7.(b)(3) Any such revenue surplus or deficiency incurred shall be recovered from, or repaid to, customers over a reasonable period of time after July 1, 1985, through a supplemental rate charge or credit applied proportionately for all other power sold by the Administrator at rates established under other subsections of this section prior to July 1, 1985.

7.(b)(4) The term "general requirements" as used in this section means the public body, cooperative or Federal agency customer's electric power purchased from the Administrator under section (5)(b) of this Act, exclusive of any new large single load. "General requirements."

7.(c)(1) The rate or rates applicable to direct service industrial customers shall be established—

7.(c)(1)(A) for the period prior to July 1, 1985, at a level which the Administrator estimates will be sufficient to recover the cost of resources the Administrator determines are required to serve such customers' load and the net costs incurred by the Administrator pursuant to section 5(c) of this Act, based upon the Administrator's projected ability to make power available to such customers pursuant to their contracts, to the extent that such costs are not recovered through rates applicable to other customers; and

7.(c)(1)(B) for the period beginning July 1, 1985, at a level which the Administrator determines to be equitable in relation to the retail rates charged by the public body and cooperative customers to their industrial consumers in the region.

7.(c)(2) The determination under paragraph (1)(B) of this subsection shall be based upon the Administrator's applicable wholesale rates to such public body and cooperative customers and the typical margins included by such public body and cooperative customers in their retail industrial rates but shall take into account—

7.(c)(2)(A) the comparative size and character of the loads served,

7.(c)(2)(B) the relative costs of electric capacity, energy, transmission, and related delivery facilities provided and other service provisions, and

7.(c)(2)(C) direct and indirect overhead costs,

7.(c)(2) all as related to the delivery of power to industrial customers, except that the Administrator's rates during such period shall in no event be less than the rates in effect for the contract year ending on June 30, 1985.

7.(c)(3) The Administrator shall adjust such rates to take into account the value of power system reserves made available to the Administrator through his rights to interrupt or curtail service to such direct service industrial customers.

7.(d)(1) In order to avoid adverse impacts on retail rates of the Administrator's customers with low system densities, the Administrator shall, to the extent appropriate, apply discounts to the rate or rates for such customers.

7.(d)(2) In order to avoid adverse impacts of increased rates pursuant to this Act on any direct service industrial customer using raw minerals indigenous to the region as its primary resource, the Administrator, upon request of such customer showing such impacts and after considering the effect of such request on his other obligations under this Act, is authorized, if the Administrator determines that such impacts will be significant, to establish a special rate applicable to such customer if all power sold to such customer may be interrupted, curtailed, or withdrawn to meet firm loads in the region. Such rate shall be established in accordance with this section and shall include such terms and conditions as the Administrator deems appropriate.

7.(e) Nothing in this Act prohibits the Administrator from establishing, in rate schedules of general application, a uniform rate or rates for sale of peaking capacity or from establishing time-of-day, seasonal rates, or other rate forms.

7.(f) Rates for all other firm power sold by the Administrator for use in the Pacific Northwest shall be based upon the cost of the portions of Federal base system resources, purchases of power under section 5(c) of this Act and additional resources which, in the determination of the Administrator, are applicable to such sales.

7.(g) Except to the extent that the allocation of costs and benefits is governed by provisions of law in effect on the effective date of this Act, or by other provisions of this section, the Administrator shall equitably allocate to power rates, in accordance with generally accepted ratemaking principles and the provisions of this Act, all costs and benefits not otherwise allocated under this section, including, but not limited to, conservation, fish and wildlife measures, uncontrollable events, reserves, the excess costs of experimental resources acquired under section 6, the cost of credits granted pursuant to section 6, operating services, and the sale of or inability to sell excess electric power.

7.(h) Notwithstanding any other provision of this section (except the provisions of subsection (a) of this section), the Administrator shall adjust power rates to include any surcharges arising under section 4(f) of this Act, and shall allocate any revenues from such charges in such manner as the Administrator determines will help achieve the purposes of section 4(f) of this Act.

7.(i) In establishing rates under this section, the Administrator shall use the following procedures:

Publication in Federal Register.

7.(i)(1) Notice of the proposed rates shall be published in the Federal Register with a statement of the justification and reasons supporting such rates. Such notice shall include a date for a hearing in accordance with paragraph (2) of this subsection.

7.(i)(2) One or more hearings shall be conducted as expeditiously as practicable by a hearing officer to develop a full and complete record and to receive public comment in the form of written and oral presentation of views, data, questions, and argument related to such proposed rates. In any such hearing—

7.(i)(2)(A) any person shall be provided an adequate opportunity by the hearing officer to offer refutation or rebuttal of any material submitted by any other person or the Administrator, and

7.(i)(2)(B) the hearing officer, in his discretion, shall allow a reasonable opportunity for cross examination, which, as determined by the hearing officer, is not dilatory, in order to develop information and material relevant to any such proposed rate.

7.(i)(3) In addition to the opportunity to submit oral and written material at the hearings, any written views, data, questions, and arguments submitted by persons prior to, or before the close of, hearings shall be made a part of the administrative record.

Publication in Federal Register

7.(i)(4) After such a hearing, the Administrator may propose revised rates, publish such proposed rates in the Federal Register, and conduct additional hearings in accordance with this subsection.

7.(i)(5) The Administrator shall make a final decision establishing a rate or rates based on the record which shall include the hearing transcript, together with exhibits, and such other materials and information as may have been submitted to, or developed by, the Administrator. The decision shall include a full and complete justification of the final rates pursuant to this section.

7.(i)(6) The final decision of the Administrator shall become effective on confirmation and approval of such rates by the Federal Energy Regulatory Commission pursuant to subsection (a)(2) of this section. The Commission shall have the authority, in accordance with such procedures, if any, as the Commission shall promptly establish and make effective within one year after the enactment of this Act, to approve the final rate submitted by the Administrator on an interim basis, pending the Commission's final decision in accordance with such subsection. Pending the establishment of such procedures by the Commission, if such procedures are required, the Secretary is authorized to approve such interim rates during such one-year period in accordance with the applicable procedures followed by the Secretary prior to the effective date of this Act. Such interim rates, at the discretion of the Secretary, shall continue in effect until July 1, 1982.

Interim rates.

7.(j) All rate schedules adopted, and all power billings rendered, by the Administrator pursuant to this section shall indicate—

7.(j)(1) the approximate cost contribution of different resource categories to the Administrator's rates for the sale of energy and capacity, and

7.(j)(2) the cost of resources acquired to meet load growth within the region and the relation of such cost to the average cost of resources available to the Administrator.

7.(k) Notwithstanding any other provision of this Act, all rates or rate schedules for the sale of nonfirm electric power within the United States, but outside the region, shall be established after the date of this Act by the Administrator in accordance with the procedures of subsection (i) of this section (other than the first sentence of paragraph (6) thereof) and in accordance with the Bonneville Project Act, the Flood Control Act of 1944, and the Federal Columbia River Transmission System Act. Notwithstanding section 201(f) of the Federal Power Act, such rates or rate schedules shall become effective after review by the Federal Energy Regulatory Commission for conformance with the requirements of such Acts and after approval thereof by the Commission. Such review shall be based on the record of proceedings established under subsection (i) of this section. The parties to such proceedings under subsection (i) shall be afforded an opportunity by the Commission for an additional hearing in accordance with the procedures established for ratemaking by the Commission pursuant to the Federal Power Act.

Rate or rate schedules, establishment.

16 USC 832-832l. 33 USC 642a–709; 16 USC 460d, 825s; 43 USC 390. 16 USC 838 note. 16 USC 824.

7.(l) In order to further the purposes of this Act and to protect the consumers of the region, the Administrator may negotiate, or establish, rates for electric power sold by the Administrator to any entity not located in the United States which shall be equitable in relation to rates for all electric power which is, or may be, purchased by the Administrator or the Administrator's customers from entities outside the United States. In establishing rates other than by negotiation, the provisions of subsection (i) shall apply. In the case of any negotiation with an entity not located in the United States, the Administrator shall provide public notice of any proposal to negotiate such rates. Such negotiated rates shall be not less than the rates established under this Act for nonfirm power sold within the United States but outside the region. The Administrator shall also afford notice of any rates negotiated pursuant to this subsection.

Negotiated rates outside U.S. Notice.

7.(m)(1) Beginning the first fiscal year after the plan and program required by section 4 (d) and (h) of this Act are finally adopted, the Administrator may, subject to the

Payments.

provisions of this section, make annual impact aid payments to the appropriate local governments within the region with respect to major transmission facilities of the Administrator, as defined in section 3(c) of the Federal Columbia River Transmission Act—

16 USC 838a.

7.(m)(1)(A) which are located within the jurisdictional boundaries of such governments,

7.(m)(1)(B) which are determined by the Administrator to have a substantial impact on such governments, and

7.(m)(1)(C) where the construction of such facilities, or any modification thereof, is completed after the effective date of this Act, and, in the case of a modification of an existing facility, such modification substantially increases the capacity of such existing transmission facility.

Payment formula.

7.(m)(2) Payments made under this subsection for any fiscal year shall be determined by the Administrator pursuant to a regionwide, uniform formula to be established by rule in accordance with the procedures set forth in subsection (i) of this section. Such rule shall become effective on its approval, after considering its effect on rates established pursuant to this section, by the Federal Energy Regulatory Commission. In developing such formula, the Administrator shall identify, and take into account, the local governmental services provided to the Administrator concerning such facilities and the associated costs to such governments as the result of such facilities.

16 USC 838i, 838k.

7.(m)(3) Payments made pursuant to this subsection shall be made solely from the fund established by section 11 of the Federal Columbia River Transmission System Act. The provisions of section 13 of such Act, and any appropriations provided to the Administrator under any law, shall not be available for such payments. The authorization of payments under this subsection shall not be construed as an obligation of the United States.

7.(m)(4) No payment may be made under this subsection with respect to any land or interests in land owned by the United States within the region and administered by any Federal agency (other than the Administrator), without regard to how the United States obtained ownership thereof, including lands or interests therein acquired or withdrawn by a Federal agency for purposes of such agency and subsequently made available to the Administrator for such facilities.

AMENDMENTS TO EXISTING LAW

Section 8.

16 USC 838i.

8.(a) Section 11(b) of the Federal Columbia River Transmission System Act is amended by striking out "or" before "(iii)" in paragraph (6), by striking out the semicolon at the end of such paragraph (6) and inserting in lieu thereof ", or (iv) on a short term basis to meet the Administrator's obligations under section 4(h) of the Pacific Northwest Electric Power Planning and Conservation Act;".

Ante, p. 2700.

8.(b) Section 11(b) of the Federal Columbia River Transmission System Act is amended by striking out "and" at the end of paragraph (10), by striking out the period at the end of paragraph (11) and inserting in lieu thereof "; and", and by adding at the end thereof the following new paragraph:

> "(12) making such payments, as shall be required to carry out the purposes and provisions of the Pacific Northwest Electric Power Planning and Conservation Act.".

16 USC 838k

8.(c) Subsection (b) of section 13 of such Act is amended by striking out "and 11(b)(11)" and inserting in lieu thereof ", 11(b)(11), and 11(b)(12)".

8.(d)(1) The first sentence of subsection (a) of section 13 of such Act is amended by inserting after the word "system," the following: "to implement the Administrator's authority pursuant to the Pacific Northwest Electric Power Planning and Conservation Act (including his authority to provide financial assistance for conservation measures, renewable resources, and fish and wildlife, but not including the authority to acquire under section 6 of that Act electric power from a generating facility having a planned capability greater than 50 average megawatts),". 16 USC 838k. *Ante*, p. 2697. *Ante*, p. 2717

8.(d)(2) The fourth sentence of such subsection (a) is amended by inserting the following before the period at the end thereof: "issued by Government corporations".

8.(d)(3) Such subsection (a) is further amended by inserting the following before the period at the end thereof: "prior to October 1, 1981. Such aggregate principal limitation shall be increased by an additional $1,250,000,000 after October 1, 1981, as provided in advance in annual appropriation Acts, and such increased amount shall be reserved for the purpose of providing funds for conservation and renewable resource loans and grants in a special revolving account created therefor in the Fund. The funds from such revolving account shall not be deemed State or local funds".

8.(d)(4) Such subsection (a) is further amended by inserting the following after the fourth sentence thereof: "Beginning in fiscal year 1982, if the Administrator fails to repay by the end of any fiscal year all of the amounts projected immediately prior to such year to be repaid to the Treasury by the end of such year under the repayment criteria of the Secretary of Energy and if such failure is due to reasons other than (A) a decrease in power sale revenues due to fluctuating streamflows or (B) other reasons beyond the control of the Administrator, the Secretary of the Treasury may increase the interest rate applicable to the outstanding bonds issued by the Administrator during such fiscal year. Such increase shall be effective commencing with the fiscal year immediately following the fiscal year during which such failure occurred and shall not exceed 1 per centum for each such fiscal year during which such repayments are not in accord with such criteria. The Secretary of the Treasury shall take into account amounts that the Administrator has repaid in advance of any repayment criteria in determining whether to increase such rate. Before such rate is increased, the Secretary of the Treasury, in consultation with the Administrator and the Federal Energy Regulatory Commission, must be satisfied that the Administrator will have the ability to pay such increased rate, taking into account the Administrator's obligations. Such increase shall terminate with the fiscal year in which repayments (including repayments of the increased rate) are in accordance with the repayment criteria of the Secretary of Energy.". Rate increase. Termination.

8.(e) Clause (2) of section 1(b) of the Act of August 31, 1964 (78 Stat. 756) is amended to read as follows: "(2) any contiguous areas, not in excess of seventy-five airline miles from said region, which are a part of the service area of a rural electric cooperative served by the Administrator on the effective date of the Pacific Northwest Electric Power Planning and Conservation Act which has a distribution system from which it serves both within and without said region.". 16 USC 837. *Ante*, p. 2697

ADMINISTRATIVE PROVISIONS

Section 9.

9.(a) Subject to the provisions of this Act, the Administrator is authorized to contract in accordance with section 2(f) of the Bonneville Project Act of 1937 (16 U.S.C. 16 USC 839f.

832a(f)). Other provisions of law applicable to such contracts on the effective date of this Act shall continue to be applicable.

9.(b) The Administrator shall discharge the executive and administrative functions of his office in accordance with the policy established by the Bonneville Project Act of 1937 (16 U.S.C. 832 and following), section 302(a) (2) and (3) of the Department of Energy Organization Act, and this Act. The Secretary of Energy, the Council, and the Administrator shall take such steps as are necessary to assure the timely implementation of this Act in a sound and business-like manner. Nothing in this Act shall be construed by the Secretary, the Administrator, or any other official of the Department of Energy to modify, alter, or otherwise affect the requirements and directives expressed by the Congress in section 302(a) (2) and (3) of the Department of Energy Organization Act or the operations of such officials as they existed prior to enactment of this Act.

42 USC 7152.

Contracts outside Pacific Northwest, limitations and conditions.

9.(c) Any contract of the Administrator for the sale or exchange of electric power for use outside the Pacific Northwest shall be subject to limitations and conditions corresponding to those provided in sections 2 and 3 of the Act of August 31, 1964 (16 U.S.C. 837a and 837b) for any contract for the sale, delivery, or exchange of hydroelectric energy or peaking capacity generated within the Pacific Northwest for use outside the Pacific Northwest. In applying such sections for the purposes of this subsection, the term "surplus energy" shall mean electric energy for which there is no market in the Pacific Northwest at any rate established for the disposition of such energy, and the term "surplus peaking capacity" shall mean electric peaking capacity for which there is no demand in the Pacific Northwest at the rate established for the disposition of such capacity. The authority granted, and duties imposed upon, the Secretary by sections 5 and 7 of such Act (16 U.S.C. 837e and 837f) shall also apply to the Administrator in connection with resources acquired by the Administrator pursuant to this Act. The Administrator shall, in making any determination, under any contract executed pursuant to section 5, of the electric power requirements of any Pacific Northwest customer, which is a non-Federal entity having its own generation, exclude, in addition to hydroelectric generated energy excluded from such requirements pursuant to section 3(d) of such Act (16 U.S.C. 837b(d)), any amount of energy included in the resources of such customer for service to firm loads in the region if (1) such amount was disposed of by such customer outside the region, and (2) as a result of such disposition, the firm energy requirements of such customer or other customers of the Administrator are increased. Such amount of energy shall not be excluded, if the Administrator determines that through reasonable measures such amount of energy could not be conserved or otherwise retained for service to regional loads. The Administrator may sell as replacement for any amount of energy so excluded only energy that would otherwise be surplus.

Definitions.

16 USC 837d.

9.(d) No restrictions contained in subsection (c) shall limit or interfere with the sale, exchange or other disposition of any power by any utility or group thereof from any existing or new non-Federal resource if such sale, exchange or disposition does not increase the amount of firm power the Administrator would be obligated to provide to any customer. In addition to the directives contained in subsections (i)(1)(B) and (i)(3) and subject to:

9.(d)(1) any contractual obligations of the Administrator,

9.(d)(2) any other obligations under existing law, and

9.(d)(3) the availability of capacity in the Federal transmission system,

9.(d) the Administrator shall provide transmission access, load factoring, storage and other services normally attendant thereto to such utilities and shall not discriminate against any utility or group thereof on the basis of independent development of such resource in providing such services.

9.(e)(1) For purposes of sections 701 through 706 of title 5, United States Code, the following actions shall be final actions subject to judicial review— Judicial review.

9.(e)(1)(A) adoption of the plan or amendments thereto by the Council under section 4, adoption of the program by the Council, and any determination by the Council under section 4(h);

9.(e)(1)(B) sales, exchanges, and purchases of electric power under section 5;

9.(e)(1)(C) the Administrator's acquisition of resources under section 6;

9.(e)(1)(D) implementation of conservation measures under section 6;

9.(e)(1)(E) execution of contracts for assistance to sponsors under section 6(f);

9.(e)(1)(F) granting of credits under section 6(h);

9.(e)(1)(G) final rate determinations under section 7; and

9.(e)(1)(H) any rule prescribed by the Administrator under section (7)(m)(2) of this Act.

9.(e)(2) The record upon review of such final actions shall be limited to the administrative record compiled in accordance with this Act. The scope of review of such actions without a hearing or after a hearing shall be governed by section 706 or title 5, United States Code, except that final determinations regarding rates under section 7 shall be supported by substantial evidence in the rulemaking record required by section 7(i) considered as a whole. The scope of review of an action under section 6(c) shall be governed by section 706 of title 5, United States Code. Nothing in this section shall be construed to require a hearing pursuant to section 554, 556, or 557 of title 5 of the United States Code.

9.(e)(3) Nothing in this section shall be construed to preclude judicial review of other final actions and decisions by the Council or Administrator.

9.(e)(4) For purposes of this subsection—

9.(e)(4)(A) major resources shall be deemed to be acquired upon publication in the Federal Register pursuant to section 6(c)(4)(B);

9.(e)(4)(B) resources, other than major resources, shall be deemed to be acquired upon execution of the contract therefor;

9.(e)(4)(C) conservation measures shall be deemed to be implemented upon execution of the contract or grant therefor; and

9.(e)(4)(D) rate determinations pursuant to section 7 shall be deemed final upon confirmation and approval by the Federal Energy Regulatory Commission.

9.(e)(5) Suits to challenge the constitutionality of this Act, or any action thereunder, final actions and decisions taken pursuant to this Act by the Administrator or the Council, or the implementation of such final actions, whether brought pursuant to this Act, the Bonneville Project Act, the Act of August 31, 1964 (16 U.S.C. 837-837h), or the Federal Columbia River Transmission System Act (16 U.S.C. 838 and following), shall be filed in the United States court of appeals for the region. Such suits shall be filed within ninety days of the time such action or decision is deemed final, or, if notice of the action is required by this Act to be published in the Federal Register, within ninety days from such

Suits.

16 USC 832–832l.

Notice, publication in Federal Register.

notice, or be barred. In the case of a challenge of the plan or programs or amendments thereto, such suit shall be filed within sixty days after publication of a notice of such final action in the Federal Register. Such court shall have jurisdiction to hear and determine any suit brought as provided in this section. The plan and program, as finally adopted or portions thereof, or amendments thereto, shall not thereafter be reviewable as a part of any other action under this Act or any other law. Suits challenging any other actions under this Act shall be filed in the appropriate court.

9.(f) For purposes of enabling the Administrator to acquire resources necessary to meet the firm load of public bodies, cooperatives, and Federal agencies from a governmental unit at a cost no greater than the cost which would be applicable in the absence of such acquisition, the exemption from gross income of interest on certain governmental obligations provided in section 103(a)(1) of the Internal Revenue Code of 1954 shall not be affected by the Administrator's acquisition of such resources if—

26 USC 103.

9.(f)(1) the Administrator, prior to contracting for such acquisition, certifies to his reasonable belief, that the persons for whom the Administrator is acquiring such resources for sale pursuant to section 5 of this Act are public bodies, cooperatives, and Federal agencies, unless the Administrator also certifies that he is unable to acquire such resources without selling a portion thereof to persons who are not exempt persons (as defined in section 103(b) of such Code), and

9.(f)(2) based upon such certification, the Secretary of the Treasury determines in accordance with applicable regulations that less than a major portion of the resource is to be furnished to persons who are not exempt persons (as defined in section 103(b) of such Code).

9.(f) The certification under paragraph (1) shall be made in accordance with this subsection and a procedure and methodology approved by the Secretary of the Treasury. For purposes of this subsection, the term "major portion" shall have the meaning provided by regulations issued by the Secretary of the Treasury.

"Major portion."

9.(g) When reviewing rates for the sale of power to the Administrator by an investor-owned utility customer under section 5(c) or 6, the Federal Energy Regulatory Commission shall, in accordance with section 209 of the Federal Power Act (16 U.S.C. 824h)—

9.(g)(1) convene a joint State board, and

9.(g)(2) invest such board with such duties and authority as will assist the Commission in its review of such rates.

9.(h)(1) No "Company" (as defined in section 2(a)(2) of the Public Utility Holding Company Act of 1935; 15 U.S.C. 79b(a)(2)), which owns or operates facilities for the generation of electricity (together with associated transmission and other facilities) primarily for sale to the Administrator under section 6 shall be deemed an "electric utility company" (as defined in section 2(a)(3) of the Public Utility Holding Company Act of 1935; 15 U.S.C. 79b(a)(3)), within the meaning of any provision or provisions of chapter 2C of title 15 of the United States Code, if at least 90 per centum of the electricity generated by such company is sold to the Administrator under section 6, and if—

15 USC 79 *et seq*.

9.(h)(1)(A) the organization of such company is consistent with the policies of section 1 (b) and (c) of the Public Utility Holding Company Act of 1935, as determined by the Securities and Exchange Commission, with the concurrence of the Administrator, at the time of such organization; and

15 USC 79a.

9.(h)(1)(B) participation in any facilities of such "company" has been offered to public bodies and cooperatives in the region pursuant to section 6(m).

9.(h)(2) The Administrator shall include in any contract for the acquisition of a major resource from such "company" provisions limiting the amount of equity investment, if any, in such "company" to that which the Administrator determines will be consistent with achieving the lowest attainable power costs attributable to such major resource.

9.(h)(3) In the case of any "company" which meets the requirements of paragraph (1), the Administrator, with the concurrence of such Commission, shall approve all significant contracts entered into by, and between, such "company" and any sponsor company or any subsidiary of such sponsor company which are determined to be consistent with the policies of section 1 (b) and (c) of the Public Utility Holding Company Act of 1935 at the time such contracts are entered into. The Administrator and the Securities and Exchange Commission shall exercise such approval authority within sixty days after receipt of such contracts. Such contracts shall not be effective without such approval.

Contracts, approval

15 USC 79a.

9.(h)(4) Paragraph (1) of this subsection shall continue to apply to any such "company" unless the Administrator or the Securities and Exchange Commission, or both, through periodic review, (A) determine at any time that the "company" no longer operates in a manner consistent with the policies of section 1 (b) and (c) of the Public Utility Holding Company Act of 1935 and in accordance with this subsection, and (B) notify the "company" in writing of such preliminary determination. This subsection shall cease to apply to such "company" thirty days after receipt of notification of a final determination thereof. A final determination shall be made only after public notice of the preliminary determination and after a hearing completed not later than sixty days from the date of publication of such notice. Such final determination shall be made within thirty days after the date of completion of such hearing.

Notice; hearing.

9.(i)(1) At the request and expense of any customer or group of customers of the Administrator within the Pacific Northwest, the Administrator shall, to the extent practicable—

9.(i)(1)(A) acquire any electric power required by (i) any customer or group of customers to enable them to replace resources determined to serve firm load under section 5(b), or (ii) direct service industrial customers to replace electric power that is or may be curtailed or interrupted by the Administrator (other than power the Administrator is obligated to replace), with the cost of such replacement power to be distributed among the direct service industrial customers requesting such power; and

9.(i)(1)(B) dispose of, or assist in the disposal of, any electric power that a customer or group of customers proposes to sell within or without the region at rates and upon terms specified by such customer or group of customers, if such disposition is not in conflict with the Administrator's other marketing obligations and the policies of this Act and other applicable laws.

9.(i)(2) In implementing the provisions of subparagraphs (A) and (B) of paragraph (1), the Administrator may prescribe policies and conditions for the independent acquisition or disposition of electric power by any direct service industrial customer or group of such customers for the purpose of assuring each direct service industrial customer an opportunity to participate in such acquisition or disposition.

Electric power acquisition, policies and conditions.

9.(i)(3) The Administrator shall furnish services including transmission, storage, and load factoring unless he determines such services cannot be furnished without substantial interference with his power marketing program, applicable operating limitations or existing contractual obligations. The Administrator shall, to the extent practicable, give priority in making such services available for the marketing, within and without the Pacific Northwest, of capability from projects under construction on the effective date of this Act, if such capability has been offered for sale at cost, including a reasonable rate of return, to the Administrator pursuant to this Act and such offer is not accepted within one year.

Report.

9.(j)(1) The Council, as soon as practicable after the enactment of this Act, shall prepare, in consultation with the Administrator, the customers, appropriate State regulatory bodies, and the public, a report and shall make recommendations with respect to the various retail rate designs which will encourage conservation and efficient use of electric energy and the installation of consumer-owned renewable resources on a cost-effective basis, as well as areas for research and development for possible application to retail utility rates within the region. Studies undertaken pursuant to this subsection shall not affect the responsibilities of any customer or the Administrator which may exist under the Public Utility Regulatory Policies Act of 1978.

16 USC 2601 note.
Functions.

9.(j)(2) Upon request, and solely on behalf of customers so requesting, the Administrator is authorized to (A) provide assistance in analyzing and developing retail rate structures that will encourage cost-effective conservation and the installation of cost-effective consumer-owned renewable resources; (B) provide estimates of the probable power savings and the probable amount of billing credits under section 6(h) that might be realized by such customers as a result of adopting and implementing such retail rate structures; and (C) solicit additional information and analytical assistance from appropriate State regulatory bodies and the Administrator's other customers.

Conservation and renewable resources, position establishment.

9.(k) There is hereby established within the administration an executive position for conservation and renewable resources. Such executive shall be appointed by the Administrator and shall be assigned responsibility for conservation and direct-application renewable resource programs (including the administration of financial assistance for such programs). Such position is hereby established in the senior executive service in addition to the number of such positions heretofore established in accordance with other provisions of law applicable to such positions.

SAVINGS PROVISIONS

Section 10.

16 USC 839g.

10.(a) Nothing in this Act shall be construed to affect or modify any right of any State or political subdivision thereof or electric utility to—

10.(a)(1) determine retail electric rates, except as provided by section 5(c)(3);

10.(a)(2) develop and implement plans and programs for the conservation, development, and use of resources; or

10.(a)(3) make energy facility siting decisions, including, but not limited to, determining the need for a particular facility, evaluating alternative sites, and considering alternative methods of meeting the determined need.

10.(b) Nothing in this Act shall alter, diminish, or abridge the rights and obligations of the Administrator or any customer under any contract existing as of the effective date of this Act.

10.(c) Nothing in this Act shall alter, diminish, abridge, or otherwise affect the provisions of other Federal laws by which public bodies and cooperatives are entitled to preference and priority in the sale of federally generated electric power.

10.(d) If any provision of this Act is found to be unconstitutional, then any contract entered into by the Administrator, prior to such finding and in accordance with such provisions, to sell power, acquire or credit resources, or to reimburse investigations and preconstruction expenses pursuant to section 5, and section 6 (a), (f) or (h) of this Act shall not be affected by such finding.

10.(e) Nothing in this Act shall be construed to affect or modify any treaty or other right of an Indian tribe.

10.(f) The reservation under law of electric power primarily for use in the State of Montana by reason of the construction of Hungry Horse and Libby Dams and Reservoirs within that State is hereby affirmed. Such reservation shall also apply to 50 per centum of any electric power produced at Libby Reregulating Dam if built. Electric power so reserved shall be sold at the rate or rates set pursuant to section 7.

10.(g) Nothing in this Act shall be construed to affect or modify the right of any State to prohibit utilities regulated by the appropriate State regulatory body from recovering, through their retail rates, costs during any period of resource construction.

Water appropriation.

10.(h) Nothing in this Act shall be construed as authorizing the appropriation of water by any Federal, State, or local agency, Indian tribe, or any other entity or individual. Nor shall any provision of this Act of any plan or program adopted pursuant to the Act (1) affect the rights or jurisdictions of the United States, the States, Indian tribes, or other entities over waters of any river or stream or over any groundwater resource, (2) alter, amend, repeal, interpret, modify, or be in conflict with any interstate compact made by the States, or (3) otherwise be construed to alter or establish the respective rights of States, the United States, Indian tribes, or any person with respect to any water or water-related right.

10.(i) Nothing in this Act shall be construed to affect the validity of any existing license, permit, or certificate issued by any Federal agency pursuant to any other Federal law.

EFFECTIVE DATE

16 USC 839 note.

Section 11. This Act shall be effective on the date of enactment, or October 1, 1980, whichever is later. For purposes of this Act, the term "date of the enactment of this Act" means such date of enactment or October 1, 1980, whichever is later.

SEVERABILITY

16 USC 839h.

Section 12. If any provision of section 4(a) through (c) of this Act or any other provision of this Act or the application thereof to any person, State, Indian tribe, entity, or circumstance is held invalid, neither the remainder of section 4 or any other provisions of this Act, nor the application of such provisions to other persons, States, Indian tribes, entities, or circumstances, shall be affected thereby.

Approved December 5, 1980.

LEGISLATIVE HISTORY:

HOUSE REPORTS:
No. 96–976, Pt. I (Comm. on Interstate and Foreign Commerce), and No. 96–, Pt. II (Comm. on Interior and Insular Affairs).

SENATE REPORT No. 96–272 (Comm. on Energy and Natural Resources).

CONGRESSIONAL RECORD:
Vol. 125 (1979): Aug. 3, considered and passed Senate.
Vol. 126 (1980): Sept. 24, 29, Nov. 12–14, 17, considered and passed House, amended, in lieu of H.R. 8157.
Nov. 19, Senate concurred in House amendment.

APPENDIX L

Appendix L

Biological Assessment and
Threatened and Endangered Species List

BIOLOGICAL ASSESSMENT

BACKGROUND

On July 19, 1989, Bonneville Power Administration (BPA) requested from field offices of the U.S. Fish and Wildlife Service (USFWS) lists of threatened, endangered and candidate species that might be affected by the alternatives in the Initial Northwest Power Sales Contracts EIS (PSC EIS). On March 20, 1991, BPA requested updated lists of threatened, endangered, and candidate species from the same USFWS field offices. The preferred alternative is a modification of Alternative 1.1, which includes a commitment by BPA to develop a policy to enforce compliance with the Northwest Power Planning Council (NWPPC) Protected Areas Rule.

In terms of its effects on operations at existing generating plants, the preferred alternative is the same as the No Action Alternative (i.e., retention of the status quo provisions in the current power sales contracts), as discussed in this document. Enhanced enforcement of the Protected Areas Rule under the preferred alternative would affect new power resources by discouraging the development of new hydroelectric projects in areas designated as Protected Areas under the NWPPC Rule.

The actions under consideration in this EIS do not involve construction. The EIS analyzes BPA's two broad contractual alternatives: to preserve the contracts without change (the No Action Alternative), or to pursue modifications. Within the second alternative are five categories corresponding to major policy issues:

1. hydro development and operations;
2. conservation;
3. resource planning and development;
4. quality of service as a resource choice; and
5. industrial load constraints.

Environmental effects of alternatives in each of these categories are analyzed in the EIS based on the operation and development of power generation facilities in an area spanning Oregon, Washington, Idaho, Montana, and parts of California, Utah, Nevada, and Wyoming. Because of the indirect relationship between contractual provisions and the operation of generating resources, this Biological Assessment is predominantly qualitative in nature. Quantitative assessment was developed for some of the alternatives in the draft EIS using various computer models of power system operations and effects. Refer to Appendices F and H for further information and technical analyses. This analysis, as discussed in the Draft (D) EIS, showed that for the preferred alternative and the No Action Alternative, minimal or no environmental impacts would be associated with continued base operation of the Northwest power generating system.

The list of proposed or listed threatened, endangered, or candidate species obtained from the USFWS field office, and other pertinent information was used to develop the following Biological Assessment.

ASSUMPTIONS AND METHODOLOGY

Focus on Operations. This assessment addresses operations of existing facilities. Parties to the power sales contracts are expected to remain the same over time, and it is service to their loads which will affect resource operations.

It should be noted that BPA power marketing does not control the operation of generating facilities. Operation of generating resources is governed by a variety of nonpower constraints which are imposed on operators through regulatory authorities including the Federal Energy Regulatory Commission (FERC). Operation of the existing hydroelectric system and the development of new energy resources are subjects of analysis in other processes, specifically the System Operation Review (SOR) EIS and the Resource Program EIS. Decisions about operations at existing hydro projects will be made based on the SOR EIS, and decisions about new resource development will be made based on the Resource Program EIS. The relationship between this EIS and these other processes is explained in the DEIS.

The proposed listing of Snake River salmon runs as threatened or endangered species has resulted in discussions between BPA and the National Marine Fisheries Service (NMFS) concerning the influence of power marketing activities on operations which may affect candidate species. BPA and NMFS are in the process of determining which activities are properly subject to conferencing over potential jeopardy to candidate species.

The "No Action" (Base Case) Alternative and Relationship to Preferred Alternative. The "No Action" alternative represents the operational condition if BPA were not to implement any of the action alternatives in the EIS. "No Action" levels of operation are those which would occur without any change in the power sales contracts. The preferred alternative does not alter the operation of existing resources from "No Action" levels, but commits BPA to establishing a policy which will influence the development of new hydro resources by creating disincentives to development in NWPPC Protected Areas.

Table 1 lists those facilities which were identified as having potential for operational changes to exceed the No Action Alternative. These are the facilities for which BPA requested species lists. The table also shows those facilities for which threatened or endangered species were identified by the USFWS (Column 3); those facilities which exceeded No Action impacts under any of the alternatives studied, or, for hydroelectric facilities, which might affect fish stocks */ under any of the alternatives (Column 4); and those facilities which are consequently analyzed in this Biological Assessment (Column 5). Only those facilities identified in Table I as covered in the assessment were analyzed for impacts on threatened or endangered species.

*/ The only potential impacts identified at dams were on fish that are a food source for bald eagles. As to potential impacts on anadromous fish stocks petitioned or proposed for listing under the Endangered Species Act (ESA), BPA is undertaking separate conference with the NMFS.

Table I
Facilities On the Original Request for Threatened and Endangered Species Data and Subsequent Results

Column 1 Hydro Facilities	2 Location	3 T & E*/	4 Fish Stocks Affected?	5 Covered in Biological Assessment?
Bonneville	OR/WA	YES	NO	NO
The Dalles	OR/WA	YES	NO	NO
John Day	OR/WA	YES	NO	NO
McNary	OR/WA	YES	NO	NO
Priest Rapids	OR/WA	YES	NO	NO
Wanapum	WA	YES	NO	NO
Rock Island	WA	YES	NO	NO
Rocky Reach	WA	YES	NO	NO
Wells	WA	YES	NO	NO
Chief Joseph	WA	YES	NO	NO
Ice Harbor	WA	YES	NO	NO
Lower Monumental	WA	YES	NO	NO
Little Goose	WA	YES	NO	NO
Lower Granite	WA	YES	NO	NO
Libby	MT	YES	YES	YES
Hungry Horse	MT	YES	YES	YES
Albeni Falls	ID	NO	NO	NO
Grand Coulee	WA	YES	NO	NO
Dworshak	ID	YES	YES	YES

*/ Supplied by USFWS. Includes both wildlife and fish species.

Table I (continued)

Column 1	2	3	4	5
Hydro Facilities	Location	T & E	Exceed No Action Alternative?	Covered in Biological Assessment?
Colstrip 1-4	MT	YES	NO	YES
Corette	MT	YES	NO	YES
Boardman	OR	NO	NO	NO
Centralia 1&2	WA	YES	NO	YES
Jim Bridger 1-4	WY	YES	NO	YES
Valmy	NV	NO	NO	NO
Combustion Turbine				
Bethel	OR	YES	NO	NO
Beaver	OR	YES	NO	YES
Whitehorn 1-3	WA	YES	NO	YES
Frederickson 1&2	WA	YES	NO	YES
Fredonia 1&2	WA	YES	NO	YES
Nuclear				
WNP-1	WA	YES	NO	NO
WNP-3	WA	YES	NO	NO
Coal Mines				
Belle-Ayre	WY	YES	NO	NO
Centralia	WA	YES	NO	NO
Rosebud	MT	YES	NO	NO
Bridger	WY	YES	NO	NO

Key Assumptions. Below are the principal assumptions used in developing this Biological Assessment.

- The information and analysis in the DEIS, and additional data developed for the final EIS provide a sufficient basis for the Biological Assessment.

- Existing facilities would be operated within design limits and capabilities in accordance with applicable laws and regulations.

- Resident fish production is adversely affected by decreased reservoir levels or streamflows.

- Anadromous fish passage and production is directly affected by forebay and streamflow levels in mainstem and tributary streams with hydroelectric dams.

- Waterfowl on the mainstem Columbia and Snake rivers would not be affected by operational actions covered by the PSC EIS.

- Quantifiable effects from the operational changes that may be possible within the alternatives to the proposed action are beyond the scope of this Biological Assessment, and must be considered on a site-by-site basis in other processes.

- No change in human use of facilities would occur as the result of these actions; therefore no additional disturbance of wildlife would be caused.

- Where coal plant operations do not exceed the No Action Alternative, the mine supplying its coal will also not exceed No Action.

- Where an alternatives' operations would fall below the level of the No Action Alternative, no significant impacts would occur on vegetation or wildlife.

ASSESSMENT

The Biological Assessment is divided into three sections: (1) discussions of generic and site-specific impacts that can occur with each type of facility covered by this assessment: hydro dams, gas-fired thermal plants, coal-fired thermal plants and coal mines; (2) tables listing individual facilities, associated species, and possible impacts, with footnotes; and (3) a detailed discussion of resident fish, a food supply of the bald eagle, at the reservoirs behind Dworshak and Hungry Horse dams.

(1) DISCUSSION

Hydro Projects

There are two basic types of power generating hydroelectric dams: run-of-the-river, and storage. The former operate on available water resulting from natural processes and upstream releases. These dams, once constructed, are limited for management of hydro production or environmental needs. Storage dams, however, are manipulated and controlled by human intervention. Operation of storage dams has direct effects upon in-river and riparian fish and wildlife resources.

Water level fluctuations have been shown to adversely impact populations of resident fish and the passage of adult and juvenile anadromous fish through the Columbia and Snake river systems. For existing hydro projects, compliance with NWPPC Fish and Wildlife Program as a contract constraint would duplicate other methods of program implementation, and therefore would not effect environmental conditions. However, the application of the NWPPC's Protected Areas Rule, which applies to new hydro development, would have benefits for fish and wildlife, which could apply both within and outside of the Columbia River Basin. These benefits would be based on the fact that new hydro would be shifted to previously determined low impact areas and away from more sensitive stream reaches. BPA has committed itself to a policy process to consider how to apply the Protected Areas Rule to BPA's power marketing activities; BPA's Long-Term Intertie Access Policy (LTIAP) requires customers using the Pacific Northwest-Pacific Southwest Intertie under the LTIAP to follow this rule with respect to new hydro developments within the Columbia basin.

Other alternatives associated with hydro operations were discussed in the DEIS. It was determined that, depending upon time and place, flow pattern shifts could both benefit and harm anadromous fish populations. In all scenarios regarding flow pattern alterations, the Water Budget flows to assist fish migration were met. The addition of planned bypass systems and other planned mitigation measures at mainstem Columbia Basin dams is expected to improve anadromous fish stock survival over time.

Resident fish are primarily affected by reservoir levels since they inhabit shallow water areas along the periphery of the reservoirs. Excessive drawdowns during the period from April to September could negatively affect these resident fish. Elevation frequency changes in reservoir levels at Dworshak, Hungry Horse, and Libby during November, as discussed in the DEIS, could result in negative impacts to fish production for fall spawning kokannee and have serious impacts to resident fish populations. However, overall results from comparing data from alternative scenarios versus the base operations (No Action Alternative) showed minimum impacts on fish populations. Nesting waterfowl residing in the mainstem Columbia and Snake rivers would essentially be unaffected by water level changes due to the water displacement of these rivers and the location of roosting and nesting trees and man-made structures. None of the noted adverse impacts would occur under the preferred alternative.

Shorter contract terms could have possible negative environmental implications should customers decide to develop new hydro resources in sensitive areas. The No Action Alternative and the preferred alternative would maintain current contract terms and thus avoid this potential.

With regard to firm load energy changes, power resources would likely be purchased to make up for any contract increase in firm load. Reservoirs would continue base operations and therefore additional fish and wildlife impacts would not be expected.

Thermal Plants

Comparison of data between alternatives and the No Action Alternative for operation of coal and gas turbine generating plants did not reveal any clear trends. Impacts can occur from increased water withdrawals at coal-fired plants, however, analysis of alternatives showed effects, specifically to fish populations, to be negligible. Environmental impacts relative to air quality, land disturbances, and water use were shown to be minimal or negligible. Thermal plants will continue to operate within design and legal limits. No impacts to threatened or endangered species or their respective habitats are expected.

Coal Mines

Coal mines within the area covered by the PSC EIS process were evaluated for operational changes and compared to the No Action Alternative. Impacts were discussed for air quality, water use, and land use. Surface coal mines operate under permits and within the confines of the land areas allocated for extraction. Consequently, additional land surface disturbance is limited to the areas of identified recoverable coal.

Since mines are mandated to be operated under permit, it is BPA's conclusion that the alternatives, including the No Action Alternative, would cause no additional environmental impacts on threatened and endangered species at mines operated within the area covered by this Biological Assessment.

Conservation

"Conservation" is treated as a resource much the same as power generation. Incentives exist and are currently used by BPA customers to increase energy efficiency. Firm load deliveries are an integral part of the contracts. Surplus generating potential may be used to improve fish and wildlife habitat, however, these benefits are determined by time and place and cannot therefore be discussed with any degree of certainty in quantitative terms within this assessment.

The DEIS analysis showed no significant environmental benefits from conservation as a condition of service above the benefits of programs already available to increase energy-efficiency in the region.

Proposed Listings under the Endangered Species Act

Snake River sockeye salmon have been proposed for listing as endangered and Snake River spring/summer and fall chinook have been proposed for listing as threatened by NMFS under the ESA. Potential impacts on the operation of the power system as a result of future listings, or the use of conservation and other resources to meet electrical loads, are the subjects of analysis in other documents currently under preparation, specifically, the SOR EIS and the Resource Program EIS. BPA is involved in discussions with NMFS concerning the effect of power system operations on the species proposed for listing. In addition, operational measures to enhance the survival of runs proposed for listing are the subject of analysis in the "1992 Columbia River Salmon Flow Measures Options Analysis/EIS" under preparation by the U.S. Army Corps of Engineers in cooperation with BPA and the Bureau of Reclamation.

(2) TABLES

Table II. Threatened and Endangered Species Potentially Affected

Table II lists those facilities where possible effects may occur on threatened or endangered species identified by the USFWS.

Table III. Findings

Table III presents conclusions for impacts on each potentially affected species. Impact review was conducted in consultation with USFWS field office personnel to focus on most likely problem areas.

Table II

THREATENED AND ENDANGERED SPECIES POTENTIALLY AFFECTED

Facility	State	Species Present
Hungry Horse	MT	Bald Eagle(E), Peregrine Falcon (E), Grizzly Bear (T), Gray Wolf (E)
Libby	MT	same as Hungry Horse
Colstrip Coal-Fired Thermal Plants 1-4	MT	Bald Eagle (E), Peregrine Falcon (E), Black-footed Ferret (E)
Rosebud Coal Mine	MT	Bald Eagle (E), Peregrine Falcon (E), Black-footed Ferret (E)
Bridger Coal Mine	WY	Bald Eagle (E), Peregrine Falcon (E), Black-footed Ferret (E), Humpback Chub (E), Colorado Squawfish (E)
Jim Bridger 1-4	WY	same as Bridger Coal Mine
Belle Ayre	WY	Bald Eagle (E), Peregrine Falcon (E), Black-footed Ferret (E)
Corette Thermal Plant	WY	Bald Eagle (E), Peregrine Falcon (E), and Black-footed Ferret (E)
Dworshak Dam	ID	Bald Eagle (T)
Bonneville Dam	OR/WA	Bald Eagle (T), Peregrine Falcon (E)
The Dalles Dam	OR/WA	Bald Eagle (T), Peregrine Falcon (E)
John Day Dam	OR/WA	Bald Eagle (T), Peregrine Falcon (E)
McNary Dam	OR/WA	Bald Eagle (T), Peregrine Falcon (E)
Priest Rapids Dam	WA	Bald Eagle (T), Peregrine Falcon (E)
Wanapum Dam	WA	Bald Eagle (T), Peregrine Falcon (E)
Rock Island Dam	WA	Bald Eagle (T), Peregrine Falcon (E)
Rocky Reach Dam	WA	Bald Eagle (T), Peregrine Falcon (E)
Wells Dam	WA	Bald Eagle (T), Peregrine Falcon (E)
Chief Joseph Dam	WA	Bald Eagle (T), Peregrine Falcon (E)
Ice Harbor Dam	WA	Bald Eagle (T), Peregrine Falcon (E)

TABLE II (continued)

Facility	State	Species Present
Lower Monumental Dam	WA	Bald Eagle (T), Peregrine Falcon (E)
Little Goose Dam	WA	Bald Eagle (T), Peregrine Falcon (E)
Lower Granite Dam	WA	Bald Eagle (T), Peregrine Falcon (E)
Grand Coulee Dam	WA	Bald Eagle (T), Peregrine Falcon (E)
Centralia 1 & 2	WA	Bald Eagle (T)
WNP-1	WA	Bald Eagle (T), Peregrine Falcon (E)
WNP-3	WA	Bald Eagle (T) There are three nesting territories near the project.
Whitehorn	WA	Bald Eagle (T), Peregrine Falcon (E)
Frederickson 1 & 2	WA	Bald Eagle (T)
Fredonia 1 & 2	WA	Bald Eagle (T)
Centralia Coal Mine	WA	Bald Eagle (T)
Bethel	OR	Bradshaw's Lomatium (E)
Beaver	OR	Bald Eagle (T)
Boardman Thermal Plant	OR	Bald Eagle (T) and Peregrine Falcon (E) may occur in migration

E = Endangered
T = Threatened

(3) Resident Fish and Bald Eagles at Dworshak, Idaho; Libby and Hungry Horse Reservoirs

Breeding, wintering, and migrating bald eagles were identified as an endangered species found in the areas of most facilities covered by this assessment. In reviewing operation of those facilities (see Tables I, II, and III), our conclusion is that operational changes under any of the alternatives are not likely to adversely affect the bald eagle. Operational changes at Hungry Horse, Libby, and Dworshak under some alternatives could affect the fishery resource, which may affect food supplies for bald eagles; this possibility and its effect on bald eagles are discussed below. The preferred alternative would not resull in any of the operational changes in question.

Resident Fisheries

Common resident fish species in Hungry Horse Reservoir include westslope cutthroat trout, mountain whitefish, northern squawfish, large-scale suckers, longnose suckers, and pygmy white fish (May and Weaver, 1987). Study of these fish populations has been underway since 1983, to quantify seasonal water levels needed to maintain or enhance the reservoir fisheries.

Common resident fish species in Dworshak Reservoir include westslope cutthroat trout, mountain whitefish, northern squawfish, large scale suckers, bridge-lipped suckers, resident rainbow, bull char, brook trout, dace, various cottids, red-side shiner, bullhead catfish, small-mouthed bass, large-mouthed bass, longnosed dace, speckled dace, chiselmouth, Pacific lamprey, and kokanee.

Common resident fish species in Libby Reservoir include westslope cutthroat trout, bull char, resident rainbow, and kokanee.

Information is limited on the extent of biological impacts to resident fish associated with changes in seasonal draft of the reservoirs. Alternatives discussed in the DEIS indicate that under certain water conditions, it is likely that fish species (such as westslope cutthroat, bull char, and mountain whitefish at Hungry Horse and kokanee at Dworshak) may be affected by increased drawdowns. As the DEIS analysis shows, drawdowns large enough to merit attention for potential effects on resident fish were expected to occur only a small percentage of any year. None of the alternatives examined would adversely affect resident fish populations downstream of the dams.

Significant changes in the frequency of reservoir elevations during November can be detrimental to fish growth and to fall spawners such as kokanee. Low run-off conditions produce the greatest change in reservoir elevations.

The NWPPC Fish and Wildlife Program addresses Libby, Hungry Horse, and Dworshak operational impacts on resident fish and provides for mitigating adverse impacts. For instance, the program calls for research at Hungry Horse on reservoir elevations and fluctuations caused by hydro power operations and related to fish population stability or changes. Operational changes at Dworshak to provide cooling or "fish flows" for the Snake River may affect reservoir elevations. However, drawdowns are expected to fall within acceptable levels.

TABLE III

IMPACTS OF PREFERRED ALTERNATIVE ON LISTED SPECIES

Species	Facility	Main Concerns	Impacts	Rationale/Findings
Bald Eagle	Hungry Horse, Libby, Dwoshak Dams; Colstrip, Bridger Thermals; Rosebud, Bridger Mines	Food Supply (1)* Roost Flooding (2) Air Emissions (3) Habitat Changes (4)	No Impacts.	The preferred alternative will not affect eagle food supply at any facility. Some alternatives might have effects at Dworshak in Idaho, and Libby and Hungry Horse in Montana. Water levels cannot exceed existing maximums, so roost areas will not be inundated. Air quality changes are insignificant. No habitat alterations. Mine operation within standards set by the U.S. Department of the Interior (USDI).
Peregrine Falcon	Hungry Horse; Colstrip, Bridger Thermals; Rosebud, Bridger Mines	Food Supply (5) Habitat Change (4)	No impacts.	No habitat alterations and no impact on food supply. Mines operate within standards set by USDI. This species migratory only at Whitehorn, WNP-2, and Boardman.
Grizzly Bear	Hungry Horse	Habitat Change (4) Increase in Human Activities (6) Food Supply (7)	No Impacts.	No habitat alteration or increased human disturbances.
Gray Wolf	Hungry Horse	Habitat Change (4) Increase in Human Activities (6)	No Impacts.	No habitat alteration or increased human disturbances.
Black-Footed Ferret	Colstrip, Bridger Thermals; Rosebud, Bridger Mines.	Mine Expansion (8) Habitat Changes (4)	No Impacts.	No habitat changes; mines operating within standards set by USDI.
Humpback Chub	Bridger Thermal; Bridger Mine	Water Withdrawals and Temp. Changes (9)	No Impacts.	Changes in water condition are insignificant.
Colorado Squawfish	Bridger Thermal; Bridger Mine	Habitat Change and Water Temp. Changes. (4)	No Impacts.	Changes in water condition are insignificant.

* See footnotes following.

TABLE III (Continued)

FOOTNOTE DISCUSSION

(1) BALD EAGLE FOOD SUPPLY. Impacts on fish have been analyzed in depth for the EIS. The studies concluded that, although there are minor impacts on some anadromous fish stocks under some alternatives, the stocks are expected to increase due to in-place and planned mitigation. Resident fish are not expected to be affected under the preferred alternative.

AIR QUALITY. Air pollution is a concern for several species in several areas. Impact could occur directly on the species itself, as well as on potential habitat or prey species. Projected changes in ambient air quality show minimal increases and decreases in pollutants, depending upon the alternative. All are judged to be negligible and insignificant.

(4) HABITAT CHANGES. No changes in habitat will occur for this action. No construction will occur, and operational changes, if any, are within design and license parameters.

(5) FOOD SUPPLY. No impacts are expected on any prey species (small birds and waterfowl) used by the peregrine falcon. No changes in habitat (See No. 4 above) for either peregrine or their prey species will occur.

(6) INCREASE IN HUMAN ACTIVITIES. Human disturbances will not increase as a result of any alternative covered by this EIS action. Facilities are in place and functioning. No construction is planned.

(7) GRIZZLY FOOD SUPPLY. Fish are an incidental part of the grizzly bear's diet at Hungry Horse (Ericson 1987). Their food supply is otherwise unaffected.

(8) MINES. Mine expansion was viewed as a potential problem, particularly in places near black-footed ferret habitat. All of the mines covered by this Assessment are on lands administered by the Bureau of Land Management, and operating under a permit issued by the Office of Surface Mining. Before these permits are issued, all applicable laws and regulations must be met, including NEPA and the Threatened and Endangered Species Act. No action covered by the PSC-EIS would cause mine expansion directly. Should expansion occur in the future, environmental impacts would be addressed through the permit system, and all applicable laws and regulations.

(9) WATER WITHDRAWALS. Withdrawals from the Green River for cooling the Bridger Thermal Plant are slight and cannot be quantified. No changes in mine operations are proposed. Therefore, no impacts due to increased water withdrawals are expected (see No. 7).

(VS6-PG-0011K)

Bald Eagle

Bald eagles have been shown to be opportunistic in their feeding habits. Fielder and Starkey (1980) have studied the bald eagle feeding habits within the Columbia Basin. These studies have shown that waterfowl make up 91 percent, and fish 7.7 percent of the winter food items. During a 15-month study in that same general area (1980), Wood observed that bald eagles fed primarily on fish; however, Wood also found prey remains of gulls, chukars, and mergansers. Fitzner et al. (1980), studying wintering bald eagles on the Columbia River on the Hanford Nuclear Reservation, found no correlation between eagle numbers and salmon carcasses, but a significant positive correlation for duck densities and eagle densities. McClelland et al. (1981) found a direct relationship between kokanee and bald eagle numbers at McDonald Creek in Glacier National Park. Bald eagles appear to be quite flexible in their feeding habits.

Studies have also shown that yearly and seasonal distribution and dispersal of eagles is tied to concentrated food supplies (Crenshaw 1987, Servheen 1975, Shea 1973, Stalmaster 1976). This accounts for their nomadic behavior during the winter.

The bald eagle is a yearlong resident and migrant at Hungry Horse and Libby dams and an overwintering migrant at Dworshak. Analyses of drawdown frequencies and levels at these three projects does not indicate adverse impact on the bald eagle populations, except during low run-off periods. This statement is based on the opportunistic feeding habits of eagles, their adaptability and foraging behavior in relation to changing food supply; the potential for big game habitat improvement efforts along Hungry Horse Reservoir; the availability of other food sources on tributaries to Libby and Dworshak dams; provisions in the NPPC Fish and Wildlife Program that provide for fishery mitigation when reservoir drawdowns due to power generation exceed specific elevations; and the commitment of BPA to manage the power generation system to avoid conflict with the NPPC Fish and Wildlife Program.

CONCLUSION

From evidence cited above, BPA has concluded that operations of the power generating facilities under the No Action Alternative, and under the element of Alternative 1.1 which BPA has selected as its preferred alternative, are not likely to adversely impact and threatened or endangered species in the project areas.

LITERATURE CITED

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DWolfe:vjh:5145:07/29/91 (VS6-PG-1753I)

Department of Energy
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

JUL 31 1991

In reply refer to: PG

Mr. Marvin L. Plenert
Regional Director
U.S. Fish and Wildlife Service,
Region 1
911 NE. 11th Avenue
Portland, OR 97232-4181

Dear Mr. Plenert:

In complying with its responsibilities under the Endangered Species Act of 1973, as amended, Bonneville Power Administration (BPA) submits to the U.S. Fish and Wildlife Service (USFWS) the enclosed Biological Assessment of effects on threatened or endangered species for the Initial Northwest Power Act Power Sales Contracts EIS (PSC EIS). Though the proposed action addressed by this EIS does not involve any major construction project and therefore, under 50 CFR §402.12(b), does not require a formal Biological Assessment, BPA has prepared the enclosed assessment to assist USFWS in its consideration of the potential effects of BPA's contracts on threatened or endangered species. This assessment addresses the threatened and endangered species listed in the letters from USFWS field offices received in response to BPA requests in July 1989 and March 1991. For your information, and in support of the analysis in the Biological Assessment, we have also enclosed copies of appendices to the EIS which discuss the impacts of generating resources on fish and wildlife.

Because the subject power sales contracts are BPA's contracts for requirements service to its Pacific Northwest customers, portions of the EIS analysis address the operations of 36 hydro and thermal electric generating resources which supply the power which serves these customer loads. The effects of BPA's power sales contracts on these resources are indirect, because resource operations must conform to the requirements imposed on resource operators for both power and nonpower purposes. If additional constraints limited the ability of these resources to meet customer electrical loads, the existence of BPA's contractual obligations could not compel operations which compromised the constraints; instead BPA would be required to meet its obligations from other resources through either purchases or development of new energy resources. The effects of the development of new energy resources would be subject to independent assessment.

Other Federal decisionmaking processes currently underway will also address the operation of some or all of the existing resources and may result in actions that alter resource operation or development. These include:

1. Proposed listings by the National Marine Fisheries Service of certain Snake River salmon species as threatened or endangered species under the Endangered Species Act, with related discussions between agencies concerning appropriate actions to protect candidate species;

2. The System Operation Review process and associated EIS, under which BPA, the U.S. Army Corps of Engineers and the U.S. Bureau of Reclamation will analyze the operation of dams on the Columbia River and its major tributaries;

3. The 1992 Columbia River Salmon Flow Measures EIS and Options Analysis, under preparation by the U.S. Army Corps of Engineers, which will address adjustments in Snake River flows to enhance the survival of salmon species proposed for listing; and

4. BPA's 1992 Resource Program and associated EIS, under which BPA will analyze the development of new conservation and generating resources.

BPA's Preferred Alternative is the element of Alternative 1.1 which requires compliance with the Northwest Power Planning Council's Protected Areas Rule. With respect to the operation of the generating plants addressed in the EIS, this alternative is the same as the No Action Alternative, that is, no change in operations from current practice. BPA will implement the Preferred Alternative through the development of a Protected Areas policy. This policy will be developed through a public process which will begin shortly after the completion of the Record of Decision on the PSC EIS. The effect of the policy will be to discourage development of new hydroelectric projects within Protected Areas, and thus it will not result in adverse impacts on listed species.

We have concluded that the operation of electric power facilities to meet BPA requirements obligations under the power sales contracts is not likely to adversely affect any federally listed threatened or endangered species under this Preferred Alternative.

We would appreciate a written response to this assessment consistent with the time limits of 50 CFR §402.12(j). Thank you for your attention to this matter. If you should have any questions, please contact me at (503) 230-5145.

Sincerely,

Don Wolfe
PSC EIS Project Manager

3 Enclosures:
Biological Assessment
PSC EIS Appendix H(1)(a) - Background on Fish, Wildlife and Vegetation Effects Due to Hydro Operations
PSC EIS Appendix H(1)(b) - Background on Fish, Wildlife and Vegetation Effects Due to Fossil Fuel Fired Plant Operations

cc:
Mr. Russell Peterson, USFWS, Portland Field Station
Mr. Dale R. Harms, USFWS, Helena Field Station
Mr. Wayne S. White, USFWS, Sacramento Field Office
Mr. Ron Starkey, USFWS, Salt Lake City Field Station
Ms. Nancy J. Gloman, USFWS, Olympia Field Station
Mr. Charles H. Lobdell, USFWS, Boise Field Station
Mr. David L. Harlow, USFWS, Reno Field Station
Mr. Reed Harris, USFWS, Cheyenne Field Station

United States Department of the Interior
FISH AND WILDLIFE SERVICE

911 N.E. 11th Avenue
Portland, Oregon 97232-4181

OCT 9 1991

Mr. Don Wolfe
PSC EIS Project Manager
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208

Dear Mr. Wolfe:

This responds to your July 31, 1991, letter requesting U.S. Fish and Wildlife Service concurrence with your determination that the Initial Northwest Power Act Power Sales Contracts are not likely to adversely affect the bald eagle (Haliaeetus leucocephalus), peregrine falcon (Falco peregrinus), grizzly bear (Ursus arctos horribilis), gray wolf (Canis lupus), and the black-footed ferret (Mustela nigripes). We have reviewed the biological assessment prepared by your agency on this proposed action and concur with your "not likely to adversely affect" determination. In accordance with 50 CFR § 402.13, consultation pursuant to section 7 of the Endangered Species Act of 1973, as amended, is hereby terminated and no further action under this authority is necessary.

If you have any questions, contact Richard Hill or Ronel Finley at FTS 429-6150.

Sincerely,

Marvin L. Plenert
MARVIN L. PLENERT

Regional Director

Department of Energy
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

MAR 2 0 1991

In reply refer to: PG

Dear :

Subject: Request for Updated List of Endangered and Threatened Species in the Bonneville Power Administration (BPA) Service Area, for Inclusion in the Long-Term Power Sales contracts Environmental Impact Statement (EIS)

In August 1981, BPA offered its customers new long-term contracts under the Pacific Northwest Electric Power Planning and Conservation Act. As a result of the decision of the Ninth Circuit of the United States Court of Appeals in the case of Forelaws on Board v. Johnson, 743 F.2d 677 (1984), BPA is now preparing a Final EIS on these long-term contracts. Two basic types of alternatives are analyzed: (1) the no-action alternative, in which BPA would preserve the Long-Term Power Sales Contracts without change; or (2) alternatives in which BPA would pursue contract modifications (see enclosed EIS summary for additional details).

The analysis covers the effects of operation of power facilities within the affected area. It also identifies quantities and types of resources that might be needed to meet future firm power loads. The EIS includes a generic discussion of impacts associated with these resources.

These long-term contracts are with customers located throughout BPA's service area, which covers the States of Washington, Oregon, and Idaho; the portion of Montana west of the Continental Divide; and small portions of Wyoming, Utah, Nevada, and northern California. Our study area also includes areas in Montana, Nevada, and Wyoming surrounding coal plants that serve the Pacific Northwest (see enclosed area description and location maps). The affected facilities within these States are identified by name, location, and energy source on the enclosed list.

In compliance with section 7(c) of the amended Endangered Species Act, BPA is requesting a list of endangered and threatened species that may occur in the area of any of these facilities; and any information on these species that might be available, such as locations and how they might be affected. BPA previously requested such a list, during preparation of the Draft EIS, by a letter dated July 19, 1989. We are now requesting an updated list for inclusion in the Final EIS.

If possible, we would appreciate having any information you may obtain by April 30, 1991, so that we can include it in our Final EIS. If you need additional information, or if I can assist in any other way, please contact me at (503) 230-5145 or FTS 429-5145.

Sincerely,

Donald V. Wolfe
Project Manager
Power Sales Contract FEIS

2 Enclosures:
EIS Summary
List of Pacific Northwest Generating Facilities

DWolfe:md:5145 (VS6-PG-9815K)

bcc:
Official File (PG EQ-14-2)

ADDRESSEES FOR DOCUMENT 9815K

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Boise Field Station
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Boise, Idaho 83705

April 9, 1991

Donald V. Wolfe
Project Manager
Department of Energy
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

Re: Long-Term Power Sales (EIS)
(SE File: 6003.0230)

Dear Mr. Wolfe:

As requested by your letter dated March 20, 1991 and received by this office on March 22, we have attached a list (Attachment A) of endangered and threatened, proposed, and/or candidate species that may be present in the proposed project area. The list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under Section 7(c) of the Endangered Species Act of 1973, as amended (Act). The requirements for Federal agency compliance under the Act are outlined in Attachment B. Please reference the species list number on Attachment A in all subsequent correspondence, reports, environmental assessments, environmental impact statements, biological assessments (evaluations), Coordination Act reports, etc. If a construction project is not commenced within 180 days of this response, a subsequent species list request is required by regulations.

If a listed species appears on Attachment A, a biological assessment (evaluation) is required. Should your biological assessment (evaluation) determine that a listed species is likely to be affected adversely by the project, the Bonneville Power Administration should request formal Section 7 consultation through this office. If a proposed species is likely to be jeopardized by a Federal action, regulations require a conference between the Federal agency and the Service.

Candidate species that appear on Attachment A have no protection under the Act, but are included for early planning consideration. Proposed species could be formally listed and candidate species could be formally proposed and listed during project planning, thereby falling within the scope of Section 7 of the Endangered Species Act. Therefore, if they appear on Attachment A, we recommend that additional surveys be made for proposed and/or candidate species that are likely to be in your project area. If the project is likely to adversely impact a candidate species, informal consultation with this office is recommended.

If you have any questions regarding Federal consultation responsibilities under the Act, please contact Jeri Williams of this office at FTS 554-1931 or 208-334-1931.

Thank you for your continued interest in the Endangered Species Program.

Sincerely,

For Charles H. Lobdell
Field Supervisor

Enclosures

cc: IDFG, Hdqtrs., Boise
IDFG, Region 1, Coeur d'Alene

ATTACHMENT A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES, AND CANDIDATE SPECIES, THAT MAY OCCUR WITHIN THE AREA OF THE LONG-TERM POWER SALES PROJECT
FWS-1-4-91-SP-482

LISTED SPECIES	COMMENTS
Albeni Falls Facility **Priest River, Bonner County**	
None	
Dworshak Facility **Clearwater River, Clearwater County**	
Bald Eagle (Haliaeetus leucocephalus)	Wintering Area

PROPOSED SPECIES

None

CANDIDATE SPECIES

None

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Fish and Wildlife Enhancement
3704 Griffin Lane SE, Suite 102
Olympia, Washington 98501
206/753-9440 FTS 434-9440

April 18, 1991

Mr. Donald V. Wolfe
Project Manager
Department of Energy
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

FWS Reference
1-3-91-SP-272

Dear Mr. Wolfe:

As requested by your letter, dated March 20, 1991, and received in this office on March 21, enclosed is a list of endangered and threatened species that may be present in the area of the proposed hydroelectric, thermal, nuclear, and combustion turbine generating facilities and coal mines of the Pacific Northwest Power System in Washington State. The list fulfills the requirement of the Fish and Wildlife Service under Section 7(c) of the Endangered Species Act of 1973, as amended. Enclosed are the requirements for Bonneville Power Administration compliance under the Act.

Should the biological assessment determine that a listed species is likely to be affected (adversely or beneficially) by the project, the Bonneville Power Administration should request formal Section 7 consultation through this office. Even if the biological assessment shows a "no effect" situation, we would appreciate receiving a copy for our information.

Also included is a list of candidate species presently under review by this Service for consideration as endangered or threatened. Candidate species are included simply as advance notice to federal agencies of species which may be proposed and listed in the future. However, protection provided to candidate species now may preclude possible listing in the future. If early evaluation of your project indicates that it is likely to adversely impact a candidate species, you may wish to request technical assistance from this office.

The sockeye salmon (*Oncorhynchus nerka*) has been proposed to be listed as threatened or endangered in the Snake River. We request that the Bonneville Power Administration contact the National Marine Fisheries Service (1002 N.E. Holladay Street, Room 620, Portland, Oregon 97232. Phone FTS 429-5435) for additional information regarding the occurrence, and effects listing of the sockeye salmon may have on Bonneville Power Administration activities.

Your interest in endangered species is appreciated. If you have additional questions regarding your responsibilities under the Act, please contact Jeff Haas or Richard Carlson of my staff at the above phone/address.

Sincerely,

Nancy J. Gloman

Nancy J. Gloman
Acting Field Supervisor

rc/kr

Enclosures

c: FWS-FWE, Boise (Parenti)
WDW, Olympia (Nongame)
WNHP, Olympia

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR WITHIN THE AREA OF THE PROPOSED HYDROELECTRIC, THERMAL, NUCLEAR, AND COMBUSTION GENERATING FACILITIES AND COAL MINES OF THE PACIFIC NORTHWEST POWER SYSTEM IN MULTIPLE COUNTIES OF THE STATE OF WASHINGTON

1-3-91-SP-305

PACIFIC NORTHWEST HYDROELECTRIC GENERATING FACILITIES

Bonneville, Skamania County (T2N R7E S22)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - breeding

PROPOSED - None

CANDIDATE - *Rorippa columbiae* (persistent sepal yellowcress)
Erigeron howellii (Howell's daisy)

The Dalles, Klickitat County (T2N R13E S35)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - breeding

PROPOSED - None

CANDIDATE - None

John Day, Klickitat County (T3N R17E S28)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - breeding

PROPOSED - None

CANDIDATE - *Lomatium laevigatum* (smooth desert-parsley)

McNary, Benton County (T5N R28E S3)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Bald eagle wintering concentration area (T5N R26E S9)
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - Ferruginous hawk (*Buteo regalis*)
Long-billed curlew (*numenius americanus*)

Priest Rapids, Yakima County (T13N R23E S2/3)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - *Astragalus columbianus* (Columbia milk vetch)
Lomatium tuberosum (Hoover's desert-parsley)

Wanapum, Grant County (T16N R23E S16/17)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - *Lomatium tuberosum* (Hoover's desert-parsley)

Rock Island, Douglas County (T21N R22E S5)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - *Phacelia lenta* (sticky phacelia)

<u>Rocky Beach, Chelan County</u> (T24N R20E S35)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - *Trifolium thompsonii* (Thompson's clover)
Petrophytum cinerascens (Chelan rockmat)

<u>Wells, Douglas County</u> (T28N R24E S6)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Bald eagle wintering concentration area (T28N R24E S6)
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - None

<u>Chief Joseph, Okanogan County</u> (T29N R25E S24)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Bald eagle wintering concentration area (T29N R25E S24)
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - None

<u>Ice Harbor, Walla Walla County</u> (T9N R31E S24)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - None

Lower Monumental, Walla Walla County (T13N R34E S34)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - None

Little Goose, Columbia County (T13N R38E S27)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - None

Lower Granite, Whitman County (T14N R43E S32)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - *Rubus nigerrimus* (northwest raspberry)

Grand Coulee, Grant County (T28N R20E S1)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Bald eagle communal night roosting are (T28N R31E S7)
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - *Allium douglasii var. constrictum* (Douglas'onion)

<u>Centralia, Lewis County</u> (T15N R1W S30)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering

PROPOSED - None

CANDIDATE - None

PACIFIC NORTHWEST <u>NUCLEAR</u> GENERATING FACILITY

<u>WNP-1, Benton County</u> (T11N R28E S5)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - Ferruginous hawk (*Buteo regalis*) - nesting may occur in the area of the project

<u>WNP-3, Grays Harbor County</u> (T17N R6W S18)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
There are 3 bald eagle nesting territories near the project (T17N R6W S12; T17N R7W S7; T17N R7W S10)

PROPOSED - None

CANDIDATE - Olympic mudminnow (*Novumbra hubbsi*)

PACIFIC NORTHWEST COMBUSTION TURBINE GENERATING FACILITIES

Whitehorn, Whatcom County (T39N R1W S12)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Bald eagle nesting territory (T39N R1W S1)

Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - None

Frederickson 1&2, Pierce County (T18N R3E S1)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering

PROPOSED - None

CANDIDATE - *Aster curtus* (white-top aster)

Fredonia Units 1&2, Skagit County (T34N R3E S9)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering

PROPOSED - None

CANDIDATE - None

PACIFIC NORTHWEST COAL MINES

Centralia, Lewis County (T15N R1W S30)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering

PROPOSED - None

CANDIDATE - None

Note: Wintering bald eagle activity occurs from about October 31 through March 31. Nesting activities occur from about January 1 through August 15.

Major concerns that should be addressed in your biological assessment of project impacts to bald eagles and peregrine falcons are:

1. Level of use of the project area by bald eagles and peregrine falcons.

2. Effect of the project on the eagle's and falcon's primary food stocks and foraging areas in all areas influenced by the project.

3. Impacts from project activities (i.e., increased human activity, loss or degradation of habitat, increased noise levels) which may result in disturbance to bald eagles and falcons and/or their avoidance of the project area.

FEDERAL AGENCIES' RESPONSIBILITIES UNDER SECTIONS 7(a) AND 7(c) OF THE ENDANGERED SPECIES ACT

SECTION 7(A) - Consultation/Conference

Requires:

1. Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species;

2. Consultation with FWS when a federal action may affect a listed endangered or threatened species to ensure that any action authorized, funded, or carried out by a federal agency is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. The process is initiated by the federal agency after it has determined if its action may affect (adversely or beneficially) a listed species; and

3. Conference with FWS when a federal action is likely to jeopardize the continued existence of a proposed species or result in destruction or an adverse modification of proposed critical habitat.

SECTION 7(c) - Biological Assessment for Construction Projects *

Requires federal agencies or their designees to prepare a Biological Assessment (BA) for construction projects only. The purpose of the BA is to identify any proposed and/or listed species which is/are likely to be affected by a construction project. The process is initiated by a federal agency in requesting a list of proposed and listed threatened and endangered species (list attached). The BA should be completed within 180 days after its initiation (or within such a time period as is mutually agreeable). If the BA is not initiated within 90 days of receipt of the species list, please verify the accuracy of the list with our Service. No irreversible commitment of resources is to be made during the BA process which would result in violation of the requirements under Section 7(a) of the Act. Planning, design, and administrative actions may be taken; however, no construction may begin.

To complete the BA, your agency or its designee should: (1) conduct an onsite inspection of the area to be affected by the proposal, which may include a detailed survey of the area to determine if the species is present and whether suitable habitat exists for either expanding the existing population or potential reintroduction of the species; (2) review literature and scientific data to determine species distribution, habitat needs, and other biological requirements; (3) interview experts including those within the FWS, National Marine Fisheries Service, state conservation department, universities, and others who may have data not yet published in scientific literature; (4) review and analyze the effects of the proposal on the species in terms of individuals and populations, including consideration of cumulative effects of the proposal on the species and its habitat; (5) analyze alternative actions that may provide conservation measures; and (6) prepare a report documenting the results, including a discussion of study methods used, any problems encountered, and other relevant information. Upon completion the report should be forwarded to our Endangered Species Division, 2625 Parkmont Lane SW, Bldg. B, Olympia, WA 98502.

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* "Construction project" means any major federal action which significantly affects the quality of the human environment (requiring an EIS), designed primarily to result in the building or erection of human-made structures such as dams, buildings, roads, pipelines, channels, and the like. This includes federal actions such as permits, grants, licenses, or other forms of federal authorization or approval which may result in construction.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Portland Field Station
2600 S.E. 98th Avenue, Suite 100
Portland, Oregon 97266

May 7, 1991

Re: 1-7-91-SP-307

Donald V. Wolfe
Department of Energy
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

Dear Mr. Wolfe:

This regards your letter dated March 20, 1991, which was received by us on March 21, 1991, requesting an updated list of threatened and endangered species. A list of threatened and endangered species was provided to your agency on August 8, 1989 (Case No. 1-7-89-SP-131). You may consider this an addendum to the August 8 letter.

We have reviewed the earlier August 8, 1989, list against current information. Since this list was provided to you, the northern spotted owl was listed as threatened on June 26, 1990. Except for the change in status of the northern spotted owl, all other information on the August 8, 1989, list is still current for species under Fish and Wildlife Service jurisdiction.

Additional information regarding proposed and petitioned species for listing under the Endangered Species Act of 1973, as amended is available from the National Marine Fisheries Service. We would advise you to contact the National Marine Fishereies Service for a list of currently listed, proposed, and petitioned threatened and endangered species.

Sincerely,

Russell D. Peterson
Field Supervisor

Attachment: August 8, 1989 1-7-89-SP-131

DH/JC/91SP307

cc: NMFS; Attn: Rob Jones
ONHP
ODFW (Nongame)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Portland Field Office
727 NE 24th Avenue
Portland, OR 97232

August 8, 1989

1-7-89-SP-131

Nandranie S. Tuck
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

Dear Ms. Tuck:

As requested by your letter dated July 19, 1989 and received by us on July 26, 1989, we have reexamined the list prepared for the Intertie Development and Use EIS. The information presented for Bonneville, The Dalles, John Day and McNary still accurrately reflects known threatened, endangered and candidate species resources in the vicinity of the aforenamed Oregon hydro facilities. However, since the project area being considered in the proposed Bonneville Power Administration Long-term Power Sales Contracts Environmental Impact Statement (EIS) is more extensive, we have attached a list of endangered and threatened species that may be present in the service area covered by your sales contract EIS. The list fulfills the requirement of the Fish and Wildlife Service under Section 7(c) of the Endangered Species Act of 1973, as amended (16 USC 1531 et. seq.). Bonneville Power Administration's requirements under the Act are outlined in Attachment B.

Should your biological assessment determine that a listed species is likely to be adversely affected by the project, Bonneville Power Administration should request formal Section 7 consultation through this office. Even if your biological assessment shows a "no effect" or "beneficial effect" situation, we would appreciate receiving a copy for our information.

Your interest in endangered species is appreciated. If you have any additional questions regarding your responsibilities under the Act, please call Diana Hwang at our office, phone (503) 231-6179 or FTS 429- 6179. All correspondence should include the above referenced case number.

Sincerely,

Russell D. Peterson
Field Supervisor

Attachment

cc: R1 FWE-SE
PFO-ES
ODFW (Nongame)
ONHP

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES
THAT MAY OCCUR IN THE AREA OF THE PROPOSED
SERVICE AREAS-OPERATING PUBLIC AGENCIES AND COOPERATIVES
(DOE/BPA MAP DATED MAY 1987)
1-7-89-SP-131

LISTED SPECIES[1/]

Mammals

Columbian white tailed Deer *Odocoileus virginianus leucurus* (E)

Columbian white-tailed deer occur along the Lower Columbia River in Clatsop (OR), Columbia (OR), and Wahkiakum (WA) Counties and in Douglas County (OR).

Birds

Peregrine Falcon *Falco peregrinus* (E) (CH in Calif)

Peregrine falcons may occur throughout the state as fall and spring migrants and may overwinter in Oregon. Reintroduction efforts are occurring along the Columbia River, Hells Canyon, Crater Lake and Lake County areas. Nesting peregrines occur in Douglas, Curry, Tillamook, Jackson, and Klamath County.

Bald Eagle *Haliaeetus leucocephalus* (T)

Wintering and nesting bald eagles occur throughout the state. Nesting concentrations occur around Upper Klamath Lake in Klamath County, around the lakes of Deschutes National Forest in Deschutes and Klamath Counties, along the Lower Columbia River, and along the Umpqua River in Douglas County. Additional nesting territories are located throughout the state in the vicinity of major water bodies, rivers, estuaries, reservoirs, and lakes. Wintering concentrations occur in Klamath County and the Lower Columbia River. Wintering eagles may also occur along other major water bodies, reservoirs, and rivers such as the Harney Basin, Crooked River and Grande Ronde Rivers in Oregon from October 31 to March 31. Nesting eagles may occur in Oregon from January 1 to August 31.

Fish

Hutton Spring tui Chub *Gila bicolor ssp.* (T)

Species is restricted to two springs along Alkali Lake in Lake County.

Foskett Spring speckled Dace *Rhinichthys osculus ssp.* (T)

Species occurs in a small Coleman Valley spring in southern Lake County.

Warner Sucker *Catoctomus warnerensis* (T) (CH)

Species occurs in Warner Valley in Lake County. (Listed Sept. 28, 1985)

Borax Lake Chub *Gila boraxobius* (E) (CH)

Species occurs in Borax Lake in Harney County.

Invertebrates

Oregon Silverspot Butterfly *Speyeria zerene hippolyta* (T) (CH)

Disjunct populations occur at Mt. Hebo and along the Oregon coast in Clatsop, Tillamook, and Lane Counties.

Plants

MacFarlane's Four o'clock *Mirabilis macfarlanei* (E)
[Four o'clock family]
Wallow County: T3N R50E S25, T2N R48E S17

Malheur Wire-lettuce *Stephanomeria malheurensis* (E)
[Aster family] Harney County: T27S R30E S12

Bradshaw's lomatium *Lomatium bradshawii* (E)
Species occurs in the vicinity of Fern Ridge Reservoir, Cottage Grove and Eugene in Lane County; Willamette Floodplain RNA and Finley NWR in Benton County; Basket Slough NWR in Polk County, and west Salem in Marion County.

PROPOSED SPECIES 2/

Northern spotted owl *Strix occidentalis caurina* (T)
Species occurs from southwestern British Columbia through western Washington, western Oregon, and the coast range area of northwestern California south to San Francisco Bay.

(E) - Endangered (T) - Threatened (CH) - Critical Habitat
(S) - Suspected (D) - Documented

1/ U. S. Department of Interior, Fish and Wildlife Service, Jan 1989, Endangered and Threatened Wildlife and Plants, 50 CFR 17.11 and 17.12.

2/ Federal Register Vol. 54, No. 120, June 23, 1989 Proposed Rule-Northern Spotted Owl

United States Department of the Interior

FISH AND WILDLIFE SERVICE

FISH AND WILDLIFE ENHANCEMENT
RENO FIELD STATION
4600 Kietzke Lane, Building C-125
Reno, Nevada 89502-5093

May 22, 1991
File No.:1-5-91-SP-98

Mr. Donald V. Wolfe
Project Manager
Department of Energy
P.O. Box 3621
Portland, Oregon 97208-3621

Dear Mr. Wolfe:

Subject: Species List for the Bonneville Power Administration Service Area

This is in reply to your letter of March 20, 1991, requesting a list of listed and proposed endangered and threatened species that may occur within the area of the subject project. We have reviewed the most recent information and to the best of our knowledge there are no federally listed or proposed species or candidates for Federal listing within the area of the project.

If you have further questions, please contact Sherry Barrett or me at (702) 784-5227.

Sincerely,

David L. Harlow
Field Supervisor

IN REPLY REFER TO:

United States Department of the Interior

TAKE PRIDE IN AMERICA

FISH AND WILDLIFE SERVICE
FISH AND WILDLIFE ENHANCEMENT
FEDERAL BUILDING, US COURTHOUSE
301 S PARK
P O BOX 10023
HELENA MT 59626

May 23, 1991

Donald V. Wolfe, Project Manager
L.T. Power Sales Contract FEIS
Bonneville Power Administration
P.O. Box 3621
Portland, OR 97208-3621

Dear Mr. Wolfe:

This responds to your March 20, 1991 request for an updated list of threatened and endangered species which may occur in the area of influence of Bonneville's proposed Long-Term Power Sales Contracts. This letter will provide species information for the following facilities in Montana:

Hydroelectric:	
Libby	- Lincoln County, Montana
Hungry Horse	- Flathead County, Montana
Thermal:	
Colstrip 1-4	- Rosebud County, Montana
Corette	- Yellowstone County, Montana
Coal Mine:	
Colstrip	- Rosebud County, Montana

In accordance with Section 7 (c) of the Endangered Species Act of 1973, as amended (ESA), we have determined that the following listed and proposed threatened or endangered (T/E) species may be present in the project area.

Listed Species	Expected Occurrence
Black-footed ferret (Mustela nigripes)	Potential resident in prairie dog (Cynomys sp.) colonies - Colstrip 1-4, Corette.
Gray wolf (Canis lupus)	Resident - Libby, Hungry Horse
Grizzly bear (Ursus arctos horribilis)	Resident - Libby, Hungry Horse
Bald eagle (Haliaeetus leucocephalus)	Year-round resident. Winter resident Migrant - All facilities.
Peregrine falcon (Falco peregrinus)	Migrant. Potential summer resident - All facilities.

Proposed Species

None

Section 7(c) of ESA requires that Federal agencies proposing major construction actions, complete a biological assessment to determine the effects of the proposed actions on listed and proposed species. If a biological assessment is not required (i.e. all other actions), your agency is responsible for review of proposed activities to determine whether listed species may be affected. We would appreciate the opportunity to review your determination document.

Sincerely,

Dale R. Harms
State Supervisor
Montana State Office

LLL/ndg

cc: L. Lockard, FWE, FWS - Kalispell, MT

"TAKE PRIDE IN AMERICA"

Department of Energy
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

May 30, 1991

In reply refer to: PG

Ms. Peggie Kohl
U.S. Fish and Wildlife Service
Sacramento Endangered Species Office
2800 Cottage Way, Room E-1803
Sacramento, CA 98525

Subject: Request for Updated List of Endangered and Threatened Species in the Bonneville Power Administration (BPA) Service Area, for Inclusion in the Long-Term Power Sales Contracts Environmental Impact Statement (EIS); From Previous Correspondence Coded 1-1-89-SP-944

Dear Ms. Kohl:

Based on a telephone conversation with your assistant, I am sending you additional material to assist you in responding to our recent request for updated listings of endangered and threatened species. Our request was based on previous correspondence in 1989, concerning this EIS, concerning listed species for the portions of our service territory which are within your district. A copy of the response letter from your office, dated August 15, 1989, is enclosed for your information.

Your assistant also requested a map of our service territory. I have enclosed copies of maps showing the service territories of our customer utilities, and excerpts from our authorizing legislation defining our service territory. This statutory language limits our service territory in northern California to areas within 75 air miles of the Oregon border or the Columbia River drainage, which are part of the service territory of a rural electric cooperative which serves loads within Oregon or the Columbia drainage. Specifically, this language limits the area of concern within your district to Modoc and Lassen Counties. These were the Counties addressed in your office's previous response in August 1989.

If listings of endangered and threatened species in these areas have not changed since your previous letter, it will be sufficient for our purposes for you to confirm that the listings are as shown in the attachments to your August 15, 1989, letter.

Thank you for your help.

Sincerely,

Donald V. Wolfe
Project Manager
Power Sales Contract FEIS

4 Enclosures

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Fish and Wildlife Enhancement
Sacramento Field Office
2800 Cottage Way, Room E-1803
Sacramento, California 95825-1846

In Reply Refer To:
1-1-91-SP-635

June 20, 1991

Mr. Donald V. Wolfe
Project Manager
Department of Energy
Bonneville Power Administration
P. O. Box 3621
Portland, Oregon

Subject: Updated Species List for Bonneville Power Administration Service Area, Modoc and Lassen Counties, California

Dear Mr. Wolfe:

As requested by letter from your agency dated May 30, 1991, you will find attached an updated list of the listed endangered and threatened species that may be present in the subject project area. (See Attachment A.) To the best of our knowledge, no proposed species occur within the area. This list fulfills the requirement of the Fish and Wildlife Service to provide a species list pursuant to Section 7(c) of the Endangered Species Act, as amended.

Pertinent information concerning the listed species life history and distribution, and a discussion of the responsibilities of federal agencies under Section 7(c) of the Act were provided for those species addressed in response to your initial request for a species list. Attached is information concerning those listed species not previously addressed.

Formal consultation, pursuant to 50 CFR § 402.14, should be initiated if you determine that a listed species may be affected by the proposed project. Informal consultation may be utilized prior to a written request for formal consultation to exchange information and resolve conflicts with respect to a listed species. If a biological assessment is required, and it is not initiated within 90 days of your receipt of this letter, you should informally verify the accuracy of this list with our office.

Also, for your consideration, we have included a list of the candidate species that may be present in the project area. (See Attachment A.) These species are currently being reviewed by our Service and are under consideration for possible listing as endangered or threatened. Candidate species have no protection under the Endangered Species Act, but are included for your consideration as it is possible that one or more of these candidates could be proposed and listed before the subject project is completed. Should the biological assessment reveal that candidate species may be adversely affected, you may wish to contact our office for technical assistance. One of the potential benefits from such technical assistance is that by exploring alternatives early in the planning process, it may be possible to avoid conflicts that could otherwise develop, should a candidate species become listed before the project is completed.

Please contact Peggie Kohl at 916/978-4866 (FTS 460-4866) if you have any questions regarding the attached list or your responsibilities under the Endangered Species Act.

Sincerely,

Wayne S. White
Field Supervisor

Attachments

ATTACHMENT A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN THE AREA OF THE BONNEVILLE POWER ADMINISTRATION SERVICE AREA MODOC AND LASSEN COUNTIES, CALIFORNIA (1-1-91-SP-635, JUNE 20, 1991)

Listed Species

Fish
- Modoc sucker, *Catostomus microps* (E)
- Lost River sucker, *Deltistes luxatus* (E)
- shortnose sucker, *Chasmistes brevirostris* (E)

Birds
- northern spotted owl, *Strix occidentalis caurina* (T)
- American peregrine falcon, *Falco peregrinus anatum* (E)

Candidate Species

Fish
- Goose Lake redband trout, *Oncorhynchus mykiss* ssp. (2)
- McCloud River redband trout, *Oncorhynchus mykiss* ssp. (2)
- rough sculpin, *Cottus asperrimus* (2)
- Goose Lake sucker, *Castostomus occidentalis lacusanserinus* (2)
- Cowhead Lake tui chub, *Gila bicolor vaccaceps* (1)

Birds
- ferruginous hawk, *Buteo regalis* (2)

Mammals
- spotted bat, *Euderma maculatum* (2)
- Sierra Nevada red fox, *Vulpes vulpes necator* (2)
- Sierra Nevada snowshoe hare, *Lepus americanus tahoensis* (2)
- white-footed vole, *Arborimus albipes* (2)
- California bighorn sheep, *Ovis canadensis californiana* (2)

Invertebrates
- Franklin's bumblebee, *Bombus franklini* (2)
- Siskiyou ground beetle, *Nebria gebleri siskiyouensis* (2R)
- Klamath Mountains ground beetle, *Nebria sahlbergii triad* (2R)

Plants
- Deschutes milk-vetch, *Astragalus tegetarioides* (2)
- Greene's mariposa, *Calochortus greenei* (2)
- Egg Lake monkeyflower, *Mimulus pygmaeus* (2)
- Columbia yellow-cress, *Rorippa columbiae* (2)

(E)--Endangered (T)--Threatened (CH)--Critical Habitat

(1)--Category 1: Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.

(2)--Category 2: Taxa for which existing information indicated may warrant listing, but for which substantial biological information to support a proposed rule is lacking.

(1R)-Recommended for Category 1 status.

(2R)-Recommended for Category 2 status.

(*)--Possibly extinct.

PALMATE-BRACTED BIRD'S-BEAK
(*Cordylanthus palmatus*)

CLASSIFICATION: Endangered 51 FR 23765

CRITICAL HABITAT: None designated

DESCRIPTION:

This annual herb of the snapdragon family (*Scrophulariaceae*) attains a height of 4 to 12 inches and produces several to many spreading ascending branches from near the base of the main stem. The pale stems are sparsely to densely hairy, often with glandular excretions of salt crystals evident on the herbage. The leaves and stems are grayish green and often very pale. The small pale whitish flowers, 1/2-inch to 1 inch long, are arranged in dense clusters (spikes) and densely surrounded by herbaceous leaflike bracts. Seedlings in late March or April. The species flowers in late spring through the summer.

DISTRIBUTION:

Historically the species was collected from seven scattered locations in Fresno, Madera, San Joaquin, Yolo, and Colusa Counties. In 1982 a new location was discovered near Livermore in Alameda County and in 1987 a colony was discovered on the Colusa National Wildlife Refuge in Colusa County. The latter stand may represent a remnant of the former populations to occur in the general area. At present four extant populations are known. These include the Livermore and Colusa NWR colonies, one near Woodland, Yolo County, and one on the Mendota State Wildlife Area, Fresno County. Additional colonies may occur in appropriate alkali sink habitats in these regions of the Central Valley and inner coast range valleys.

SPECIAL CONSIDERATIONS:

Population fluctuations are common in the palmate-bracted bird's-beak. These oscillations may be a result of changes in pollination success, rainfall patterns, freshwater influence, and marsh pollution. Consequently, researchers should take into account the unreliability of a single-season survey.

REFERENCES FOR ADDITIONAL INFORMATION

Chuang, T. I., and L. R. Heckard. 1971. Observations on root-parasitism in *Cordylanthus* (Scrophulariaceae). Am. J. Bot. 58:218-228.

Chuang, T. I., and L. R. Heckard. 1973. Taxonomy of *Cordylanthus* subgenus *Hemistegia* (Scrophulariaceae). Brittonia 25:135-158.

Ferris, R. S. 1918. Taxonomy and distribution of *Adenostegia*. Bull. Torrey Bot. Club. 45:399-423.

AMERICAN PEREGRINE FALCON

(Falco peregrinus anatum)

CLASSIFICATION:

Endangered 35 **Federal Register** 16047, October 13, 1970, and 49 **Federal Register** 10526, March 20, 1984.

CRITICAL HABITAT: Designated in Sonoma, Napa, and Lake Cos.

DESCRIPTION:

A medium-sized, swift flying bird of prey with pointed wings. Wingspan is 3 to 4 feet. Adults have slate gray backs with white underparts that are streaked or barred in black. They have distinctive white and black facial markings.

DISTRIBUTION:

Historically nested throughout North America from the boreal forest south into Mexico, wherever suitable nesting and foraging habitat occurred. Remnant breeding populations currently occur in California, Arizona, New Mexico, Utah, Texas, and Alaska. A few pairs nest in other states in the northeast and northwest.

SPECIAL CONSIDERATIONS:

The American peregrine falcon has suffered major population declines due principally to DDT contamination of their food chain. With the banning of DDT for use in the U.S. in 1972 and implementation of a management program, populations have for the most part stabilized. Unfortunately, pesticide data indicate that there has been a continued input of DDT into the local environments. Some nest sites are now protected from human disturbance. Poor quality eggs are taken from the wild for artificial incubation, and young are placed in nests after hatching from wild eggs taken into captivity or laid by captive parents.

REFERENCES FOR ADDITIONAL INFORMATION:

J. J. Hickey (ed). 1969. Peregrine falcon populations their biology and decline. Univ. of Wisconsin Press. Madison, WI.

Ratcliffe, D. 1980. The peregrine falcon. Buteo Books. Vermillion, SD.

U.S. Fish and Wildlife Service. 1982. Pacific Coast Recovery Plan for the American Peregrine Falcon. Portland, OR. 87 pp.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
FISH AND WILDLIFE ENHANCEMENT
UTAH STATE OFFICE
2078 ADMINISTRATION BUILDING
1745 WEST 1700 SOUTH
SALT LAKE CITY, UTAH 84104-5110

TAKE PRIDE IN AMERICA

In Reply Refer To

(FWE)

August 1, 1991

Donald V. Wolfe
Power Sales Contract FEIS
Bonneville Power Administration
PO Box 3621
Portland, Oregon 97208-3621

Dear Mr. Wolfe:

We have received your letter concerning the Long-Term Power Sales Contracts Environmental Impact Statement. The materials provided have been reviewed and we find nothing of significant concern to the Fish and Wildlife Service in the State of Utah. Therefore we will offer no comments.

We would be pleased to address specific issues identified by you if necessary at a later date.

Sincerely,

Robert Benton

for Clark D. Johnson
Assistant Field Supervisor

Department of Energy
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208 - 3621

JUL 19 1989

In reply refer to: PGA

Mr. Ralph Swanson
Fish & Wildlife Enhancement
U.S. Fish & Wildlife Service
1002 NE. Holladay Street
Portland, OR 97232-4181

Dear Mr. Swanson:

Subject: Request for List of Endangered and Threatened Species in the Bonneville Power Administration Service Area, for Inclusion in the Long-Term Power Sales Contracts Environmental Impact Statement (EIS)

In August 1981, Bonneville Power Administration (BPA) offered its customers new long-term contracts under the Pacific Northwest Electric Power Planning and Conservation Act. At that time, BPA prepared an Environmental Report to accompany the initial contract offer, but did not prepare an Environmental Assessment or an EIS. The United States Court of Appeals has since ordered BPA to prepare an EIS.

BPA is now in the process of analyzing the environmental impacts of these long-term contracts in an EIS. Two basic alternatives are being analyzed: (1) the no-action alternative in which BPA would preserve the Long-Term Power Sales Contracts without change; or (2) an alternative in which BPA would pursue contract modifications (see enclosed material for additional details). The analysis covers the effects of operation of power facilities within the affected area. It also identifies quantities and types of resources that might be needed to meet future firm power loads. The EIS will include a generic discussion of impacts associated with these resources.

These long-term contracts are with customers located throughout BPA's service area, which covers the States of Washington, Oregon, and Idaho; the portion of Montana west of the Continental Divide; and small portions of Wyoming, Utah, Nevada, and northern California. Our study area also includes areas in Montana, Nevada, and Wyoming surrounding coal plants that serve the Pacific Northwest (see enclosed area description and location maps). The affected facilities within these States are identified by name, location, and energy source on the enclosed list.

In compliance with section 7(c) of the amended Endangered Species Act, BPA is requesting a list of endangered and threatened species that may occur in the area of any of these facilities; and any information on these species that might be available, such as locations and how they might be affected. If no species or their critical habitat are being or will be affected by these alternatives, please notify BPA of this finding as well. The list you recently prepared for our Intertie Development and Use EIS, which covered much the same territory, is also enclosed for your information.

According to our conversation of June 30, 1989, my understanding is that Regions 2 and 6 will each take the lead to consult and coordinate the species list with their respective field offices and that each region will provide a single response to this request. We would, however, appreciate a list of contacts at the appropriate field offices, should the need arise in the future for more detailed followup during the consultation process.

If possible, we would appreciate having any information you may obtain by September 15, 1989, so that we can include it in our draft EIS. If you need additional information, or if I can assist in any other way, please contact me at (503) 230-4235 or FTS 429-4235.

Sincerely,

Nandranie S. Tuck

Nandranie S. Tuck
Environmental Specialist
Environmental Compliance Section

4 Enclosures

Department of Energy
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208 - 3621

JUL 19 1989

In reply refer to: PGA

Mr. Galen Buterbaugh
Regional Director
U.S. Fish & Wildlife Service
P.O. Box 25486
Denver Federal Center
Denver, CO 80225

Dear Mr. Buterbaugh:

Subject: Request for List of Endangered and Threatened Species in the Bonneville Power Administration Service Area, for Inclusion in the Long-Term Power Sales Contracts Environmental Impact Statement (EIS)

In August 1981, Bonneville Power Administration (BPA) offered its customers new long-term contracts under the Pacific Northwest Electric Power Planning and Conservation Act. At that time, BPA prepared an Environmental Report to accompany the initial contract offer, but did not prepare an Environmental Assessment or an EIS. The United States Court of Appeals has since ordered BPA to prepare an EIS.

BPA is now in the process of analyzing the environmental impacts of these long-term contracts in an EIS. Two basic alternatives are being analyzed: (1) the no-action alternative in which BPA would preserve the Long-Term Power Sales Contracts without change; or (2) an alternative in which BPA would pursue contract modifications (see enclosed material for additional details). The analysis covers the effects of operation of power facilities within the affected area. It also identifies quantities and types of resources that might be needed to meet future firm power loads. The EIS will include a generic discussion of impacts associated with these resources.

These long-term contracts are with customers located throughout BPA's service area, which covers the States of Washington, Oregon, and Idaho; the portion of Montana west of the Continental Divide; and small portions of Wyoming, Utah, Nevada, and northern California. Our study area also includes areas in Montana, Nevada, and Wyoming surrounding coal plants that serve the Pacific Northwest (see enclosed area description and location maps). The affected facilities within these States are identified by name, location, and energy source on the enclosed list.

In compliance with section 7(c) of the amended Endangered Species Act, BPA is requesting a list of endangered and threatened species that may occur in the area of any of these facilities; and any information on these species that might be available, such as locations and how they might be affected. If no species or their critical habitat are being or will be affected by these alternatives, please notify BPA of this finding as well. The list you recently prepared for our Intertie Development and Use EIS, which covered much the same territory, is also enclosed for your information.

According to my conversation with Mr. Ralph Swanson of Region 2 on June 30, 1989, my understanding is that Regions 2 and 6 will each take the lead to consult and coordinate the species list with their respective field offices and that each region will provide a single response to this request. We would, however, appreciate a list of contacts at the appropriate field offices, should the need arise in the future for more detailed followup during the consultation process.

If possible, we would appreciate having any information you may obtain by September 15 1989, so that we can include it in our draft EIS. If you need additional information, or if I can assist in any other way, please contact me at (503) 230-4235 or FTS 429-4235.

Sincerely,

Nandranie S. Tuck

Nandranie S. Tuck
Environmental Specialist
Environmental Compliance Section

4 Enclosures

PACIFIC NORTHWEST GENERATING FACILITIES*

HYDROELECTRIC

FACILITY	COUNTY	STATE	T.	R.	S.
BONNEVILLE	Multnomah	OR	2 N	7 E	21, 22
	Skamania	WA	2 N	7 E	21, 22
			(Bonneville Dam 15')		
THE DALLES	Wasco	OR	1 N	13,14 E	31, 35
	Klickitat	WA	1 N	13,14 E	31, 35
			(Dalles Dam 15')		
JOHN DAY	Sherman	OR	3 N	17 E	28
	Klickitat	WA	3 N	17 E	28
			(Rufus 7-1/2')		
MCNARY	Umatilla	OR	5 N	28 E	10
	Benton	WA	5 N	28 E	3
			(Umatilla 7-1/2')		
PRIEST RAPIDS	Yakima	WA	13 N	23 E	2, 3
	Grant	WA	14 N	23 E	35, 36
			(Priest Rapids 15')		
WANAPUM	Kittitas	WA	16 N	23 E	17, 20
	Grant	WA	16 N	23 E	16, 7
ROCK ISLAND	Douglas	WA	21 N	22 E	5
	Chelan	WA	21 N	22 E	5
			(Rocky Island Dam 7-1/2')		
ROCKY REACH	Douglas	WA	24 N	20 E	35
	Chelan	WA	24 N	20 E	35
			(Rocky Reach Dam 7-1/2')		
WELLS	Douglas	WA	28 N	24 E	6
	Chelan		28 N	24 E	6, 20
			(Wells Dam 7-1/2')		
CHIEF JOSEPH	Douglas	WA	29 N	25 E	24
	Okanogan	WA	29 N	25 E	24
			(Chief Joseph Dam 7-1/2')		
ICE HARBOR	Walla Walla	WA	8 N	30 E	2
	Franklin	WA	8 N	30 E	2, 3
			(Pasco 7-1/2')		
LOWER MONUMENTAL	Walla Walla	WA	12,13 N	34 E	2, 3, 34
	Franklin	WA	13 N	34 E	34
			(Lower Monumental Dam 7-1/2')		
LITTLE GOOSE	Columbia	WA	13 N	28 E	27
	Whitman	WA	13 N	28 E	27
			(Starbuck East 7-1/2')		
LOWER GRANITE	Whitman	WA	14 N	43 E	29, 32
	Garfield	WA	14 N	43 E	32
			(Almota 7-1/2')		
LIBBY	Lincoln	MT			
HUNGRY HORSE	Flathead	MT			
ALBENI FALLS	Bonner	ID			
GRAND COULEE	Okanogan	WA	0 28 N	30 E	1
	Douglas	WA	0 28 N	30,31 E	1, 6
			(Grand Coulee 15')		
DWORSHAK	Clearwater	ID			

* Facilities within the "affected environment" of the Power Sales Contract EIS.

PACIFIC NORTHWEST GENERATING FACILITIES*

THERMAL

PLANT	OWNER	CITY	STATE	COUNTY	T.	R.	S.
COLSTRIP 1-4	MPC	Colstrip	MT	Rosebud	2 N	41 E	35
CORETTE	MPC	Billings	MT	Yellowstone			
BOARDMAN	PGE	Boardman	OR	Morrow	(Near N. Border)		
CENTRALIA 1&2	PP&L	Centralia	WA	Lewis	15 N	1 W	30
JIM BRIDGER 1-4	PP&L	Rock Springs	WY	Sweetwater	20 N	101 W	3
VALMY 1&2	Sierra Pacific	Valmy	NV	Humbolt	35 N	43 E	27

NUCLEAR

PLANT	OWNER	CITY	STATE	COUNTY	T.	R.	S.
WNP-1	WPS	Richland	WA	Benton	11 N	28 E	5
					(Wooded Island 7-1/2')		
WNP-3	WPS	Satsop	WA	Grays Harbor	17 N	6 W	18
					(Grays Harbor 7-1/2')		

COMBUSTION TURBINE

PLANT	OWNER	CITY	STATE	COUNTY	T.	R.	S.
BETHEL	PGE	Salem	OR	Marion	7 S	2 W	29
BEAVER	PGE	Clatskanie	OR	Columbia			
WHITEHORN 1-3	PSP&L	Custer	WA	Whatcom	39 N	1 W	12
FREDERICKSON 1&2	PSP&L	Tacoma	WA	King	18 N	3 E	1
FREDONIA UNITS 1&2	PSP&L	Burlington	WA	Skagit	34 N	3 E	9

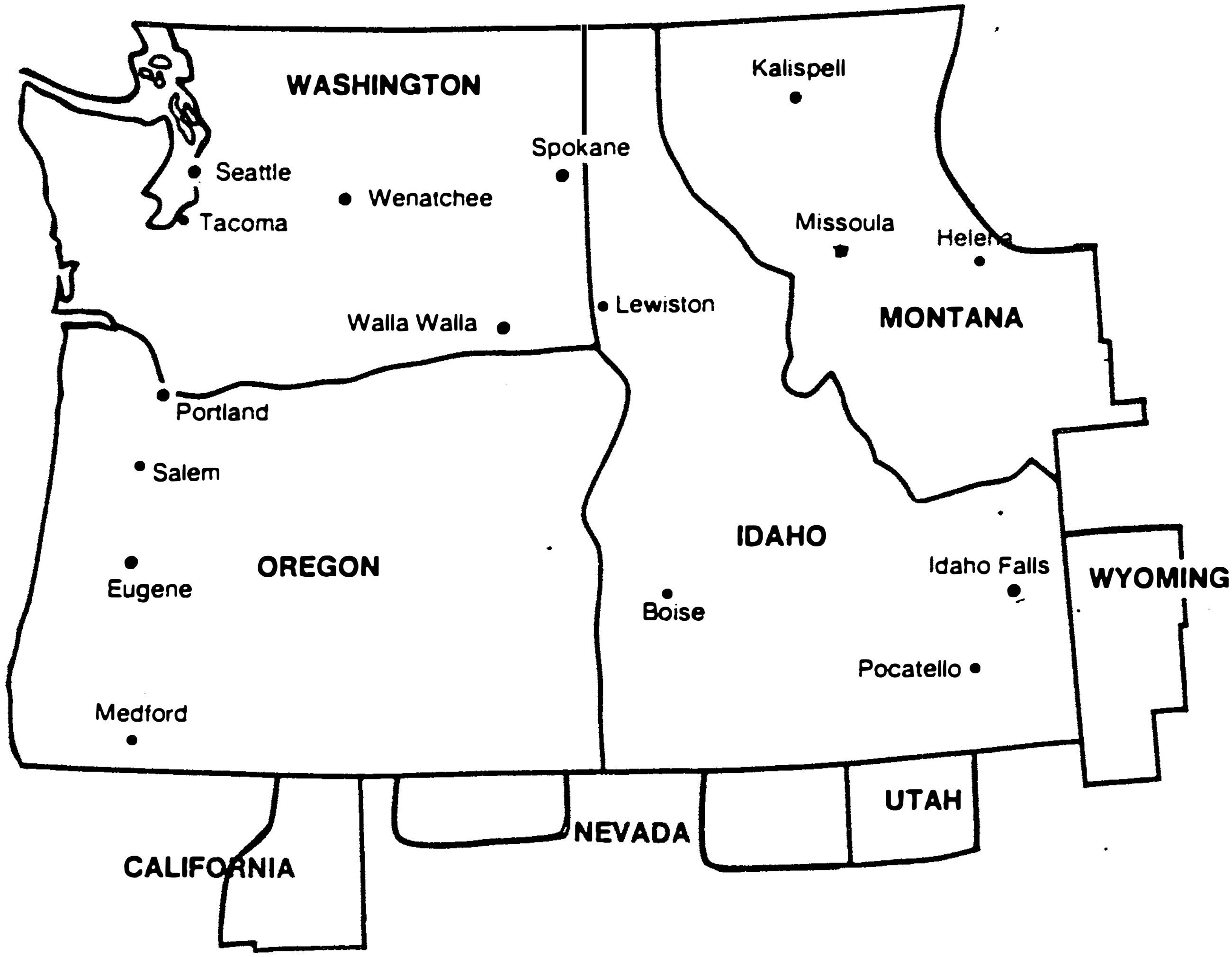
COAL MINES SUPPLYING GENERATING RESOURCES

POWER PLANT	MINE	CITY	STATE	COUNTY	T.	R.	S.
BOARDMAN	Belle Ayre	Campbell	WY				
CENTRALIA	Centralia	Centralia	WA	Lewis	15 N	1 W	30
COLSTRIP	Rosebud	Rosebud	MT				
JIM BRIDGER	Bridger	Sweetwater	WY				

* Facilities within the "affected environment" of the Power Sales Contract EIS.

Figure 2.1

BPA SERVICE AREA



United States Department of the Interior

FISH AND WILDLIFE SERVICE
Portland Field Office
727 NE 24th Avenue
Portland, OR 97232

August 8, 1989

1-7-89-SP-131

Nandranie S. Tuck
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

Dear Ms. Tuck:

As requested by your letter dated July 19, 1989 and received by us on July 26, 1989, we have reexamined the list prepared for the Intertie Development and Use EIS. The information presented for Bonneville, The Dalles, John Day and McNary still accurrately reflects known threatened, endangered and candidate species resources in the vicinity of the aforenamed Oregon hydro facilities. However, since the project area being considered in the proposed Bonneville Power Administration Long-term Power Sales Contracts Environmental Impact Statement (EIS) is more extensive, we have attached a list of endangered and threatened species that may be present in the service area covered by your sales contract EIS. The list fulfills the requirement of the Fish and Wildlife Service under Section 7(c) of the Endangered Species Act of 1973, as amended (16 USC 1531 et. seq.). Bonneville Power Administration's requirements under the Act are outlined in Attachment B.

Should your biological assessment determine that a listed species is likely to be adversely affected by the project, Bonneville Power Administration should request formal Section 7 consultation through this office. Even if your biological assessment shows a "no effect" or "beneficial effect" situation, we would appreciate receiving a copy for our information.

Your interest in endangered species is appreciated. If you have any additional questions regarding your responsibilities under the Act, please call Diana Hwang at our office, phone (503) 231-6179 or FTS 429- 6179. All correspondence should include the above referenced case number.

Sincerely,

Russell D. Peterson
Field Supervisor

Attachment

cc: R1 FWE-SE
PFO-ES
ODFW (Nongame)
ONHP

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES
THAT MAY OCCUR IN THE AREA OF THE PROPOSED
SERVICE AREAS-OPERATING PUBLIC AGENCIES AND COOPERATIVES
(DOE/BPA MAP DATED MAY 1987)
1-7-89-SP-131

LISTED SPECIES1/

Mammals

Columbian white tailed Deer *Odocoileus virginianus leucurus* (E)

Columbian white-tailed deer occur along the Lower Columbia River in Clatsop (OR), Columbia (OR), and Wahkiakum (WA) Counties and in Douglas County (OR).

Birds

Peregrine Falcon *Falco peregrinus* (E) (CH in Calif)

Peregrine falcons may occur throughout the state as fall and spring migrants and may overwinter in Oregon. Reintroduction efforts are occurring along the Columbia River, Hells Canyon, Crater Lake and Lake County areas. Nesting peregrines occur in Douglas, Curry, Tillamook, Jackson, and Klamath County.

Bald Eagle *Haliaeetus leucocephalus* (T)

Wintering and nesting bald eagles occur throughout the state. Nesting concentrations occur around Upper Klamath Lake in Klamath County, around the lakes of Deschutes National Forest in Deschutes and Klamath Counties, along the Lower Columbia River, and along the Umpqua River in Douglas County. Additional nesting territories are located throughout the state in the vicinity of major water bodies, rivers, estuaries, reservoirs, and lakes. Wintering concentrations occur in Klamath County and the Lower Columbia River. Wintering eagles may also occur along other major water bodies, reservoirs, and rivers such as the Harney Basin, Crooked River and Grande Ronde Rivers in Oregon from October 31 to March 31. Nesting eagles may occur in Oregon from January 1 to August 31.

Fish

Hutton Spring tui Chub *Gila bicolor ssp.* (T)

Species is restricted to two springs along Alkali Lake in Lake County.

Foskett Spring speckled Dace *Rhinichthys osculus ssp.* (T)

Species occurs in a small Coleman Valley spring in southern Lake County.

Warner Sucker *Catoctomus warnerensis* (T) (CH)

Species occurs in Warner Valley in Lake County. (Listed Sept. 28, 1985)

Borax Lake Chub *Gila boraxobius* (E) (CH)

Species occurs in Borax Lake in Harney County.

Invertebrates

Oregon Silverspot Butterfly *Speyeria zerene hippolyta* (T) (CH)

Attachment A

Disjunct populations occur at Mt. Hebo and along the Oregon coast in Clatsop, Tillamook, and Lane Counties.

Plants

MacFarlane's Four o'clock *Mirabilis macfarlanei* (E)
[Four o'clock family]
Wallow County: T3N R50E S25, T2N R48E S17

Malheur Wire-lettuce *Stephanomeria malheurensis* (E)
[Aster family] Harney County: T27S R30E S12

Bradshaw's lomatium *Lomatium bradshawii* (E)
Species occurs in the vicinity of Fern Ridge Reservoir, Cottage Grove and Eugene in Lane County; Willamette Floodplain RNA and Finley NWR in Benton County; Basket Slough NWR in Polk County, and west Salem in Marion County.

PROPOSED SPECIES[2/]

Northern spotted owl *Strix occidentalis caurina* (T)
Species occurs from southwestern British Columbia through western Washington, western Oregon, and the coast range area of northwestern California south to San Francisco Bay.

(E) - Endangered (T) - Threatened (CH) - Critical Habitat
(S) - Suspected (D) - Documented

1/ U. S. Department of Interior, Fish and Wildlife Service, Jan 1989, Endangered and Threatened Wildlife and Plants, 50 CFR 17.11 and 17.12.
2/ Federal Register Vol. 54, No. 120, June 23, 1989 Proposed Rule-Northern Spotted Owl

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
2625 Parkmont Lane SW, Bldg B
Olympia, Washington 98502

August 11, 1989

Ms. Nandranie S. Tuck
Environmental Specialist
Department of Energy
Bonneville Power Administration
PO Box 3621
Portland, Oregon 97208-3621

FWS Reference: 1-3-89-SP-305

Dear Ms. Tuck:

As requested by your letter, dated July 19, 1989, and received in this office on July 26, attached is a list of endangered and threatened species (Attachment A) that may be present in the area of the proposed hydroelectric, thermal, nuclear, and combustion turbine generating facilities and coal mines of the Pacific Northwest Power System in Washington State. The list fulfills the requirement of the Fish and Wildlife Service under Section 7(c) of the Endangered Species Act of 1973, as amended. The requirements for Bonneville Power Administration compliance under the Act are outlined in Attachment B.

Should the biological assessment determine that a listed species is likely to be affected (adversely or beneficially) by the project, Bonneville Power should request formal Section 7 consultation through this office. Even if the biological assessment shows a "no effect" situation, we would appreciate receiving a copy for our information.

Also included is a list of candidate species presently under review by this Service for consideration as endangered or threatened. Candidate species have no protection under the Endangered Species Act, and a determination of "may affect" for candidates does not require preparation of a biological assessment or consultation with the Fish and Wildlife Service. Candidate species are included simply as advance notice to federal agencies of species which may be proposed and listed in the future. If early evaluation of your project indicates that it is likely to adversely impact a candidate species, Bonneville Power may wish to request technical assistance from this office.

Your interest in endangered species is appreciated. If you have additional questions regarding your responsibilities under the Act, please contact Jim Michaels or Jeff Haas of my staff at the above phone/address.

Sincerely,

John R. Kerbow
Acting Field Supervisor

Attachments

c: WDW (Nongame)
WNHP

JWH:gb

ATTACHMENT A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR WITHIN THE AREA OF THE PROPOSED HYDROELECTRIC, THERMAL, NUCLEAR, AND COMBUSTION GENERATING FACILITIES AND COAL MINES OF THE PACIFIC NORTHWEST POWER SYSTEM IN MULTIPLE COUNTIES OF THE STATE OF WASHINGTON

1-3-89-SP-305

PACIFIC NORTHWEST HYDROELECTRIC GENERATING FACILITIES

Bonneville, Skamania County (T2N R7E S22)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - breeding

PROPOSED - None

CANDIDATE - *Rorippa columbiae* (persistent sepal yellowcress)
Erigeron howellii (Howell's daisy)

The Dalles, Klickitat County (T2N R13E S35)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - breeding

PROPOSED - None

CANDIDATE - None

John Day, Klickitat County (T3N R17E S28)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - breeding

PROPOSED - None

CANDIDATE - *Lomatium laevigatum* (smooth desert-parsley)

McNary, Benton County (T5N R28E S3)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Bald eagle wintering concentration area (T5N R26E S9)
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - Ferruginous hawk (*Buteo regalis*)
Long-billed curlew (*Numenius americanus*)

Priest Rapids, Yakima County (T13N R23E S2/3)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - *Astragalus columbianus* (Columbia milk vetch)
Lomatium tuberosum (Hoover's desert-parsley)

Wanapum, Grant County (T16N R23E S16/17)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - *Lomatium tuberosum* (Hoover's desert-parsley)

Rock Island, Douglas County (T21N R22E S5)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - *Phacelia lenta* (sticky phacelia)
Astragalus misellus var. pauper (pauper milk-vetch)

Rocky Reach, Chelan County (T24N R20E S35)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - *Trifolium thompsonii* (Thompson's clover)

Wells, Douglas County (T28N R24E S6)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - None

Chief Joseph, Okanogan County (T29N R25E S24)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Bald eagle wintering concentration area (T29N R25E S24)
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - None

Ice Harbor, Walla Walla County (T9N R31E S24)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - None

Lower Monumental, Walla Walla County (T13N R34E S34)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - None

Little Goose, Columbia County (T13N R38E S27)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - None

Lower Granite, Whitman County (T14N R43E S32)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - *Rubus nigerrimus* (northwest raspberry)

Grand Coulee, Grant County (T28N R30E S1)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Bald eagle communal night roosting area (T28N R31E S7)
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - *Allium douglasii var. constrictum* (Douglas' onion)

Centralia, Lewis County (T15N R1W S30)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering

PROPOSED - None

CANDIDATE - None

PACIFIC NORTHWEST NUCLEAR GENERATING FACILITY

WNP-1, Benton County (T11N R28E S5)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - Ferruginous hawk (*Buteo regalis*) - nesting may occur in the area of the project.
Swainson's hawk (*Buteo swainsoni*) - nesting may occur in the area of the project.

WNP-3, Grays Harbor County (T17N R6W S18)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
There are 3 bald eagle nesting territories near the project (T17N R6W S12; T17N R7W S7; T17N R7W S10)

PROPOSED - None

CANDIDATE - Olympic mudminnow (*Novumbra hubbsi*)

Whitehorn, Whatcom County (T39N R1W S12)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering
Bald eagle nesting territory (T39N R1W S1)
Peregrine falcon (*Falco peregrinus*) - migrant

PROPOSED - None

CANDIDATE - None

<u>Frederickson 1&2, Pierce County</u> (T18N R3E S1)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering

PROPOSED - None

CANDIDATE - *Aster curtus* (white-top aster)

<u>Fredonia Units 1&2, Skagit County</u> (T34N R3E S9)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering

PROPOSED - None

PROPOSED - None

PACIFIC NORTHWEST COAL MINES

<u>Centralia, Lewis County</u> (T15N R1W S30)

LISTED - Bald eagle (*Haliaeetus leucocephalus*) - wintering

PROPOSED - None

CANDIDATE - None

Note: Wintering bald eagle activity occurs from about October 31 through March 31. Nesting activities occur from about January 1 through August 15.

Major concerns that should be addressed in your biological assessment of project impacts to bald eagles and peregrine falcons are:

1. Level of use of the project area by bald eagles and peregrine falcons.
2. Effect of the project on the eagle's and falcon's primary food stocks and foraging ares in all areas influenced by the project.
3. Impacts from project activities (i.e., increased human activity, loss or degradation of habitat, increased noise levels) which may result in disturbance to bald eagles and falcons and/or their avoidance of the project area.

FEDERAL AGENCIES' RESPONSIBILITIES UNDER SECTIONS 7(a) AND 7(c) OF THE ENDANGERED SPECIES ACT

SECTION 7(A) - Consultation/Conference

Requires:

1. Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species;

2. Consultation with FWS when a federal action may affect a listed endangered or threatened species to ensure that any action authorized, funded, or carried out by a federal agency is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. The process is initiated by the federal agency after it has determined if its action may affect (adversely or beneficially) a listed species; and

3. Conference with FWS when a federal action is likely to jeopardize the continued existence of a proposed species or result in destruction or an adverse modification of proposed critical habitat.

SECTION 7(c) - Biological Assessment for Construction Projects *

Requires federal agencies or their designees to prepare a Biological Assessment (BA) for construction projects only. The purpose of the BA is to identify any proposed and/or listed species which is/are likely to be affected by a construction project. The process is initiated by a federal agency in requesting a list of proposed and listed threatened and endangered species (list attached). The BA should be completed within 180 days after its initiation (or within such a time period as is mutually agreeable). If the BA is not initiated within 90 days of receipt of the species list, please verify the accuracy of the list with our Service. No irreversible commitment of resources is to be made during the BA process which would result in violation of the requirements under Section 7(a) of the Act. Planning, design, and adminstrative actions may be taken; however, no construction may begin.

To complete the BA, your agency or its designee should: (1) conduct an onsite inspection of the area to be affected by the proposal, which may include a detailed survey of the area to determine if the species is present and whether suitable habitat exists for either expanding the existing population or potential reintroduction of the species; (2) review literature and scientific data to determine species distribution, habitat needs, and other biological requirements; (3) interview experts including those within the FWS, National Marine Fisheries Service, state conservation department, universities, and others who may have data not yet published in scientific literature; (4) review and analyze the effects of the proposal on the species in terms of individuals and populations, including consideration of cumulative effects of the proposal on the species and its habitat; (5) analyze alternative actions that may provide conservation measures; and (6) prepare a report documenting the results, including a discussion of study methods used, any problems encountered, and other relevant information. Upon completion the report should be forwarded to our Endangered Species Division, 2625 Parkmont Lane SW, Bldg. B, Olympia, WA 98502.

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* "Construction project" means any major federal action which significantly affects the quality of the human environment (requiring an EIS), designed primarily to result in the building or erection of human-made structures such as dams, buildings, roads, pipelines, channels, and the like. This includes federal actions such as permits, grants, licenses, or other forms of federal authorization or approval which may result in construction.

ATTACHMENT B

United States Department of the Interior

FISH AND WILDLIFE SERVICE

BOISE FIELD OFFICE
4696 Overland Road, Room 576
Boise, Idaho 83705

August 16, 1989

Nandranie S. Tuck, Environmental Specialist
Environmental Compliance Section
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

Re: 1-4-89-SP-332

Dear Mr. Tuck:

We have reviewed your July 19, 1989 letter concerning the Long-Term Power Sales Contracts in Bonner and Clearwater counties, Idaho. We are providing a list of threatened and endangered species (Attachment A) that may be impacted by this project. This list fulfills the requirements of the Fish and Wildlife Service under Section 7(c) of the Endangered Species Act (ESA) of 1973, as amended.

Attachment B lists the continuing responsibilities as described in Section 7(a) and (c) of the ESA. If there are any questions regarding your responsibilities under the ESA, please contact Rich Howard at the above address or by phone at 334-1806. However, pursuant to regulations under Section 7, Bonneville Power Administration should renew its species list request after 180 days past this response.

Additional information on Federally listed and candidate species and State species of special concern is available through the Idaho Department of Fish and Game's Natural Heritage Program, Attn: Craig Groves, Idaho Department of Fish and Game, 600 S. Walnut, P.O. Box 25, Boise, Idaho 83707, phone 334-3402.

Thank you for the opportunity to provide these comments.

Sincerely yours,

Walter D. Ray
for Charles H. Lobdell
Field Supervisor

Enclosures

cc: FWS, AFWE-SE, Portland
IDFG, Hdqtrs., Boise
IDFG, Region 1, Coeur d'Alene
IDFG, Region 2, Lewiston

ATTACHMENT A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES, AND CANDIDATE SPECIES THAT MAY OCCUR WITH THE POWER SALES CONTRACTS AREAS IN BONNER AND CLEARWATER COUNTIES, IDAHO
1-4-89-SP-332

LISTED SPECIES	COMMENTS
Bald Eagle (Haliaeetus leucocephalus)	Albeni Falls - major northwest wintering area where 400 bald eagles use Pend Oreille Lake from October - March. Five nesting bald eagles in the same area.
Bald Eagle (Haliaeetus leucocephalus)	Dworshak - 20-40 wintering bald eagles.

PROPOSED SPECIES

None

CANDIDATE SPECIES

None

ATTACHMENT B

FEDERAL AGENCIES' RESPONSIBILITY UNDER SECTIONS 7(a) and (c) OF THE ENDANGERED SPECIES ACT

SECTION 7(a) - Consultation/Conference

Requires: 1) Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species;

2) Consultation with FWS when a Federal action may affect a listed endangered or threatened species to insure that any action authorized, funded or carried out by a Federal agency is not likely to jeopardize the continued existence of listed species; or result in destruction or adverse modification of critical habitat; and

3) Conference with FWS when a Federal action is likely to jeopardize the continued existence of a proposed species or result in destruction or adverse modification of proposed critical habitat.

SECTION 7(c) - Biological Assessment for Major Construction Activities [1/]

Requires Federal agencies or their designees to prepare Biological Assessment (BA) for major construction activities. The BA analyzes the effects of the action on listed and proposed species. The process begins with a Federal agency in requesting from FWS a list of proposed and listed threatened and endangered species (list attached). The BA should be completed within 180 days after its initiation (or within such a time period as is mutually agreeable). If the BA is not initiated within 90 days of receipt of the species list, the accuracy of the list species should be informally verified with our Service. No irreversible commitment of resources is to be made during the BA process which would foreclose reasonable and prudent alternatives to protect endangered species. Planning, design, and administrative actions may be taken; however, no construction may begin.

We recommend the following for inclusion in the BA; an onsite inspection of the area to be affected by the proposal which may include a detailed survey of the area to determine if the species are present; a review of literature and scientific data to determine species' distribution, habitat needs, and other biological requirements; interviews with experts, including those within FWS, State conservation departments, universities and others who may have data not yet published in scientific literature; an analysis of the effects of the proposal on the species in terms of individuals and populations, including consideration of cumulative effects of the proposal on the species and its habitat; an analysis of alternative actions considered. The BA should document the results, including a discussion of study methods used, any problems encountered, and other relevant information. The BA should conclude whether or not a listed or proposed species will be affected. Upon completion, the BA should be forwarded to our office.

1/ A major construction activity is a construction project (or other undertaking having similar physical impacts) which is a major action significantly affecting the quality of human environment as referred to in the NEPA (42 U.S.C. 4332 (2)(c).

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Endangered Species Office
2800 Cottage Way, Room E-1823
Sacramento, California 95825-1846

In Reply Refer To:
1-1-89-SP-944

August 15, 1989

Nandranie S. Tuck
Environmental Specialist
Environmental Compliance Section
Department of Energy
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

Subject: Species List for the Bonneville Power Administration Service Area Long-Term Power Sales Contract, Modoc and Lassen Counties, California

Dear Ms. Tuck:

As requested by letter from your agency dated July 19, 1989, you will find attached a list of the proposed and listed endangered and threatened species that may be present in the subject project area. (See Attachment A.) This list fulfills the requirement of the Fish and Wildlife Service to provide a species list pursuant to Section 7(c) of the Endangered Species Act, as amended.

Some pertinent information concerning the distribution, life history, habitat requirements, and published references for the listed species is also attached. This information may be helpful in preparing the biological assessment for this project, if one is required. Please see Attachment B for a discussion of the responsibilities Federal agencies have under Section 7(c) of the Act and the conditions under which a biological assessment must be prepared by the lead Federal agency or its designated non-Federal representative.

Formal consultation, pursuant to 50 CFR § 402.14, should be initiated if you determine that a listed species may be affected by the proposed project. If you determine that a proposed species may be adversely affected, you should consider requesting a conference with our office pursuant to 50 CFR § 402.10. Informal consultation may be utilized prior to a written request for formal consultation to exchange information and resolve conflicts with respect to a listed species. If a biological assessment is required, and it is not initiated within 90 days of your receipt of this letter, you should informally verify the accuracy of this list with our office.

Also, for your consideration, we have included a list of the candidate species that may be present in the project area. (See Attachment A.) These species are currently being reviewed by our Service and are under consideration for possible listing as endangered or threatened. Candidate species have no protection under the Endangered Species Act, but are included for your consideration as it is possible that one or more of these candidates could be proposed and listed before the subject project is completed. Should the biological assessment reveal that candidate species may be adversely affected, you may wish to contact our office for technical assistance. One of the potential benefits from such technical assistance is that by exploring alternatives early in the planning process, it may be possible to avoid conflicts that could otherwise develop, should a candidate species become listed before the project is completed.

Please contact Peggie Kohl at 916/978-4866 (FTS 460-4866) if you have any questions regarding the attached list or your responsibilities under the Endangered Species Act.

Sincerely,

Gail C. Kobetich

Gail C. Kobetich
Field Supervisor

Attachments

ATTACHMENT A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN THE AREA OF THE BONNEVILLE POWER ADMINISTRATION SERVICE AREA LONG-TERM POWER SALES CONTRACT MODOC AND LASSEN COUNTIES, CALIFORNIA 1-1-89-SP-944

Listed Species

Birds
- American peregrine falcon, *Falco peregrinus anatum* (E)
- bald eagle, *Haliaeetus leucocephalus* (E)

Fishes
- Modoc sucker, *Catostomus microps* (E)

Proposed Species

Birds
- northern spotted owl, *Strix occidentalis caurina* (PT)

Candidate Species

Fishes
- redband trout, *Salmo* sp. (2)
- rough sculpin, *Cottus asperrimus* (2)
- Goose Lake sucker, *Catostomus occidentalis lacusanserinus* (2)
- Cowhead Lake tui chub, *Gila bicolor vaccaceps* (1)

Mammals
- spotted bat, *Euderma maculatum* (2)
- California bighorn sheep, *Ovis canadensis californiana* (2)

Plants
- Deschutes milk-vetch, *Astragalus tegetarioides* (2)
- Greene's mariposa, *Calochortus greenei* (2)
- long-haired star-tulip, *Calochortus longebarbatus* var. *longebarbatus* (2)
- Sierra Valley evening-primrose, *Camissonia tanacetifolia* subsp. *quadriperforata* (2)
- prostrate buckwheat, *Eriogonum prociduum* (2)
- Mathais' coyote-thistle, *Eryngium mathiasiae* (2)
- Modoc bedstraw, *Galium glabrescens* subsp. *modocense* (2)
- Warner Mountains bedstraw, *Galium serpenticum* subsp. *warnerense* (2)
- Ash Creek ivesia, *Ivesia paniculata* (2)
- Egg Lake monkeyflower, *Mimulus pygmaeus* (2)
- Lassen County bluegrass, *Poa fibrata* (2)
- Columbia yellow-cress, *Rorippa columbiae* (2)
- Ravendale skullcap, *Scutellaria holmgreniorum* (2)

(E)--Endangered (T)--Threatened (CH)--Critical Habitat

(1)--Category 1: Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.

(2)--Category 2: Taxa for which existing information indicated may warrant listing, but for which substantial biological information to support a proposed rule is lacking.

ATTACHMENT B

FEDERAL AGENCIES' RESPONSIBILITIES UNDER
SECTIONS 7(a) and (c) OF THE ENDANGERED SPECIES ACT

SECTION 7(a) Consultation/Conference

Requires: 1) Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species; 2) Consultation with FWS when a Federal action may affect a listed endangered or threatened species to insure that any action authorized, funded or carried out by a Federal agency is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. The process is initiated by the Federal agency after determining the action may affect a listed species; and 3) Conference with FWS when a Federal action is likely to jeopardize the continued existence of a proposed species or result in destruction or adverse modification of proposed critical habitat.

SECTION 7(c) Biological Assessment--Major Construction Activity[1]

Requires Federal agencies or their designees to prepare a Biological Assessment (BA) for major construction activities. The BA analyzes the effects of the action[2] on listed and proposed species. The process begins with a Federal agency requesting from FWS a list of proposed and listed threatened and endangered species. The BA should be completed within 180 days after its initiation (or within such a time period as is mutually agreeable). If the BA is not initiated within 90 days of receipt of the list, the accuracy of the species list should be informally verified with our Service. No irreversible commitment of resources is to be made during the BA process which would foreclose reasonable and prudent alternatives to protect endangered species. Planning, design, and administrative actions may proceed; however, no construction may begin.

We recommend the following for inclusion in the BA: an on-site inspection of the area affected by the proposal which may include a detailed survey of the area to determine if the species or suitable habitat are present; a review of literature and scientific data to determine species' distribution, habitat needs, and other biological requirements; interviews with experts, including those within FWS, State conservation departments, universities and others who may have data not yet published in scientific literature; an analysis of the effects of the proposal on the species in terms of individuals and populations, including consideration of indirect effects of the proposal on the species and its habitat; an analysis of alternative actions considered. The BA should document the results, including a discussion of study methods used, any problems encountered, and other relevant information. The BA should conclude whether or not a listed or proposed species will be affected. Upon completion, the BA should be forwarded to our office.

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[1] A construction project (or other undertaking having similar physical impacts) which is a major Federal action significantly affecting the quality of the human environment as referred to in NEPA (42 U.S.C. 4332(2)C).

[2] "Effects of the action" refers to the direct and indirect effects on an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action.

BALD EAGLE

(*Haliaeetus leucocephalus*)

CLASSIFICATION:

Endangered (**Federal Register** 43:633; February 14, 1978).

CRITICAL HABITAT: None designated.

DESCRIPTION:

Next to the California condor, the bald eagle is the largest bird in California with a wingspan measuring 6 to 7 feet. Adults are brownish black with a white head and tail and yellow bill. Immatures are variously brownish black.

DISTRIBUTION:

Bald eagles can and do occur virtually anywhere in California during migration. They nest near water bodies in the northern portion of the state and winter throughout the state wherever suitable prey resources are available.

SPECIAL CONSIDERATIONS:

Although some bald eagle populations began to decline in the 19th century due to human persecution and habitat loss, the drastic declines in reproduction experienced by most eagle populations occurred between 1947 and 1970. Research indicated that certain organochlorine pesticides interfered with productivity, and other pesticides were responsible for direct mortalities. Most bald eagle populations are now stable or increasing in numbers.

REFERENCES FOR ADDITIONAL INFORMATION:

Detrich, P. J. 1986. The status and distribution of the bald eagle in California. M. S. Thesis. Chico State Univ., CA

Frenzel, R. W. 1984. Ecology and environmental contaminants of bald eagles in southcentral Oregon. Ph.D. Thesis. Oregon State Univ., Corvallis, OR.

Lehman, R. N., D. E. Craigee, P. L. Collins, and R. S. Griffen. 1980. An analysis of habitat requirements and site selection criteria for nesting bald eagles in California. Report by Wilderness Research Institute, Arcata, CA for U.S. Forest Service, Region 5, San Francisco, CA.

U.S. Fish and Wildlife Service. 1986. Recovery plan for the Pacific Bald Eagle. Portland, OR.

AMERICAN PEREGRINE FALCON

(*Falco peregrinus anatum*)

CLASSIFICATION:

Endangered 35 **Federal Register** 16047, October 13, 1970, and 49 **Federal Register** 10526, March 20, 1984.

CRITICAL HABITAT: Designated in Sonoma, Napa, and Lake Cos.

DESCRIPTION:

A medium-sized, swift flying bird of prey with pointed wings. Wingspan is 3 to 4 feet. Adults have slate gray backs with white underparts that are streaked or barred in black. They have distinctive white and black facial markings.

DISTRIBUTION:

Historically nested throughout North America from the boreal forest south into Mexico, wherever suitable nesting and foraging habitat occurred. Remnant breeding populations currently occur in California, Arizona, New Mexico, Utah, Texas, and Alaska. A few pairs nest in other states in the northeast and northwest.

SPECIAL CONSIDERATIONS:

The American peregrine falcon has suffered major population declines due principally to DDT contamination of their food chain. With the banning of DDT for use in the U.S. in 1972 and implementation of a management program, populations have for the most part stabilized. Unfortunately, pesticide data indicate that there has been a continued input of DDT into the local environments. Some nest sites are now protected from human disturbance. Poor quality eggs are taken from the wild for artificial incubation, and young are placed in nests after hatching from wild eggs taken into captivity or laid by captive parents.

REFERENCES FOR ADDITIONAL INFORMATION:

J. J. Hickey (ed). 1969. Peregrine falcon populations their biology and decline. Univ. of Wisconsin Press. Madison, WI.

Ratcliffe, D. 1980. The peregrine falcon. Buteo Books. Vermillion, SD.

U.S. Fish and Wildlife Service. 1982. Pacific Coast Recovery Plan for the American Peregrine Falcon. Portland, OR. 87 pp.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

RENO FIELD STATION
4600 Kietzke Lane, Building C
Reno, Nevada 89502

August 3, 1989
File No.: 1-5-89-SP-159

Nandranie S. Tuck, Environmental Specialist
Environmental Compliance Section
Bonneville Power Administration
U. S. Department of Energy
P. O. Box 3621
Portland, Oregon 97208-3621

Dear Ms. Tuck:

Your letter of July 19, 1989 to Mr. Ralph Swanson, Fish and Wildlife Enhancement, U. S. Fish and Wildlife Service, Portland, Oregon requested a list of endangered and threatened species which may be present in the area of or be affected by the Long-term Power Sales Contracts of the Bonneville Power Administration under the Pacific Northwest Electric Power Planning and Conservation Act. This office was asked to provide you with information relative to species in the vicinity of the Valmy 1 & 2 thermal generating facilities in Nevada. To the best of our knowledge, no proposed, listed, or candidate species occur within the Valmy area.

This fulfills our requirement to provide a list of species under Section 7(c) of the Endangered Species Act of 1973, as amended.

If you have any questions please contact Donna Withers at (702) 784-5227 or FTS 470-5227. Thank you for your interest in endangered species.

Sincerely,

Richard J. Navarre
Field Supervisor

cc: Assistant Regional Director (AFWE), Portland, Oregon

United States Department of the Interior
FISH AND WILDLIFE SERVICE

MAILING ADDRESS:
Post Office Box 25486
Denver Federal Center
Denver, Colorado 80225

STREET LOCATION:
134 Union Blvd
Lakewood, Colorado 80228

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

FWE
MAIL STOP 60120

SEP 1989

Ms. Nandranie S. Tuck
Environmental Specialist
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

Dear Ms. Tuck:

This responds to your July 19, 1989, request for a list of threatened and endangered species which may occur in the area of influence of the Bonneville Power Administration's long-term power sales contracts. The information provided herein applies to the following facilities:

(1)	Hungry Horse Power Plant	Flathead County, Montana
(2)	Libby Power Plant	Lincoln County, Montana
(3)	Colstrip 1-4 Power Plant	Rosebud County, Montana
(4)	Corette Power Plant	Yellowstone County, Montana
(5)	Jim Bridger Power Plant	Sweetwater County, Wyoming
(6)	Belle Ayre Mine	Campbell County, Wyoming
(7)	Rosebud Mine	Rosebud County, Montana
(8)	Bridger Mine	Sweetwater County, Wyoming

Threatened and endangered species that may occur in the area of influence of the above facilities are listed below. Immediately following each species are numbers corresponding to the facilities where the species may be found.

Colorado River Squawfish (Ptychocheilus lucius) E*
Water depletions from the Green River may affect this species downstream in the Colorado River. (5)(8)

Humpback Chub (Gila cypha) E*
Water depletions from the Green River may affect this species downstream in the Colorado River. (5)(8)

Bald Eagle (Haliaeetus leucocephalus) E*
Yearlong resident and migrant. All facilities.

Peregrine Falcon (Falco peregrinus) E*
Migrant and potential summer resident. All facilities.

Black-footed Ferret (Mustela nigripes) E*
Potential resident in prairie dog towns. (3)(4)(5)(6)(7)

Gray Wolf (Canis lupus) E*
Resident. (1)(2)

Grizzly Bear (Ursus arctos) T*
Resident. (1)(2)

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* E=Endangered, T=Threatened

Should you need further assistance or have questions about the information provided, you may contact Mr. Larry Lockard at (406) 755-7870 on Montana issues or Mr. Richard Hill at FTS 328-2374 on Wyoming issues.

Sincerely,

Deputy Regional Director

DOE/BP-1797
January 1992
750