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October 1, 2007

Honorary Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

RE: Wells Hydroelectric Project No 2149-131
Reply to Douglas PUD Revised Study Plan

Dear Secretary Bose:

On behalf of the City of Pateros ("the City"), we submit the following reply comments to Douglas County PUD's ("Douglas PUD") Revised Study Plan dated September 14, 2007.

BACKGROUND

In our letter dated February 28, 2007 (and supplemented by further correspondence dated April 2, 2007 and August 15, 2007), the City has requested that Douglas PUD conduct the following studies as part of the Integrated Licensing Process (ILP) for Douglas PUD's Wells Dam Relicensing application:

1. Socio-Economic Impacts. A study of the socio-economic impacts of the Wells Project on Okanogan County and the cities of Pateros, Brewster and Bridgeport, all of which are located within the Project boundary.
2. Operation and Maintenance of Recreation Facilities. A study of the specific costs for operation and maintenance of city parks.
3. Visitor Information Center. A study of the feasibility of a regional Visitor Information Center.

On September 14, 2007, Douglas PUD submitted its Revised Study Plan. However, Douglas PUD continues to assert that it should not be required to conduct any of the studies requested by the City as part of the ILP process.

I. Reply Comments to Douglas PUD's Denial of Study Request for Socio-Economic Study

In our initial letter of February 28, 2007, the City provided the information required under 18 CFR § 5.9(b) to support its request for a socio-economic study. After Douglas PUD refused to include a study plan for socio-economic impacts in its June 2007 Draft Study Plan, the City submitted comments on August 15, 2007 further explaining the clear legal and factual basis for the study.

In its September 14, 2007 Revised Study Plan, Douglas PUD continues to refuse to include a socio-economic study in its overall ILP study process. Although Douglas PUD addresses the City's request for a socio-economic study at p. 22-25 of the Plan, it attempts to confuse the issues by re-characterizing the City's arguments and making a number of inaccurate statements.

A. The City has demonstrated a "nexus" between project operations and socio-economic impacts to the communities located within the Wells Project boundary.

During the course of these proceedings, Douglas PUD has claimed that the City has not demonstrated a nexus between the Wells Dam project operations and the socio-economic health of the surrounding communities. While Douglas PUD repeatedly alleges that the construction and operation of Wells Dam has resulted in positive social and economic benefits to the surrounding communities, it refuses to agree that it is also relevant to study the historic and ongoing negative impacts caused by the Wells project.

In our August 15, 2007 letter, the City cited ample authority under the Federal Power Act ("FPA"), the Electric Consumers Protection Act of 1986 ("ECPA") and the National Environmental Protection Act ("NEPA") requiring that FERC consider the socio-economic impacts of granting a new license. This includes the following language in the *Elkem Metals* decision:

The Commission must consider socio-economic impacts in making its licensing decisions, since it is required to consider all aspects of the public interest under Section 10(a)(1) of the FPA. See Udall, 387 U.S. 428, 450 (U.S. 1967).

Elkem Metals, 45 FERC ¶61,044, at p. 61,148 (1988) (emphasis supplied). See also, Brookside Hydroelectric Co., 67 FERC ¶61,041, at p. 61,122 (1994) ("the socio-economic impact on the area involved, including [the intervenor's] business, is relevant in the Commission's consideration of the public interest in

licensing a project.") While Douglas PUD is correct that the *Elkem Metals* case involved a project where the water flows would be increased to mitigate damage to fish runs, the language cited by the courts in these cases could not be any clearer.

In response to these authorities, Douglas PUD now finally acknowledges that "social and economic effects can be considered by FERC in the proper context, but this is subject to limitations". The "limitations" Douglas PUD outlines are essentially that (1) the purpose of any such socio-economic analysis must be to identify socio-economic impacts specifically related to the project and its proposed operations and (2) the scope of the study should be tailored to meet this purpose.

The City agrees that the purpose and scope of the socio-economic study should be aimed at determining the impacts caused by the project operations. The City also believes that the proposed study plan it identified in its April 2, 2007 letter is in accordance with these objectives. The goals and objectives of the plan were stated as:

- Identify, describe and document factors that influence regional and local economics, including health care, agriculture, schools and other public entities, industry and tourism.
- Identify the socio-economic impacts of the Wells Dam project on Okanogan County and the cities of Pateros, Brewster and Bridgeport.
- Identify future growth opportunities and estimate the impact of Project operations on these resources
- Specifically identify the socio-economic impacts resulting from the City of Pateros' relocation and displacement when Wells Dam was originally built in 1962 and the continuing effects of said relocation and displacement.

See *April 2, 2007 City of Pateros letter*.

Douglas PUD focuses on the first item to claim that the City's request for a study is too broad. However, there can be no question that it is first necessary to determine the factors that influence the area economies in order to then identify the specific socio-economic impacts of the Wells Dam Project.

Douglas PUD also claims that any effects are limited to "recreation opportunities" and that the City has "effectively conceded" as much. This is simply not true. The statement alluded to by Douglas PUD in the City's August 15, 2007 comments was in relation to a possible mitigation agreement reached between the City and Douglas PUD. The City stated, "The benefits provided to the City under the agreement would likely be tied to recreational-related improvements intended to offset the socio-

economic impacts caused by continued operation of the Wells Dam facility." *See City's August 15, 2007 Comments, p. 10.* Nothing in that statement concedes that the only detrimental effects of the Wells Dam project are recreation-related.

Indeed, the City has consistently argued that the construction and operation of Wells Dam has had significant adverse impacts on the economies and civic structures of the City of Pateros and surrounding communities. In our April 2, 2007 Study Request, we identified the following direct, indirect and cumulative effects:

- The construction of the dam impacted the City of Pateros directly by flooding the City's downtown area and displacing much of its business, civic and population centers.
- The past, present and future operation of the Dam has and will cause direct, indirect and cumulative effects on the City of Pateros' economic, civic and social conditions including: the loss of area businesses, the loss of revenue (property, sales, excise and hotel/motes tax), changes in the cost of providing services, increased maintenance costs of new park assets, damage to the City's civic and social fabric, the loss of valuable agricultural land and warehouses, the loss of different kinds of recreation opportunities associated with a free-flowing river, and environmental costs.

As this demonstrates, The City has been consistent in its position that the Wells Dam project has negatively impacted the economic and social well-being of Pateros and the surrounding communities.

Douglas PUD concludes the first section of its response by again claiming that "Pateros' study request clearly fails to satisfy FERC's study criterion 5, which requires an explanation of the nexus between project operations and effects on the resources to be studied." This statement simply ignores that the City has already identified the impacts referenced above.

Moreover, Douglas PUD's claim is also contradicted by the fact that two different socio-economic studies conducted as part of the Chelan County PUD Rocky Reach relicensing process determined that construction and operation of Rocky Reach Dam has had substantial socio-economic impacts on the City of Entiat, a neighboring city that also lost much of its downtown core to a hydroelectric project. Given the similar situations faced by the two cities, one can reasonably expect that a full-scale study of the Wells Dam project's impacts on the City of Pateros would lead to similar conclusions.

In fact, the December 1, 2000 Final Socioeconomic study conducted by McHugh & Associates for Chelan PUD identified the similarities between Entiat and Pateros in its conclusions:

Of particular interest are the cities of Entiat in Chelan County and Pateros in Okanogan County, both of which experienced dislocations of substantial portions of their downtown areas due to flooding of the lands upstream of the newly constructed dams (Rocky Reach Dam in the case of Entiat and Wells Dam in the case of Pateros).

. . .

Clearly, these communities experience substantial population loss during the initial period of dam construction and operations. They have recovered the pre-dam development population levels, but only through a combination of very slow growth over a long period or annexation of nearby areas.

See Socioeconomic Study of McHugh & Associates, December 1, 2000; p. 2-3, attached as Exhibit A.

Specifically relating to the City of Entiat, the Chelan PUD consultants recognized that many factors influenced Entiat's economic condition during this time, but said the following about the long-term impacts of Rocky Reach Dam:

Nonetheless, the loss of population and property valuation, associated with the dislocation of the downtown core as a result of developing the Rocky Reach Project, was a major turning point in the economic and social history of Entiat **leading to long-term economic stagnation.**

The loss of an economic base consisting of a vital downtown area as well as stable employment opportunities within a viable industrial structure has led to **depressed economic conditions within the Entiat area.** A major consequence of this has been the diminished capacity of the public sector to provide adequate services to the area population.

For the city of Entiat and Entiat School District No. 127 this has meant **lower property tax collections resulting smaller available resources to fund necessary expenditures.** Public utility excise tax receipts received by the city over the years were **insufficient to make up the difference for the loss of the property tax base. . . .**

See Socioeconomic Study of McHugh & Associates, December 1, 2000, p. 2-3 (emphasis supplied).

McHugh & Associates recognized that lost real estate taxes was one measure of damages associated with the continuing operation of the Rocky Reach Dam:

The methodology for considering possible fiscal impacts on the city of Entiat is based on comparative analysis of property tax base changes for Chelan County as a whole and the city of Cashmere. [Cashmere] was chosen because it was the smallest city in the county with a similar economic base (mostly agriculture-related industries) enjoyed by Entiat prior to the development of the Rocky Reach Project.

. . .

Clearly, over time, the city of Entiat has seen a worsening of its property base relative to what it might have been, if conditions in the economy and property market had followed the pattern experienced by the city of Cashmere and, even more so, by the county as a whole.

. . .

A case could be made that the NPV [net present value] figure of \$506,847 represents the fiscal loss, in terms of operating revenues, to the city of Entiat as a result of the economic dislocations caused by the inundation of the downtown area.

See Socioeconomic Study of McHugh & Associates, December 1, 2000, p. A-46-47 (emphasis supplied).

It is important to reiterate that these conclusions were reached by a consultant retained by the Chelan County PUD to study the impacts of the Rocky Reach project. However, The City of Entiat (and City of Entiat School District #127) also retained another consultant to conduct an independent study the socio-economic impacts of the project. In April 2003, ECONorthwest issued its study, a copy of which is attached as Exhibit B. The report examines the impacts of the Rocky Reach project in great detail, but the abstract states the following:

The analysis begins by showing that the City and School District were negatively affected by the dam. The economic base on which they depended for revenue was uprooted, and the one-time compensation paid to them by PUD did not begin to cover the stream of revenues that they have foregone for almost 50 years

and will continue to forego. The analysis describes why that stream of lost revenue is a reasonable measure of the damages they have suffered, and estimates the present value of past and potential future lost revenue. The lost revenues result, directly or indirectly, from losses of economic activity and tax base in Entiat.

The City loses revenues (revenues that it otherwise would have expected if the dam had not been built) from four sources: property tax, sales tax, real estate excise tax, and hotel/motel tax. . . .

Our estimates of the average present value (2002 dollars) of the past and future lost revenues are \$13.4 million for the City of Entiat and \$20.5 million for the School District.

April 2003 ECONorthwest Study, page iii (emphasis supplied).

As we have previously noted, the cities of Pateros and Entiat (and to a lesser extent, the city of Brewster) each lost their vibrant downtown cores as a result of the construction of the Wells and Rocky Reach projects. The studies conducted on the Rocky Reach project establish a clear nexus between the construction and ongoing operations of these dams and the social and economic health of the surrounding communities. While a study that specifically studies the socio-economic impacts of the Wells Project is necessary, there can be no question that the Rocky Reach studies provide ample basis under section 5 of FERC's study criterion.¹

B. The original socio-economic impacts of the Wells Project have not been mitigated - and will continue into the future.

In its Revised Study Plan, Douglas PUD asserts that the original socio-economic impacts caused by the construction of the dam have "already been fully mitigated" and should not be considered again. See *Douglas PUD revised Study Plan, at P. 24*. Douglas PUD supports this claim by reciting how Douglas PUD paid fair market value for the property acquired and hired consulting engineers and planners to assist in the reconfiguration of the cities of Pateros and Brewster.

¹ In its Revised Study Plan, Douglas PUD disingenuously argues that the Chelan PUD/Rocky Reach studies are irrelevant because they were conducted under the Alternative Licensing Process (ALP) rather than the ILP. Douglas PUD claims that the ALP allowed for studies of issues that were not related to the project operations. However, regardless of whether there is a difference in nexus requirements, there is no question that both the McHugh & Associates and ECONorthwest studies found a direct (and indirect) correlation between the Rocky Reach project and the socio-economics of the City of Entiat.

Regardless of such payments, this argument still ignores the fact that Douglas PUD has never paid any money to any of these cities for socio-economic impacts caused by the construction and operation of the dam. As both of the studies conducted on the Rocky Reach Project recognized, purchasing the land to be inundated may have compensated the landowners for the value of their property, but it did not take into consideration the loss of tax base and other economic opportunities caused by the condemnation of property owned in the affected cities.

This very subject was also discussed in the Chelan PUD socio-economic study on the Rocky Reach Project. In that case, the consultants hired by Chelan PUD recognized that the condemnation payments made by the utility did not compensate for economic impacts to the City and School District, stating:

Despite the payments made by the Chelan County PUD to private property owners and to the public sector, the dislocation of the downtown core has had severe consequences. Many individuals and business owners decided to locate elsewhere rather than invest in the development of a new downtown core. Also, existing owners of upland properties at locations that could have formed the basis for a new downtown center had varying levels of interest in selling to recently displaced property owners. . . .

See Socioeconomic Study of McHugh & Associates, December 1, 2000, p. A-59 (emphasis supplied).

The ECONorthwest study further concluded that the impacts caused by the original construction of the Rocky Reach Dam are ongoing and will continue into the future. In addition to the language quoted above, ECONorthwest also concluded:

There is reason to believe that the per capita property tax shortfall will continue into the future. The difference in per capita property taxes, relative to other Chelan County municipalities has increased over the past 40 years and has accelerated over the past decade. The combined impact of rapid population growth in Entiat over the past decade and limited available commercial, industrial, and agricultural land in and around the City are likely to further a situation where Entiat serves as bedroom community for other cities. The fiscal impact to the City is that it will have a growing population to serve, but may have a tax base that grows at a slower rate.

Thus, in addition to being compensated for all past fiscal damages, the City and School District should be compensated for all future damages. **If Entiat had been compensated in circa 1960 for the fiscal damage the Rocky Reach Dam caused to the City and School District, there would be no need for this current analysis.** It follows that if the City and School District are compensated now for the ongoing damages, there will be no need to calculate damages in 2040 for the years 2004 through 2040. **Our conclusion, based on estimates of lost revenues, is that Entiat has been fiscally damaged each of the past 40+ years. If they are compensated today for these future damages, the City and School District will be able to use this money to help mitigate the ongoing damage.**

In summary, if Entiat and the School District have been losing revenues in every year from around 1959 to 2002, then in the absence of any compensation by the PUD, **they will continue to lose revenue (relative to what they would have had) into the future.** Basic economic principles require that **any current settlement needs to account for the present value of those future losses.**

April 2003 ECONorthwest Study, page 14 (emphasis supplied).

In short, Douglas PUD's claim that the City of Pateros has received compensation for the past, present and ongoing socio-economic damages is exactly the same argument made by the Chelan PUD in the Rocky Reach relicensing project. Subsequent studies conducted by well-established firms following recognized economic principles concluded otherwise. Given the similarities between the cities of Pateros and Entiat, the same can be expected to hold true in the current proceedings.

- C. Socio-economic studies provide relevant information for the FERC's consideration of issuing a new license and are appropriate in relicensing proceedings regardless of whether new facilities are contemplated.

Douglas PUD further attempts to downplay the studies conducted on the Rocky Reach project by claiming, "Ultimately the study cited by Pateros and conducted by Chelan PUD was not used to inform any license decisions and did not result in any terms or conditions for the Rocky Reach license." *Revised Study Plan, p. 25.*

This disingenuous assertion ignores the fact that after these studies were conducted, the City of Entiat entered into a Settlement Agreement with Chelan PUD for the relicensing of the

Rocky Reach project. *See Rocky Reach Settlement Agreement dated February 3, 2006, attached as Exhibit C.* As part of the Settlement Agreement, the City of Entiat agreed to not contest the Chelan PUD's proposed Environmental Impact Statement, which included a substantial mitigation package for the City of Entiat. These amenities consisted of significant upgrades to Entiat Park, wastewater treatment plant upgrades, design and construction of an Entiatqua Trail link, and implementation of a lease/purchase agreement with the City of Entiat relating to valuable Columbia River waterfront property. *See Section 2 of Chelan PUD Final Environmental Impact Statement dated August 4, 2006, at p. 21, attached as Exhibit D.* Douglas PUD's assertion that the socio-economic studies did not play a role in the final license conditions submitted by Chelan PUD is simply not true.

Douglas PUD also claims that the socio-economic studies conducted in other re-licensing cases across the country are distinguishable from the Wells Dam process because "Douglas PUD is not currently proposing to construct any significant new facilities at the Wells Project during the term of the next license."

In the Appalachian Power Company's application for a new license for the Smith Mountain Project in Virginia, FERC Project 2210, the licensee was not proposing to add new facilities. While Douglas PUD claims that the socio-economic analysis was limited, it is important to note the language contained within the February 2007 study itself:

The land use, population, fiscal, and economic analysis conducted in this study is intended to address these issues by providing the basis for understanding the project's effect on the local economy and community. The analysis may help relicensing participants identify enhancement measures that could address any adverse project effects and help ensure that the project continues to contribute to the long-term vitality of the region.

See The City of Pateros's August 15, 2007 Comments, Exhibit C p. iv. The Smith Mountain relicensing process - as well as the Rocky Reach project - demonstrate that other licensees have undertaken socio-economic studies even if there are no significant new facilities planned during the next license.

II. Comments On Refusal To Study Operation and Maintenance Of The City's Recreation Facilities.

In our August 15, 2007 comments, the City stated that it would be willing to accept Douglas PUD's proposal to conduct a Recreation Needs Analysis and Public Access Study, followed by an

evaluation of measures appropriate for meeting the identified needs. The City was willing to agree with this proposal, provided that the obligations of Douglas PUD as set forth above are incorporated in the revised ILP Study Plan document. Based on the language in the Revised Study Plan, it appears that Douglas PUD is in agreement with this plan. With that understanding, the City does not object to Douglas PUD's Revised Study Plan as it relates to recreation facilities.

III. Comments On Refusal To Study Visitor Center.

As stated in our August 15, 2007 comments, the City had been informed by Douglas PUD staff that they intended to recommend that a new Visitor Information Center be built at the current Wells Dam Overlook. Based on this representation, the City did not believe that a formal study of this issue would be required.

However, in the Revised Study Plan, Douglas PUD gives no reassurance that staff will recommend relocating the existing Visitor Center, instead merely stating that it will evaluate the issue after conducting the Recreation Needs Analysis. Given Douglas PUD's apparent unwillingness to commit to the new Visitor Center, the City believes it is appropriate for FERC to require a study of the feasibility of a new regional Visitor Information Center.

CONCLUSION

For the reasons stated above, we believe that FERC should require Douglas PUD to conduct studies of the (1) socio-economic impacts of the Wells Dam project and (2) a regional Visitor Information Center. We believe that both of these studies will provide important information about how the relicensing of the Wells Dam project will impact the City of Pateros and the surrounding communities. We also believe that the results of the study will provide the basis for providing mitigation measures associated with the issuance of a new license to Douglas PUD.

Please let me know if you need any additional information.

Sincerely,

Gail A. Howe

Gail A. Howe, Mayor
City of Pateros

Attachments: Pateros Exhibit A, Pateros Exhibit B, Pateros
Exhibit C, Pateros Exhibit D

SOCIOECONOMIC STUDY

Final

**ROCKY REACH HYDROELECTRIC PROJECT
FERC Project No. 2145**

December 1, 2000



Prepared by:
**McHugh & Associates
Seattle, Washington**

Prepared for:
**Public Utility District No. 1 of Chelan County
Wenatchee, Washington**

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SECTION 1: ABSTRACT

This study documents current and recent historical conditions with respect to the regional population and economy as well as the impacts of continued operations of the Rocky Reach Dam within the impact area comprised of Chelan and Douglas counties, located in the central portion of Washington state. The focus of the study is on determining the influence of the Rocky Reach Dam on specific industrial sectors and communities within the two-county region.

The industrial sectors that have been impacted significantly by the Rocky Reach Dam include the agricultural, basic metals (aluminum) manufacturing, tourism and recreation, and public utilities sectors. Communities that have been most affected by the Rocky Reach Dam include the city of Entiat (Chelan County) and the unincorporated communities of Orondo (Douglas County) and Malaga (Chelan County). Other communities in the two-county region have also been affected by the Project, although as a consequence of indirect economic activity associated with spending by the Chelan County Public Utility District No. 1 and induced activity associated with the re-spending of direct and indirect earnings by employees of the public utility and other firms engaged in direct and indirect activities attributable to the Project.

The analysis performed in the study indicates that the agriculture sector, which receives water from the reservoir behind Rocky Reach Dam for irrigation, contributed total (direct, indirect, and induced) output in 1999 amounting to \$166.3 million to the two-county impact region. Total employment and earnings associated with that production amounted to 2,550 jobs and \$47.9 million in earnings, with average annual earnings of \$18,803.

The basic metals manufacturing sector, which directly obtains electricity from the Rocky Reach Dam, was estimated to generate total output of \$254.9 million in 1999. The associated employment and earnings amounted to 1,365 jobs and \$53.5 million, respectively, with average earnings of \$39,198.

Public utilities and electric services providers in the two-county region contributed a total of 307 jobs (including direct, indirect, and induced employment components) and \$11.4 million in earnings in 1999 associated with power distributed to other industrial customers from direct allocations (approximately 15 percent of power generated is allocated to Chelan County PUD No. 1 and Douglas County PUD No.1) of electricity generated at the Rocky Reach Dam.

Tourism and recreation industries, which depend on facilities at Rocky Reach Dam and the reservoir behind the dam, were estimated to generate total (direct, indirect and induced) output of \$42.9 million in 1999. The associated employment and earnings amounted to 1,108 jobs and \$15.3 million, respectively, with average earnings of \$13,802.

The communities of Entiat and Orondo, which are located at opposite sides of the Rocky Reach Dam reservoir (Lake Entiat), derive economic and social benefits from the existence of the reservoir. The former community, however, had been adversely affected by the Project, as a

Socioeconomic Study

result of the necessity to relocate the downtown core when the Project was first developed. This effectively changed the character and the economic welfare of the community during subsequent decades. However, the community has experienced modest improvements in economic conditions, particularly in the real estate market, during the most recent decade (1990s). A detailed analysis of the impact of the Rocky Reach Project on the city of Entiat and Entiat School District No. 127 is provided in the appendix to this study. Orondo is a small rural center located on the east side of the Rocky Reach Dam reservoir in the unincorporated portion of Douglas County. The community is dependent on agriculture and tourism and recreation. The Malaga community is located approximately eight miles southeast of the city of Wenatchee and is the site of the Alcoa Wenatchee Works, a major aluminum manufacturing facility. The community is located in the unincorporated portion of Chelan County. The community benefits from the operation of the aluminum smelter, which has been in operation since the 1950s.

Analysis of historical and projected conditions regarding the operations of the Rocky Reach Dam was also undertaken as part of this study. The analysis (presented in section 4) concluded that there would likely be no significant changes in the operating parameters of the dam itself, although there will be increased costs associated with relicensing, fish mitigation, and normal increases in plant operations. Energy generation at Rocky Reach Dam is anticipated to continue at current levels. Also, it is anticipated that there would be no significant changes in the operation of the Columbia River and, thus, there would be no detrimental effects on the cost structure associated with dam operations above those indicated.

Under the anticipated future operation of the Columbia River and fish mitigation measures, water levels of the Rocky Reach Dam reservoir are not expected to significantly change from current operating conditions.

As a result, the impacts of continued operations of the Rocky Reach Dam are expected to be insignificant with respect to the following:

Agriculture (Water Extraction or Diversion)

Modest changes in water levels of the Rocky Reach Dam reservoir would have no significant effect on agricultural production from irrigated lands in the region. Water levels would have to fall to extremely low levels before there would be detrimental impacts on existing major water withdrawal or pumping systems.

Tourism and Recreation

Modest changes in water levels of the Rocky Reach Dam reservoir, not to exceed two or three feet from existing operating levels during summer months, would have no significant effect on tourism and recreation activities in the region. Reductions in water levels beyond this magnitude would result in the need for lakeside infrastructure improvements required to ensure access to the reservoir.

Basic Metals Manufacturing

Modest changes in the water budget for the Columbia River would have no significant effect on basic metals manufacturing. Under conditions in which dam operations are limited by reduced

water flow, basic metals manufacturing could be impacted by increased replacement power costs. Currently, Rocky Reach's cost of power (\$8.30 per MWh) is significantly below the Bonneville Power Administration's (BPA) Direct Service Industrial (DSI) rate (\$23.50 per MWh). Additionally, under forecasted operating costs for the new license period, the real cost of Rocky Reach power is forecasted to increase at a little more than one-half a percent (0.5%) per annum¹.

Public Utilities

Modest changes in the water budget for the Columbia River and/or changes in energy generated from Rocky Reach Dam would have no significant effect on the operations of the Chelan County Public Utility District No. 1 and Douglas County Public Utility District No. 1, local electricity service providers, and basic (export-oriented) firms that receive electricity supplied by the Project in the two-county region.

General Economic Activity and Population Changes

Modest changes in the water budget for the Columbia River and/or changes in energy generated from Rocky Reach Dam would have no significant effect on the population and economic activity within the two-county impact region.

Chelan PUD has taken steps to encourage broad participation by various segments of the local population in this study and in the Rocky Reach relicensing process. Advertisements inviting participation at scoping meetings and at issue identification meetings have been placed in weekly and daily newspapers of record in the two-county area and have been broadcast on the radio. Some advertisements and home mailings directly to PUD customers have been in Spanish and English to communicate effectively with the minority Spanish-speaking population, many of whom are employed in the agriculture sector at the lower end of the economic scale. Meetings have been held in the local communities, as well as at Chelan PUD headquarters, in order to provide an opportunity for those who face travel restrictions to participate. Measures relevant to the issue of environmental justice will be discussed by the Social Sciences Working Group as part of their deliberations on potential protection, mitigation and enhancement steps for the new license.

¹ However, at the termination of the existing power contracts in 2011, electricity sales to power purchasers would likely increase to reflect market prices.

SECTION 2: OVERVIEW

2.1 Purpose

The proposed socioeconomic study for the re-licensing of the Rocky Reach Hydroelectric Project (FERC Project No. 2145) is intended to provide information and analysis for the following broadly defined objectives:

- Identify, describe, and document factors that affect Project economics, including long-term debt, cost of power, and cost of relicensing.
- Identify, describe, and document public and private sector facilities or activities that are directly or indirectly impacted by project operations and evaluate them with respect to resource use (electricity or water), environmental conditions, and benefits provided (goods or services provided and/or revenues generated). Such factors or activities will include agriculture, manufacturing industry, recreation/tourism, and relevant public entities, e.g., Chelan PUD, Chelan County, Douglas County, and selected communities and school districts.
- Evaluate impacts of the Project on public and private sector facilities or activities that are identified as potentially impacted by Project operations.
- Evaluate historical impacts of the Rocky Reach Project on the city of Entiat.
- Evaluate the potential for expansion of existing markets and the potential for developing new markets.

The major reason for conducting the proposed socioeconomic study is to provide documentation of historical and forecasted socioeconomic impacts associated with the Project's operation. This is a necessary part of the FERC relicensing process, which requires that consideration be given to the purposes of enhancement of fish and wildlife, the protection of recreational opportunities, and the preservation of other aspects of environmental quality, in addition to the provision of power sources as well as other development purposes.

2.2 Geographic Scope of Project

The Rocky Reach Project is located in north central Washington State approximately seven miles north of the city of Wenatchee on the Columbia River in Chelan County. The dam is 215 river miles below the Canadian border and 474 river miles above the mouth of the Columbia at Astoria, Oregon. Lake Entiat, the Rocky Reach Project reservoir, extends upriver 43 miles (to Wells Dam) and has a surface area of approximately 9,100 acres. The reservoir contains 36,400 acre-feet of usable storage. The project location map for the Rocky Reach Hydroelectric Project is shown in Figure 2-1.

The drainage area of the Project at the dam is about 87,000 square miles. The watershed lies east of the Cascade Mountains and west of the Rocky Mountains, consisting of parts of Washington, Idaho, Montana, and British Columbia. The normal headwater elevation is 707 feet above mean sea level (MSL) and the normal tailwater is at elevation 615 feet.

Socioeconomic Study

The Columbia River valley surrounding the Rocky Reach reservoir is a wide canyon characterized by basalt cliffs and exposed rock outcroppings. The valley land area is generally rural in nature. The city of Entiat and communities of Chelan Falls and Orondo (east side of the reservoir in Douglas County) are located along the reservoir. Agricultural uses, recreational sites developed by Chelan PUD, and some residential lands surround approximately half the reservoir within the project boundary.² Agricultural uses consist primarily of fruit orchards and some pasture lands. Irrigation pumps and pump houses to withdraw water from the Columbia River are often located on agricultural lands or within townsites. Recreation sites provide for swimming, boating, fishing, personal watercraft, camping, picnicking, water-skiing, and other recreational uses. Recreational use generated at these sites is intensive during the summer season, Memorial Day through Labor Day. The remainder of the lands surrounding the reservoir is undeveloped. These lands can be characterized as drylands. They include shrub steppe and grassland vegetation with patches of exposed rock. Much of the undeveloped shoreline lies in areas where the reservoir is in close proximity to a small, private railroad on the west side and to State Routes 97A (west side) and 97 (east side).

The study area for the proposed socioeconomic study is the two-county area: Chelan and Douglas counties, although the primary focus is on communities immediately adjacent to the Rocky Reach boundary (or project area) and/or likely to be directly impacted by project operations. The principal jurisdictions or geographic areas of interest in the study area consist of Chelan and Douglas counties, the incorporated city of Entiat and unincorporated communities of Orondo and Malaga. Other jurisdictions of interest include the city of Wenatchee and city of Waterville.

With respect to the Chelan County communities, headquarters operations of Chelan PUD are located in the city of Wenatchee, which is also the county seat of Chelan County. Alcoa-Wenatchee Works, which is a major power purchaser from the Project, is located near the unincorporated community of Malaga. The city of Entiat is located adjacent to the reservoir upstream from the dam site. The unincorporated community of Orondo is located adjacent to the reservoir, across from Entiat on the east side in Douglas County. The city of Waterville, county seat of Douglas County, is located approximately 10 miles east of the reservoir on the Columbia plateau.

2.3 Overview of Mid-Columbia River Dams

An overview of the mid-Columbia River dams beginning with the Wells Dam to the north and terminating at the Priest Rapids Dam is presented in Table 2-1. The table indicates the expiration date of current licenses. In addition, population data is provided for the situs counties and nearby cities and towns located upstream of the dam headwaters at decennial periods between 1950 and 1999. As shown in the table, the operating licenses for the Rocky Reach Dam and both Priest Rapids Dam and Wanapum Dam (Grant County PUD) terminate within the current decade, June 30, 2006 and June 30, 2005, respectively. The latter two dams operate under the same operating license. The operating license for Wells Dam (Douglas County PUD) expires May 31,

² The Rocky Reach boundary is defined on contour lines on each side of the reservoir beginning at the 711 feet MSL elevation at the Rocky Reach Dam upstream to the Wells Project tailrace. The boundary varies in elevation along the reservoir and corresponds to areas likely to be impacted by water surface elevation associated with the probable maximum flood. The Rocky Reach Project contains a total of 1,345 acres of land of which Chelan PUD owns approximately 100 acres or 7 percent.

2012. The operating license for Rock Island Dam (Chelan PUD) expires during the third millennial decade. Grand Coulee Dam and Chief Joseph Dam, also located on the mid-Columbia River are federal dams and, as such, are not subject to FERC oversight.

Several cities and towns border or are located nearby the Columbia River upstream of the dam sites for the five PUD-owned mid-columbia dams. Upstream of the Wells Dam they include the cities of Pateros and Brewster in Okanogan County as well as Bridgeport in Douglas County. With respect to Rocky Reach Dam, the upstream communities include Entiat in Chelan County and Waterville in Douglas County. The cities of Rock Island and East Wenatchee in Douglas County and Wenatchee in Chelan County are located upstream of Rock Island Dam. The Grant County cities of George and Quincy are upstream and several miles east of the Wanapum Dam, while Mattawa is located near the Columbia River upstream from Priest Rapids Dam.

Population figures are presented for the decennial periods 1950 through 1990 and, in addition, for 1995 and 1999, with respect to the communities located near the dam sites. Of particular interest are the cities of Entiat in Chelan County and Pateros in Okanogan County, both of which experienced dislocations of substantial portions of their downtown areas due to flooding of the lands upstream of the newly constructed dams (Rocky Reach Dam in the case of Entiat and Wells Dam in the case of Pateros).

Construction of Rocky Reach began in 1956 with operations beginning in 1961. As shown in the table, Entiat's population declined by 15 percent, from 420 people to 357 people, between 1950 and 1960 for an average annual rate of growth (AARG) of minus 1.6 percent. During the first decade of dam operations (1960 – 1970) the population of Entiat remained relatively constant with population in 1970 of 355 people. By 1980 the population of Entiat increased by 100 persons to 445 people and remained essentially unchanged by the beginning of the next decade, with a 1990 a population of 449 people. After 1990 the population increased dramatically, with most of the growth occurring between 1995 and 1999. However, about 37 percent of the growth during the decade of the nineties, amounting to 178 people, occurred through annexations. The AARG of population in Entiat (including additions of population through annexation) for the 49-year period – 1950 to 1999 – amounted to 1.6 percent. This growth rate compares to an AARG for Chelan County of 1.0 percent over the period.

Construction of the Wells Dam began in 1962, with operations commencing during the latter part of the decade of the 1960s. Between 1960 and 1970 the population of Pateros declined by 30 percent, from 673 people to 472 people, for an AARG of minus 3.5 percent. (It is important to note that the population had declined between 1950 and 1960 from 866 people to 673 people, prior to construction of Wells Dam.) Between 1970 and 1980 the population increased to 555 people for an AARG of 1.6 percent. Thereafter, except for the most recent four-year period (1995 – 1999) the population has grown at a modest rate (0.5 percent or less), increasing to 585 people by 1995. Between 1995 and 1999, the population increased by 45 to 630 people for an AARG of 1.9 percent. During the period 1960 – 1999 the town of Pateros experienced a net population loss or only 43 persons; however, during the initial period of dam construction and operations (1960 – 1970), the town lost 201 persons, declining from 673 people to 472 people. It

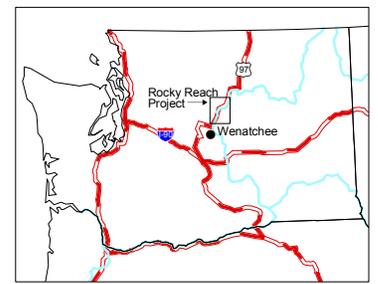
Socioeconomic Study

took an entire decade for about half of the losses to be made up and nearly two decades of slow growth to achieve a population level that is close to that indicated for 1960.

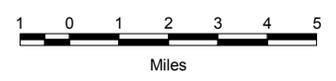
Clearly, these communities experienced substantial population loss during the initial period of dam construction and operations. They have recovered the pre-dam development population levels, but only through a combination of very slow growth over a long period or annexation of nearby areas. No other communities among those indicated in Table 2-1 experienced substantial population losses during the period of dam construction and initial operations with respect to the mid-Columbia River dams evaluated by this study. (The one possible exception is Waterville, which experienced a decline from 1,013 people to 919 people or 7.8 percent between 1960 and 1970 and, thereafter, has grown at a relatively slow rate to a level that is approximately 10 percent above the 1960 population or 1,120 people in 1999.)

FIGURE 2-1
PROJECT LOCATION MAP
ROCKY REACH HYDROELECTRIC PROJECT

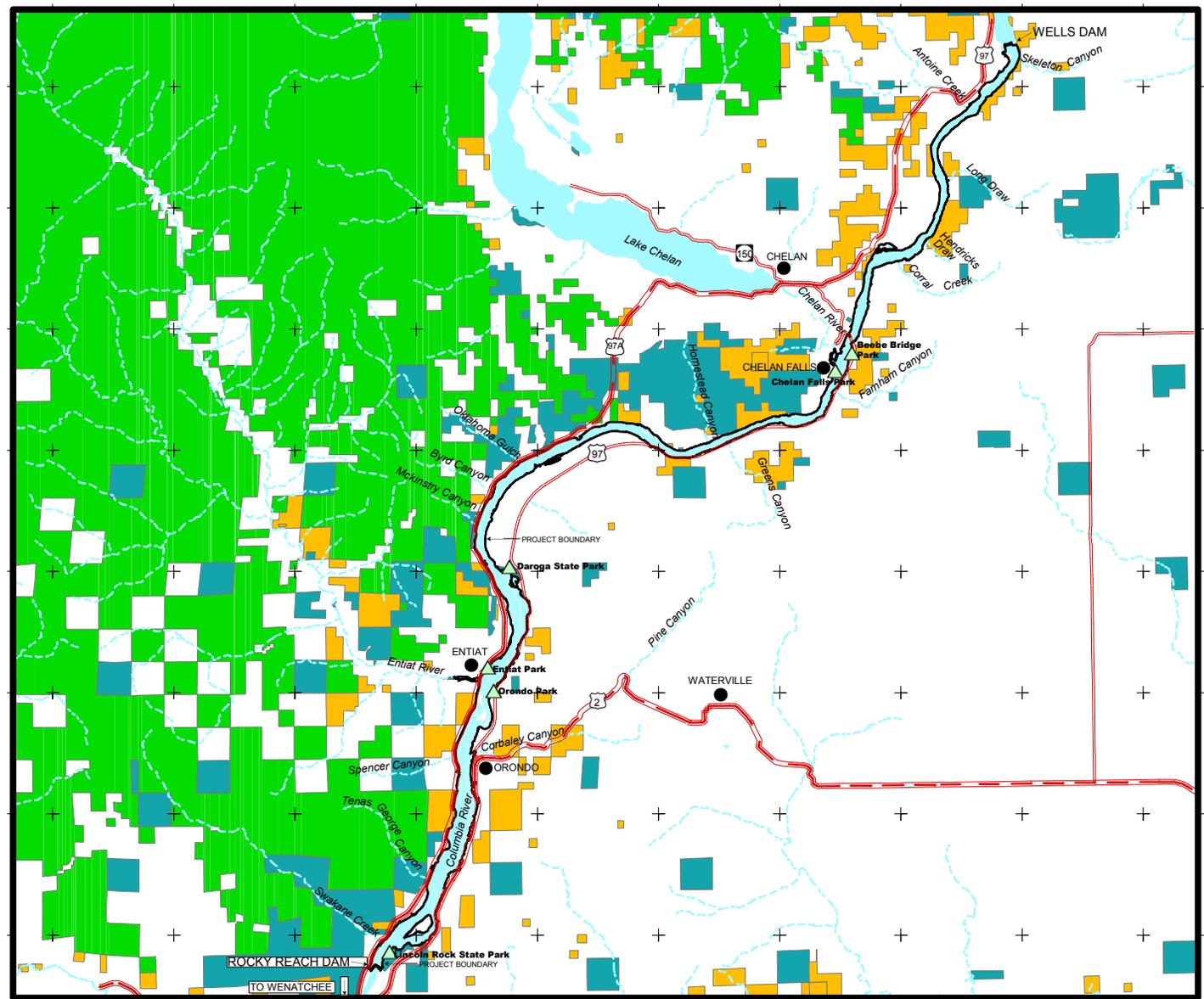
PUBLIC UTILITY DISTRICT NO. 1
CHELAN COUNTY WENATCHEE, WASHINGTON
FERC PROJECT NO. 2145 SEPTEMBER 18, 2000



- LEGEND**
- PROJECT BOUNDARY
 - US HIGHWAY
 - STATE HIGHWAY
 - TRIBUTARIES
 - STATE OF WASHINGTON
 - BUREAU OF LAND MANAGEMENT
 - US FOREST SERVICE
 - CITY / TOWN
 - PARKS / RECREATION SITES



1:200,000



Socioeconomic Study

Table 2-1: Mid-Columbia River Dams and Nearby (Upstream) Cities and Towns

Dam		Location		Population (AARG)						
	Licence Expiration	City/ Town	County	1950	1960	1970	1980	1990	1995	1999
Wells Dam (Douglas Co. PUD)	5/31/12									
		Pateros	Okanogan Co.	866	673	472	555	570	585	630
		Brewster	Okanogan Co.	851	940	1,059	1,337	1,633	2,023	2,065
		Bridgeport	Douglas Co.	802	876	952	1,174	1,498	1,725	2,125
Rocky Reach (Chelan Co. PUD)	6/30/06									
		Entiat	Chelan Co.	420	357	355	445	449	555	935
		Waterville	Douglas Co.	1,013	1,013	919	908	995	1,115	1,120
Rock Island (Chelan Co. PUD)	12/31/28									
		Rock Island	Douglas Co.	360	369	327	491	524	585	630
		East Wenatchee	Douglas Co.	389	383	913	1,640	2,701	4,850	5,395
		Wenatchee	Chelan Co.	13,072	16,726	16,912	17,257	21,829	24,180	25,620
Wanapaum (Grant Co. PUD)	6/30/05									
		Quincy	Grant Co.	809	3,269	3,237	3,525	3,734	3,925	4,120
		George	Grant Co.			273	261	324	438	478
Priest Rapids (Grant Co. PUD)	6/30/05									
		Mattawa	Grant Co.		394	180	299	941	1,685	1,870
			Chelan Co.	39,301	40,744	41,355	45,061	52,250	60,000	63,000
			Douglas Co.	10,817	14,890	16,787	22,144	26,205	29,600	31,700
			Okanogan Co.	29,131	25,520	25,867	30,663	33,350	36,900	38,400
		Grant Co.	24,346	46,477	41,881	48,522	54,798	64,500	70,600	

Table 2-1: (Cont) Mid-Columbia River Dams and Nearby (Upstream) Cities and Towns

Dam			Location		Population (AARG)						
	Licence Expiration	MW	City/ Town	County	1950 - 1960	1960 - 1970	1970 - 1980	1980 - 1990	1990 - 1995	1995 - 1999	1950 - 1999
Wells Dam (Douglas Co. PUD)	5/31/12										
			Pateros	Okanogan Co.	-2.50%	-3.50%	1.60%	0.30%	0.50%	1.90%	-0.60%
			Brewster	Okanogan Co.	1.00%	1.20%	2.40%	2.00%	4.40%	0.50%	1.80%
			Bridgeport	Douglas Co.	0.90%	0.80%	2.10%	2.50%	2.90%	5.40%	2.00%
Rocky Reach (Chelan Co. PUD)	6/30/06										
			Entiat	Chelan Co.	-1.60%	-0.10%	2.50%	-0.10%	4.30%	13.90%	1.60%
			Waterville	Douglas Co.	0.00%	-1.00%	-0.10%	0.90%	2.30%	0.10%	0.20%
Rock Island (Chelan Co. PUD)	12/31/28										
			Rock Island	Douglas Co.	0.20%	-1.20%	4.10%	0.70%	2.20%	1.90%	1.10%
			East Wenatchee	Douglas Co.	-0.20%	9.10%	6.00%	5.10%	12.40%	2.70%	5.50%
			Wenatchee	Chelan Co.	2.50%	0.10%	0.20%	2.40%	2.10%	1.50%	1.40%
Wanapaum (Grant Co. PUD)											
			Quincy	Grant Co.	15.00%	-0.10%	0.90%	0.60%	1.00%	1.20%	3.40%
			George	Grant Co.			-0.40%	2.20%	6.20%	2.20%	
Priest Rapids (Grant Co. PUD)	6/30/05										
			Mattawa	Grant Co.		-7.50%	5.20%	12.10%	12.40%	2.60%	
				Chelan Co.	0.40%	0.10%	0.90%	1.50%	2.80%	1.20%	1.00%
				Douglas Co.	3.20%	1.20%	2.80%	1.70%	2.50%	1.70%	0.70%
				Okanogan Co.	-1.30%	0.10%	1.70%	0.80%	2.00%	1.00%	0.40%
			Grant Co.	6.70%	-1.00%	1.50%	1.20%	3.30%	2.30%	2.20%	

SECTION 3: BASELINE CONDITIONS

3.1 Economic and Demographic Conditions – Two-County Study Area

Analysis of baseline conditions is necessary prior to assessing the potential impacts associated with the future operations of Rocky Reach Dam. For purposes of assessing impacts it is necessary to distinguish between direct and indirect/induced effects of alternative futures regarding the operation of the dam. Direct effects refer to changes in industry activity that result from:

- Changes in the availability and cost of electric power in the two-county study area from Rocky Reach hydroelectric generation associated with alternative dam operating regimes.
- Additional major construction at the dam site, if any, under alternative dam operations.
- Changes in the availability of water for agricultural irrigation from the Rocky Reach reservoir associated with alternative dam operations.
- Changes in tourism/recreation opportunities afforded by project facilities associated with the alternative dam operations.

Indirect effects refer to the change in output of related industries, e.g., transportation services, food processing, metals manufacturing, and industrial, commercial and residential construction, brought about by any substantive changes in direct industry activity. Induced effects refer to the change in output of industries within the impact region associated with re-spending of earnings received by households of direct and indirect industry workers. The predominant industries that are likely to be impacted by changes in household spending are construction, transportation, and public utilities and communications, retail trade, services, finance, insurance and real estate (FIRE), and state and local government.

This baseline economic and demographic profile indicates recent historical conditions and suggests the likely changes in the economy and population of the two-county impact area, consisting of Chelan and Douglas counties. The focus of the baseline is on developing information that can be used as a framework for analyzing the impacts of operating Rocky Reach on the Columbia River within the two-county impact region. As noted above, for purposes of this study the primary study area is generally considered to be the area including the Rocky Reach boundary and adjacent communities located within Chelan and Douglas counties. However, when considering indirect economic activity, it is important to acknowledge the influence of other communities within the two counties. Similarly, induced economic activity associated with respending of incomes earned by direct and indirect industry-related households is expected to be distributed within the two-county impact region.

3.2 Social and Economic Trends in the Study Area

3.2.1 Population Trends

3.2.1.1 Population Change in Chelan and Douglas Counties

Population in Chelan County has grown at a moderate rate during the last two decades, with the highest rate of growth occurring in the early 1990s. Between 1980 and 1999, the population of Chelan County grew by 39.8 percent; from 45,061 people in 1980 to 63,000 people in 1999, which is shown graphically in Figure 3-1 with numerical tabulations provided in Table 3-1. In 1999 55 percent of the county's population resided within the five incorporated cities and towns, with the remainder living in the unincorporated area. The growth in the county's population over the period was comparable to that experienced by the state as a whole (39.3 percent). Annual growth rates (measured in terms of AARG) were slightly lower for the county between 1980 – 1990 (1.5 percent) than the state (1.7%) between 1980 and 1990. The reverse was the case between 1990 and 1999, when the state experienced a modestly lower growth rate (1.9 percent) compared to the county (2.1 percent).

Population growth rates for the cities of Cashmere, Entiat, Leavenworth, and Wenatchee varied substantially during the period 1980 – 1999. Cashmere grew at a modest rate during the 1980s (1.3 percent per annum) and very slowly during the 1990s (0.6 percent per annum). Chelan and Wenatchee (county seat of Chelan County) also grew at modest rates with the former growing at 0.6 percent per annum between 1980 and 1990 and 0.6 percent per annum between 1990 and 1999 and the latter growing at 2.4 percent between 1980 and 1990 and 1.8 percent between 1990 and 1999. However, both Leavenworth and Entiat experienced rapid growth during the decade of the 1990s, although more than a third of the population growth in Entiat was attributable to annexations.³ Leavenworth's growth rate was 1.0 percent per annum between 1980 and 1999 and 3.3 percent per annum between 1990 – 1999. Population in Entiat increased by only 0.1 percent per annum between 1980 and 1990, but grew substantially by 8.5 percent per annum from 1990 to 1999. Population in unincorporated areas grew at a modest rate (0.9 percent per annum) during the 1980s and a relatively high rate during the 1990s (2.1 percent per annum). The Malaga area grew at a relatively high rate (3.6 percent per annum between 1980 and 1990). The Chelan County Comprehensive Plan 2000 provided an estimate of the 1997 population for the area at 4,023 people, which implies an annual compounded growth rate of 6.4 percent per year since 1990. Assuming this rate of growth, the estimated 1995 population is estimated at 3,557 people.

Population growth in Douglas County roughly paralleled that of Chelan County, increasing at an AARG of 1.7 percent between 1980 and 1990 and 2.1 percent between 1990 and 1999. However, the fastest rates of growth occurred in the incorporated cities and towns as opposed to the unincorporated areas, as occurred in Chelan County during the two most recent decades. The growth in the county's population over the period 1980 – 1999, at 43.2 percent overall, exceeded that of the state.

³ Between April 2, 1990 and April 1, 1999 there were eight parcels encompassing 0.607 square miles of land that were annexed by the city of Entiat. A total of 60 housing units (all occupied) with population of 178 people were located in the annexed parcels.

East Wenatchee experienced rapid growth, particularly between 1990, when the rate of growth was 12.4 percent per annum. Bridgeport, located on the dam reservoir north of Wells Dam, also experienced relatively high growth rates during the period, especially during 1990 – 1995, when the rate of growth was 5.2 percent per annum. Coulee Dam (part), with a small population base, lost population during the 1980 – 1999 period. Population growth at Mansfield and Rock Island was modest during the period. Waterville (county seat of Douglas County), experienced relatively slow growth during the period. Indeed the growth rate between 1995 and 1999 was only 0.1 percent. The unincorporated Orondo area is assumed to have grown at the same rate as experienced by the county.⁴

3.2.2 Components of Population Change

The two major components of population change consist of natural increase - the number of births minus the number of deaths - and net migration - the balance of people moving in and out of an area. Table 3-2 shows the contribution of natural increase and net migration in Chelan and Douglas counties between 1990 and 1999. The migratory element of population change reacts more quickly to economic change than does natural increase. Population change during the major portion of the most recent decade in the two counties reveals the extent to which migration has had a relatively greater effect on population growth. For instance, during this period, net migration resulted in a gain of 7,004 residents in Chelan County or 65.2 percent of total population change versus a gain of 3,746 people associated with natural increase or 34.8 percent of the total. For Douglas County, net migration contributed 3,449 people or 62.8 percent of total population change, while natural increase resulted in a gain of 2,046 people or 37.2 percent of the total. As shown in the table, the relative contribution of the two population change components for the two counties was similar to the state during the period.

⁴ Douglas County 1995 Comprehensive Plan.

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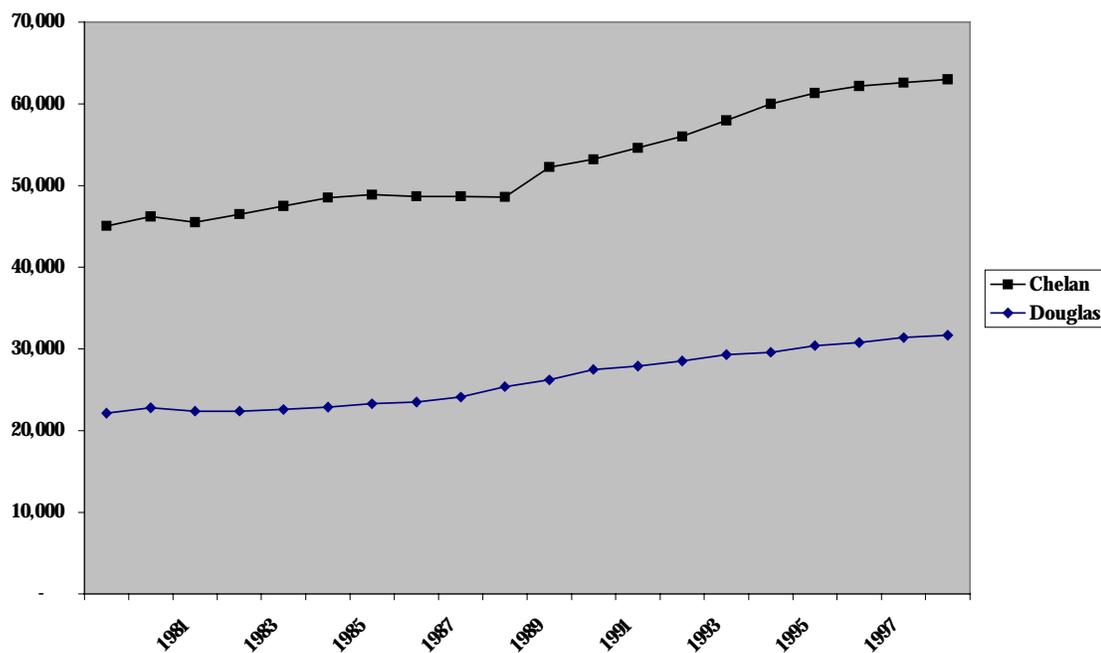


Figure 3-1: Population - Chelan and Douglas Counties

Table 3-1: Population in Chelan and Douglas Counties, Selected Cities and Towns, and State of Washington, 1980 – 1999

Jurisdiction	1980	1990	1995	1999	Average Annual Rate of Growth			
					1980-1990	1990-1995	1995-1999	1990-1999
Chelan County	45,061	52,250	60,000	63,000	1.5%	2.8%	1.2%	2.1%
Unincorporated Area	20,791	22,760	27,300	28,085	0.9%	3.7%	0.7%	2.4%
Incorporated Area	24,270	29,490	32,700	34,915	2.0%	2.1%	1.6%	1.9%
Cashmere	2,240	2,544	2,670	2,685	130.0%	1.0%	0.1%	0.6%
Chelan	2,802	2,976	3,230	3,410	0.6%	1.7%	1.4%	1.5%
Entiat	445	449	555	935	0.1%	4.3%	15.9%	8.5%
Leavenworth	1,526	1,692	2,065	2,265	1.0%	4.1%	2.3%	3.3%
Wenatchee	17,257	21,829	24,180	25,620	2.4%	3.1%	1.5%	1.8%
Malaga Area a)	1,781	2,608	3,557	N/A	3.9%	6.4%	3.5%	N/A
Douglas County	22,144	26,205	29,600	31,700	1.7%	2.6%	1.7%	2.1%
Unincorporated Area	17,374	19,958	20,746	21,855	1.4%	0.8%	1.3%	1.0%
Incorporated Area	4,770	6,247	8,854	9,845	2.7%	7.2%	2.7%	5.2%
Bridgeport	1,174	1,498	1,725	2,125	2.5%	2.9%	5.4%	2.3%
Coulee Dam (part)	242	218	209	210	-1.0%	-0.9%	0.1%	-0.4%
East Wenatchee	1,640	2,701	4,850	5,395	5.1%	12.4%	2.7%	8.0%
Mansfield	315	311	370	365	-0.1%	3.5%	-0.3%	1.8%
Rock Island	491	524	585	630	0.7%	2.2%	1.9%	2.1%
Waterville	908	995	1,115	1,120	0.9%	2.3%	0.1%	1.3%
Orondo Area b)	N/A	383	433	464	N/A	2.6%	1.7%	2.1%
State of Washington	4,132	4,867	5,430	5,757	1.7%	2.2%	1.5%	1.9%

Sources: Washington State Office of Financial Management, Population Division, various years.

a) Based on 1980 and 1990 Census actual population for Malaga CCD. The 1995 population is based on Chelan County Comprehensive Plan 2000 estimated growth rate for the area.

b) The post-1990 population for the unincorporated Orondo area is estimated based on assumptions applied in the 1995 Douglas County Comprehensive Plan in which the 1990 Census population share of the total county

Table 3-2: Components of Population Change Between 1990 – 1999 Chelan and Douglas Counties and State of Washington

County/State	Total Population	Net Migration	Percent of Total Change	Natural Increase	Percent of Total Change
Chelan County	10,750	7,004	65.2%	3,746	34.8%
Douglas County	5,495	3,449	62.8%	2,046	37.2%
State of Washington	890,700	546,000	61.3%	344,700	38.7%

Source: Washington State Office of Financial Management, Databook, 1999.

3.2.3 Demographic Characteristics

3.2.3.1 Age Distribution

A notable demographic characteristic of the study area is its age distribution. As shown in Table 3-3, both Chelan and Douglas counties have relatively large proportion of their populations in the higher age brackets, compared to the statewide population.

As noted, the age distribution of each of the counties reflects a moderately higher than average age population compared to the state, with a median age of 36.3 years in Chelan County and 37.1 years in Douglas County compared to 35.1 years statewide in 1999. The percentage of total population in the 65+ years age bracket in Chelan County at 14.0 percent and 13.0 percent in Douglas County is considerably above that of the state at 11.3 percent. The percentage of population in the 45-64 years age bracket, at 21.6 percent for Chelan County and 24.2 percent for Douglas County compares to the statewide share of the population in this age group, which is shown to be 22.3 percent. The percentage of the population in the primary working age groups (20 – 24 years and 25 – 44 years) in both counties is shown to be somewhat lower than the state shares for these groups. The percentage of the population in the younger (essentially preschool and school aged groups) is modestly higher than indicated for the state. Thus, the population of the two-county study area appears to be maturing, despite the somewhat encouraging pattern of increasing percentage shares in the younger age groups.

3.2.3.2 Racial and Ethnic Distribution

The racial and ethnic composition of Chelan and Douglas counties is quite similar; however, there are marked differences when compared to the state, as shown in Table 3-4. Both counties have relatively low nonwhite racial percentage shares, comprising only 2 – 2.5 percent of the total population in 1998, compared to about 11 percent for the state. Although small in

percentage terms, the Native American share of the population represents the largest nonwhite racial component in the two counties. There has been very little change in the racial composition of the two county's populations since 1990. Conversely, both counties have relatively high percentage shares of the population designated as having Hispanic Origin. In Chelan County, the share of the population consisting of people of Hispanic origin represented 16.0 percent of the total in 1998, increasing from 9.2 percent in 1990. For Douglas County, the figures were 17.3 percent in 1998 and 10.4 percent in 1990. Statewide the percentage share of the population designated as having Hispanic origin was 6.0 percent in 1998, increasing from 4.4 percent in 1990. There are no American Indian reservations in Chelan and Douglas counties, but a large number of Native Americans live in the general region due to their historic presence and existence of nearby reservations.

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Table 3-3: Age Distribution of Population in Chelan County, Douglas County, and State of Washington – 1998

County/State	Median Age	Percentage of Population in Age Bracket						
		0-4	5-14	15-19	20-24	25-44	45-64	65+
Chelan County	36.3	8.0%	16.2%	6.8%	4.6%	28.8%	21.6%	14.0%
Douglas County	37.1	6.6%	16.2%	7.3%	4.8%	27.9%	24.2%	13.0%
State of Washington	35.1	7.0%	15.3%	7.2%	6.2%	30.7%	22.3%	11.3%

Sources: Washington State Office of Financial Management, Databook, 1999.

Table 3-4: 1990 and 1998 Population by Race and Hispanic Origin Chelan and Douglas Counties and State of Washington

County/State	Total	Percent				
		White	Black	Native	Asian	Hispanic
Chelan						
1990	52,250	98.0%	0.2%	1.1%	0.8%	9.2%
1998	62,600	97.5%	0.2%	1.2%	1.1%	16.0%
Douglas County						
1990	26,205	98.2%	0.2%	0.9%	0.7%	10.4%
1998	31,400	97.9%	0.3%	0.9%	0.9%	17.3%
Washington						
1990	4,866,692	90.6%	3.1%	1.8%	4.4%	4.4%
1998	5,685,300	88.8%	3.4%	1.9%	5.9%	6.0%

Source: Washington State Office of Financial Management,

3.2.4 Population Forecasts

Population projections for Washington state and counties are available from Office of Financial Management (op. cit., December, 29, 1995) for the period 1990 through 2020 with a range from low to medium to high. Table 3-5 presents population forecasts for Chelan and Douglas counties as well as the state at five-year intervals, beginning year 2000, for each of the forecast scenarios. Chelan County is shown to increase between 77,677 and 94,984 people by 2020, with a medium scenario projection of 86,213 people; Douglas County population is projected to increase between 41,984 people and 52,369 people. As shown in the table, Chelan County is anticipated to grow at similar average annual growth rates assumed for the state under the various scenarios, i.e., 0.9 percent per annum under the low scenario, 1.3 percent per annum for the medium scenario, and 1.7 percent per annum if the high population growth scenario is assumed. Douglas County is projected to increase at a higher rate than for Chelan County as well as statewide, with the low growth scenario assuming an average annual rate of population growth of 1.3 percent. The medium- and high-scenario growth rates are 1.7 percent per annum and 2.3 percent per annum. The long-run growth rates under the high population projection scenario are comparable to the average annual rates of growth experienced by these jurisdictions in the 1980 – 1990 and 1990 - 1999 time frames, as indicated in Table 3-1.

For purposes of Growth Management Act planning, Chelan County adopted the OFM high growth scenario projection through year 2017 (the final year of the projection horizon for the Chelan County Comprehensive Plan), with total population forecast at 90,444 persons. Sixty percent of the anticipated growth is expected to be inside Urban Growth Areas (UGAs), whereas 40 percent is projected to occur on rural and resource lands. Douglas County developed long-range population projections (through 2015) that roughly correspond to the high growth scenario projections prepared by OFM. The year 2015 total population for the county is forecast at 46,063 (compared to 47,582 people, as projected by OFM under the high-growth scenario), with urban growth areas projected to receive about 77 percent of the total increase in population between 1990 and 2015, or 36,457 people. The rural areas are projected to receive the remainder, or 9,606 people during the 25-year period. The Orondo area, which is located in the rural area (and of special importance to this study), is projected to increase to 921 people by 2015 for an increase of 538 persons over the 1990 figure of 383 people.

Table 3-5: Total Population Projections for Chelan and Douglas Counties and State of Washington: 2000 – 2020

County/State	2000	2005	2010	2015	2020	AARG 2000-2020
Chelan County						
Low Scenario	65,021	68,550	71,479	74,567	77,677	0.9%
Medium Scenario	66,390	71,468	76,093	81,054	86,213	1.3%
High Scenario	67,679	74,267	80,612	87,535	94,919	1.7%
Douglas County						
Low Scenario	32,097	35,255	37,497	39,803	41,984	1.4%
Medium Scenario	32,683	36,557	39,596	42,801	45,969	1.7%
High Scenario	33,551	38,514	42,822	47,512	52,369	2.3%
Washington State						
Low Scenario	5,757,353	6,093,963	6,379,631	6,698,816	7,023,452	1.0%
Medium Scenario	5,849,893	6,291,772	6,693,325	7,142,144	7,610,089	1.3%
High Scenario	5,960,530	6,532,874	7,082,719	7,702,782	8,365,569	1.7%

Source: Washington State Office of Financial Management, Total Population Projections for Washington Counties: 1990 – 2020, December 29, 1995.

3.2.5 Labor Market and Employment Trends

3.2.5.1 Labor Force Trends

Chelan and Douglas counties experienced increases in the numbers of persons in the civilian labor force during the past 10 years, 1989 – 1999, as shown in Table 3-6. However, the labor force in Douglas County grew at a much higher rate than its neighboring county to the west. Between 1989 and 1998, the Chelan County civilian labor force⁵ grew from 29,360 to 35,180 people, an increase of 5,810 persons or 19.8 percent. Douglas County's civilian labor force, which in 1989 was only half the size of the Chelan County labor force, grew from 13,400 to 19,540 people, an increase of 4,910 persons or 33.6 percent.

3.2.5.2 Unemployment

Unemployment is considered one of the key indicators of a region's economic health. On average, Chelan County's unemployment rate has been about three and a half percentage points above the statewide rate. Douglas County's unemployment rate has exceeded that of the state by about one and a half percentage points on average. Interestingly, the rate of unemployment declined in both counties in 1997 by about two percentage points, paralleling the decline at the state level. The reason for this has to do with the increase in the number of jobs generated during this period in both regional and state economies, without proportionate increases in the labor force. Recent job increases in the two-county study area are discussed below.

⁵ The resident civilian labor force is defined as all persons 16 years of age and older in a specific geographical area, who are either working or looking for work. Excluded from the resident civilian labor force are institutionalized persons and those persons serving in the military.

It is important to recognize that annual unemployment rates tend to mask the seasonal variability of unemployment levels in rural, agriculturally-based regions. Monthly unemployment rates in the Chelan-Douglas Labor Market Area (Washington State Department of Employment Security) ranged from a high of 11.4 percent (January) to a low of 5.2 percent (September and October) in 1999, a variation of 6.2 percent. In comparison, the monthly unemployment figures for the state of Washington ranged from a high of 5.7 percent (February) to a low of 4.2 percent in September through November) of that year.

3.2.5.3 Proprietors

Information on proprietors (i.e., farm proprietors and other self-employed, partners, and those employed in tax-exempt cooperatives) confirms the growing importance of the self-employed, particularly in non-farm sectors of the regional economy. In Chelan County farm proprietor's employment declined slightly from 1,400 workers in 1993 to 1,369 workers in 1997, the latest year for which data is available. Other (nonfarm) proprietors employment increased during this timeframe from 6,547 workers to 7,617 workers. While the vast majority of people employed in Chelan and Douglas Counties are wage and salaried workers, nonfarm proprietor's employment has grown at a much faster rate (AARG of 3.9 percent) than indicated for total employment (AARG of 2.4 percent) during the recent period, as shown in Table 3-6 below. A similar pattern emerges from inspection of employment data for Douglas County. Farm proprietor's employment declined slightly from 1,055 workers in 1993 to 1,032 workers in 1997. Nonfarm proprietor's employment, however, increased from 1,208 workers to 1,504 workers during this period for an AARG of 5.6 percent. The corresponding increase in total employment between 1993 and 1997 in Douglas County reflected an AARG of 3.5 percent, as shown in Table 3-6 below.

3.2.5.4 Microenterprises: Entrepreneurs, Self-employed individuals and Sole proprietors

As suggested by the above discussion, one of the most dramatic developments in recent years generally is the increase in self-employment in nonfarm industry sectors. In 1997, there were 10.5 million self-employed workers in the United States; an increase of 21.5 percent over 1980. Two-thirds of the self-employed work in their own unincorporated businesses (e.g., sole proprietors); one-fifth own incorporated businesses; and the remainder worked for wages and salaries as their primary job but also self-employed in part-time businesses (U. S. Bureau of Labor Statistics). Many of the self-employed work in "home-based businesses" and of those self-employed that work outside the home; most of these businesses are located within their town of residence. Employment in these businesses is presumably included in the proprietor totals indicated in the previous section.

Self-employment holds great attraction for many people. Compared to working for someone else, it seems to promise higher earnings, enhanced professional standing, and independence. Practical considerations, such as the desire to work at home or adjust a work schedule to meet family needs, can also motivate people to start their own enterprise. Retired people often become self-employed to supplement their pensions and to have something to do. Finally, others wish to work for themselves because of job dissatisfaction and simply want a change.

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On a national basis, the self-employed differ markedly from wage and salary workers in their personal and social characteristics. Compared with wage and salary workers, the self-employed are older and more likely to be men and may have less—but not substantially less—formal education. Relative to their numbers in the labor force, minority groups (excluding Asians) are significantly underrepresented in self-employment. Although the proportion of self-employed women remains substantially lower than that of self-employed men, women have been a major contributor to the recent growth in self-employment, according to Bregger, John E. “Measuring Self-Employment in the United States,” *Monthly Labor Review*, January-February, 1996: 3-9.

Furthermore, recent attention has been directed toward attracting certain types of entrepreneurs. Dubbed “lone eagles,” these entrepreneurs, free-lance professionals, and other knowledge-based workers (e.g., writers, analysts, brokers, lawyers), are leaving the frenetic pace of urban and suburban America and relocating to smaller, slower-paced, amenity-rich communities. Although not all successful professionals are exiting metropolitan America and not every small, rural community is the likely future home of a flock of prospering entrepreneurs, attention to this lone eagle phenomenon is growing (see Bregger, John E. “Measuring Self-Employment in the United States,” *Monthly Labor Review*, January-February, 1996: 3-9).

No one knows the full extent of the economic contribution of lone eagles to rural communities, but that contribution could be significant. Researchers at Washington State University, for instance, estimated that at least 2,100 lone eagles moved into the state during a 12-month period between 1994 and 1995. Many of these lone eagles located outside metropolitan areas in small cities and rural areas of the state.

Researchers at the University of Washington have developed a profile of lone eagles. They tend to be college-educated men in their 40s who earn more than \$50,000 a year. They also have an entrepreneurial streak and sell highly specialized goods and services to clients anywhere in the world. Most lone eagles need an efficient local telecommunications system (for high-speed modem/fax access), a reliable overnight courier service, and nearby airport with commuter flights. Finally, these lone eagles are attracted to “amenity-rich” locations such as areas with natural beauty, outdoor recreation, milder climates and lower crime rates, as noted in Beyers, William B., David P. Lindahl and Ezra Hamill. “Lone Eagles and Other High Flyers in the Rural Producer Services,” presented at the Pacific Northwest Regional Economic Conference, Missoula, Montana, May 1995.

Table 3-6: Labor Force, Employment, and Unemployment in Chelan and Douglas Counties

	Civilian Labor Force	Chelan County			Civilian Labor Force	Douglas County		
		Total Employ.	Total Unemploy.	Unemploy. Rate		Total Employ.	Total Unemploy.	Unemploy. Rate
1989	29,360	26,350	3,010	10.3%	14,630	13,400	1,240	8.5%
1990	30,990	28,360	2,630	8.5%	16,350	15,150	1,200	7.3%
1991	31,220	27,920	3,300	10.6%	16,290	14,920	1,370	8.4%
1992	32,510	28,840	3,670	11.3%	16,890	15,410	1,480	8.8%
1993	33,230	29,680	3,550	10.7%	17,620	16,160	1,460	8.3%
1994	33,540	30,740	2,800	8.3%	18,090	16,840	1,250	6.9%
1995	33,440	30,080	3,360	10.0%	18,130	16,770	1,360	7.5%
1996	34,650	30,950	3,700	10.7%	18,780	17,220	1,560	8.3%
1997	34,610	31,850	2,760	8.0%	19,280	18,060	1,220	6.3%
1998	35,030	31,960	3,070	8.8%	19,470	18,120	1,350	6.9%
1999	35,180	32,160	3,020	8.6%	19,540	18,210	1,330	6.8%

Source: Washington State Department of Employment Security, March 2000.

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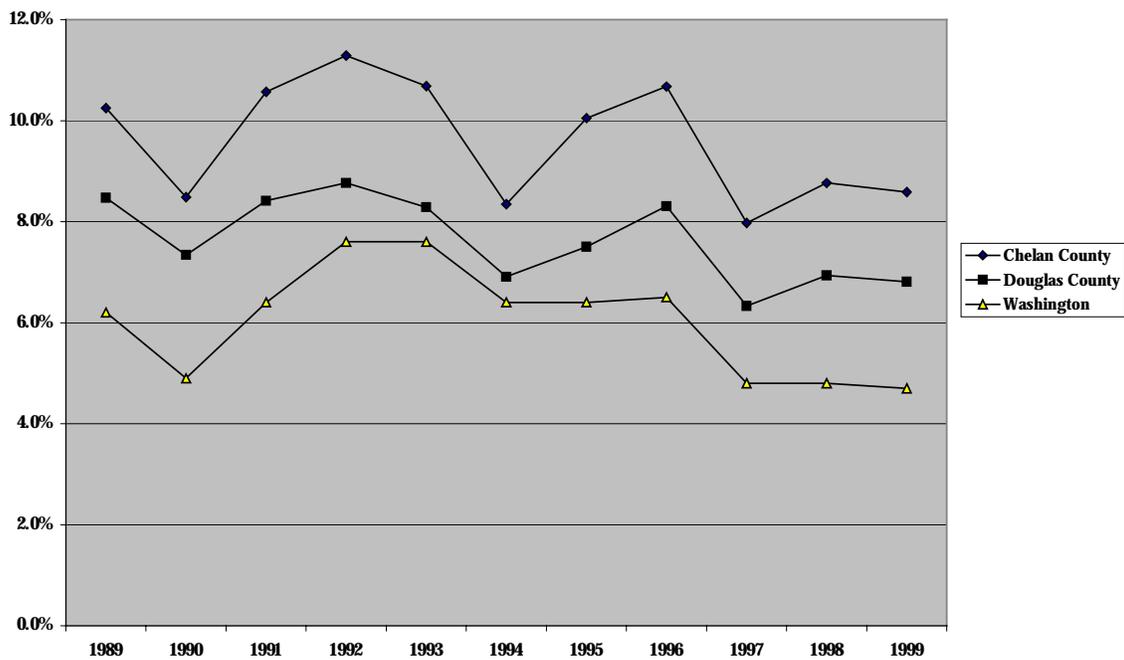


Figure 3-2: Unemployment

3.2.6 Employment Trends

Table 3-7 and Table 3-8 present full- and part-time employment in Chelan and Douglas counties during the most recent five-year period for which data is available: 1993 through 1997, based on U.S. Department of Commerce, Bureau of Economic Analysis information. The data in this series reflects the broadest measure of employment in the local economy available. The employment counts include wage and salary workers, sole proprietors, including the self-employed, and multiple jobholders.

Between 1993 and 1997, total employment in Chelan County increased from 40,432 employees to 44,394 employees for an average annual rate of change of 2.4 percent or 9.8 percent over the period. It is worth noting that most of the increase (2,713 jobs out of total of 3,962 jobs) was generated in 1994, the first year of the employment series shown, followed by a slight decline in 1995 and then a recovery in 1996, when the employment count was at its highest during the period.

Most industrial sectors experienced growth, with some growing rapidly. Farm employment growth was substantial, increasing from 4,762 jobs in 1993 to 5,395 jobs in 1997 for an average annual rate of change of 3.2 percent or 13.2 percent over the period. Nonfarm employment growth was substantial in the construction, TCPU⁶, wholesale trade, services, and local government sectors. Manufacturing employment growth was positive, but insubstantial during the period, increasing at only 0.6 percent per annum. Retail trade, FIRE⁷, and federal (excluding military) and state government sectors experienced modest growth during the period. Agricultural services, forestry and fishing, and mining, as well as military experienced employment losses.

Douglas County employment growth was also substantial during the recent five-year period, increasing from 9,721 employees in 1993 to 11,173 employees in 1997 for an overall increase of 14.9 percent and average annual rate of growth of 3.5 percent. In this case, nonfarm employment grew at a faster rate (AARG of 4.0 percent) than farm employment (AARG of 2.6 percent). The fastest rates of growth in the nonfarm sectors were evidenced in the construction, manufacturing, FIRE, retail trade, and state government sectors. Agricultural services, forestry, and fishing appeared to have grown at a rapid rate during 1994 - 1995; however, there are no data for this sector for 1999, due to data disclosure restrictions. Mining employment is also not shown for the same reason. Services, federal civilian, and local employment grew at modest rates during the 1993 - 1997 time frame. Wholesale employment grew at a relatively slow rate and military employment declined.

⁶ TCPU refers to transportation, communications, and public utilities industries.

⁷ FIRE refers to finance, insurance, and real estate industries.

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Table 3-7: Chelan County, Total Full- & Part-Time Employment, 1993 – 1997

Sector	1993	1994	1995	1996	1997	AARG 1993-97
Total Employment	40,432	43,145	42,965	43,444	44,394	2.4%
Wage & Salary	32,485	34,622	34,499	34,686	35,408	2.2%
Proprietors'	7,947	8,523	8,466	8,758	8,986	3.1%
Farm Employment	4,762	5,465	5,525	5,819	5,395	3.2%
Non-Farm Employment	35,670	37,680	37,440	37,625	38,999	2.3%
Private employment	30,108	31,747	31,412	31,593	32,787	2.2%
Ag., Forestry, Fishing	2,366	2,765	2,203	2,112	N/A	N/A
Mining	246	209	84	59	N/A	N/A
Construction	2,221	2,499	2,362	2,563	2,656	4.6%
Manufacturing	2,835	2,837	2,854	2,899	2,900	0.6%
TCPU	1,108	1,173	1,251	1,305	1,363	5.3%
Wholesale Trade	2,404	2,534	2,606	2,391	2,699	2.9%
Retail trade	7,210	7,668	7,669	7,599	7,870	2.2%
FIRE	2,503	2,558	2,665	2,701	2,707	2.0%
Services	9,215	9,504	9,718	9,964	10,499	3.3%
Government	5,562	5,933	6,028	6,032	6,212	2.8%
Federal, Civilian	698	713	782	748	718	0.7%
Military	263	251	246	241	230	-3.3%
State & local	4,601	4,969	5,000	5,043	5,264	3.4%
State	1,102	1,285	1,174	1,161	1,165	1.4%
Local	3,499	3,684	3,826	3,882	4,099	4.0%

Notes: TCPU refers to transportation, communication & public utilities; FIRE refers to finance, insurance & real estate; AARG refers to average annual (compounded) rate of growth.

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System, Table 025, updated July 21, 1999.

Table 3-8: Douglas County, Total Full- & Part-Time Employment, 1993 – 1997

Sector	1993	1994	1995	1996	1997	AARG
						1993-97
Total Employment	9,721	10,265	10,843	11,067	11,173	3.54%
Wage & Salary	7,458	7,835	8,403	8,576	8,637	3.74%
Proprietors'	2,263	2,430	2,440	2,491	2,536	2.89%
Farm Employment	2,510	2,718	2,789	2,958	2,730	2.12%
Non-Farm	7,211	7,547	8,054	8,109	8,443	4.02%
Employment						
Private employment	5,546	5,808	6,297	6,330	6,626	4.55%
Ag., Forestry, Fishing	308	328	666	N/A	N/A	N/A
Mining	N/A	N/A	N/A	N/A	N/A	N/A
Construction	398	431	486	512	546	8.22%
Manufacturing	170	146	159	148	224	7.14%
TCPU	442	506	457	N/A	N/A	N/A
Wholesale Trade	319	309	334	318	342	1.76%
Retail trade	1,730	1,827	1,881	1,946	1,965	3.24%
FIRE	352	398	391	406	428	5.01%
Services	1,824	1,859	1,918	1,952	2,000	2.33%
Government	1,665	1,739	1,757	1,779	1,817	2.21%
Federal, Civilian	159	152	143	142	139	-3.30%
Military	139	134	135	132	128	-2.04%
State & local	1,367	1,453	1,479	1,505	1,550	3.19%
State	51	55	58	67	67	7.06%
Local	1,316	1,398	1,421	1,438	1,483	3.03%

Notes: TCPU refers to transportation, communication & public utilities; FIRE refers to finance, insurance & real estate; AARG refers to average annual (compounded) rate of growth.

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System, Table 025, updated July 21, 1999.

3.2.7 Covered Employment and Wages

Annual employment and wages and salaries of covered⁸ workers by major (nonfarm) industry sector in 1998 are presented for Chelan and Douglas counties and the state of Washington in Table 3-9. Not surprisingly, agricultural services is the largest sector in terms of employment in both Chelan and Douglas counties, with the share of total employment in 1998 indicated at 23.5 percent in the former and 34.0 percent in the latter county. The relative share of Washington state employment represented by this industry sector is a mere 3.7 percent in comparison. Services, retail trade, and government are the next largest sectors in terms of employment in both counties. Nonetheless, the relative shares of services employment at 19.0 percent and 13.2 percent for Chelan County and Douglas County, respectively, are considerably lower than indicated for the state of Washington or 26.1 percent. This undoubtedly results from lower *producer* services employment shares in the two-county region than statewide. Retail trade is shown to have a similar relative employment share composition between the two counties and the state, with the sector contributing 16.9 percent of total employment in Chelan County.

Similarly, government employment shares in both Chelan and Douglas counties are comparable to that of the state as a whole. In contrast to the foregoing, the manufacturing sector employment is shown to be only half the statewide share in Chelan County and about a sixth of the statewide share in Douglas County. Transportation, communications, and public utilities are also much lower in terms of relative employment shares in both counties compared to the state.

Annual average wages for covered employment in 1998 at \$21,933 in Chelan County and \$19,613 in Douglas County represent 66.3 percent and 59.3 percent, respectively, of the statewide average of \$33,071. Except for the government sector, wage differences between the two-county area and the state are similar and reflect substantially lower wage payments to most employees in the study region than the state as a whole.

⁸ Covered employment refers to Bureau of Labor Statistics ES202 employment covered by unemployment insurance. As such, it excludes those that are sole proprietors and partners in businesses.

Table 3-9: Covered Employment and Wages by Industry in 1998 - Chelan and Douglas Counties and State of Washington

	Chelan County			Douglas County			Washington State		
	Average Employ.	Average Annual Wage	Percent Share Sector Employ.	Average Employ.	Average Annual Wage	Percent Share Sector Employ.	Average Employ.	Average Annual Wage	Percent Share Sector Employ.
Agric. Forestry & Fishing	8,507	\$ 12,089	23.5%	2,962	\$ 12,794	34.0%	94,726	\$ 15,613	3.7%
Mining	N/A	N/A	N/A	N/A	N/A	N/A	3,252	\$ 42,915	N/A
Construction	1,635	\$ 27,880	4.5%	402	\$ 26,671	4.6%	133,803	\$ 33,653	5.2%
Manufacturing	2,622	\$ 32,418	7.2%	202	\$ 36,217	2.3%	373,802	\$ 42,247	14.4%
Transportation, Communic. & Public Utilities a	1,037	\$ 26,563	2.9%	289	\$ 31,160	3.3%	129,585	\$ 40,299	5.0%
Wholesale Trade	2,348	\$ 25,737	6.5%	298	\$ 25,729	3.4%	148,159	\$ 39,140	5.7%
Retail Trade	6,133	\$ 14,932	16.9%	1,511	\$ 14,729	17.3%	460,669	\$ 17,908	17.8%
Finance, Insur. & Real Estate	1,205	\$ 24,978	3.3%	186	\$ 22,454	2.1%	131,806	\$ 40,700	5.1%
Services	6,898	\$ 23,329	19.0%	1,151	\$ 16,883	13.2%	676,209	\$ 35,887	26.1%
Total Government	5,885	\$ 32,563	16.2%	1,713	\$ 30,610	19.7%	441,415	\$ 33,872	17.0%
Total	36,270	\$ 21,933	100.0%	8,714	\$ 19,613	100.0%	2,593,426	\$ 33,071	100.0%

* Estimated for Chelan County.

Source: Washington State Employment Security Department, LMEA data file.

3.2.8 Employment Structure or Economic Base of the Chelan-Douglas County Area

It is evident that the employment distributions for Chelan and Douglas counties differ substantially from that represented at the state level. A simple analysis using location quotients provides some indication as to the economic specialization pertaining to the two counties. Location quotients are measures of specialization that compare the share of total employment in a particular industrial grouping in, say, Chelan County with the share it represents in Washington. The quotient for any industry or sector is determined by dividing its share of Chelan County employment by its share of state employment. A quotient of 1.0 denotes an industry in which the county is typical to the state as a whole; a value above 1.0 shows an industrial specialization for the county; and a value below 1.0 marks an industry under-represented in the County. Location quotients for Chelan County nonfarm industrial sectors are presented graphically in Figure 3-3. Similar results with respect to Douglas County are presented in Figure 3-4.

The location quotient is often used as a proxy for the extent to which an area's production is being consumed locally or sold to non-local markets. Such an approach helps to identify a region's export sectors. Implicitly, this notion contends that a regional economy depends upon the vigor of its export industries. Other economic sectors in the region in turn support these export-oriented industries by providing needed supplies and services. As these export industries grow, then linked local sectors will in turn expand.

The method also indicates which sectors are not meeting local needs, meaning that local residents and businesses need to import some goods or services to meet production or consumption requirements. Thus, in location quotient analysis, specialization or exporting within a sector is indicated by a value greater than 1.00 (or allowing for data imperfections, a value perhaps greater than 1.25). A value less than 1.00 (or again allowing for data imperfections, a value less than 0.75) indicates importing within the sector.

Results shown in Figure 3-3 and Figure 3-4 indicate that only the agricultural service is a major export-oriented sector in Chelan and Douglas counties. The figures also indicate on an aggregate basis that the counties do not appear to specialize in the major industry groups of manufacturing; transportation, communications, and public utilities; wholesale and retail trade; services; finance, insurance, real estate; and government. Only wholesale trade and retail trade, as well as government sectors are near 1.0 indicating that they serve primarily as a regional trade center.

A more detailed location quotient analysis of Chelan County⁹ confirms that the area's economy is highly specialized in primary metals manufacturing (which surely reflects the importance of the Alcoa aluminum smelting operation at Malaga) and agriculture production and services, and a portion of services (hotel and other lodging places), as shown in Table 3-10.

⁹ Disaggregated information on industry sectors for Douglas County is unavailable for most 2-digit SIC sectors, because of disclosure restrictions imposed to ensure the confidentiality of information provided by individual industries. Nonetheless, areas of specialization that are apparent include agricultural production and services and a portion of retail trade (general merchandise stores).

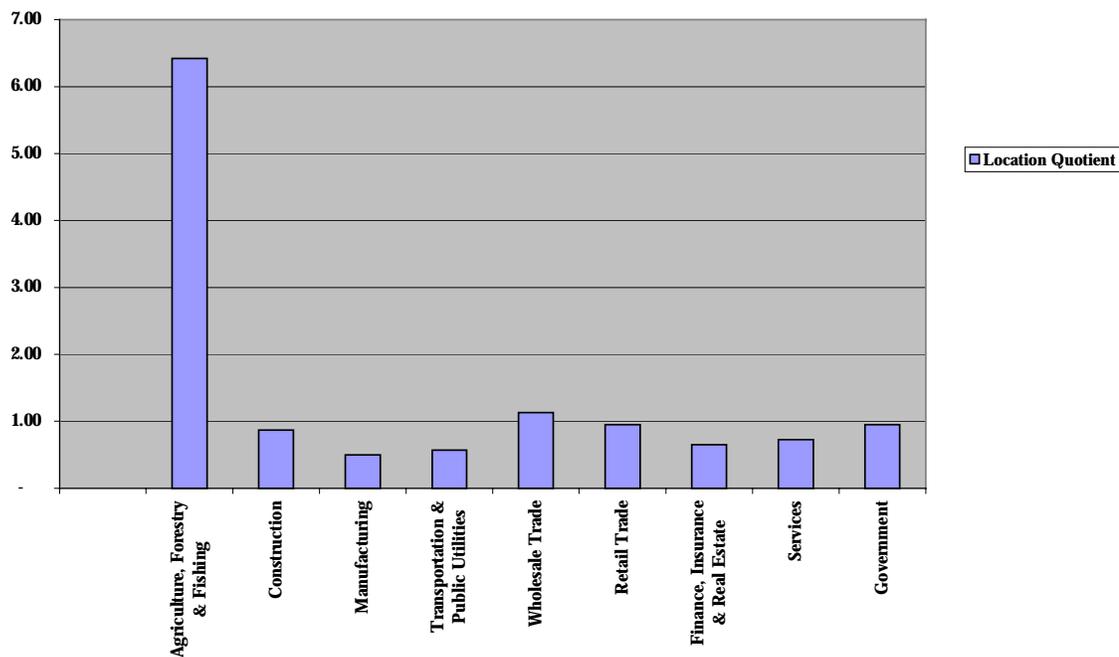


Figure 3-3: Chelan County -- Industry Specialization Ratio

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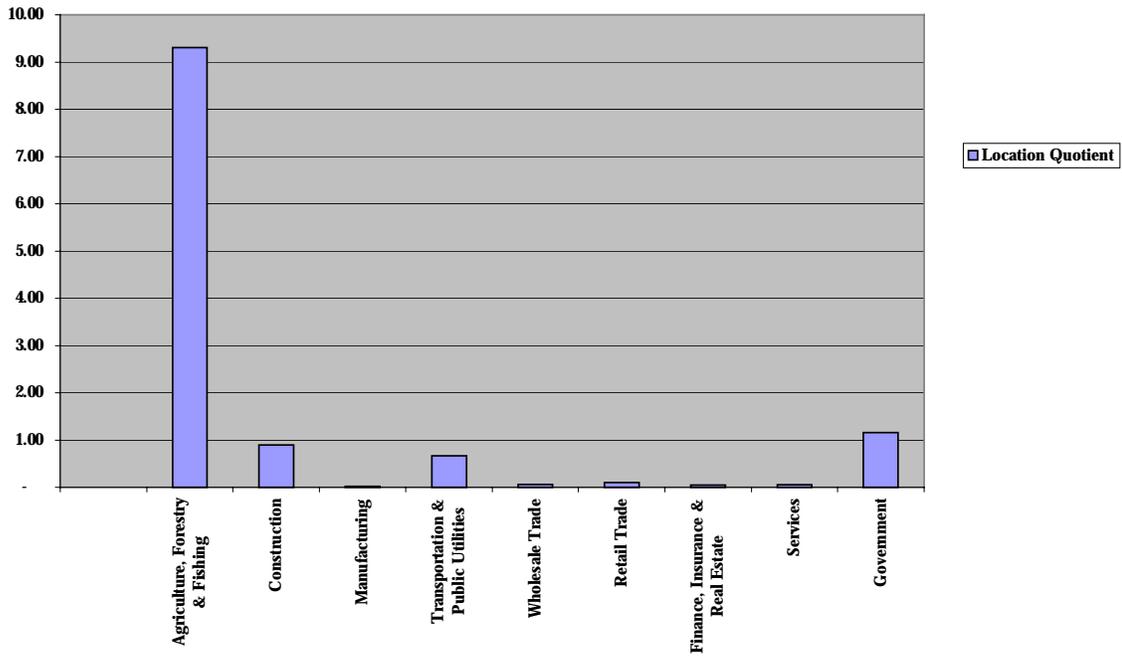


Figure 3-4: Douglas County -- Industry Specialization Ratio

Table 3-10: Location Quotients for Selected Sectors, Chelan County, 1998

Industry	Location Quotient	Industry	Location Quotient
Agriculture, Forestry & Fishing	6.42	Transportation & Public Utilities	0.57
Agricultural Production Crops	6.82	Wholesale Trade	1.13
Agricultural Services	8.24	Retail Trade	0.95
Construction	0.87	General Merchandise Stores	1.08
General Building Contractors	1.07	Food stores	1.02
Heavy Construct., excl. Bldgs.	1.12	Auto. Dlrs. & Service Stations	1.03
Special Trade Contractors	0.70	Eating & Drinking Places	0.90
Manufacturing	0.50	Miscellaneous retail	0.95
Food & Kindred Products	0.72	Finance, Insurance & Real Estate	0.65
Lumber and Wood Products	0.52	Services	0.73
Printing & Publishing	0.75	Hotels & Other Lodging Places	2.25
Primary Metal Industries a)	3.61	Health Services	1.00
Fabricated Metal Products	0.52	Government	0.95
Industrial Machinery & Equip.	0.37		

Source: Washington State Employment Security Department, LMEA data file.

3.2.9 Recent Employment and Wages Trends by ZIP Code

Covered employment and wage data on selected areas within the two-county study area are presented in Table 3-11. The information is provided at the ZIP Code Area level for the following communities and related U.S. Post Office ZIP Codes:¹⁰

- Wenatchee (98801)
- Entiat (98822)
- Malaga (98828)
- Orondo (98843)
- Waterville (98858)

Washington State Employment Security Department provided data on total covered employment and wages within these ZIP Code Areas for the years 1994 through 1996, as shown in Table 3-11. As shown in the table, employment growth has been modest in Wenatchee, but declining in other areas during the most recent three-year period for which data are available. Wage disparities are substantial between the incorporated cities and unincorporated areas represented in the table. Average wages in the Malaga area (which exclude the influence of the Alcoa Wenatchee Works) were 66.2 percent of the Wenatchee area level in 1996. Entiat area wages were not quite as low on average at 76.5 percent of the Wenatchee area level in that year. Average wages in Orondo were only 60.0 percent of the Waterville area level.

¹⁰ Information is unavailable for Chelan Falls ZIP Code Area 98817.

Table 3-11: Covered Employment and Wages by Selected ZIP Code Areas in Chelan and Douglas County

Year/Location	Total Firms	Employment	Total Wages Paid	Average Wage Paid
Chelan County:				
Wenatchee (98801) a)				
1994	1552	17585	\$ 348,594,393	\$ 19,823
1995	1,482	17,950	\$ 365,584,585	\$ 20,367
1996	1,709	17,625	\$ 382,361,567	\$ 21,694
Malaga (98828) b)				
1994	67	588	\$ 7,087,289	\$ 12,053
1995	68	527	\$ 6,844,660	\$ 12,988
1996	74	467	\$ 6,704,435	\$ 14,356
Entiat (98822)				
1994	72	377	\$ 6,262,616	\$ 16,612
1995	72	400	\$ 6,642,593	\$ 16,606
1996	83	355	\$ 5,887,262	\$ 16,584
Chelan Falls (98817)				
1994	N/A	N/A	N/A	N/A
1995	N/A	N/A	N/A	N/A
1996	N/A	N/A	N/A	N/A
Douglas County:				
Waterville (98858)				
1994	62	197	\$ 3,416,249	\$ 17,341
1995	58	187	\$ 3,500,753	\$ 18,721
1996	64	180	\$ 3,432,903	\$ 19,072
Orondo (98843)				
1994	82	973	\$ 10,706,549	\$ 11,004
1995	81	904	\$ 10,444,110	\$ 11,553
1996	96	940	\$ 10,750,901	\$ 11,437

a) Primary metals manufacturing associated with the Alcoa Wenatchee Works is reported within the Wenatchee Zip Code Area.

b) Information on primary metals manufacturing (Alcoa Wenatchee Works) is not reported within this ZIP Code area.

3.2.10 Personal Income Change in Chelan and Douglas Counties

Personal income¹¹, the most broad-based measure of general purchasing power available at the county level, amounted to nearly \$1,350.7 million for Chelan County and \$583.5 million for Douglas County in 1997. Both counties had nearly three-fold increases in nominal total personal income between 1980 and 1997. Personal income grew faster (approximately 1.2 times) in the state of Washington than it did in two-county study area over the same period. The average annual growth rate in nominal personal income was 4.5 percent for the state compared with 3.9 percent and 3.8 percent for Chelan and Douglas counties, respectively.

3.2.10.1 Per Capita Income

Per capita income¹² for Chelan County was \$22,723 and \$18,177 for Douglas County in 1997, the latest year in which published information is available. These personal income figures for the two counties were considerably lower than the statewide average of \$26,451.

3.2.10.2 Major Sources of Personal Income in Chelan and Douglas Counties

Personal income consists of three major components, identified by net earnings, property incomes, and transfer payments. Net earnings, which accounted for 61.1 percent of Chelan County's total personal income and 59.6 percent of Douglas County's total personal income in 1997, versus 67.4 percent for the State of Washington, can be considered as payment for current labor services, as shown in Figure 3-5. Net earnings include wage and salary disbursements, proprietors' income, and other labor income, which are mostly employer contributions to private pension and welfare funds. The contributions that individuals make to social insurance programs—Social Security taxes, for instance—are excluded from net earnings.

The remaining 29.9 percent of Chelan County's and 30.4 percent of Douglas County's personal income was split between dividends, interest, and rent (which is also called property income) and transfer payments. Property incomes refer to those incomes from the ownership of property and other assets such as cash payments from corporations. Transfer payments, which are commonly

¹¹ Personal income is defined by the U.S. Bureau of Economic Analysis as the money value of income received by persons from three major sources: earnings from participation in current production, property incomes, and transfer payments. Earnings include private and government wage and salary disbursements, other labor income, and farm and nonfarm proprietors' income. Property incomes include rental income of persons, personal dividend income, and personal interest income. Transfer payments include payments by government and business to individuals and nonprofit institutions for which they do not render current services. Personal income is measured before the deduction of personal income taxes or other personal taxes. Gross Domestic Product (GDP) is the most widely followed and comprehensive measure of the level of economic activity on the national level. Personal income is perhaps the broadest economic yardstick for measuring and comparing the size and performance of county economies.

¹² County per capita income is the total personal income of county residents for a specific year divided by the county resident population as of July 1. The per capita income measure should be used with caution. Since personal income is measured as a flow throughout the year, and population is measured at midyear, per capita income may be distorted should a significant change in population occur during the year. In any given year, per capita income may be exceptionally high or low as a result of unusual local conditions such as a bumper crop, catastrophe, or major construction project. Also, the presence of a large institutional population—such as residents of a state prison—can significantly lower per capita income estimates of an area. Such results may not reflect the economic well-being of the noninstitutional population, and thus may lead to misleading interpretations. Since per capita income is only a simple average, it does not account for the concentration or distribution of personal income among county residents or households.

referred to as “unearned income,” are payments from the government to people for reasons other than labor services. Transfer payments are an increasing (though modestly) component of total personal income in Chelan County and a substantially increasing component of total personal income in Douglas County. Transfer payments, which are commonly referred to as “unearned income,” are payments from the government for reasons other than labor services. They include payments by government and businesses to individuals and nonprofit institutions¹³ In 1997, transfer payments constituted 18.5 percent of Chelan County’s and 21.9 percent of Douglas County’s total personal income (compared with 15.2 percent of the state’s total). Transfers range from retirement and disability insurance programs to income maintenance programs, unemployment compensation, and veterans benefit payments.

3.2.10.3 Industry Sources of Personal Income

Industry earnings, defined as earnings received by persons for direct participation in the production of goods and services, are among the best available measures to track changes in the level of economic activity within counties. Industry earnings¹⁴ have three major components: (1) wage and salary disbursements, defined as the monetary remuneration of private and public sector employees, including compensation of corporate officers; commissions, tips, and bonuses; and pay-in-kind that represents income to recipients; (2) other labor income, consisting of employer contributions to private pension and welfare funds, including privately insured workers’ compensation funds; and (3) proprietors’ income is treated as income received by individuals and is composed of income from proprietorships, partnerships, and tax-exempt cooperatives.

The bulk of industry earnings in Chelan and Douglas counties are from wages and salaries. Of the total earnings by place of work for Chelan County, which amounted to \$1,054.4 million in 1997, 78.6 percent (or \$828.3 million) was composed of wages and salaries. This is slightly lower than the state’s (80.5 percent) share from wages and salaries. The remaining portions consist of other labor income (\$74.3 million) and proprietors’ income (\$151.8 million). The corresponding figures for Douglas County reflect a relatively higher wages and salaries share of total earnings, at 86.0 percent. Other labor income amounted to 7.3 percent of total earnings, while proprietor’s income represented 6.7 percent of total earnings.

¹³ Transfer payments are generally classified into six broad categories: 1) Retirement-related transfer payments, including Social Security; 2) those for specific retirement programs covering railroad workers, federal civilian employees, military personnel, and state and local government employees; and for workers’ compensation and other government disability, insurance, and retirement programs; 3) medical payments for such programs as Medicare, Medicaid, and Civilian Health and Medical Plan of the Uniformed Services (CHAMPUS); 4) unemployment insurance programs; 5) income maintenance payments for such programs as Aid to Families with Dependent Children (AFDC), food stamps, and Supplemental Security Income (SSI) payments; veterans’ benefit payments including pensions and other compensations, educational assistance, and life insurance benefit payments; 6) and other transfer payments covering payments for education and training assistance, business payments to individuals for such things as cash prizes, unrecovered thefts and consumer bad debts, and government and business payments to nonprofit institutions. Roughly half of all 1997 transfer payments in the nation were within the retirement-related category.

¹⁴ The county earnings estimates reported by the U.S. Bureau of Economic Analysis for individual industry categories are based on the place of work of the recipients. In other words, they reflect the location of employment of the recipient, not the county of residence. Because county personal income estimates are intended to measure the income of county residents, total earnings by place of work are adjusted to derive a measure for the industry earnings of borough or county residents. This “residence adjustment” is an estimate of the net flow of earnings based on intercounty commuting patterns.

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Characteristics relating to the composition of (nonfarm) industry earnings in Chelan County and state of Washington are shown in Figure 3-6. (Similar figures are shown for Douglas County in Figure 3-7.) Services, retail trade, and government were the leading industry groups in earnings shares for both Chelan and Douglas counties compared with the state, where services, manufacturing, and government are the leaders.

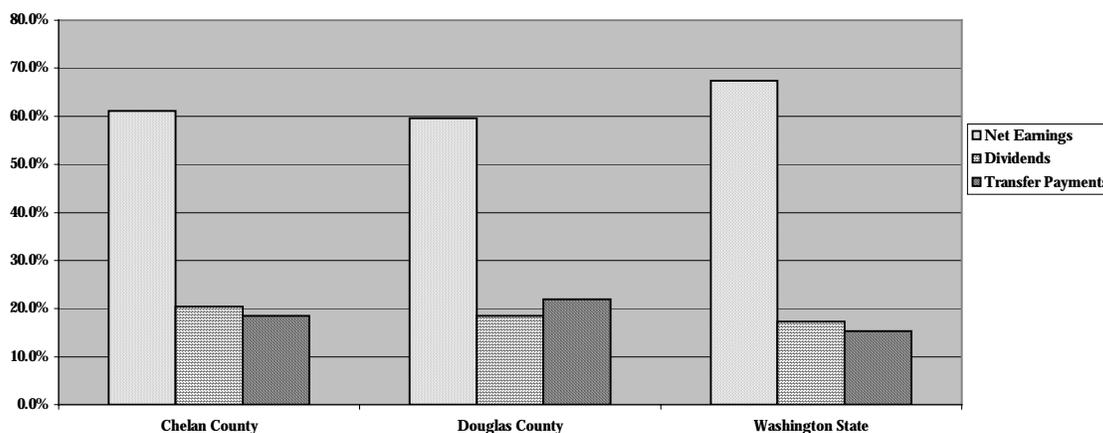


Figure 3-5: Major Sources of Personal Income – 1997

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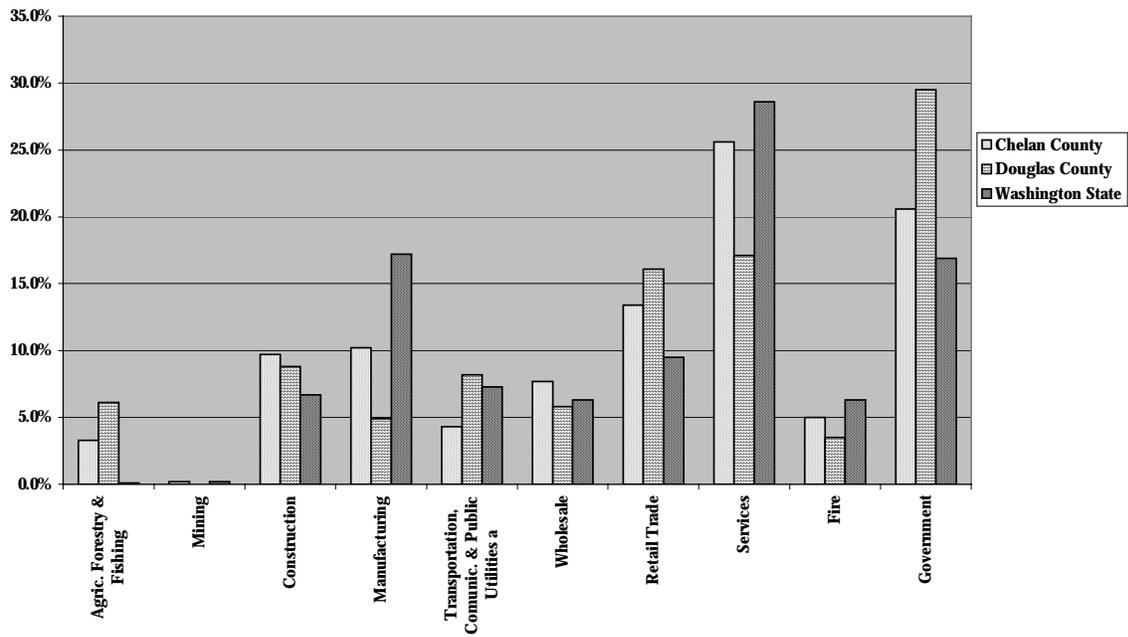


Figure 3-6: Percent of 1997 Total Earnings By Industry Group

3.3 Electricity- and Water-Dependent Industries in Chelan and Douglas Counties

Major basic private industries in the two-county study area include agriculture (farming and farm products services and manufacturing and transportation); basic metals manufacturing; and, tourism/recreation, all of which are dependent on energy and water resources in the area. In addition, the transportation, communications, and public utilities sector is an important component of the regional economy because of the influence of the numerous dams and hydroelectric generating and distribution facilities in the area. The focus in this section is on the specific industries that are dependent on the water storage capabilities and electrical generating capacity of the Rocky Reach Dam. These four major industry groups will be briefly discussed in turn.

3.3.1 Agriculture Industry

3.3.1.1 Overview

An overview of current conditions and recent history is best approached by considering two tables covering general agricultural production and crop area, and, more specifically, apple production, including number of farms engaged in such production and average acres per farm in the two-county study area. While disaggregated data at the sub-county level, particularly in areas in which irrigation water withdrawals from the Rocky Reach reservoir take place, would be most useful, they are unavailable from published sources. Thus, it was necessary to obtain more limited information drawing on educated estimates from local experts (Washington State University Agriculture Extension Service). This information, though less detailed than the regional aggregates published by the Washington State Department of Agriculture and U.S. Census, indicates levels of activity with respect to acreage in production and fruit harvest yields and valuations.

Table 3-12 and Table 3-13 provide overall agricultural production and crop area statistics for 1992 and 1997, based on the 1997 Census of Agriculture for Chelan County and Douglas County, respectively. As shown in the Table 3-12, the agricultural industry in Chelan County consists of crop production and almost all of this production is in the fruits, nuts, and berries categories. The main message of this table is the dominance of the fruits, nuts, and berries commodities, as determined by value of sales in the county. Also, it is important to note the substantially falling market value of agricultural output in the county. Market value levels in 1997 were 3.7 percent less than the 1992 levels in nominal dollars or about 17.0 percent less in real (inflation adjusted) dollars.

Irrigated acreage amounted to 30,562 acres in Chelan County in 1997, up slightly from 1992 (30,008 acres). Orchards account for the overwhelming majority of agricultural land use in Chelan County, with the land area in orchard use amounting to 29,249 acres out of 33,167 harvested acres in 1997 or 88.2 percent of the total. Other uses include hay, wheat consisting of 5.9 percent, 5.6 percent, respectively, as well as barley and nursery uses, which together represent less than 1 percent of the total crop land area.

Table 3-13 presents similar information for Douglas County. As shown in the table, the agricultural industry is more broadly distributed in terms of crop production than in Chelan

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County; nonetheless, orchard raised crops (fruits, nuts, and berries) that are grown principally on irrigated lands in the Columbia River corridor are dominant in terms of production valuations. Market value levels in 1997 were 7.7 percent greater than the 1992 levels in nominal terms, but less in real dollar terms by 5.6 percent than the 1992 levels. The value of orchard production grew by only 3.2 percent (following the pattern shown for Chelan County) in nominal dollars, whereas, the value of wheat production increased by 41.0 percent over the five-year period, for a substantial real dollar increase (27.7% after adjusting for inflation) in output. Cattle and calves also grew substantially between 1992 and 1997 in terms of market value of production, increasing by 17.4 percent in nominal dollars and 4.1 percent when measured in real dollars.

Irrigated acreage amounted to 21,199 acres in Douglas County, which represented a 5.7 percent increase above 1992 levels (20,062 acres). Land in orchards use was 17,910 acres in 1997, up from 17360 acres in 1992. Of course the majority of agricultural land uses consisted of dry land crops with the land area in wheat use amounting to 200,291 acres of 225,102 harvested acres in 1997 or about 89.0 percent.

Table 3-14 presents production details of the apple growing industry for the five major apple growing counties in the state of Washington for 1992 and 1997, including Chelan and Douglas counties. As shown in the table, total farms in apple production in these counties declined by 8.5 percent over the period. The number of farms in Chelan and Douglas counties decreased by 16.5 percent and 14.1 percent, respectively. However, total acreage increased in the five counties, rising by 21.0 percent; nonetheless, Chelan County (and Okanogan County) experienced a modest decline in acreage during the period. Average acres per farm is shown to have increased substantially in all of the major apple growing counties, with Chelan County increasing from 22 to 25 acres or 14.8 percent, while Douglas County increased from 34 to 41 acres or 18.5 percent. Total pounds of produce increased 17.5 percent, while pounds per acre decreased modestly by 2.9 percent in the aggregate for all major apple-producing counties.

According to the *Lake Chelan Hydroelectric Project Socio-Economic Element*, prepared by BST Associates, January 27, 2000), there are reasons to suggest that the restructuring of the apple growing industry to larger, corporate-owned and -operated farms is a continuing process.¹⁵ This will likely result in changes in the relative size of the industry in the (major) apple growing counties, with the consequence that there will be fewer smaller independent farms engaged in such production. The reasons are as follows:

- A decrease in the total number of farms engaged in apple growing in the state.
- A decrease in the number of farms overall.
- A decrease in total acreage devoted to apple growing.
- The average size of apple orchards has increased.
- The average value of land, building, and equipment has increased.

¹⁵ Based on information recently collected on the agriculture industry of Chelan County by Chelan County Public Utility District (contracted research by BST Associates) and presented in *Lake Chelan Hydroelectric Project Socio-Economic Study Element*, Final Report, January 27, 2000.

A discussion of future conditions related to apple production in the state of Washington was also presented in the above-noted study. Forecasts of apple production in terms of acreage and fruit production are regularly produced by the Washington State University Impact Center in a document titled *Trends in Production, Utilization and Price of Washington Apples to 2005*. The most recent forecast was prepared in June 1999. The general conclusions made in this forecast are as follows:

- Total Washington state acreage will continue to increase, although modestly through the forecast period. Total acreage in 1993 (last acreage census) stood at 172,000 acres; projected acres for 2000 amounts to 183,778 acres or 6.8 percent over the five-year period; and, projected acres for 2005 amounts to 185,427 acres or 0.9 percent over the latter five-year interval.
- Total Washington state apple production is expected to increase from 115,476 thousand 42 pound box equivalents in 1995 (actual) to 132,100 thousand in 2000, or 14.4 percent over the five-year period, and to 139,000 thousand in 2005, or 5.2 percent over the latter five-year interval.
- Red Delicious and Golden Delicious apple production is expected to remain the dominant varieties; however, total acreage and production forecasts call for smaller relative shares in future years.
- Utilization of Washington apples between fresh pack and processing markets is expected to shift to the former. Actual fresh pack production was 78,990 thousand 42 pound boxes in 1995 and is forecast at 99,221 thousand boxes in 2000 and 104,379 thousand boxes in 2005. Actual processing amounted to 766,200 tons in 1995 and is forecast to decline to 694,550 tons in 2000 and, then, to increase to 730,651 tons in 2005.
- Average prices of all varieties of apples produced in Washington State are expected to decline slightly in real dollars (1996 dollars) from \$16.22 per box in 1995-96 to a forecast price of \$15.56 in 2000 and \$15.31 in 2005.

3.3.1.2 Columbia River Corridor Agriculture Industry Served by Rocky Reach Dam

Major areas within the Columbia River Corridor provide impressive growing conditions for fruits, mostly apples, pears, and cherries, due to well-drained sandy soils, warm, sunny weather, and availability of irrigation water from mid-Columbia River dams. For this study the area utilizing water withdrawn from the river used for irrigation of agricultural lands upstream from the Rocky Reach Dam is of special interest. In Chelan County, tree fruit production in this portion of the Columbia River corridor amounted to 280,000 42-pound boxes of apples, 60,000 42-pound boxes of pears, and 1,200 tons of cherries from total irrigated land area estimated at 900 acres, as shown in Table 3-15. The market value of this production was estimated at \$6.4 million in 1999. In Douglas County production amounted to 5.6 million boxes of apples, 300,000 boxes of pears, and 5,400 tons of cherries, having a total value of \$83.8 million in 1998.¹⁶ The market values are based on 1999 prices: an average of \$11 per box for fresh packed apples and \$120 per ton for processed apples; \$14 per box for fresh packed pears and \$80 per ton

¹⁶ WSU Extension Agent estimates.

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for processed pears; \$1,800 per ton of fresh packed cherries and \$1,333 per ton for processed cherries; and, \$1,400 per ton for other fresh packed tree fruit.

It is important to mention that the market values reflect FOB prices after completion of fresh packing and, thus, ready for shipment. Packing costs are approximately \$6.00 per box for apples, representing about 55 percent of the market value per box; \$6.50 per box for pears, or 46 percent of the market value per box; and, \$500 per ton for cherries and other tree fruit, representing between 28 percent and 36 percent of total market value of production of these crops, respectively.

In order to estimate total economic activity associated with agricultural production dependent on water withdrawals from the Columbia River, it was necessary to estimate the forward linkages such crop production has on other sectors of the economy. Obviously, costs associated with fresh packing represent components of direct costs that are applied to agricultural production beyond the farm gate. These costs have been included in the market valuations of tree fruit production, as such they may be considered backward linked.

For estimating forwarded linked industry sectors, a direct requirements matrix was developed for the two-county area, based on the IMPLAN model.¹⁷ The matrix was used to determine what portions of the crop sectors outputs are used as inputs for other major basic sectors of the economy. For instance, 25.1 percent of the gross output from the fruits sector was used in the canning and preserving, frozen foods, and dehydrated foods sectors, with an increase in outputs estimated at about four times additional inputs, based on the direct requirements matrix. Given the study area total value of processed fruit output of \$6.5 million (indicated in Table 3-15), this translated to total output delivered to final demand for these sectors of \$26.0 million. To complete agricultural forward linkages, motor vehicle and rail transportation was estimated to increase by 5 percent for the portions of output from fruit going to final demand or \$4.5 million. Thus, the total real gross output delivered to final demand associated with orchard production in the mid-Columbia River corridor area is estimated at \$120.7 million in 1999, as shown in Table 3-16. The table also provides estimates of direct labor requirements, and wages and salaries associated with these direct activities as well as the indirect economic activities,¹⁸ such as wholesale trade, transportation, business services, etc., involving intermediate production associated with these basic industrial sectors; along with induced effects associated with re-spending of earnings by both direct and indirect workers. Direct employment was estimated at 1,112 workers, with earnings of \$17.9 million for an average of \$16,101 per worker in 1999. Total employment was estimated at 2,550 workers. Total output and earnings were estimated at \$166.3 million and \$47.9 million, respectively, in 1999 dollars. Overall average annual earnings were estimated at \$18,803.

¹⁷ IMPLAN is a multi-sector input-output model developed by the U.S. Forest Service and Federal Emergency Management Agency for assessing impacts of policy changes on economic activity at the state and county (or combination of counties) levels.

¹⁸ Induced/indirect economic effects are derived from multipliers obtained from the two-county IMPLAN model developed for this study.

Table 3-12: Chelan County Agricultural Production, 1992 and 1997

(\$ in thousands)

Item	1992	1997	Percent Change
Market Value of Agricultural Products Sold			
Total Value of Agricultural Products Sold	\$ 152,015	\$ 146,403	-3.7%
Value of Crops including Nursery	\$ 151,111	\$ 145,675	-3.6%
Value of Livestock and Poultry	\$ 904	\$ 728	-19.5%
Top Five All Commodities – Value of Sales (\$ in thousands):			
Fruits, Nuts, Berries	\$ 150,704	\$ 144,846	-3.9%
Cattle and Calves	\$ 642	\$ 439	-31.6%
Nursery and Greenhouse Crops	\$ 185	\$ 423	128.6%
Hay, Silage, Field Seeds, Grass Seeds	\$ 86	\$ 195	126.7%
Wheat	N/A	N/A	
Top Five Commodities – Crop Area in Acres:			
Land in Orchards	28,949	29,249	1.0%
Land in Hay Crops	1,503	1,953	29.9%
Land in Wheat	1,010	1,864	84.6%
Land in Barley	N/A	N/A	
All Nursery Acres	N/A	56	
Total Cropland Acreage	40,567	41,046	1.2%
Cropland Harvested (Acres)	31,240	33,167	6.2%
Irrigated Acreage	30,008	30,562	1.8%

Source: U.S. Bureau of the Census, 1992 and 1997 Census of Agriculture; Washington Agricultural Statistics Service, *Washington Agricultural County Data*.

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Table 3-13: Douglas County Agricultural Production, 1992 and 1997

(\$ in thousands)

Item	1992	1997	Percent Change
Market Value of Agricultural Products Sold			
Total Value of Agricultural Products Sold	\$ 109,236	\$ 117,623	7.7%
Value of Crops including Nursery	\$ 104,662	\$ 112,350	7.3%
Value of Livestock and Poultry	\$ 4,574	\$ 5,274	15.3%
Top Five All Commodities – Value of Sales (\$ in thousands):			
Fruits, Nuts, Berries	\$ 81,762	\$ 84,406	3.2%
Cattle and Calves	\$ 4,225	\$ 4,959	17.4%
Nursery and Greenhouse Crops	N/A	\$ 151	
Hay, Silage, Field Seeds, Grass Seeds	\$ 333	\$ 265	-20.4%
Wheat	19,182	27,105	41.3%
Top Five Commodities – Crop Area in Acres:			
Land in Orchards	17,307	17,910	3.5%
Land in Hay Crops	7,530	10,685	41.9%
Land in Wheat	192,782	200,291	3.9%
Land in Barley	3,726	2,751	-26.2%
All Nursery Acres	N/A	N/A	
Total Cropland Acreage	535,492	532,757	-0.5%
Cropland Harvested (Acres)	217,293	225,102	3.6%
Irrigated Acreage	20,062	21,199	5.7%

Source: U.S. Bureau of the Census, 1992 and 1997 Census of Agriculture; Washington Agricultural Statistics Service, *Washington Agricultural County Data*.

Table 3-14: Washington State Apple Production by County

Category/Year	Chelan County	Douglas County County	Grant County	Okanogan County	Yakima County	Total
Number of Farms						
1992	826	411	243	631	1,454	4,596
1997	690	353	318	503	1,334	4,207
Percent Change	-16.5%	-14.1%	30.9%	-20.3%	-8.3%	-8.5%
Total Acres						
1992	17,825	14,126	24,154	25,395	61,910	169,107
1997	17,096	14,383	33,615	24,164	75,264	204,674
Percent Change	-4.1%	1.8%	39.2%	-4.8%	21.6%	21.0%
Average Acres per Farm						
1992	22	34	99	40	43	37
1997	25	41	106	48	56	49
Percent Change	13.6%	20.6%	7.1%	20.0%	30.2%	32.4%
Pounds (million)						
1992	N/A	N/A	N/A	N/A	N/A	N/A
1997	368	306	995	503	1,854	4,891
Percent Change	N/A	N/A	N/A	N/A	N/A	N/A
Pounds/Acre						
1992	N/A	N/A	N/A	N/A	N/A	24,608
1997	21,502	21,247	29,594	20,816	24,628	23,895
Percent Change	N/A	N/A	N/A	N/A	N/A	-2.9%

Sources: U.S. Bureau of the Census, 1997 Census of Agriculture (data obtained from Lake Chelan Hydroelectric Project, Socio-economic Study, op. cit. January 27, 2000).

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Table 3-15: Tree Fruit Production in the Columbia River Corridor

Crop/County	Acres	Packed Production	Processed Production	Packed Value	Processed Value	Total Value
Chelan County						
Apples	400	280,000 boxes	2,400 tons	\$3,080,000	\$288,000	\$3,368,000
Pears	100	60,000 boxes	100 tons	840,000	8,000	848,000
Cherries	200	1,200 tons	60 tons	2,052,000	80,000	2,152,000
Other Fruit	-	-	-	-	-	-
Total	900	8,340 tons	2,560 tons	\$5,972,000	\$376,000	\$6,368,000
Douglas Co.:						
Apples	8,000	5,600,000 boxes	48,000 tons	\$61,600,000	\$5,760,000	\$67,360,000
Pears	500	300,000 boxes	500 tons	4,200,000	40,000	4,240,000
Cherries	900	5,400 tons	270 tons	9,720,000	360,000	10,080,000
Other Fruit	300	1,500 tons	0	2,100,000	0	2,100,000
Total	9,700	123,900 tons	48,770 tons	\$77,620,000	\$6,160,000	\$83,780,000
Grand Total	10,600	132,240 tons	51,330	\$83,592,000	\$6,536,000	\$90,148,000

Table 3-16: Estimates of Output, Employment, Wages and Salaries from Tree Fruit Production in Columbia River Corridor Adjacent to Rocky Reach Dam in 1999

Economic Effects	Agricultural Fruits Sector	Canning & Preserving, Frozen Food, Dehydrated Food Sectors	Motor & Rail Transportation Sectors	Total
Output Delivered to	\$ 90,148,000	\$ 26,039,841	\$ 4,507,400	\$ 120,695,241
Direct Employment	899	164	49	1,112
Direct Earnings	\$ 13,987,499	\$ 2,672,551	\$ 1,240,304	\$ 17,900,354
Average Earnings	\$ 15,556	\$ 16,305	\$ 25,475	\$ 16,101
Total Industrial Output	\$ 157,641,808	\$ 38,890,972	\$ 6,882,620	\$ 166,292,089
Total Employment	2,119	355	77	2,550
Total Earnings	\$ 40,377,964	\$ 5,708,593	\$ 1,855,899	\$ 47,942,456
Average Earnings	\$ 19,055	\$ 16,121	\$ 24,154	\$ 18,803

3.3.2 Basic Metals Manufacturing

Chelan County was shown in Table 3-9 to have total covered manufacturing employment amounting to 2,622 jobs in 1998; the figure for Douglas County was 202 jobs. Of particular interest for this analysis is the status of primary metals manufacturing, namely, the manufacture of aluminum ingots and related production at the Alcoa Wenatchee Works located in unincorporated Malaga, Chelan County. The principal reason for this interest is because the plant (through a subsidiary utility operation) obtains electricity directly from Chelan County PUD to operate the facility. Because of disclosure restrictions due to confidentiality, Washington State Employment Security Department does not provide details on primary metals manufacturing in Chelan County. Nonetheless, published information is available on production, employment, wages and salaries, as well as other aspects of the manufacturing process at the Alcoa aluminum smelting plant. In 1999 average annual employment at the Alcoa facility was estimated at 575 workers, with total estimated labor costs of \$40.5 million including benefits. This translates to average labor costs of \$70,434 per annum. Excluding non-wage and salary benefits, average earnings amounted to about \$54,445 per annum. Total production value (based on relationships development from the IMPLAN model) was estimated at \$176.1 million in 1999.

The Alcoa plant has five pot lines, which comprise the primary factory infrastructure for the production of aluminum ingots. Three of the lines are currently in operation (lines one, two, and five); with a fourth line (number three) due to come on line in the summer of year 2000. The fifth line is not anticipated to be activated in the near future; nonetheless, full operation of the plant is subject to market conditions, which may continue to be quite positive and, to the need to operate the plant at full capacity within the next decade. Forecasts of future economic activity, however, can only be conjectured. Thus, none is presented in this study.

Alcoa purchases electricity through a wholly owned subsidiary (Colockum), a Washington state public utility, which acquires power from Chelan PUD and, in turn, sells it to Alcoa Wenatchee Works. Under the existing power sales contract with Chelan PUD, the company is entitled to 23 percent of the power generated at Rocky Reach Dam on a cost reimbursement basis. When power demands at the Alcoa facility are higher, the Chelan PUD sells it to the company at market rates. Public utility taxes are levied on power sales made by the utility at a rate of 3.873 percent of the sales price of power purchased from Chelan PUD. With total electricity purchases of \$32.4 million in 1998, the company paid approximately \$1.26 million in public utility excise taxes. Alcoa buys from Bonneville Power Administration only when at full capacity, i.e., all pot lines are in use. Such power sales from a federal entity are exempt from public utility taxes. In 1998 Alcoa Wenatchee Works electricity consumption amounted to 242 average MW. Total assessed valuations of the Alcoa Wenatchee Works in 1998 amounted to \$54.3 million.

Almost all materials inputs to the aluminum manufacturing process at the Alcoa Wenatchee Works are obtained from outside the two-county region. Alumina, the major raw materials input, which is mined in and ocean transported from Australia, is shipped by rail from the Port of Vancouver in Clark County directly to the plant at Malaga. Alcoa spends approximately \$10 million per annum on capital projects, mostly machinery and equipment.

Most of the production from Alcoa Wenatchee Works is exported from the two-county region; however, there are forward linkages to other manufacturing industries in the area that utilize the output from the aluminum smelting facility as input to other goods manufacturing or as intermediate products for resale to the Alcoa system. Of course there are forward linkages to the motor and rail transportation sector, which have been estimated at 5 percent of output from the plant. In addition, there are backward linkages (considered indirect industrial activity) associated with primary aluminum manufacturing and motor and rail transportation, such as business services, banking, wholesale trade, electrical utility, and rail and truck transportation, etc., as there are direct purchases by Alcoa as well as by the heavy transportation sectors for such goods and services. These indirect effects, along with induced economic impacts associated with household spending by direct and indirect workers, can be estimated using impact multipliers. Table 3-17 presents the details associated with direct and indirect/induced effects on the two-county study area economy associated with primary aluminum production. Total real gross output delivered to final demand associated with primary metals (aluminum) production was estimated at \$176.1 million in 1999, as shown in Table 3-17. Direct employment was estimated at 611 workers with earnings of \$33.0 millions for an average of \$54,045 per worker in 1999. Total employment was estimated at 1,366 workers. Total output and earnings were estimated at \$254.9 million and \$54.0 million, respectively, in 1999 dollars. The overall average annual individual earnings were estimated at \$39,525.

*Socioeconomic Study***Table 3-17: Estimates of Gross Output, Employment, Wages and Salaries from Primary Aluminum Production and the Study Area in 1999**

Economic Effects	Primary Aluminum Manufacturing Sector	Motor and Rail Transportation Sectors	Total
Estimated Output Delivered to Final Demand	\$171,620,863	\$4,507,400	\$176,128,263
Direct Employment	575	36	611
Direct Earnings	\$31,306,500	\$1,401,698	\$32,708,198
Average Earnings	\$54,445	\$47,628	\$53,533
Total Industrial Output	\$248,249,578	\$6,610,192	\$254,859,771
Total Employment	1,310	56	1,365
Total Earnings	\$51,517,976	\$1,999,138	\$53,517,114
Average Earnings	\$39,335	\$35,976	\$39,198

3.3.3 Public Utilities

Public utilities are included in the broad industrial sector titled transportation, communications, and public utilities. Total covered employment in 1998 for this sector was shown in Table 3-9 above at 1,037 workers and 289 workers in Chelan County and Douglas County, respectively. Again, the interest for this study is on public utilities employment generated by Rocky Reach Dam, which is owned and operated by Chelan County PUD. Employment associated with the Project in 1999 was estimated at 202 workers with total earnings, including fringe benefits, of \$14.3 million for average labor costs of \$70,792.¹⁹ Excluding nonwage benefits, average annual individual earnings are estimated at \$53,144.²⁰ Under existing power contracts with other utilities and end users, total electricity generated by the Project in 1999 amounted to 7,364,657 MWh's. This generation was divided between the following power purchasers: Colockum (utility that serves Alcoa) of 23.0 percent; Public Utility District No. 1 of Chelan County of 15.13 percent and Public District No. 1 of Douglas County of 2.77 percent for sales to the local grid; and, exports of 59.1 percent (Puget Sound Energy – 38.9 percent; Portland General Electric Company – 12.0 percent; PacifiCorp – 5.3 percent; and Avista Corp – 2.9 percent). Because electrical generation from the dam is provided to the various purchasers on a cost replacement basis independent of market prices under the purchase agreements negotiated among the various purchasers and Chelan County PUD No. 1, corresponding measures of power sales are not available. Thus, for regional economic analysis the focus is on employment and earnings only.

The component of power purchases and associated PUD-related direct power plant operations employment and earnings by Alcoa were netted out of direct employment and earnings associated with Project operations, although they were considered basic industrial activity, as presented in the previous section. In addition, a major share of power generated by the Project for the local grid represents nonbasic industrial activity to the region (only purchases of power by exporting industries, estimated at 30 percent of total local power purchases, would comprise inputs of basic or export-oriented industrial activity. As such, the nonbasic component was netted out of total power purchases for purposes of estimating the economic activity in the two-county study area generated by the Project.²¹ However, it is necessary to consider the forward linkages of local sales to export-oriented industries, i.e., 5.4 percent of total power purchases from the project, through the local electrical services sector.

Table 3-18 presents the details associated with net direct and indirect/induced effects on the two-county study area economy associated with electric power production at Rocky Reach Dam. Total direct employment and earnings associated with such production (after netting out the effects of power purchases by Alcoa and nonbasic activity associated with local sales) was calculated at 130 workers and \$6.9 million in 1999, for an average of \$53,144 per worker, as shown in Table 3-18. Direct employment in the electric services sector was estimated at 11.2

¹⁹ The earnings figures include \$0.8 million for temporary contract labor for turbine and other electrical generating equipment rehabilitation and \$1.9 million for fish enhancement.

²⁰ Based on average district-wide wages of \$25.55 per hour.

²¹ It is assumed that the level of employment at Chelan PUD would be unaffected by marginal power sales for local non-basic industry and household uses.

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workers with earnings of \$404.1 thousand for an average of \$36,077 per worker in 1999. Total overall employment (associated with direct, indirect and induced activity for both sectors) was estimated at 307.1 workers. The corresponding earnings were estimated at \$11.4 million in 1999 dollars. The overall average annual earnings were estimated at \$37,253.

Table 3-18: Estimates of Employment, Wages and Salaries from Electric Power Production at Rocky Reach Dam in the Study Area (1999)

Economic Effects	State and Local Utility Sector	Electric Services Sector	Total
Direct Employment	130	11.2	141.2
Direct Earnings	\$6,908,720	\$404,066	\$7,312,786
Average Earnings	\$53,144	\$36,077	\$51,790
Total Employment	288.3	18.8	307.1
Total Earnings	\$10,870,180	\$570,218	\$11,440,398
Average Earnings	\$37,704	\$30,330	\$37,253

3.3.4 Recreation/Tourism

The visitor industry includes private businesses serving both residents and nonresidents of the two-county study area and both tourists (vacation/pleasure visitors) and business or family visitors. The focus of the economic analysis is on tourism and recreation-related activity of nonresident visitors. This segment of tourism/recreation use contributes to basic industry activity or the addition of “new money” to the local economy. Leisure recreation activities by residents are also considered in terms of levels of activity or use of facilities established as a result of developing and operating the Rocky Reach Dam.

3.3.4.1 Chelan and Douglas Counties Tourism Markets

Information provided by Washington State Division of Tourism indicates that Chelan County accounted for an estimated 3,790 tourism-related jobs with a payroll of \$43.6 million in 1998. These jobs and related earnings are associated with \$229.6 in expenditures by tourism-related visitors. The tourism-related job count represented about 10.5 percent of total covered employment in the county for that year. Douglas County accounted for an estimated 21.3 million in tourism-related expenditures, 370 jobs, with 4.2 million in earnings in 1998.²² The tourism-related job count for Douglas County amounted to about 4.2 percent of total covered employment in that year.

Table 3-19 presents comparative data on tourism-related expenditures by category for the two counties and the State of Washington between the four-year period 1993 and 1998. Travel expenditures (in nominal dollars) increased at an average annual rate of growth of 5.6 percent in Chelan County and 2.7 percent in Douglas County, compared to 6.9 percent for the state of Washington between 1993 and 1998. The relative shares of expenditures by category are shown to have remained about the same in all categories except retail trade, which increased by one full percentage point, in Chelan County compared to the state over the five-year period. The pattern indicated for Douglas County suggests a broadly based decline in the relative expenditure shares compared to the state.

²² Washington State Community, Trade Economic Development, Washington State 1991 – 1999p Travel Impacts and Visitor Volume, prepared by Dean Runyan and Associates, January 2000.

Table 3-19: Visitor Expenditures by Category in Chelan and Douglas Counties and the State of Washington 1993 & 1998 (Current Dollars)

<i>Category</i>	<i>1993</i>	<i>1998</i>	<i>Percent Change (AARG)</i>	<i>Percent of State in 1993</i>	<i>Percent of State in 1998</i>
Chelan County (\$ 10⁶)					
Accommodations	\$33	\$46	8.4%	3.5%	3.3%
Eating & Drinking	\$43	\$58	7.5%	2.7%	2.6%
Food Stores	\$13	\$16	6.2%	2.7%	2.6%
Ground Transportation	\$19	\$22	3.7%	2.6%	2.5%
Recreation	\$21	\$29	7.4%	3.0%	4.0%
Retail Sales	\$30	\$40	7.1%	2.2%	2.2%
Air Transportation	\$1	\$1	5.7%	0.1%	0.1%
Total	\$161	\$212	5.6%	2.2%	2.2%
Douglas County (\$ 10⁶)					
Accommodations	\$2	\$2	-1.2%	0.2%	0.1%
Eating & Drinking	\$6	\$7	4.0%	0.4%	0.3%
Food Stores	\$2	\$2	3.9%	0.4%	0.3%
Ground Transportation	\$3	\$3	0.0%	0.3%	0.3%
Recreation	\$3	\$3	3.4%	0.4%	0.3%
Retail Sales	\$4	\$5	3.6%	0.3%	0.3%
Air Transportation	\$0	\$0	0.0%	-	-
Total	\$19	\$21	2.7%	0.3%	0.2%
Washington State (\$ 10⁶)					
Accommodations	\$942	\$1,376	9.9%	-	-
Eating & Drinking	\$1,610	\$2,183	7.9%	-	-
Food Stores	\$475	\$621	6.9%	-	-
Ground Transportation	\$726	\$870	4.6%	-	-
Recreation	\$712	\$956	7.7%	-	-
Retail Sales	\$1,352	\$1,813	7.6%	-	-
Air Transportation	\$1,541	\$1,800	4.0%	-	-
Total	\$7,358	\$9,619	6.9%	-	-

Source: Washington State Community Trade and Economic Development, Washington State 1991 – 1999p Travel Impacts and Visitor Volume, prepared by Dean Runyan & Associates, January 2000.

3.3.4.2 Recreation/Tourism in the Columbia River Corridor Served by Rocky Reach Dam

3.3.4.2.1 Recreation Facilities

A major portion of recreation/tourism activity in the two-county study area takes place on or near the reservoir behind Rocky Reach Dam, which extends to the base of Wells Dam some 43 miles upriver from Rocky Reach.²³ Public recreational access to project lands and waters is widely available and dispersed. Since its construction, the Rocky Reach Dam has provided the region a variety of developed and dispersed recreation opportunities, including camping, picnicking, swimming, fishing, flat water boating, water skiing, personal watercraft (PWC) use, among other recreational activities.

The project area includes a total of seven primary recreation sites. (These sites were recently surveyed as part of Rocky Reach Dam relicensing data collection and analysis activities, which is summarized below.²⁴) Six of the sites are located upstream from the dam on the reservoir; one, the information and interpretive centers and fish viewing area, is located at the dam site. The facilities and use areas at these recreation sites include:

- Rocky Reach Dam Visitor Information Center, fish viewing area, and Powerhouse Interpretative Area
- Lincoln Rock State Park
- Entiat Park
- Chelan Falls Park
- Beebe Bridge Park
- Daroga State Park
- Orondo River Park

Other recreation facilities as well as game ranges and wildlife recreation areas exist in close proximity to the above sites. These include:

- Washington State Department of Transportation (WSDOT) viewpoint, located westside of the reservoir on SR 97A and rest area, located east side of the reservoir on SR 97.
- Wenatchee Boat Club private boat launch and dock, located on the west side of the reservoir on US 97A.
- Sun Cove, formerly Lake Entiat Estates private recreation area, located east side of the reservoir on SR 97.

²³ In 1974 the Chelan Public Utility District submitted a detailed recreation plan as part of responding to a Federal Power Commission requirement that Exhibit R be filed by the district as a condition of approval of Amendment No. 5 to the district's license to operate the dam. In 1991 the PUD submitted a report titled *Report on the Status of the Rocky Reach Exhibit R Recreation Plan & Request for Revisions of the Recreation Plan*, which presents the latest information on recreation plans for Rocky Reach. Descriptions of recreation facilities contained in this section are largely based on the 1974 plan as updated in the 1991 report.

²⁴ Rocky Reach Recreation Study, Summary of Peak-Season 1999 Monitoring (draft report), April 2000.

- Swakane game range and wildlife recreation area, located on the west side of the reservoir.
- Blue Grade dove and upland game bird shooting area, located east side of the reservoir.
- Entiat game range and wildlife recreation area, located on the west side of the reservoir)
- Chelan Butte game range and wildlife recreation area, located on the west side of the reservoir.
- Green-Wooten public shooting area, located on the west side of the reservoir.
- Boyd District dove and upland game bird shooting area, located on the west side of the reservoir.

USFS and BLM lands used for recreation in the immediate vicinity of the reservoir are identified in the document *Existing Information Analysis for Rocky Reach Hydroelectric Project No. 2145*, Wenatchee National Forest, August 1999.

Several recreation sites, in addition to those listed above, were planned for development, as proposed in the original Exhibit R (op. cit., 1974), of which one, Lincoln Rock State Park, has been developed. Some of the sites were deleted or plans were changed to provide for other uses. These include:

- Eastbank concessions, day use, camping, boat launch, and boat dock, located east side of the reservoir just upstream from Rocky Reach Dam (developed with substantially expanded facilities as Lincoln Rock State Park).
- Turtle Rock day use area, camping area, swimming area, and boat dock, located on an island in mid-river 1.5 miles upstream from Rocky Reach Dam (deleted in 1986 Exhibit R revision, because of anticipated conflicts between recreationalists and fish hatchery and wildlife management operations; however, may be developed in future as a limited day use facility).
- Weed-Hart Site swimming area, day use area, and boat dock, located on the west side of the reservoir on SR 97A (FERC approval in 1993 of requested deletion from Exhibit R plan).
- North Bank of Entiat River at the confluence area of the Entiat and Columbia Rivers fishing area/local parks, located on the west side of the reservoir²⁵ (FERC approval in 1993 of requested deletion of plans for facilities and removal from within the Entiat recreation site boundary; the area would remain within the Project boundary and available for wildlife habitat management and passive public use).
- Azwell boat launch and boat dock, located west side of the reservoir on the fore-bay of Wells Dam (FERC approval in 1993 of requested deletion from Exhibit R plan).

²⁵ There is no mention of this area being developed in the Master Plan, Entiat Park, prepared by DOH Associates on behalf of Public Utility District No. 1 of Chelan County in Cooperation with the City of Entiat, December 1992; although, a trail extension was envisioned that would include a trail head just beyond the south end turnaround of Entiat Park and pass under US 97A to access other public lands along the Entiat River to the west.

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Facilities and use areas at the seven project area recreation sites located on the Project reservoir are discussed sequentially. As noted these sites were surveyed in summer 1999 to determine peak season use levels, activities, visitor satisfaction, visitor demographics, and expenditure levels. The results of the survey are summarized below. A location map of recreation facilities is provided in the Introduction (Figure 2-1).

3.3.4.2.1.1 Rocky Reach Dam Recreation Facilities and Visitor Center

This 38-acre site is located at Rocky Reach Dam on the southwest shoreline. The site is owned and operated by Chelan PUD. The dam was dedicated in public ceremonies on June 20, 1963. That year the four-story Public Information and Tour Center opened and nearly 200,000 people visited the landscaped grounds, fish viewing rooms Interpretive History Gallery, and information center (in 1999 the total visitor count was 289,827). Recreation facilities include two picnic shelters, picnic tables, formal gardens, playground equipment, and interpretive displays. The park continues to be a popular stopping point for the traveling public and area residents.

There is a primitive boat launch located approximately one-half mile downstream of the dam on the west bank and a primitive fisherman's access located approximately one-quarter mile downstream on the east bank of the river. Washington State Department of Fish and Wildlife's (WSDOF&W) Swakane Game Range and Wildlife Recreation Area is located two and one-half miles northwest of the site.

There is an existing viewpoint (Lincoln Rock Viewpoint owned by WSDOT) north of the dam on the west side of SR 97A. Views of the dam and Turtle Rock are excellent from this point.

3.3.4.2.1.2 Lincoln Rock State Park

This 60-acre facility is located just north of Rocky Reach Dam on the east bank of the river. The site is owned by Chelan PUD and maintained and operated by the Washington State Parks and Recreation Commission (WSP&RC) under a cooperative agreement. Lincoln Rock State Park opened in 1981. Expansion of the park began in 1986 and a dedication ceremony was held on September 16, 1987. The park expansion increased the developed area from 17 acres to its present size. Two new camp loops and 67 campsites were added, increasing the total number of sites to 94.

Shoreline access to the southern part of the site is restricted due to the proximity of the dam. Most of the northern portion of the site is relatively undeveloped, except for a trail system that links to the central part of the site, where most of the facilities are located. The facilities in the central portion include an overnight RV/camping area (94 units), with a restroom facility and a generous day-use and picnic area (74 units) from which there are views to Turtle Rock and Lincoln Rock. There is also a concession area, with gas sales for boats, boat rentals, groceries, restrooms, and a sanitary dump station. A large boat dock and boat launch facility, with related parking, is located nearby. A trail paralleling the shoreline extends south toward Rocky Reach Dam.

Views upriver towards Turtle Rock are outstanding from this area. The WSDF&W's Blue Grade Dove and Upland Game Bird Shooting Area is located about five miles southeast of this site.

Bonneville Power Administration's Sickler Substation is located adjacent to the central portion of this site.

3.3.4.2.1.3 Entiat Park

Entiat Park is located on the west side of the Columbia River within the city of Entiat. It lies just upstream of the confluence of the Entiat and Columbia Rivers. Entiat Park is owned by Chelan PUD, but operated and maintained by the city of Entiat under a cooperative agreement. Entiat Park was the first park developed after FERC approval of the 1974 recreation plan. The redevelopment and expansion of the park was completed in 1978, joining together two existing community parks: Silico Saska (the main city park prior to establishment of the dam) and Will Risk Memorial Park. Park development provided for the improvement and expansion of recreational facilities along approximately 4,000 feet of shoreline and included a day use picnic area, restroom facilities, parking lot area, boat launch and boat handling facilities along with overnight camping. The park serves an important role as a focal point for many community activities. A museum has been established in the north end of the park giving the community a place to display and reflect their heritage.

The northern portion of the park is the most extensively developed, consisting of a tent camping area (50 units); RV parking stations (31 units); picnic shelter including restrooms and showers; large open area for day use, picnicking, and recreation; boat mooring and launch facilities; swimming beach; parking areas; as well as an office building and museum. The southern portion of the park includes two major use areas: Silico Saska Park and the boat launch. Two buildings located at in this area include a pump house and a storage building, which includes bathrooms and an exterior shower. This area also consists of a camping area, day use area, with a picnic shelter, and parking areas.

The WSDF&W's Entiat Game Range and Wildlife Recreation Area is located on the uplands west of the city of Entiat near the park facility.

3.3.4.2.1.4 Orondo Park

This 5-acre site lies just south of and across the Columbia River from the City of Entiat. The park is maintained and operated by the Port of Douglas County under a cooperative agreement with Chelan PUD. The park was originally developed by the Port District in 1974, but was expanded by Chelan PUD as part of recreation plan "Exhibit R" for the Rocky Reach Hydroelectric Project. Completion of the expanded park occurred in the summer of 1980. The site consists of a swimming area inside a log boom; a boat dock; a restroom/bathhouse; a picnic area (8 units); 14 designated RV/tent sites; and, a grassy area that can accommodate 10 – 15 tent units. There is a man-made spit, which serves to shelter the boating and swimming areas from the river current.

3.3.4.2.1.5 Daroga State Park.

This 140-acre site is located on the east shore of the reservoir, seven miles north of the Orondo community. The park is owned by Chelan PUD, but maintained and operated by WSP&RC under a cooperative agreement. A private owner originally developed the site when the Rocky Reach Dam reservoir was created. Expansion and development of the park was undertaken by

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Chelan PUD in the late 1980s and completed in April 1990, when it was opened to the public. Dedication ceremonies were held September 20, 1990. Recreation facilities offered at the park consist of a camp loop with 28 camping units, 17 hike-in or boat-in camp units, and two large group camp area with capacity for up to 100 people (or 50 camping units) for a total of 95 camping units to accommodate the public. An additional group camp facility completed in 1994 has added capacity for up to 100 people (or 50 camping units). The site has numerous water-oriented recreation facilities including a boat launch; two boat docks; water ski float; a lagoon and spit areas for swimming and small boat use; wind-surfing beach area; extensive day use and picnic facilities (122 units); a dump-lift station for recreational vehicles and boats; parking facilities; site utilities (including domestic and irrigation water systems, power, and sewage facilities); and, an administrative center and entrance control station.

3.3.4.2.1.6 Chelan Falls Park

This 53-acre site lies at the confluence of the Chelan and Columbia Rivers on the west shore of the Columbia River. The site, which is owned and operated by the Chelan PUD, is divided into two parts by an existing railroad that parallels the Columbia. The park was constructed by Chelan PUD, as part of "Exhibit R" recreation plan for the Rocky Reach Hydroelectric Project. Construction of the park was completed in 1993 and opened to the public in early June of that year. The southern portion lies along the Columbia River at the base of the Chelan Falls town site. The northern portion of the site lies on the southern shore of Chelan River near the base of the Chelan Falls powerhouse. This is considered a desirable area for swimming. Recreation facilities include a two-lane boat launch, two boat tie-up docks, two swim beaches, picnic tables, and two picnic shelters, restrooms with showers, playground equipment, and athletic fields and courts.

WDFW's Chelan Butte Game Range and Wildlife Recreation Area is located downriver to the west of the site; the Department's Green-Wooten (Galaher Flat) Public Shooting Area is located upriver on the west bank. The Department's Boyd District Dove and Upland Game Bird Shooting Area, also, are located nearby (west of the city of Chelan).

Improvements on the site include a boat ramp, boat dock, an extensive day-use picnicking area (70 units), with restrooms, and a trail, which connects this part with the northern part of the park. At the Chelan River portion of the site, a picnicking and swimming area, with a bath-house, and boat dock is provided. Both areas are extensively landscaped.

3.3.4.2.1.7 Beebe Bridge Park

This 56-acre site is directly opposite and slightly north of the Chelan Falls Park site. The park is owned and operated by Chelan PUD. It lies between the Columbia River and SR 97, just south of the point where the highway crosses the river. The park was constructed by Chelan PUD, as part of "Exhibit R" recreation plan for the Rocky Reach Hydroelectric Project. Construction of the park was completed in 1993 and opened to the public in July of that year. The site consists of overnight camping (54 units), with restrooms and guest parking; day use and picnic facilities (51 units) located around a swimming area in the central portion of the site, with a boat ramp and boat dock located just to the south. A trail system connects the various parts of the site. A recent (1994) 11-acre expansion increased the total number of campsites from 27 to 54 units.

3.3.4.2.2 Recreation Facility Usage

As shown in Table 3-20, demand for recreation resources and activities provided in the project area has grown substantially over the years. The visitor counts provided in the table are for the period 1978 – 1999. Like many other recreation facilities in the Pacific Northwest, recreation use is typically high during the summer peak season and is much lower during the remainder of the year (peak season activity is discussed in the next section). The visitor counts indicated in the table are based on vehicles crossing automatic recording devices, with the results factored up by 2.5 to reflect average vehicle occupancy. The visitation counts reflect visitor arrivals at individual sites; it is possible that some visitors utilize recreation resources at multiple sites during each day of their visitor stays. The overall visitor counts to Project facilities increased from 125,605 in 1978 to 1,006,153 in 1999 for an annual average rate of growth (AARG) of 10.4 percent. The AARG for the most recent five years – 1994 to 1999 – was 2.5 percent. Rocky Reach Dam and Lincoln Rock State Park received the greatest number of visitors at 289,827 people and 232,181 people, respectively, followed by Daroga Park at 164,611 people, in 1999. Chelan Falls Park and Beebe Bridge Park had roughly similar numbers of visitors at 94,520 people and 97,346 people, respectively, also in 1999. Entiat Park experienced 84,390 person visits and Orondo Park had 43,278 person visits during the year. The growth rates for the most recent five-year period – 1994 to 1999 – suggest that visitor growth at Beebe Bridge Park, Chelan Falls Park, Rocky Reach Dam, and Doroga Park continue at high rates. Entiat Park and Orondo Park have stabilized more or less; and, in the case of the latter have declined in terms of visitor counts in recent years.

Table 3-21 presents overnight visitor counts for the sites with RV/camping facilities, namely, Lincoln Rock State Park, Daroga State Park, and Beebe Bridge Park for which data from Chelan PUD are available. The figures for these parks reflect the maximum number of overnight stays during any year for the period data were available (1995 through 1998). Estimates of overnight stays for Entiat Park and Orondo Park are also presented, based on average utilization rates indicated for Daroga State Park and Beebe Bridge Park (which are similar to the Entiat and Oronda parks in terms of overnight visitor capacity and total visitor counts and for which actual counts are available) and RV/camping unit capacity. The difference between total visitors (indicated in Table 3-20) and overnight visitors equals day visitors (not shown). As shown in the table, total overnight visitors are estimated at 98,973 persons or about 9.8 percent of total visitors counted in 1999.

3.3.4.2.3 Peak Season Activity in 1999

Peak-season recreation monitoring was conducted by staff of Chelan PUD from May 30 through September 9, 1999. Public recreation sites monitored included Rocky Reach Dam, Lincoln Rock State Park, Entiat Park, Chelan Falls Park, Beebe Bridge Park, Daroga State Park, and Orondo River Park.

Monitoring efforts at the seven recreation sites included car runs and on-site surveys. A total of 16 car runs were conducted during the peak-season. This included driving to each of the seven recreation sites and recording the number of people at the site and the activities they were engaged in. License plate numbers of vehicles at the sites were also recorded in order to

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determine where visitors were from, and vehicles with trailers were recorded to estimate boat ramp use.

On-site surveys were conducted during eight survey days at each of the seven recreation sites in the Rocky Reach Project area. During on-site surveys, interviewers asked visitors questions including where they were from, how long they were staying, what activities they are participating in during their visit and questions related to their likes, dislikes and attitudes regarding their recreation experience during their visit. Additionally, interviewers documented the number of day users, campsites in use, and the number of empty vehicles with trailers at the sites in order to estimate visitor use during survey days.

3.3.4.2.3.1 Distribution of Use

During car runs, instantaneous counts of people were made at each of the seven recreation sites. Figure 3-8 shows the average number of visitors observed during the peak-season weekday and weekend car runs. It also shows the maximum number of people observed during a single observation. As shown in the figure, the greatest number of people observed during the weekend car runs, on average, were at Lincoln Rock State Park and Entiat Park. During weekday car runs, more people were observed at Lincoln Rock State Park and Beebe Bridge Park. The greatest number of people observed during a single car run was at Entiat Park with 341 people observed at the park at one time. Rocky Reach Dam came in second with 338 people observed at one time, and Lincoln Park came in third with 321 people observed at the park at one time.

Among the seven public recreation sites that were monitored, five of these have camping facilities. These sites include Beebe Bridge Park with 46 RV/tent sites, Daroga State Park with 28 tent/RV sites and 17 walk-in or boat-in sites, and Orondo River Park with 14 designated RV/tent sites and a large grassy area that can accommodate 10 to 15 tents. The largest of the five camping sites are Entiat Park with 50 tent sites and 31 RV sites, and Lincoln Rock State Park with 94 tent/RV sites.

During eight peak-season weekend car runs, campgrounds at Beebe Bridge Park, Daroga State Park and Lincoln Rock State Park were full approximately 40 percent of the time. Orondo River Park was full approximately 25 percent of the time and Entiat Park was full approximately 15 percent of the time (Figure 3-8).

During eight peak-season weekday car runs, Beebe Bridge Park, Daroga State Park and Orondo River Park were full approximately 15 percent of the time (Figure 3-8).

3.3.4.2.3.2 Visitor Demographics

On-site surveys during the peak-season showed the majority of visitors to Rocky Reach area recreation sites coming from the Seattle metropolitan area (61 percent). The Seattle metropolitan area includes King, Snohomish, Kitsap, Pierce, and Thurston counties. Approximately 16 percent of survey respondents were from Chelan County and around 5 percent were from Douglas County. Approximately 17 percent of visitors were from other Washington counties including Skagit, Grant, Kittitas, Okanogan, Yakima, Island, Spokane, Whatcom, Grays Harbor and Franklin counties. Few visitors were from other states or from Canada (Figure 3-9).

3.3.4.2.4 Regional Economic Impacts.

Regional economic impact analysis was undertaken by evaluating the spending patterns of visitors in 1999 with respect to the Chelan PUD recreation sites within the Rocky Reach Project boundary. Tourism-related visitor expenditures (of nonresident visitors) were allocated among industrial sectors pertaining to the input-output accounting framework of IMPLAN (1991-F Version), an economic impact model developed by the U.S. Forest Service. Expenditures by nonresidents on lodging, eating and drinking, gasoline and other auto expenses, and other goods and services are considered to be “new money” and, thus, contribute to basic or export-oriented industrial activity. It is assumed, that project-related recreation expenditures made by residents are nonbasic in that they represent re-spending of incomes by households generated by other basic industries (e.g., farming and food processing) in the two-county area. This is a conservative assumption, resulting in potentially understated estimates of economic activity.²⁶ As discussed above, input-output multipliers from IMPLAN can be used to estimate the impact of direct expenditures on additional indirect activity due to spending on intermediate goods and services, as well as induced activity due to respending of earnings by direct recipients (businesses and households) engaged in the visitor/tourism industries. Regional economic activity is thus estimated in terms of total employment, earnings, and output. The study area for the IMPLAN model, as in the case of the analyses of other industry sectors evaluated as part of this study, consists of Chelan and Douglas counties.

Details of the regional economic analysis of visitor spending and related economic activity under baseline conditions (year 1999) are presented in Table 3-22 and Table 3-23 (the former table breaks down total expenditures for day and overnight visitors into the various margins or components; the second presents direct and total output, earnings, and employment associated with project-related recreation activities). An analysis of baseline conditions with respect to visitor use provides a benchmark for evaluating regional economic activity associated with changes in the operation of the Rocky Reach Project, including any changes in dam operations affecting reservoir levels, particularly during peak recreation periods.

A total of 1,006,153 visitors were counted in 1999 at the seven recreation facilities associated with the Rocky Reach Project. Fifteen percent of the visitors counted were assumed to visit multiple sites or depart and return to a single site within given visitor stays. Thus, after considering likely duplication of visitor counts, net visitors to the seven recreation sites were estimated at 855,230 visitors. All overnight visitors are assumed to represent single (unduplicated) visitor counts. Seventy percent of net visitors to the Project recreation sites are assumed to be nonresidents, based on experience at Lake Chelan (*Final Study Report, 1998/1999 Recreational Use Assessment, Lake Chelan Hydroelectric Project, FERC No. 637*, prepared by Public Utility District No. 1 of Chelan County and Howe Consulting, Inc., which indicated that 79 percent of peak season visitation was attributable to nonresidents). Visitation activity was allocated over various support activities or components, as shown in the table. After accounting

²⁶ In the absence of project-related recreation opportunities, resident households may find substitutes either inside or outside the study region or, alternatively, they may substitute outdoor recreation expenditures for other goods or services. To the extent that “expenditure leakage” from the region is reduced because of recreation opportunities afforded by the Rocky Reach Project, this would potentially stimulate basic industrial activity, but the magnitude of such reductions in “expenditure leakage” is uncertain.

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for all visitor expenditures, using industry use factors and average expenditures per visitor, total expenditures in 1999 dollars were estimated at \$23.2 million, allocated 73% to overnight visitors and 27% to day visitors. The average expenditure per visitor was estimated at \$38.81.

Table 3-23 attributes the Rocky Reach project-related visitor expenditures of about \$23.2 million across industry sectors. The shares of visitor expenditures are shown from highest to lowest to be in eating and drinking places and hotels and other lodging, followed by general merchandise stores, amusement and recreation services, and automobile repair and services. Total direct employment of 773 workers is associated with \$9.3 million in direct earnings, with average annual earnings (in 1999 dollars) for workers in the sectors presented of \$12,016.

The table also presents total impacts under baseline conditions in terms of employment, earnings, and output generated from final demand changes for each of the industry sectors. Total employment of 1,108 workers is associated with total earnings of \$15.3 million and total output of \$42.9 million.

Table 3-20: Rocky Reach Project Recreation Visitors

Year	Rocky Reach Dam	Lincoln Rock State Park	Entiat Park	Orondo Park	Daroga State Park	Chelan Falls Park	Beebe Bridge Park	Total
1978	125,605	-	-	-	-	-	-	125,605
1979	111,801	-	-	-	-	-	-	111,801
1980	106,051	-	-	-	-	-	-	106,051
1981	114,028	22,682	-	-	-	-	-	136,710
1982	110,891	153,709	-	-	-	-	-	264,600
1983	107,466	150,062	-	-	-	-	-	257,528
1984	107,060	133,897	-	30,807	-	-	-	271,764
1985	92,052	184,571	97,133	30,763	-	-	-	404,519
1986	118,309	212,292	70,600	48,920	-	-	-	450,121
1987	113,330	236,913	80,150	53,000	-	-	-	483,393
1988	106,026	306,539	77,000	39,500	-	-	-	529,065
1989	106,364	420,826	77,000	40,672	-	-	-	575,562
1990	100,000	415,000	72,000	37,000	130,000	-	-	754,000
1991	179,367	365,126	74,284	36,398	119,411	-	-	774,586
1992	177,529	333,283	110,296	54,762	124,300	-	-	800,170
1993	192,898	299,192	83,764	58,623	116,891	22,058	35,722	809,148
1994	187,663	226,044	186,942	70,622	120,658	48,668	44,891	885,488
1995	208,535	291,331	60,847	40,131	139,585	60,232	83,138	883,799
1996	199,991	271,790	56,703	47,393	144,270	70,493	97,346	887,986
1997	214,963	272,817	47,411	35,644	144,283	114,800	92,113	922,031
1998	276,488	256,508	150,278	36,824	137,360	127,073	109,923	1,094,459
1999	289,827	232,181	84,390	43,278	164,611	94,520	97,346	1,006,153
AARG a								
Operating Life	4.1%	13.8%	-1.0%	2.3%	4.0%	27.0%	18.2%	10.4%
1994-99	9.1%	0.6%	N/A	-9.3%	6.4%	14.2%	16.7%	2.5%

a AARG refers to average annual rate of growth.

Source: Public Utility District No. 1 of Chelan County, Parks & Recreation.

*Socioeconomic Study***Table 3-21: Rocky Reach Project Overnight Recreation Visitors**

Recreation Facility	Overnight Visitors	RV/Camping Units	Full Capacity Equivalent Days^a	Overnight as Percent of Total Visitors in 1999
Rocky Reach Dam	0	-	-	0.0%
Lincoln State Park	41,170	94	73	17.7%
Entiat Park	19,440 est.	81	40 est.	23.0%
Orondo Park	6,480 est.	27	40 est.	15.0%
Daroga State Park	20,446	78	44	12.4%
Chelan Falls Park	0	-	-	-
Beebe Bridge Park	11,437	54	35	11.7%
Total	98,973	334	-	9.8%

^a Assumes 6 visitors per RV/camping unit. For Daroga State Park, group camping capacity of 33 6-person units is assumed.

Table 3-22: Rocky Reach Project - Visitor Expenditures

(in 1999 Dollars)	Facilities Visitation	Day Visitors	Overnight Visitors	Overnight Visitors	TOTAL EXPENDITURES
TOTAL VISITORS	1,006,153			98,603	
NET VISITORS a	855,230	-	-	98,603	
Tourism-Related Visitors (Nonresident) b c	598,661	329,264	269,397	93,673	
Tourists - Private Automobile d	448,996	60%	40%	70,255	
Tourists - RV e	149,665	40%	60%	23,418	
SUPPORT ACTIVITIES f		<u>Expenditures</u>	<u>Expenditures</u>		
Lodging:					
Hotels/Motels					
Overnight Stays	109,344				
Room Nights	43,737				
Rate g			\$50.00		
Expenditure			\$4,373,747		\$4,373,747
RV Campgrounds:					
Overnight Stays	89,799				
Fee h			\$20.00		
Expenditure			\$718,393		\$718,393
Tent Campgrounds:					
Overnight Stays	70,255				
Fee i			\$7.50		
Expenditure			\$421,528		\$421,528
Food & Drink:					
Person Days	598,661	329,264	269,397		
Per Diem		\$7.50	\$25.00		
Expenditures		\$1,975,581	\$5,387,949		\$7,363,531
Shopping (Retail):					
Person Days	598,661	329,264	269,397		
Per Diem		\$5.00	\$15.00		
Expenditure		\$1,317,054	\$3,232,770		\$4,549,824
Entertainment (Biking/Fishing/Swimming):					
Person Days	598,661	329,264	269,397		
Per Diem		\$5.00	\$10.00		
Expenditure		\$1,317,054	\$2,155,180		\$3,472,234
Other Recreation (Water Skiing/PWC)					
Person Days j	299,331	164,632	134,699		
Watercraft Launches k		32,926	26,940		
Per Diem		\$25.00	\$25.00		
Expenditure		\$411,579	\$336,747		
Automobile Expenses:					
Vehicle Miles l	21,551,797	14,439,704	7,112,093		
Cost/Mile		\$0.15	\$0.15		
Expenditure		\$1,082,978	\$533,407		\$1,616,385
RV Expenses:					
Vehicle Miles m	7,183,932	4,813,235	2,370,698		7,183,932
Cost/Mile		\$0.20	\$0.20		
Expenditure		\$481,323	\$237,070		\$718,393
TOTAL EXPENDITURES		\$6,173,991	\$17,060,044		\$23,234,035
Average Expenditure per Nonresident Visitor					\$38.81

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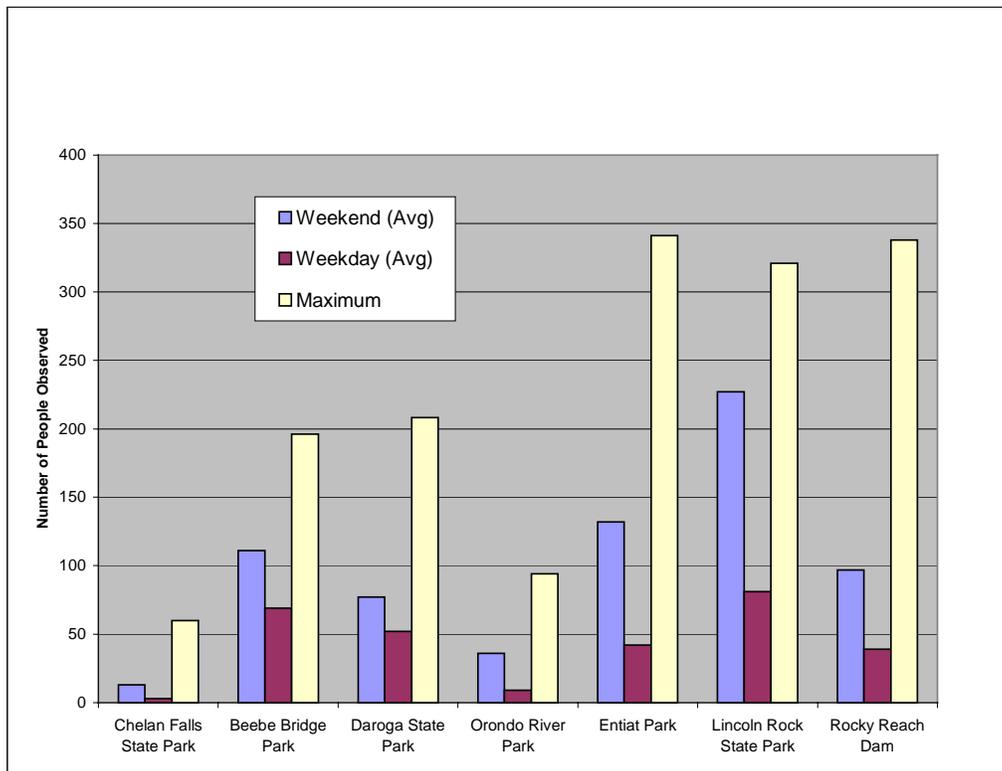
Table 3-22 (cont)
 Rocky Reach Project – Visitor Expenditures
 Footnotes

- a Eighty-five percent of total visitors are assumed to be one-time visitors; 15 percent are assumed to visit multiple sites or leave and return to a single site. Netting multiple visits removes the possibility of duplication in the visitor counts. Overnight visitors are assumed to be counted once only.
- b Seventy-nine percent of total visitors during the peak summer season (Memorial Day through Labor Day) are nonlocal, based on summer 1999 survey data; it is assumed that the year round nonresident share is lower at 70 percent.
- c Ninety-five percent of overnight visitors to Rocky Reach Project recreation facilities are assumed to be nonresidents.
- d Based on 75 percent of visitor arrivals using automobile/vans/pickups; 60 percent are considered day visitors and 40 percent overnight visitors.
- e Based on 25 percent of visitor arrivals using RVs; 40 percent are considered day visitors and 60 percent overnight visitors.
- f The "new money" component of total visitor expenditures differs for the various activities. All lodging and campground expenditures as well as food and drink, shopping, and entertainment expenditures and 50 percent of other recreation and automobile/RV expenditures are considered "new money" to the impacted region.
- g Based on the mid-range of prices for available units at double or greater occupancy; an occupancy factor of 2.5.
- h Based on \$20 per night stay, 2.5 persons per vehicle.
- I Based on \$7.50 per night stay, 2.5 persons per vehicle.
- j Based on one-half of visitors engaged in water craft recreation.
- k Based on 5 visitors per vessel.
- l Based on 2.5-person automobile occupancy and average round trip length in the study area of 120 miles and local purchases of \$0.15 per mile.
- m Based on 2.5-person vehicle occupancy and average round trip length in the study area of 120 miles and local purchases of \$0.20 per mile.

Table 3-23: Estimates of Gross Output, Employment, Wages and Salaries from Recreational Activities at the Rocky Reach Project in the Study Area in 1999

Economic Effects	Hotels & Lodging (incl. Camping/RV) Sector	Eating & Drinking Places Sector	Automobile Repair & Services Sector	General Merchandise Stores Sector	Amusement & Recreation Services Sector	Total
Estimated Output Delivered to Final Demand	\$5,513,668	\$7,363,531	\$2,334,778	\$4,549,824	\$3,472,234	\$23,234,035
Direct Employment (FTEs)	188	235	48	123	179	773
Direct Earnings	\$2,480,048	\$2,376,948	\$1,061,157	\$2,110,208	\$1,256,254	\$9,284,615
Average Earnings	\$13,206	\$10,132	\$22,061	\$17,101	\$7,022	\$12,016
Total Industrial Output	\$9,732,176	\$13,907,500	\$3,765,763	\$7,941,263	\$7,555,581	\$42,902,283
Total Employment (FTEs)	261	346	72	180	250	1,108
Total Earnings	\$3,789,017	\$4,390,460	\$1,484,240	\$3,125,852	\$2,508,489	\$15,298,057
Average Earnings	\$14,523	\$12,704	\$20,672	\$17,347	\$10,042	\$13,802

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**Figure 3-7: Distribution of Use Peak-Season 1999
(Based on Instantaneous Counts by Car)**

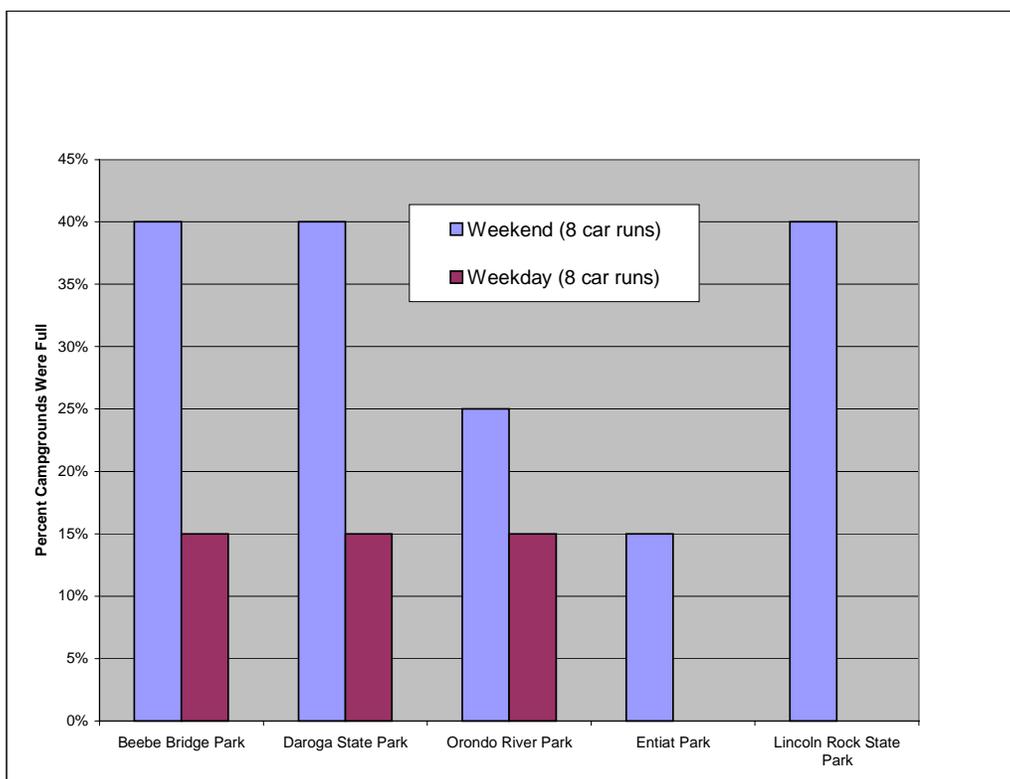


Figure 3-8: Car Run Observations -- Campground Occupancy Levels

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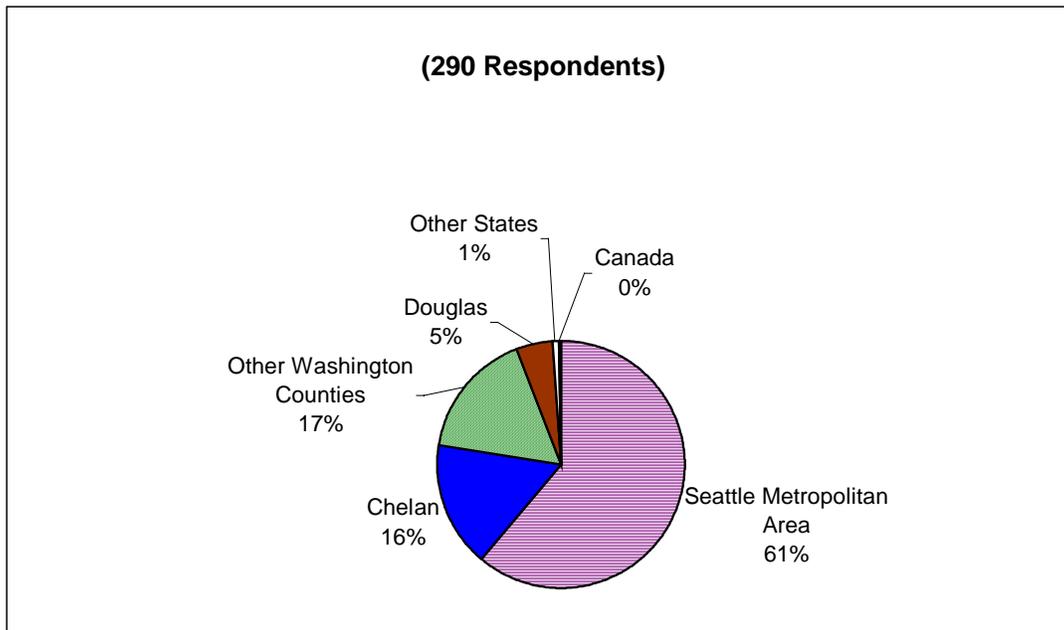


Figure 3-9: Where Survey Respondents are From All Sites

3.4 Communities Affected by the Rocky Reach Project

In addition to the two county governments, Chelan County and Douglas County, several incorporated and unincorporated communities are directly affected by the Rocky Reach Project. These include the incorporated town of Entiat and the unincorporated community of Malaga, both located in Chelan County, and the unincorporated community of Orondo located in Douglas County. Several school districts are also in the affected area, including Entiat School District and Wenatchee School District (which encompasses the Malaga area) in Chelan County, and Orondo School District in Douglas County. Finally, several irrigation districts and independent water providers, which draw water from the Rocky Reach Project reservoir for agricultural, industrial, and municipal uses, are directly affected by the Project. A brief discussion of service area boundaries, population served, facilities and services provided, and land use planning is presented for each of the above jurisdictions and other service providers.

One of the most significant land use changes in the last decade is the increase in primary or secondary residences along and/or overlooking the Rocky Reach reservoir. The trend will likely continue. It will undoubtedly change the visual attributes of the area, particularly the view of the shoreline and immediate uplands from the reservoir. It will also likely result in changes in how people interact with the water, namely, access to the water will be greatly increased for private property owners with residences along the shoreline. In Chelan County, the new housing development is scattered along or near the shoreline, particularly at locations just south of the city of Entiat. Within the city, development along the shoreline is more concentrated. In Douglas County, there are both village developments, e.g., Sun Cove, and linear developments, with many of the new homes being quite large.

3.4.1 Chelan County

Chelan County is located on the east side of the Cascade Mountains and shares its mostly western boundary with Skagit, Snohomish, and King counties. Roughly oval in shape, the county is about 90 miles long and 60 miles wide, with its main axis lying in a northwesterly direction. The Wenatchee Mountain Range forms the county's southwestern and southern boundary, which is shared with Kittitas County. The eastern boundary follows the Columbia River and is shared with Douglas County. Finally, the county's northeastern boundary follows the Sawtooth Ridge and is shared with Okanogan County. The vast majority of the land in Chelan County is in federal and state ownership. According to the *Chelan County Comprehensive Plan*, February 1, 2000, the county is not currently constrained with respect to the availability of land to meet current and projected needs; however, it is constrained by a lack of funding resources for public utilities. Further it is anticipated that, as population increases, conflicts between agriculture and more intensive land uses will be exacerbated. The demand for recreation and retirement properties, primarily from people from the Puget Sound area, is also anticipated to increase over time, particularly in the Chelan, Manson, Stehekin, Leavenworth, Plain, and Lake Wenatchee areas. This will add to growth pressures on the remaining developable land in these areas of the county.

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The county's comprehensive plan covers the unincorporated areas outside of the city urban growth areas. The five incorporated cities in the county prepared their own comprehensive plans, which included unincorporated areas within urban growth areas. Chelan County has committed to the adoption of the city plans to regulate the unincorporated areas of the cities' urban growth areas. Within the county-wide plan (covering the unincorporated areas located outside urban growth areas), seven study areas were identified and sub-area plans developed. These include: Chelan-Manson Study Area; Lower Wenatchee River Valley Study Area; Upper Wenatchee River Valley Study Area; Plan-Lake Wenatchee Study Area; Stehekin Study Area; Entiat Valley Study Area; and, Malaga-Stemilt-Squilchuck Study Area. The latter two study areas are of particular interest for this study. The primary components of the comprehensive plan with respect to each of the study areas comprise land use, rural, housing, capital facilities, and transportation elements. Reference can be made to the plan for details on each of the elements for the various study areas. For purposes of this study, however, information is summarized for the two study areas of primary interest, as noted above.

3.4.1.1 Entiat Valley Study Area and the City of Entiat

The Entiat Valley Study Area encompasses the Entiat River Basin. The Entiat River begins at the terminus of the Entiat Glacier on Mt. Maude and flows approximately 50 miles into the Columbia River at the south end of the city of Entiat. The Entiat Census County Division, which corresponds to the study area, had a 1990 population of 1,507 people, including the population of the city of Entiat, which stood at 449 people. The county comprehensive plan population estimate for the Entiat CCD amounted to 1,600 people in 1997. The CCD population was projected to increase to 1,861 people in year 2017.

There were 750 housing units in the Entiat CCD in 1990, rising to 860 units in 1997. The share of mobile homes of total units in 1990 amounted to 175 units or 23.3 percent of the total. Also, in 1990 the breakdown of units by tenure indicated 64.1 percent owner-occupied and 35.9 percent renter-occupied. In terms of housing condition in 1990, 11.5 percent of housing units lacked complete plumbing facilities, compared to 3.6 percent county-wide, and 3.4 percent lacked complete kitchen facilities, indicating much worse conditions than suggested by the countywide figures of 3.6 percent and 1.8 percent, respectively.

Home values and rents in the Entiat Valley Study Area were some of the lowest in the county in 1990. The median home value for the Entiat CCD in 1990 stood at \$55,800, compared to \$71,500 countywide.

Water is provided in the city of Entiat and its urban growth area by the city's water system. Outside the city's service area, private associations and households provide water.

Chelan County Fire District No. 8 provides fire protection for the Entiat Valley Study Area. Five stations serve the city of Entiat, the Entiat River Valley and property north and south of the city of Entiat adjacent to the Columbia River from Tenas George Canyon to Stayman Flats. The residents of Navarre Coulee have also been annexed recently into the district. The district's stations and equipment are listed as follows:

- Station No. 1: Located at 4674 Entiat River Road, Entiat, Washington. Equipment and personnel includes two water tender/tankers, one brush truck and 40 volunteers (for the entire district).
- Station No. 2: Located at Entiat River Road and Entiat Way. Equipment includes one fire engine and two ambulances.
- Station No. 3: Located at city of Entiat Station in conjunction with the City Hall. Equipment includes one pumper truck and one brush truck.
- Station No. 4: Located at Ardenvoir. Equipment includes one fire engine, one brush truck, and one water tender.
- Station No. 5: Located at Stayman Flats. Equipment includes one brush truck.
- Station No. 6: Located at Riverwood Estates (Entiat River). Equipment includes one fire engine.

There are no planned improvements by Fire District No. 8, according to the Chelan County comprehensive plan. However, a seventh station is being planned for Navarre Coulee in 2005.

Chelan County has a materials stockpile and fuel storage facility at Ardenvoir Shop, located at 9486 Entiat River Road.

Television service is available in the city of Entiat and surrounding area through Charter Cable, and in Navarre Coulee through Sun Cable. In the remainder of the study area, cable television service is not available. Air Touch Cellular has a cellular tower located on Badger Mountain in Douglas County that provides service to the north Wenatchee and Entiat areas. Electric power is provided by Chelan County Public Utility District No. 1. The PUD has in place electrical substations at the city of Entiat and in Entiat Valley.

The City of Entiat, Washington *Comprehensive Land Use Plan, 1997* covers the city of Entiat and its urban growth area. The plan is divided into several elements comprising land use, urban growth areas, housing, capital facilities, utilities, transportation, and economic development. A detailed discussion is provided in a separate report titled *Impact from Rocky Reach Project Operation on the City of Entiat and Entiat School District No. 127*, Draft Report, Prepared by McHugh & Associates, August 2000, regarding the population, economy, land uses, and public services and facilities of the city of Entiat.

3.4.1.2 Malaga-Stemilt-Squilchuck Study Area

The Malaga-Stemilt-Squilchuck Study Area covers the southeast corner of Chelan County. The study area includes Pitcher Canyon, Halverson Canyon, Mission Peak, Wenatchee Heights, Jumpoff Ridge, the Malaga and Three Lakes communities, Rock Island Dam and vicinity, and the drainage basins of Squilchuck Creek, Stemilt Creek, and Colockum Creek. The area is bordered by the Columbia River to the north and east and by the Kittitas County border to the south. Chelan County's first irrigation ditch was built in Malaga to serve the orchards and vineyards planted by early settlers. Malaga was named for the grapes that were grown in the area for many years. The town site of Malaga was originally platted in 1903. Development of the Alcoa plant in the early 1950s stimulated residential development in the area. Most of the recent development has occurred southwest of the original town site especially around Cortez Lake,

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which is part of the Three Lakes residential area. Recreation, industrial development, and agriculture are the most significant contributors to the economic base of the planning area. Mission Ridge ski area is located in the upper most portion of the planning area and is accessed by the Squichuck Road. The Malaga Census County Division (CCD), which corresponds to the study area, had a 1990 population of 2,608 people of which 594 were school-aged (ages 5 to 18) or 23 percent of the total population. It was estimated by the comprehensive plan for the county that the Malaga CCD population amounted to 4,023 people, with the population projected to double to 8,040 people in year 2017.

There were 981 housing units in the Malaga CCD in 1990, increasing to 1,524 units in 1997, according to the comprehensive plan. Mobile home units comprised 304 units in 1990 or 31.0 percent of the total. Also, in 1990 the distribution of housing units by tenure for Malaga CCD was 74.7 percent owner-occupied and 25.3 percent renter-occupied. Of the housing units in Malaga CCD in 1990 only 1.2 percent lacked complete plumbing facilities, compared to 3.6 percent of housing units countywide, and a mere 0.9 percent lacked complete kitchen facilities, compared to 1.8 percent countywide.

The median home value in the Malaga-Stemilt-Squilchuck Study Area at \$77,800 in 1990 was higher than the countywide figure (\$71,500).

The Malaga Water District service area includes the Malaga area. Within its boundaries several smaller systems continue to exist. The system consists of two wells, 16 miles of distribution lines, three booster stations and six reservoirs located along the Malaga-Alcoa Highway and Joe Hamlin Road loop. According to the comprehensive plan there are currently 290 connections on the system, which has a capacity of 700 to 1,000 connections. The future projected demand for the system is 1,200 connections, through year 2014. Up to 13 miles of additional water lines are needed for future projected demand.

Chelan County Fire District No. 1 provides fire protection to the Malaga area, although the district covers only about one-third of the Malaga-Stemilt-Squilchuck Study Area. Fire protection services to the area not within the public fire district boundary on federal lands are coordinated between the district and the U.S. Forest Service pursuant to an Emergency Fire Suppression Agreement. Five stations operated by the district serve the Malaga area. They are as follows:

- Station No. 4 located at 4852 Squilchuck Road, 1836 S. Mission, Wenatchee, Washington.
- Station No. 5 located at 320 Bohart Road, Wenatchee, Washington.
- Station No. 7 located at 3760 West Malaga Road, Wenatchee, Washington.
- Station No. 9 located at 7650 Rock Island Dam Road.

Since most of the area in the outlying areas is not served with public water, the threat of fire (especially in summer) usually results in road closures, which restrict access and activities in certain areas.

Chelan County has sand storage facility in the study area (Squilchuck Sand Storage), which includes a metal building and materials stockpile. In addition it has several pit sites in the area: Colockum Pit; Malaga Pit K-129 on 2.02 acres; West Malaga Pit K-104, which consists of a metal building and materials stockpile on 7.58 acres.

Television service is provided in the Malaga area by Sun County Cable. Charter Cable provides service in the Squilchuck corridor. Cascade Natural Gas provides natural gas service with service available along the transmission line that runs near the Malaga-Alcoa Highway and within the old town site of Malaga. No homes in the old town site are connected to the line, although along the highway several homes receive gas service. Electric power is provided by the Chelan County Public Utility District No. 1, which has substations located at Malaga, Valhhalla McKenzie (Malaga area), Kawecki (Malaga area), the Alcoa Plant, and Squilchuck.

3.4.1.3 Entiat School District No. 127

A detailed discussion is provided in a separate report titled *Impact from Rocky Reach Project Operation on the City of Entiat and Entiat School District No. 127* (op. cit., August 2000) regarding pupil enrollments, tax base, and facilities of the Entiat School District.

3.4.1.4 Wenatchee School District No. 246 (Malaga Area)

No public schools are located within the Malaga-Stemilt-Squilchuck Study Area; according to the Chelan County comprehensive plan (op. cit., February 1, 2000). The Malaga area school closed in 1969 when the Wenatchee School District extended its boundaries to include that part of the county. Students from the Malaga area attend Wenatchee School District facilities.

District enrollment (K-12) at Wenatchee School District for the 1999-00 school year (October count) was as follows:

1999 – 2000 <u>School Year</u>	<u>Pupils</u>
Elementary – Grades K-8	4,664
Secondary – Grades 9-12	2,222
Total	6,886

According to the 1990 Census, there were 330 elementary school age children living in the Malaga-Stemilt-Squilchuck Study Area. Projections of school-age children contained in the comprehensive plan suggest that the number of school-aged children in elementary grades could range between 590 and 689 children. If the projections were realized, it is likely that a new elementary school would be needed to serve the area. The Wenatchee School District has indicated that a threshold of 500 children is required to establish the need for new elementary schools.

3.4.1.5 Lake Entiat Irrigation Districts

There are two irrigation districts on the west side of the Rocky Reach Project reservoir – Entiat Irrigation District and Chelan Falls Irrigation District. In addition several cities and agriculture

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water users draw water from the northern portion of the reservoir in Chelan County. All of these are listed as follows:

- Entiat Irrigation District
- Chelan Falls Irrigation District
- City of Entiat Water System
- Chelan Falls Water System

The Entiat Irrigation District has rights to 980 shares some of which are related to earlier uses that were obtained by the (then) Great Northern Railroad and Chelan County PUD No. 1 when lands were taken out of farm production in order to prepare for the development of Rocky Reach Dam. The rights to water are uninterrupted; however, the district is prohibited from extending the irrigation boundary, which extends from the Entiat River (south boundary) to Ribbon Cliff or approximately one and one-half miles north of the city limits (north boundary). The eastern boundary is close to and parallels the city limit line. The district has 725 h.p. maximum pumping capacity and the system is operated to provide a minimum of 40 pounds pressure to customers. Demand is variable and depends primarily on the orchard crop growing season and weather conditions. The aqueduct used to draw water from the reservoir extends out into the lake approximately 60 feet to 20 feet below the surface (at a lake level of 707 feet MSL). At its mouth it is six feet in diameter and is screened at the intake.

The Chelan Falls Irrigation District serves 27 customers at the south end of Chelan Falls and along the Columbia River south to the end of the Dovex Property, according to the Chelan County comprehensive plan (op. cit., February 1, 2000). The system was upgraded in 1995 – 1996. The system capacity is 15 CFS by agreement with Chelan County PUD No. 1. There are no plans for expansion of the system; ongoing improvements include normal maintenance.

The city of Entiat Water System consists of a city-owned and operated water supply, storage, treatment, transmission, and distribution facilities. In 1994, the city of Entiat completed a water system upgrade. The city has sufficient water rights to accommodate the allotted population growth projection contained in the city's comprehensive land use plan (op. cit. 1997).

The Chelan Falls water system is located along the Columbia River, southeast of the city of Chelan. In 1987 the Chelan County PUD No. 1 assumed maintenance and operation of the system, which is owned by the Chelan Falls Water District. Two wells, a pump station, a storage tank, and approximately 1,500 lineal feet of six-inch diameter distribution mains serve approximately 100 connections. The PUD is authorized to withdraw 1,350 gallons per minute at any given time, not to exceed a total yearly withdrawal of 300-acre feet (97.8 million gallons per year). Current withdrawal rates are about half of total available water rights; thus, adequate water rights exist to meet the future needs of the Chelan Falls system.

3.4.2 Douglas County

Douglas County is located close to the geographic center of Washington state. It lies on the northern edge of the Columbian Basin in the shelter of the Cascade Mountains to the west. It is bordered on the north and west by the Columbia River, sharing boundaries with Chelan and

Okanogan counties, and on the east by the Grand Coulee Equalization Reservoir (Banks Lake) and Sun Lakes, with the boundary shared by Grant County. Roughly oval in shape, it is about 70 miles long and 40 miles wide encompassing 1,831 square miles with its main axis lying in a northeasterly direction. According to the *Douglas County Comprehensive Plan, 1995*, maintaining the agricultural base of the county is a primary goal; however, issues involving the provision of transportation and other public infrastructure are of major concern.

The countywide plan addresses land use issues which are rural and resource related and of similar concern outside the urban growth areas in the unincorporated portion of the county. The cities of Waterville, Mansfield, and Bridgeport have developed individual plans, which include urban growth areas lying outside city limits. Because the city of East Wenatchee only encompasses approximately one-third of the entire urbanizing area around it, the determination was made to develop a sub-area plan for the larger area. Similarly, a sub-area plan was developed for the area known as the "Rock Island Tea Cup", with an identified urban growth area for the city of Rock Island and agricultural lands outside of that area. All of the plans are intended to work as a whole with implementation regulations, which recognize the features of all the plans, to be adopted by the various municipal entities. Similar to the comprehensive plan for Chelan County, the Douglas County Comprehensive Plan comprises numerous elements, including agricultural resource, rural land use and housing, transportation, capital facilities, utilities, economic development, resource and critical areas conservation, and essential public facilities elements. Reference can be made to the countywide plan for details on each of the elements. Nonetheless, information is provided, as available on the planning environment and goals and objectives relating to the Orondo community, which is of primary interest for this study.

3.4.2.1 Orondo Community

The Orondo area is located on the east bank of the Columbia River approximately 13 miles upstream from the city of Wenatchee or six miles upstream from the Rocky Reach Dam site. As noted above in the section dealing with the socioeconomic baseline (Table 3-1), the Orondo area had a population in 1990 of 383 people, representing approximately 1.5 percent of the Douglas County population. Assuming a constant share of the county's population, this translates to about 464 people in 1999. Over time it is assumed that the relative share of total county population will increase to 2 percent in the Orondo area. Thus, by 2015 the projected population for the area is shown in the comprehensive plan to amount to 921 people.

The lands in the area of Orondo are classified a River-Related Irrigated Agricultural. These lands are used almost exclusively for the production of hard and soft fruit products and located in the Columbia River valley between Turtle Rock to the south and the Beebe Bridge area to the north, as well as other areas between Brewster Bridge and the city of Bridgeport. The areas under this classification include Orondo and Bray's Landing and are bounded by the Columbia River and the basalt breaks on the west and east. It is the intent of the comprehensive plan to maintain and project such agricultural lands.

Orondo is designated as a rural service center. Such designation is given to areas where historic, unincorporated communities or older recreationally-oriented subdivisions are characterized by

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urban type densities and that may offer some urban services such as community water, limited community uses, etc. It is intended that these areas continue to be a mixture of land uses, particularly residential and limited neighborhood businesses and services. The areas are also to accommodate needed agricultural-related commercial as well as light industrial uses, but only after a site specific review process to determine and address potential impacts. The designation is not intended to accommodate new, recreationally-oriented residential developments or Master Planned Resorts.

Generally, potable water is provided to the area by small community water systems and private wells. Telephone service is provided by Verizon. For television service, most rural areas rely on privately owned and operated television transformers. Electric power is provided by Douglas County Public Utility District No. 1.

3.4.2.2 Orondo School District No. 013

Orondo School District provides elementary education to about 220 pupils from preschool to grade six, all contained in one school. The district also provides secondary education (grades 7 – 12) to about 222 – 26 pupils at its evening alternative high school. 1998 – 1999 school year enrollment amounted to 179 FTE pupils of which 26 were in the high school grades. The number remained about the same in 1999 – 2000 school year, with FTE enrollment (October count) at 177 pupils.

SECTION 4: ROCKY REACH – PROJECT ECONOMICS

4.1 Study Methodology

The Rocky Reach - Project Economics Study is intended to provide the underlying project economics and will provide the historical and forecasted cost basis for the dam relicensing process. The study describes, estimates and documents factors that affect the project's economics. The study includes the following categories:

- Generation
- Normal Operation
 - Debt Service
 - Operations
 - Maintenance
 - Administrative and General
- Relicensing
 - Process
 - Enhancement
- Fish Enhancement
 - Debt Service
 - Operations
 - Maintenance

The study methodology for the assessment of the long-term operations of the Rocky Reach dam consisted of the determination of the historical costs for the above cost categories and then forecasted these costs for the term of the new FERC license. For the project economics study, the new license term was assumed to be 50 years. Table 4-1 summarizes the study's global assumptions.

*Socioeconomic Study***Table 4-1: Global Inputs**

Initial Year of Operation	1962		
Study Year	2000		
Initial Year of Study	1978		
Initial Year of New License	2007		
New License Term	50	Years	
End Year	2056		
Forecasted Inflation Rate	2.5%		
Forecasted Financing Rate			
Taxable			
Rate	8.95%	Fish Studies	
Term	50		
Taxable			
Rate	8.80%	Normal Capital Additions	
Term	30		
Tax Exempt			
Rate	6.50%	Fish e.g. Bypass	
Term	30		
Taxable			
Rate	8.95%	Relicensing	
Term	50		
Discount Rate	8.00%		
Rocky Reach - Peak Generating Capability	1,280		MW
Units 1 -7		111.15	MWs per Unit
Units 8 - 11		125.40	MWs per Unit

4.2 Historical Generation

Table 4-2 summarizes Rocky Reach's historical annual generation, average availability, capacity factor, power sales²⁷, and mills per kWh. Rocky Reach's nameplate Capacity is 1,280 MW. Rocky Reach's availability factor has ranged from 82% to 92% with an average of 87%. Its generation has ranged from 4,922,119 MWh (562 aMW) to 7,364,657 (841 aMW) with an average of 6,031,302 MWh (688 aMW).

For the term of the new license Rocky Reaches availability factor is assumed to be 87% and its average annual generation is forecasted to be equal to its historical average of 6,031,302 MWh (688 aMW).

Availability Factor refers to RR Hydro Project system's readiness to generate electricity. For example, Rocky Reach's nameplate capacity is 1279 MW's, if on average 1000 MW is ready to generate electricity in a given year; the availability factor would be 78%. Capacity Factor refers to the systems actual generation given system nameplate capacity, stream flow, river regulation policies, etc. As noted by the high Availability Factor percentages, RR generation potential has been quite high, ranging from about 83% to 92% over the period 1978 – 1999. The capacity factor has been much lower due to limitations on stream flow or river regulation requirements, ranging from about 44% to 66 % during the period 1978 – 1999.

²⁷ Rocky Reach's power is sold at cost to the power purchasers identified in the Global Inputs table above. Therefore, the sales number and mills per kWh reflects the annual cost of Rocky Reach's energy.

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Table 4-2: Rocky Reach Generation, Availability & Sales

Year	Nameplate Capacity (MW)	Annual Generation (MWh/yr)	Availability Factor	Capacity Factor	Power Sales	Mills / kwh
			Average			
			87.0%	53.8%		
1978	1279.65	6,089,921		54.3%	\$ 20,345,000	3.48
1979	1279.65	5,411,143		48.3%	\$ 20,956,000	4.05
1980	1279.65	5,384,496		48.0%	\$ 21,608,000	4.04
1981	1279.65	6,528,221		58.2%	\$ 22,090,000	3.45
1982	1279.65	6,365,278		56.8%	\$ 22,044,000	3.32
1983	1279.65	6,428,038		57.3%	\$ 22,607,000	3.56
1984	1279.65	5,962,471		53.2%	\$ 23,505,000	3.94
1985	1279.65	5,791,385		51.7%	\$ 23,311,000	4.12
1986	1279.65	5,695,092	84.64%	50.8%	\$ 24,597,000	4.31
1987	1279.65	5,441,014	86.94%	48.5%	\$ 24,776,000	4.59
1988	1279.65	5,300,522	82.18%	47.3%	\$ 26,342,000	5.09
1989	1279.65	5,291,081	90.16%	47.2%	\$ 27,904,000	5.34
1990	1279.65	6,780,238	92.44%	60.5%	\$ 29,310,000	4.38
1991	1279.65	7,228,010	92.23%	64.5%	\$ 31,465,000	4.38
1992	1279.65	5,510,851	88.53%	49.2%	\$ 33,015,000	6.04
1993	1279.65	4,922,119	89.08%	43.9%	\$ 34,593,000	7.18
1994	1279.65	5,013,094	86.98%	44.7%	\$ 38,105,000	7.69
1995	1279.65	5,759,122	86.45%	51.4%	\$ 40,042,000	7.01
1996	1279.65	7,239,559	85.63%	64.6%	\$ 43,901,000	6.02
1997	1279.65	7,281,845	84.42%	65.0%	\$ 58,165,000	7.92
1998	1279.65	5,900,491	82.89%	52.6%	\$ 51,896,000	8.96
1999	1279.65	7,364,657	85.86%	65.7%	\$ 58,141,000	8.19

4.3 Total Cost Summary

Rocky Reach's historical and forecasted annual operating costs (nominal and real) are summarized in Table 4-3. The forecasts are based on the best available information and should be a good representation of the future costs of operating Rocky Reach over the term of the new license. Figure 4-1 illustrates Rocky Reach's cost components for 1999. Nominal dollars refer to the actual dollar amounts in the year they occur. Real dollars refer to the actual dollars adjusted for inflation, i.e., the effects of inflation are removed from nominal prices. Real dollar values are typically used in inter-temporal analysis to allow for comparisons in costs and benefits between time periods.

The actual cash flows for the project can vary significantly from the projections depending upon the actual escalation of the underlying cost, interest rates, relicensing costs, and river regulation. The cost forecasts do not consider cost associated with catastrophic equipment failure, significant changes in system operation due to environmental issues such as the Endangered Species Act, or technological improvements.

Operating costs are forecasted to be \$12.4 million (in \$2000) or \$14.8 million (nominal) in the first year of operation under new license and \$33.6 million (in \$2000) or \$133.8 million (nominal) in the last year of operation.²⁸ A linear trend was estimated for the historical operating costs (in \$2000). The forecasted operating costs are based on this historical trend. Real and nominal operating costs are forecasted to grow at a 2.05% and 4.60% average annual rate of growth (AARG), respectively.

Maintenance costs are forecasted to be \$7.4 million (in \$2000) or \$8.8 million (nominal) in the first year of operation under new license and \$14.5 million (in \$2000) or \$57.9 million (nominal) in the last year of operation. A linear trend was estimated for the historical maintenance costs (in \$2000). The forecasted maintenance costs are based on this historical trend. Real and nominal maintenance costs are forecasted to grow at a 1.38% and 3.91% average annual rate of growth (AARG), respectively.

Administrative and general costs are forecasted to be \$7.1 million (in \$2000) or \$8.5 million (nominal) in the first year of operation under new license and \$17.1 million (in \$2000) or \$68.2 million (nominal) in the last year of operation. A linear trend was estimated for the historical A & G costs (in \$2000). The forecasted administrative and general costs are based on this historical trend. Real and nominal operating costs are forecasted to grow at a 1.79% and 4.34% average annual rate of growth (AARG), respectively.

A Department of Energy (DOE) study²⁹ of the total mitigation costs of relicensing 88 hydro projects around the U.S. estimated that the mitigation and enhancement costs (including fish) for

28 For an in-depth comparison of Rocky Reach's historical costs and the costs of a typical 1250 MW hydroelectric station see "Draft Engineering Audit Study for Rocky Reach Hydroelectric Project," Duke Engineering & Services, September 1999.

29 Idaho National Engineering Laboratory, (U.S. Department of Energy), 1997. Hydropower Resources at Risk: The Status of Hydropower Regulation and Development – 1997, DOE/ID – 10603.

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a dam the size of Rocky Reach would be approximately \$144 million (in \$1996) or \$157 million (in \$2000)³⁰.

The cost estimates for fish enhancement are forecasted by Chelan County PUD. These costs reflect Chelan's best estimate of the costs that will be necessary to meet fish enhancement requirements. Chelan has already implemented a significant effort and expenditures for enhancement and the enhancement costs forecasted for relicensing can be considered as a continuation of this effort. Under the forecasted schedule of capital expenditures, the present value of the fish enhancement costs is approximately \$116 million of the above \$157 million in 2000 dollars.

The Rocky Reach Dam relicensing costs are estimated to be approximately \$64 million (net present value). The relicensing process costs, net of mitigation and enhancement, are estimated to be approximately \$23 million³¹. Other mitigation costs are estimated to be approximately \$41 million (\$157 million minus \$116 million fish enhancement from above). This estimate includes costs for the relicensing process, protection, mitigation and enhancement (PME) measures (excludes fish enhancement studies and ongoing protection) for a 50-year license.

The relicensing cost forecast can vary significantly from the estimate. The major factors that can influence the cost of relicensing include the expenses associated with the potential for open-ended licensing requirements, the value of lost capacity and generation to satisfy agency requirements at relicensing (e.g. fish enhancement or river regulation), and other ongoing enhancement expenditures over the life of the license. Additionally, Rocky Reach Dam is significantly larger than the dams relicensed in the DOE study. This may lead to relicensing costs different than the estimate because cost extrapolated from a small data set can introduce an estimate bias.

It was a conclusion of the study that the increases in costs, under the forecasted operation for Rocky Reach over the life of the new license, would not constitute a significant socio-economic impact on the Chelan and Douglas county area. {The operating costs for Rocky Reach are forecasted to grow annually at 0.8% (real \$) from 2000 through the end of the license. The nominal annual growth rate is forecasted to be 3.3%.} Costs incurred by Chelan Count PUD are passed on to consumers on a cost basis, since the PUD is a non-profit organization.

30 Mitigation Costs (\$ - Millions) = (0.960) MW 0.701

31 Licensing Costs (\$ - Millions) = (0.401) MW 0.548 Twenty million dollars plus capitalized annual costs of approximately \$2.8 million (FERC's hydropower-related operations, plus licensing related activities of other federal agencies that are reported to the FERC for collection, \$2177 / MW. (2000 dollars))

Table 4-3: Annual Costs - Summary

(Thousands of Dollars)

	Total (Nominal)	Total (Real)
1987	31,318	47,077
1988	24,399	35,220
1989	25,855	35,605
1990	27,619	36,085
1991	30,141	37,790
1992	32,888	40,029
1993	34,112	40,313
1994	37,963	43,743
1995	39,193	43,915
1996	44,164	48,067
1997	57,458	61,133
1998	50,454	52,857
1999	57,663	59,105
2000	49,824	49,824
2001	54,955	53,615
2002	59,130	56,281
2003	66,759	61,993
2004	52,584	47,639
2005	54,505	48,174
2006	56,352	48,592
2007	66,636	56,058
2008	69,012	56,641
2009	71,059	56,899
2010	73,238	57,214
2011	76,366	58,202
2012	78,641	58,474
2013	78,881	57,222
2014	79,283	56,110
2015	81,274	56,117
2016	83,363	56,155
2017	84,522	55,548
2018	87,116	55,856
2019	89,838	56,196
2020	92,829	56,651

*Socioeconomic Study***Table 4-3: (Cont.) Annual Costs - Summary****(Thousands of Dollars)**

	Total (Nominal)	Total (Real)
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2021	95,787	57,030
2022	98,817	57,399
2023	101,952	57,776
2024	105,624	58,397
2025	109,450	59,036
2026	111,206	58,520
2027	113,344	58,191
2028	117,183	58,694
2029	122,061	59,646
2030	125,716	59,934
2031	131,922	61,359
2032	139,725	63,403
2033	146,145	64,699
2034	151,832	65,577
2035	157,817	66,499
2036	164,329	67,555
2037	170,962	68,567
2038	176,200	68,945
2039	181,650	69,343
2040	187,463	69,817
2041	194,267	70,586
2042	200,110	70,936
2043	206,177	71,304
2044	212,599	71,732
2045	219,439	72,234
2046	226,235	72,654
2047	233,203	73,066
2048	240,590	73,541
2049	248,160	74,005
2050	255,722	74,400
2051	263,677	74,844
2052	272,112	75,354
2053	280,741	75,847
2054	289,166	76,218
2055	297,816	76,583
2056	307,098	77,044

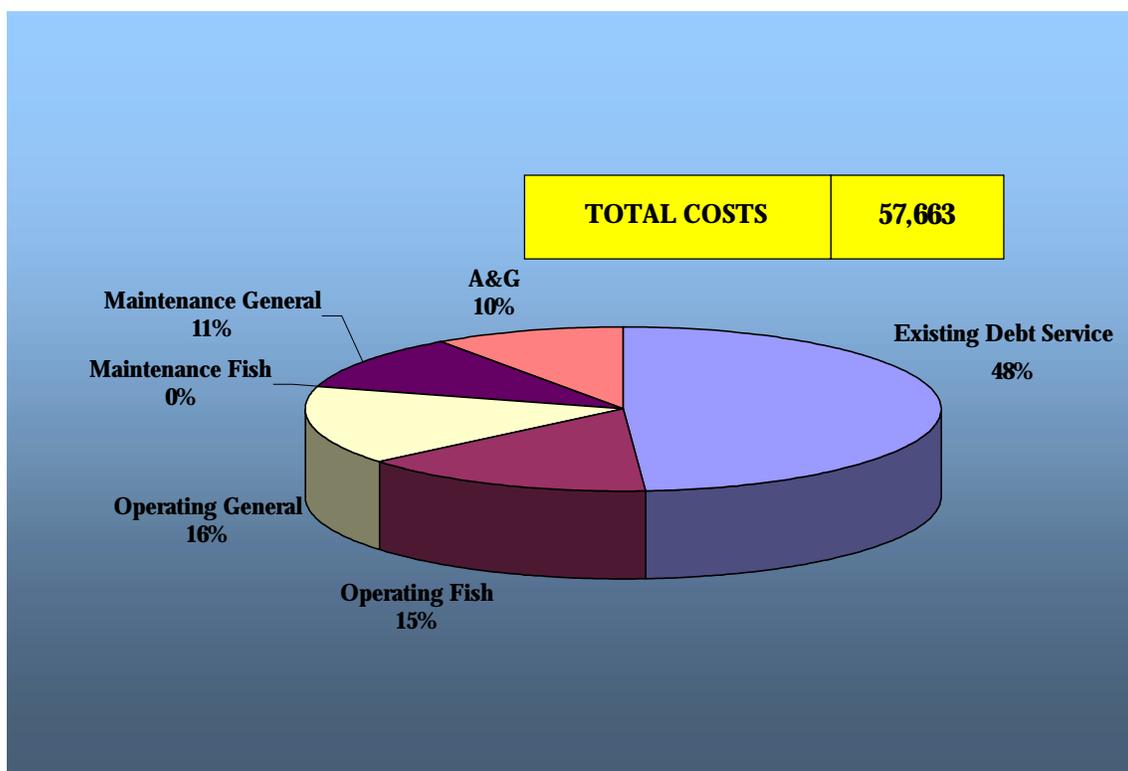


Figure 4-1: Rocky Reach Costs – 1999 (Thousands)

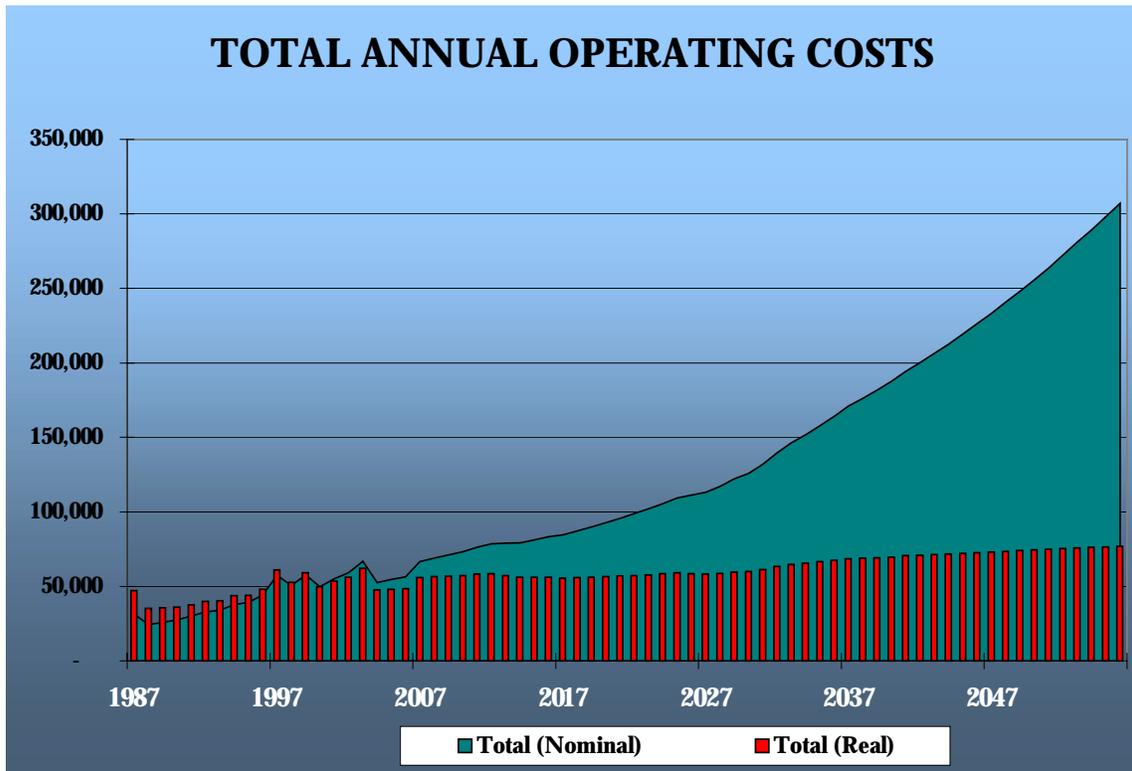


Figure 4-2: Total Annual Costs: 1987 – 2056 (Thousands)

SECTION 5: IMPACTS OF CHANGES IN PROJECT OPERATION

5.1 Direct and Indirect Effects on Electricity and Water Dependent Industry Sectors

The changes, if any, in water storage and flow operations and energy generation are likely to be quite modest for the foreseeable future. River regulation flows and dam minimum and maximum operating levels would be expected to remain within parameters set under current operating conditions. It is likely, however, that contractual arrangements with dam participants would be modified (as existing long-term power purchasing contracts expire) to reflect higher operating costs associated with relicensing and normal operation for power generated at Rocky Reach Dam. This could adversely impact users in the region, particularly industries whose competitive position with respect to their principal product markets depends on the availability at the current level of low cost electric power. Conversely, the Chelan County PUD No. 1 could realize substantial financial benefits from the realignment of purchasing agreements with major participants.

The impacts of changes in project operations are considered with respect to specific industry sectors as well as the general economy and population in the two-county study area. The industrial sector focus is on agriculture (namely, irrigated orchard crop production at locations along the Columbia River); primary metals manufacturing (i.e., Alcoa Aluminum Company's aluminum smelting plant at Malaga); public utilities (i.e. the Chelan PUD No.1, headquartered in Wenatchee); and, tourism/recreation (e.g., the recreation facilities located at the Rocky Reach Project reservoir and associated tourism infrastructure within the two-county study area). Effects on the population and general economy of the two-county study area are considered in terms of potential population changes as well as changes in employment and personal income. Public sector impacts are considered in terms of potential infrastructure needs, tax base changes, and financing requirements, at both county and community levels. The communities of interest include the incorporated city of Entiat, the unincorporated community of Orondo. In addition, impacts on Entiat, Wenatchee, and Orondo school district enrollment and tax base are considered. Finally, a discussion is provided on possible changes to land use planning with respect to the Entiat, Orondo, and Malaga communities as a consequence of changes in project operation.

Energy generation at Rocky Reach Dam is anticipated to continue at current levels; the costs of generation will rise due to relicensing costs, fish mitigation, and normal increases in plant operation³². It is anticipated that there would be no significant changes in the operation of the Columbia River and, thus, there would be no detrimental effects on the cost structure associated with dam operations above those indicated.

Under the anticipated future operation of the Columbia River and fish mitigation measures, water levels of the Rocky Reach Dam reservoir are not expected to significantly change from current operating conditions.

³² See Socioeconomic Study, Rocky Reach Hydroelectric Project, Project Economics, August 2000.

*Socioeconomic Study***5.1.1 Agriculture (Water Extraction or Diversion)**

Modest changes in water levels of the Rocky Reach Dam reservoir would have no significant effect on agricultural production from irrigated lands in the region. Water levels would have to fall to extremely low levels before there would be detrimental impacts on existing major water withdrawal or pumping systems.

Local irrigation districts that receive water from the Rocky Reach Dam reservoir would not be affected by the continued operation of the dam under conditions in which modest changes in water levels take place.

5.1.2 Tourism and Recreation

Modest changes in water levels of the Rocky Reach Dam reservoir, not to exceed two or three feet from existing operating levels during summer months, would have no significant effect on tourism and recreation activities in the region. Reductions in water levels beyond this magnitude would result in the need for lakeside infrastructure improvements required to ensure access to the reservoir.

5.1.3 Basic Metals Manufacturing

Modest changes in the water budget for the Columbia River would have no significant effect on basic metals manufacturing. Under conditions in which dam operations are limited by reduced water flow, basic metals manufacturing could be impacted by increased replacement power costs.

Currently, Rocky Reach's cost of power (\$8.30 per MWh) is significantly below the Bonneville Power Administration's (BPA) Direct Service Industrial (DSI) rate (\$23.5 per MWh). The price could increase up to the BPA price. Under any conceivable increase in price, the Alcoa would likely be cost effective. Additionally, under forecasted operating costs for the new license period, the real cost of Rocky Reach power is forecasted to increase at a little more than one-half a percent (0.5%) per annum³³.

5.1.4 Public Utility District

Modest changes in the water budget for the Columbia River and/or changes in energy generated from Rocky Reach Dam would have no significant effect on the operations of the Chelan County Public Utility District No. 1 and Douglas County Public Utility District No. 1, local electricity service providers, and basic (export-oriented) firms that receive electricity supplied by the Project in the two-county region.

5.2 General Economic Activity and Population Changes

Modest changes in the water budget for the Columbia River and/or changes in energy generated from Rocky Reach Dam would have no significant effect on the population and economic activity within the two-county impact region.

33 See Socioeconomic Study, Rocky Reach Hydroelectric Project, Project Economics, August 2000.

5.2.1 Population

Populations in the two-county region are likely to continue to grow at rates experienced during the past decade, with net migration contributing the greatest share of overall population growth. There is no apparent reason to assume that growth rates during future years would differ from projections adopted by both Chelan and Douglas counties in their comprehensive plans, which assume relatively high population growth rates. The future operation of the Rocky Reach Dam would not result in any significant changes in underlying conditions that could influence population growth in the area.

5.2.2 Employment and Earnings

Employment and earnings as well as personal income in the two-county region are likely to continue to grow at relatively high rates, following the recent pattern. The opening of a pot-line at the Alcoa Wenatchee Works during the Summer 2000 will likely boost near-term employment growth in the manufacturing sector, which had been lagging during the most recent period for which data are available. The future operation of the Rocky Reach Dam would not result in significant changes in underlying conditions that could influence employment and earnings growth in the area.

5.2.3 Public Sector Changes

5.2.3.1 County Governments and Communities

Both Chelan and Douglas counties have adopted comprehensive plans that provide guidance in the areas of land use planning, public facilities, and transportation infrastructure development in unincorporated areas of their respective jurisdictions. The principal cities within these counties also have prepared and adopted comprehensive plans. Facilities and services are provided by the responsible jurisdictions, in accordance with the laws and regulatory framework that reflect the will and approval of the public at large. The future operation of the Rocky Reach Dam would not result in any substantive changes in the need for public facilities or services provided by local governmental jurisdictions beyond those required as a result of normal growth in the demand for such services and facilities.

5.2.3.2 School Districts

The principally affected school districts of Entiat School District No. 127, Wenatchee School District No. 246 (Malaga area), and Orondo School District No. 013 would not be impacted by the future operations of the Rocky Reach Dam. School enrollments in each of these districts would be expected to grow at rates consistent with the recent historical patterns. Entiat School District No. 127 would likely continue to grow at a modest rate, depending on development activity within the UGA for the City of Entiat, which in recent years has experienced rapid growth. Wenatchee School District No. 246 enrollment growth, as applied to the Malaga area, is likely to grow at a rapid rate following recent population growth trends for the area. The opening of an additional pot-line at the Alcoa Wenatchee Works could positively influence growth in the area. Orondo School District No. 013 enrollment growth would be expected to remain quite stable.

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5.2.3.3 Land Use Planning

Land use planning activities engaged in by the various municipal governments in the two-county region would not be influenced by the continued operation of the Rocky Reach Dam.

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***APPENDIX A: IMPACT FROM ROCKY REACH PROJECT
OPERATION ON THE CITY OF ENTIAT AND ENTIAT SCHOOL
DISTRICT***

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SECTION 1: OVERVIEW

1.1 Purpose

The proposed socioeconomic study for the relicensing of the Rocky Reach Hydroelectric Project (FERC Project No. 2145) is intended to provide information and analysis for the following broadly defined objectives:

- Identify, describe, and document factors that affect Project economics, including long-term debt, cost of power, and cost of relicensing.
- Identify, describe, and document public and private sector facilities or activities that are directly or indirectly impacted by project operations and evaluate them with respect to resource use (electricity or water), environmental conditions, and benefits provided (goods or services provided and/or revenues generated). Such factors or activities will include agriculture, manufacturing industry, recreation/tourism, and relevant public entities, e.g., Chelan PUD, Chelan County, Douglas County, and selected communities and school districts.
- Evaluate impacts of the Project on public and private sector facilities or activities that are identified as potentially impacted by Project operations.
- Evaluate historical impacts of the Rocky Reach Project on the city of Entiat.
- Evaluate the potential for expansion of existing markets and the potential for developing new markets.

The major reason for conducting the proposed socioeconomic study is to provide documentation of historical and forecasted socioeconomic impacts associated with the Project's operation. This is a necessary part of the FERC relicensing process, which requires that consideration be given to the purposes of enhancement of fish and wildlife, the protection of recreational opportunities, and the preservation of other aspects of environmental quality, in addition to the provision of power sources as well as other development purposes.

This study, which was conducted as part of the overall Rocky Reach Socioeconomic study, but published separately, is focused on the latter objectives listed above; namely, to provide evaluations of current socioeconomic conditions, potential future markets, as well as historical impacts of the Rocky Reach Project on the city of Entiat and Entiat School District No. 127.

1.2 Geographic Scope of Project

The Rocky Reach Project is located in north central Washington State approximately seven miles north of the City of Wenatchee on the Columbia River in Chelan County. The dam is 215 river miles below the Canadian border and 474 river miles above the mouth of the Columbia at Astoria, Oregon. Lake Entiat, the Rocky Reach Project reservoir, extends upriver 43 miles (to Wells Dam) and has a surface area of approximately 9,100 acres. The reservoir contains 36,400 acre-feet of usable storage.

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The drainage area of the Project at the dam is about 87,000 square miles. The watershed lies east of the Cascade Mountains and west of the Rocky Mountains, consisting of parts of Washington, Idaho, Montana, and British Columbia. The normal headwater elevation is 707 feet above mean sea level (MSL) and the normal tail water is at elevation 615 feet.

The Columbia River valley surrounding the Rocky Reach reservoir is a wide canyon characterized by basalt cliffs and exposed rock outcroppings. The valley land area is generally rural in nature. The city of Entiat and communities of Chelan Falls and Orondo (east side of the reservoir in Douglas County) are located along the reservoir. Agricultural uses, recreational sites developed by Chelan PUD, and some residential lands surround approximately half the reservoir within the project boundary.³⁴ Agricultural uses consist primarily of fruit orchards and some pasture lands. Irrigation pumps and pump houses to withdraw water from the Columbia River are often located on agricultural lands or within town sites. Recreation sites provide for swimming, boating, fishing, personal watercraft, camping, picnicking, water-skiing, and other recreational uses. Recreational use generated at these sites is intensive during the summer season, Memorial Day through Labor Day. The remainder of the lands surrounding the reservoir is undeveloped. These lands can be characterized as drylands. They include shrub steppe and grassland vegetation with patches of exposed rock. Much of the undeveloped shoreline lies in areas where the reservoir is in close proximity to a small, private railroad on the west side and to State Routes 97 (east side) and 97A (west side).

The study area for the proposed socioeconomic study is the Rocky Reach boundary (or project area) and communities immediately adjacent to the boundary and/or likely to be directly impacted by project operations. The primary study area consists of Chelan and Douglas counties, the incorporated city of Entiat and Entiat School District No. 127, as well as the unincorporated communities of Orondo and Malaga. Other jurisdictions of interest include the city of Wenatchee and city of Waterville.

With respect to the Chelan County communities, headquarters operations of Chelan PUD are located in the City of Wenatchee, which is also the county seat of Chelan County. Alcoa-Wenatchee Works, which is a major power purchaser from the Project, is located in the unincorporated community of Malaga. The city of Entiat is located adjacent to the reservoir upstream from the dam site. The unincorporated community of Orondo is located adjacent to the reservoir, across from Entiat on the east side in Douglas County. The city of Waterville, county seat of Douglas County, is located approximately 10 miles east of the reservoir on the Columbia plateau.

³⁴ The Rocky Reach boundary is defined on contour lines on each side of the reservoir beginning at the 711 feet MSL elevation at the Rocky Reach Dam upstream to the Wells Project tailrace. The boundary varies in elevation along the reservoir and corresponds to areas likely to be impacted by water surface elevation associated with the probable maximum flood. The Rocky Reach Project contains a total of 1,345 acres of land of which Chelan PUD owns approximately 100 acres or 7 percent.

Table 1-1: Mid Columbia River Dams and Nearby (Upstream) Cities and Towns

Dam			Location		Population						
	Licence Expiration	MW	City/ Town	County	1950	1960	1970	1980	1990	1995	1999
Wells Dam (Douglas Co. PUD)	5/31/12										
			Pateros	Okanogan Co.	866	673	472	555	570	585	630
			Brewster	Okanogan Co.	851	940	1,059	1,337	1,633	2,023	2,065
			Bridgeport	Douglas Co.	802	876	952	1,174	1,498	1,725	2,125
Rocky Reach (Chelan Co. PUD)	6/30/06										
			Entiat	Chelan Co.	420	357	355	455	449	555	935
			Waterville	Douglas Co.	1,013	1,013	919	908	995	1,115	1,120
Rock Island (Chelan Co. PUD)	12/31/28										
			Rock Island	Douglas Co.	360	369	327	491	524	585	630
			East Wenatchee	Douglas Co.	389	383	913	1,640	2,701	4,850	5,395
			Wenatchee	Chelan Co.	13,072	16,726	16,912	17,257	21,829	24,180	25,620
Wanapaum (Grant Co. PUD)											
			Quincy	Grant Co.	809	3,269	3,237	3,525	3,734	3,925	4,120
			George	Grant Co.			273	261	324	438	478
Priest Rapids (Grant Co. PUD)	6/30/05										
			Mattawa	Grant Co.		394	180	299	941	1,685	1,870
				Chelan Co.	39,301	40,744	41,355	45,061	52,250	60,000	63,000
				Douglas Co.	10,817	14,890	16,787	22,144	26,205	29,600	31,700
				Okanogan Co.	29,131	25,520	25,867	30,663	33,350	36,900	38,400
			Grant Co.	24,346	46,477	41,881	48,522	54,798	64,500	70,600	

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Dam			Location		Population (AARG)						
	Licence Expiration	MW	City/ Town	County	1950 - 1960	1960 - 1970	1970 - 1980	1980 - 1990	1990 - 1995	1995 - 1999	1950 - 1999
Wells Dam (Douglas Co. PUD)	5/31/12										
			Pateros	Okanogan Co.	-2.50%	-3.50%	1.60%	0.30%	0.50%	1.90%	-0.60%
			Brewster	Okanogan Co.	1.00%	1.20%	2.40%	2.00%	4.40%	0.50%	1.80%
			Bridgeport	Douglas Co.	0.90%	0.80%	2.10%	2.50%	2.90%	5.40%	2.00%
Rocky Reach (Chelan Co. PUD)	6/30/06										
			Entiat	Chelan Co.	-1.60%	-0.10%	2.50%	-0.10%	4.30%	13.90%	1.60%
			Waterville	Douglas Co.	0.00%	-1.00%	-0.10%	0.90%	2.30%	0.10%	0.20%
Rock Island (Chelan Co. PUD)	12/31/28										
			Rock Island	Douglas Co.	0.20%	-1.20%	4.10%	0.70%	2.20%	1.90%	1.10%
			East Wenatchee	Douglas Co.	-0.20%	9.10%	6.00%	5.10%	12.40%	2.70%	5.50%
			Wenatchee	Chelan Co.	2.50%	0.10%	0.20%	2.40%	2.10%	1.50%	1.40%
Wanapaum (Grant Co. PUD)											
			Quincy	Grant Co.	15.00%	-0.10%	0.90%	0.60%	1.00%	1.20%	3.40%
			George	Grant Co.			-0.40%	2.20%	6.20%	2.20%	
Priest Rapids (Grant Co. PUD)	6/30/05										
			Mattawa	Grant Co.		-7.50%	5.20%	12.10%	12.40%	2.60%	
				Chelan Co.	0.40%	0.10%	0.90%	1.50%	2.80%	1.20%	1.00%
				Douglas Co.	3.20%	1.20%	2.80%	1.70%	2.50%	1.70%	0.70%
				Okanogan Co.	-1.30%	0.10%	1.70%	0.80%	2.00%	1.00%	0.40%
				Grant Co.	6.70%	-1.00%	1.50%	1.20%	3.30%	2.30%	2.20%

SECTION 2: GENERAL ECONOMIC CONDITIONS

This section provides a brief overview of recent historical and current conditions relating to the city of Entiat's population and economy. Much of the data on population is derived from the main report titled *Rocky Reach Socioeconomic Study*, September 18, 2000, Chapter 3 - Baseline Economic Conditions, as augmented by 1990 U.S. Census Data, and detailed information on school enrollments provided by Entiat School District. The discussion on general economic conditions is similarly based on information provided at the regional level in Chapter 3 of the main report. However, details of the economy provided from the 1990 Census are also presented, as well as more recent data from local sources.

2.1 Geography and Functions of the City and School District

The city of Entiat is located at the confluence of the Entiat River and the Columbia River approximately 15 miles north of Wenatchee. The city is situated on a northwest-southeast axis fronting Lake Entiat, which is the reservoir created by the development of Rocky Reach Dam. It is linked to the rest of Washington state via State Highway 97A and the railroad service of Cascade and Columbia River Railroad and the LINK public transit system. The population of the city in 1999 amounted to 935 people, which was more than double the population in 1990 (449 people), largely because of recent annexations. In 1999 the land area of Entiat amounted to 1.377 square miles, increasing from 0.73 square miles in 1990.

The city of Entiat is a non-charter code city with a mayor-council form of government and operates under Chapter 35A of the Revised Code of Washington. The mayor is the chief executive of the city. The City Council, comprised of five positions at large, is the legislative arm of city government.

Operations of the city are guided by a mission statement, which memorializes the organizational structure and goals and objectives of the city. The city budget outlines sources of revenues and functional areas of expenditures, which for the current fund totaled \$355,742 in 1999. The city adopted a *Comprehensive Land Use Plan* in 1997, placing it in compliance with the 1990 Growth Management Act.

The city hall and public works buildings are located at 14070 Kinzel Street, Entiat, Washington. Administrative services as well as city records, finances, utility records, contract documentation, and land use planning are headquartered in the City Hall.

Police protection services are provided by the Chelan County Sheriff under a contractual agreement. The Regional Law and Justice Building in Wenatchee houses the headquarters of the Sheriff's Office, the 911 emergency dispatch center, the jail, and the County Prosecutor's Office.

Fire protection is provided by Chelan County Fire District No. 8. Five stations or equipment facilities serve the city of Entiat, the Entiat River Valley, and property north and south of the city adjacent to the Columbia River from Tenas George Canyon to Stayman Flats. Recently the

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citizens of Navarre Coulee have been annexed into the fire district. The district is volunteer-operated, with a personnel roster of 40 volunteers. The fire stations include:

- Station No. 1: 4494 Entiat River Road, Entiat, Washington. Equipment at this location consists of a water tender/tanker and a brush truck.
- Station No. 2: city of Entiat, Washington (near City Hall). Equipment at this location consists of a fire truck.
- Station No. 3 (Ambulance Shed): city of Entiat, Washington. Equipment at this location consists of a rescue/medical assistance vehicle, brush truck, and two ambulances.
- Station No. 4: Ardenvoir. Equipment at this location consists of a fire engine and brush truck.
- Station No. 5: Stayman Flats. A brush truck is located at this facility.

Park and recreation facilities include the Entiat City Park, which is maintained and operated under a lease agreement with the Chelan County PUD, and Kiwanis Baseball field (also leased from Chelan PUD) and Rainbow Gardens.

The city of Entiat maintains seven miles of streets and arterial roads within the city limits. These include cleaning, plowing, sanding, and patching surfaces as needed. Re-stripping is contracted each spring with WSDOT; street sweeping is also contracted with Chelan County Road Department. The city provides the county and state agencies with gravel and sand storage and water for tank truck needs in the Entiat area as partial payment of contracted services.

The city of Entiat Water System consists of a city-owned and operated water supply, storage, treatment, transmission, and distribution facilities. In 1994, the city of Entiat completed a water system upgrade. In 1995, the city of Entiat adopted a Comprehensive Water Plan that identifies the locations, capacities, as well as any deficiencies and proposed improvements of water system components. According to the *City of Entiat, Comprehensive Land Use Plan 1997*, the city has sufficient water rights to accommodate the allotted population growth projection over the 20-year planning period.

As of 1997, the city of Entiat had approximately 3,070 feet of gravity sewers and an overflow lagoon with secondary treatment. The existing lagoon was built in 1960 and is comprised of two cell lagoons, each 120'X40' in size, and a single eight-inch overflow pipe discharging chlorinated effluent at the river bank into the Columbia River. The city recently completed a Comprehensive Sewer Plan that identifies the locations, capacities, as well as deficiencies and proposed improvements of the sanitary sewer system. The city of Entiat has no storm water retention and collection system; the Chelan County system consists of the provision of a system of roadside drainage ditches.

Solid waste collection and disposal is provided by a private firm, Waste Management, Inc. The company owns and operates a regional landfill in Douglas County. Individual residents and businesses make arrangements directly with Waste Management for collection and disposal of residential, commercial, and industrial waste.

The Entiat School District No. 127 encompasses an area roughly corresponding to the Entiat CCD with the northern boundary continuing from the city of Entiat along the Columbia River to Stayman Flats. South of the city, the district boundary extends along the Columbia River to Swakane Canyon Road. From the city of Entiat, the boundary extends west up the Entiat River Valley approximately 25 miles. The school district's facilities include the Paul Rumberg Elementary School with 23,163 square feet of space in the fixed structure and 2,400 square feet in portable classroom space. The Entiat Junior/Senior High School, located on the same property as the elementary school at 2650 Entiat Way, Entiat, Washington, has 23,855 square feet devoted to classroom and district office space, 3,120 square feet of elementary and high school offices, 9,263 square feet for a multi-purpose room, an 8,000 square foot gymnasium, and 484 square feet is provided for a concession stand. In addition, the school district has a bus garage located at 13580 Davis Street with 4,285 square feet of space. According to the *Chelan County Comprehensive Plan 2000* (op. cit., February 1, 2000), the district anticipates building a new school on the existing 25-acre school site by 2005 to accommodate projected enrollment growth.³⁵

2.2 Population and Demographic Characteristics

2.2.1 Population

According to the 1990 Census, the total population in the city of Entiat stood at 449 people in 1990, reflecting a slight increase (0.9 percent) from the 1980 level of 445 people. The population in the Entiat Census County District (CCD) amounted to 1,507 in 1990, increasing from 1,323 in 1980 or 13.9 percent. Thus, the rural area outside the Entiat city limits experienced modest growth during the decade, while the city essentially stagnated in terms of population change. The census district roughly corresponds to the Entiat School District, which continues up the Entiat River past Ardenvoir (interestingly, the school district experienced somewhat higher enrollment growth during the 10-year period, some 15.0 percent). The growth trend in the city's population in the early 1990s was definitely upward, however, rising slowly at first to 555 people by 1995, and accelerating to 935 people by 1999. Much (approximately 1/3) of the rapid increase in population is attributable to annexations of adjacent areas during this period. Official information on population change in the Entiat CCD is not available, but the *Chelan County Comprehensive Plan 2000* (op. cit., February 1, 2000) provides a 1997 population estimate of about 1,600 people.

In 1990, the median age of the population in the city of Entiat was 34.8 years, compared to 34.0 years for the CCD and 35.1 years for Chelan County. Also in 1990 there were slightly more females, at 230, than males 219, following the county-wide pattern for which data were presented in Chapter 3 (Table 3-3) of the main report (op. cit., September 18, 2000). The reverse was true for the CCD with 725 females and 782 males. In terms of racial composition, the city of Entiat population was constituted of 95.7 percent white, 0.2 percent black, 3.3 percent American Indian, Eskimo or Aleut, 0.2 percent Asian or Pacific Islander, and 0.2 percent other race. The share of the population of Hispanic origin (any race) was 4.0 percent. For the CCD, the relative

³⁵ Discussions with Jeff Davis, Superintendent of Entiat School District (telecom 5/25/00) suggested that a new middle school would likely be needed; however, there is no pending bond issue to support construction, as of this date.

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population shares were 91.4 percent white, 0.3 percent black, 2.3 percent Native American, 0.1 percent Asian or Pacific Islander, and 5.8 percent other race. The Hispanic population share (any race) stood at 10.8 percent. The CCD figures correspond to the county pattern for which data were presented in Chapter 3 (Table 3-4) of the main report.

In 1990, there were 187 households in the city of Entiat, which translates to an average household size of 2.6 persons. The corresponding ratio for Chelan County was 2.49 persons per household.

Of the 433 residents in the city that were 5 years of age in 1990, 243 people or 56.1 percent lived in the same house in 1985. Sixty-six people, or 14.9 percent, lived in the same county and the remainder (30.0 percent) lived elsewhere. Thus, it is likely, given the slight increase in the total population between 1980 and 1990 (there was an increase of only 4 people), that the city has a relatively high population turnover, with perhaps a few more persons out-migrating than immigrating, assuming a positive level of natural increase during the period.

2.2.2 School Enrollment

School enrollments at Entiat School District have been increasing modestly (about 1.7 percent annually) in recent years. District enrollment (K-12) for the 1996-1997 through the 1999-2000 school years is shown in Table 2-1.

Table 2-1: Entiat School District– Enrollment between 1996-1997 and 1999-2000

<i>School Year</i>	<i>Elementary Grades</i>	<i>Secondary Grades</i>	<i>Total</i>
1996 - 1997	215	168	383
1997 - 1998	225	167	392
1998 - 1999	225	168	393
1999 - 2000	214	188	402

Source: Entiat School District, May 2000.

Most of the enrollment growth in the most recent period (1998-1999 to 1999-2000) has been in the high school grades, particularly in grades 7 - 8.

2.3 General Economic Conditions

2.3.1 Employment and Occupation

According to the 1990 Census, there were 181 employed persons 16 years and over in the City of Entiat. Persons employed were distributed by industry sector, as shown in Table 2-3.

Employment of Entiat residents was predominantly in the retail and wholesale trade sectors, followed in descending order by durable goods manufacturing, agriculture and forestry, construction, educational services, among other industry sectors. (Note that the employment data

reflect employment by place of residence; this perhaps accounts for low or zero employment indicated for some sectors.)

The occupation profile of employed persons 16 years and over in 1990 is presented in Table 2-3. The predominant occupations of persons employed are farming and forestry and machine operators, assemblers, and inspectors, followed in descending order by other services, professional specialty, administrative support, and transportation and materials moving, among other occupations.

There are no published disaggregated employment data available for the subsequent period. However, covered employment totals are available from the Washington State Employment Security Department for the mid-1990s, as shown in Chapter 3, Table 3-11 of the main report. The figures for 1994 through 1996 are shown in Table 2-4.

Nonetheless, a special tabulation of businesses in Entiat for this study yielded information on firms by major category, square footage floor space, and number of employees in the summer of 2000. Table 2-5 presents this information.

*Socioeconomic Study***Table 2-2: Entiat Employment by Industry Sector (1990)**

<i>Industry Sector:</i>	<i>Employment</i>	<i>Percent</i>
Agriculture, Forestry & Fisheries	18	9.9%
Mining	4	2.2%
Construction	15	8.3%
Manufacturing (nondurable goods)	3	1.7%
Manufacturing (durable goods)	23	12.7%
Transportation	4	2.2%
Communications and other		
Public Utilities	2	1.1%
Wholesale Trade	34	18.8%
Retail Trade	29	16.0%
Finance Insurance and Real Estate	2	1.1%
Business and Repair Services	5	2.8%
Personal Services	7	3.9%
Entertainment and Recreation Services	0	0.0%
Professional and Related Services:	8	4.4%
Health Services		
Educational Services	16	8.8%
Other Professional Services	7	3.9%
Public Administration	4	2.2%
Total	181	100.0%

Source: United States Department of Commerce, Bureau of the Census, *1990 Census of Population and Housing*.

Table 2-3: Entiat Employment by Occupational Sector (1990)

<i>Occupation:</i>	<i>Employed</i>	<i>Percent</i>
Managerial and Professional:		
Executive, Administrative, and Managerial	7	3.9%
Professional Specialty	20	11.0%
Technical, Sales, and Administrative Support:		
Technicians and Related Support	0	0.0%
Sales	10	5.5%
Administrative Support	19	10.5%
Service:		
Private Household	0	0.0%
Protective Service	6	3.3%
Other Service	22	12.2%
Farming, Forestry, & Fishing	30	16.6%
Precision Production, Craft and Repair	28	15.5%
Operators, Fabricators & Laborers:		
Machine Operators, Assemblers, and Inspectors	12	6.6%
Transportation and Materials Moving	15	8.3%
Handlers, Equipment Cleaners, Helpers, and Laborers	12	6.6%
Total	181	100.0%

Source: United States Department of Commerce, Bureau of the Census, *1990 Census of Population and Housing*.

*Socioeconomic Study***Table 2-4: Covered Employment and Wages by Zip Code in Entiat 1994 through 1996**

<i>Entiat (ZIP 98822)</i>	<i>Employment</i>	<i>Total Wages Paid (Current Dollars)</i>	<i>Average Wage</i>
1994	377	\$6,262,616	\$16,612
1995	400	\$6,642,593	\$16,606
1996	355	\$5,887,262	\$16,584

Source: Washington Employment Security Department, unpublished series.

Table 2-5: Entiat Private Employment and Commercial/Industrial Floorspace (2000)

<i>Business Type and Name</i>	<i>Square Footage Floor Space</i>	<i>Employees</i>
General Commercial:		
Entiat Food Center	6,500	8
North Central Credit Union	1,500	2
Lucky's Texaco	2,600	12
Entiat Liquor & Gift Store	2,100	4
Tim's Auto Repair	2,000	1
Branding Iron Restaurant, Entiat Valley Explorer, and McClellan Trucking	6,000 (complex)	8
Troy's Pub & Grub	2,800	5
Chamber's Door Making	8,000 (multi-bays)	2
S&E Mini Storage	3,000	3
Cashmere Valley Bank	36 (kiosk)	0
Daily Grind Espresso	36 (kiosk)	3
Swift Air, Inc.	1,500	2
Entiat Boat & RV Storage	1,500	2
Animals & More Gifts	500	2
Northwest Auction Services	3,600	3
Industrial:		
Kompan	40,000	14
Aeromet America	88,300	127
Naumes	17,000	1
Vacant Buildings:		
Dovex – Industrial	14,000	-
Stevens Trucking	1,500	-
Columbia River Sheet Metal	1,400	-
Mini Mart	1,300	-
New Construction:		
North Central Credit Union	2,000	-
North Cascade Heating & A/C	10,000	-
Entiat Pastry & Coffee House	1,050	-
Total	218,222	199
Source: City of Entiat, June 2000.		

2.3.2 Income

According to the 1990 Census, in 1989 the median family income amounted to \$25,313, while per capita income was \$9,807. In comparison, the median family income and per capita income for Chelan County in 1989 amounted to \$24,312 and \$12,533, respectively.

Twenty-one percent of the population in Entiat had poverty level incomes in 1989, compared to 15.3 percent countywide.

2.3.3 Housing

According to the 1990 Census, in 1990 there were 174 housing units of which 12 were vacant. Forty-five units or 25.8 percent of the units were built prior to 1950. Nineteen units or 10.9 percent of the units existing in 1990 were built between 1950 and 1959; 31 units or 17.8 units were built between 1960 and 1969; and, 77 units or 44.3 percent were built between 1970 and March 1990. The median age of the structures was 23 years. Only 1.6 percent of housing units were considered seasonal, compared to the county, where the seasonal component amounted to 11.1 percent of total units.

Owner-occupied structures comprised 97 units or 55.7 percent of total units, with renter-occupied at 65 units or 37.4 percent and the remaining 12 units or 6.9 percent unoccupied. The median value of owner-occupied housing units was \$52,400, compared to \$71,500 for the county. The median gross contract rent for renter-occupied units was \$294, compared to \$343 countywide.

The Office of Financial Management, *State of Washington, 1999 Population Trends*, placed the number of units in 1999 at 371 units of which 60 units were added to the housing stock through annexations.

2.3.4 New Construction Permits

Building permit activity during the most recent three-year period, 1997 – 1999 is shown in Table 2-6.

During this period, the majority of permits for occupied structures issued have been for manufactured homes, although a substantial number of permits for construction of single-family residences have also been issued. Permitting activity for new residential units declined over the period, however, it appears to have stabilized at about 16 units per year. Officials of the City of Entiat anticipate continued heavy residential permitting activity associated with new subdivision development, which is discussed in a separate section below. The “other” category covers docks and decks, and other miscellaneous construction.

Table 2-6: New Construction Permits in Entiat (1997 – 1999)

<i>Type of Permits Issued</i>	<i>1997</i>	<i>1998</i>	<i>1999</i>
Manufactured Homes	29	12	12
Single-Family Residence	4	10	4
Garages	14	12	6
Other	11	11	6
Total	58	45	28

Source: City of Entiat, April 2000.

2.3.5 Land Use

Land use policies of the city of Entiat are delineated in the *City of Entiat, Washington Comprehensive Land Use Plan, 1997* (op. cit., 1997) including the requirement for a designated urban growth area (UGA). The UGA for the city of Entiat includes areas east of the city limits, as shown in Figure 2-1. The largest of the areas located outside the city limits consists of parcels designated residential low density that are located east of the city limit line and west of SR-97A between Cammack Avenue and Howe Avenue. Another major parcel lying outside the city limits, but within the UGA, is located in what is known as Wolf Street Basin to the southwest of the central portion of the city. Finally, a small area within the UGA boundary, but outside the city limits, is located just north of the Shadow Ridge development and fronting SR-97A at the north end of the city. Figure 2-1 indicates current zoning of the areas within the UGA. Vacant land within the UGA consists of the following:³⁶

- Residential Low (RL) Density District, UGA outside of city limits: 221.35 acres.
- Residential Low (RL) Density District, inside city limits: 275.85 acres.
- Residential Medium (RM) Density District (inside city limits): 15.71 acres.
- Waterfront Business (WB) District (inside city limits): 67.47 acres.
- General Commercial (CG) District (inside city limits): 23.92 acres.
- Warehouse Industrial (WI) District (inside city limits): 24.50 acres.

³⁶ As noted in the City of Entiat Comprehensive Plan (op. cit., 1997), gross acres available with the UGA excludes land with slopes exceeding 40 percent, floodways, lakes, rivers, railways, irrigation canals, major roads, and existing developed lands other than orchards. Agricultural lands were combined with vacant land to give the gross acreage for development within the UGA.

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Residential densities are as follows:

- RL: up to 8.6 housing units per acre.
- RM: up to 13 housing units per acre.
- WB: up to 13 housing units per acre.
- CG: none.
- WI: none.

Future population growth in the Entiat planning area (namely, the Entiat CCD) is forecast in the City of Entiat Comprehensive Land Use Plan. Population in the Entiat CCD in 1990 amounted to 1,572 people was estimated that the 1997 population stood at 1,681 people increase of 109 persons over the period. The population is expected to grow to 2,785 people by 2017, an increase of 1,213 people over the 20-year planning horizon. Sixty percent of the growth in population is anticipated to locate within Entiat's UGA or 728 people. The 60-percent growth allotment translates to an increase of 303 year-round housing units. The vacant land available within the UGA consists of space for 353 year-round housing units in the area zoned RL within the UGA outside the city limits; 440 units in the area zoned RL within the city limits; and, 58 units in the area zoned RM within the city limits for a total of 851 residences.

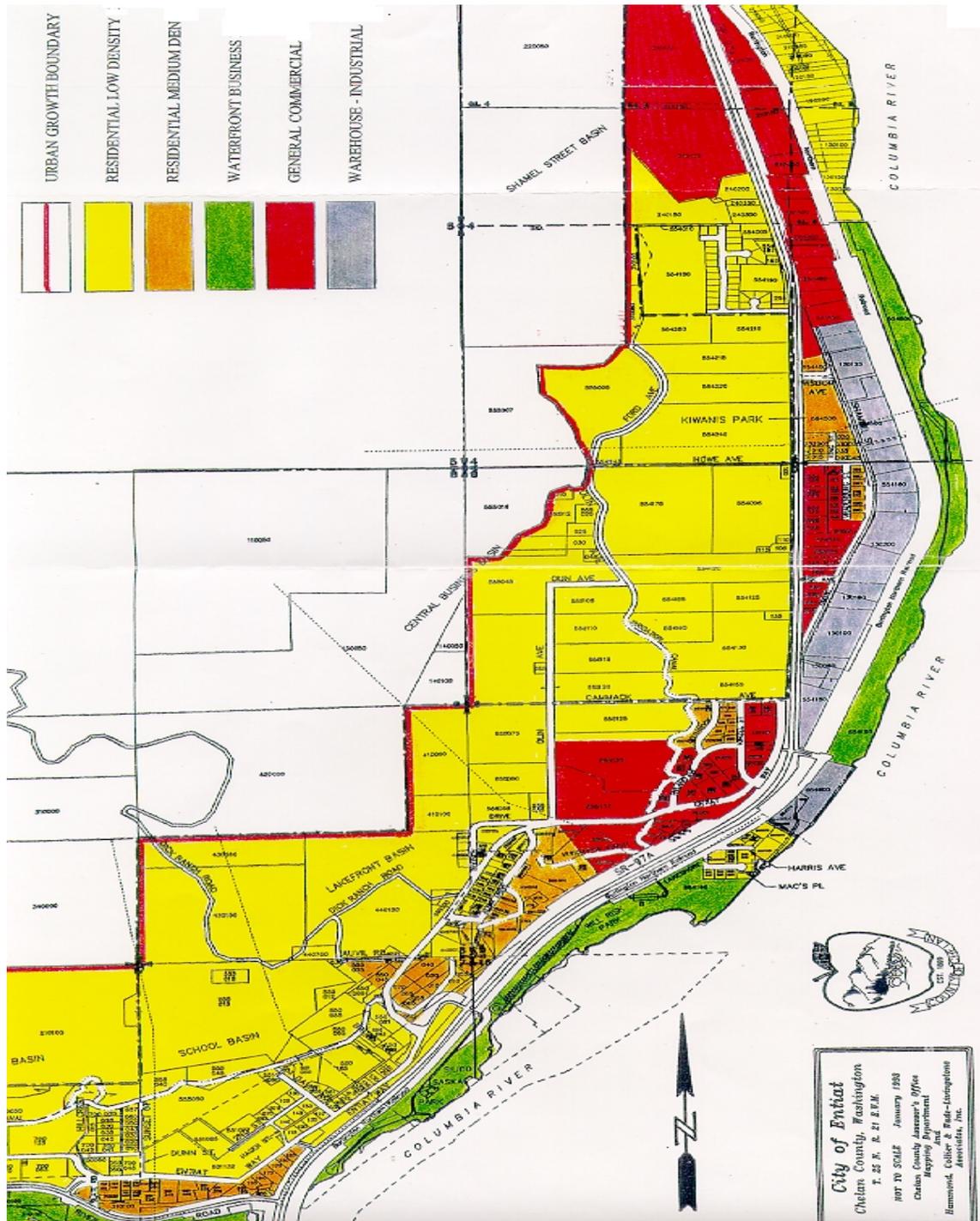


Figure 2-1: Entiat Zoning Map

2.3.6 Property Tax

A discussion of the changes in the property tax base and related tax revenues is presented in a separate section below. It is useful, nonetheless, to consider the recent history with respect to growth in the property tax base and tax revenue flows. In 1990 the city's property tax base amounted to \$11.2 million. By 1999, the tax base more than tripled (247 percent) to \$38.9 million. The tax yield also increased, but by a much lower percentage, 121 percent. It is interesting to note that the city levy rate in 1999 at 1.94 mills was much lower than in 1990, when it was 3.04 mills. The 106 property tax limitation is the primary reason for the sequential reduction in millage rates during the period. The "106 limitation" was enacted into law by the Legislature in 1971 that places a limit of 106 percent of the regular property tax levied at the highest of the three most recent years. The limit may be lifted only by voter approval. The value of new construction and improvements may be added without a vote. Thus, the amount of the taxing jurisdiction's regular levy would be computed by taking the highest regular tax of the three most recent years plus 6 percent of that amount plus the levy on the assessed valuation of new construction and improvements. If a jurisdiction, such as the city of Entiat, experiences rapid growth in property valuations, due to expansions to the property base through construction or appreciation of existing property, in excess of 6 percent in any year, this will result in a lower effective levy rate than occurred in the previous year. To illustrate this using a simplified mathematical example, involving an equation that expresses the relationship between taxes collected and property valuation, the numerator, which is the amount of property taxes collected in the prior year multiplied times 1.06 would increase at a slower rate than the denominator, which is the property base in the current year. The quotient, which is the effective levy rate, therefore, would be smaller than the rate of the previous year. This is what has happened in the case of the recent trend with respect to levy rates for the city of Entiat. Levy rates for the years 1990 through 1999 are shown as follows: 1990 - 3.04 mills; 1991 - 3.00 mills; 1992 - 2.95 mills; 1993 - 2.93 mills; 1994 - 2.89 mills; 1995 - 2.28 mills; 1996 - 2.02 mills; 1997 - 2.12 mills; 1998 - 2.21 mills; 1999 - 1.94 mills. With the exception of slight increases in millage in 1997 and 1998, the trend showed a continuous drop in millage during the decade of the 1990s.

It is important to mention that the commercial property base in 1999, consisting of 34 parcels, amounted to \$9.3 million or roughly one-quarter of the total assessed valuation of the city of Entiat.³⁷ Excluding five parcels for which land uses were multifamily residential and mobile home courts, the total assessed commercial valuation amounted to \$8.2 million. The parcels are distributed among industrial sectors, as shown in Table 2-7.

³⁷ Interestingly, the value of industrial property in 1957, before the relocation of the town site, was more than half of total taxable property in Entiat (\$288,760 out of \$500,373).

Table 2-7: Commercial Property Base in Entiat (1999)

<i>Primary Land Use</i>	<i>Number of Parcels</i>	<i>Total Assessed Value</i>	<i>Acres</i>
Hotel/Motel Services	1	\$14,400	0.22
Lumber & Wood Products Manufacturing	1	2,233,485	10.95
Primary Metals Industry	2	3,541,409	5.08
Retail Trade - Food	2	326,390	2.16
Retail Trade – Automotive & Marine	5	549,860	2.54
Retail Trade – Eating & Drinking Establishments	3	316,275	1.45
Other Retail Trade	4	251,010	3.93
Finance, Insurance & Real Estate	1	46,430	0.20
Personal Services	2	158,400	1.28
Business Services	1	99,030	3.07
Repair Services	2	151,345	0.97
Government Services	1	34,690	0.59
Agriculture-Related Services	3	507,474	6.17
Total	28	\$8,230,198	68.61

Source: Chelan County Assessor, data sheet, April 2000.

2.3.7 Retail Sales Tax

The 1970 Legislature authorized the cities of the state to adopt a retail sales tax in the amount of one-half of one percent of the selling price of taxable goods and services. City of Entiat began imposing the sales and use tax (one-half cent) in 1973. The rate was increased by ordinance in 1982 to one cent (the Legislature allowed cities and counties to impose a local option tax at rates varying from 0.1 to 0.5 percent). Table 2-8 presents sales and use taxes collected, based on City of Entiat finance data, for the period 1973 through 1999. Aggregate and per capita tax receipts are shown in terms of both nominal and real (inflation adjusted) dollars. Between 1973 and 1981 aggregate nominal tax receipts were shown to have grown at an average annual rate of 5.3 percent and -3.8 percent in terms of real dollars. The corresponding per capita tax collections increased by 2.7 percent in nominal terms and decreased by 6.2 percent in real terms during the period. Between 1981 (after imposition of the option tax) and 1999 aggregate nominal tax receipts increased at an AARG of 8.6 percent and 5.5 percent in terms of real dollars. The corresponding per capita figures changed by 5.0 percent in nominal dollars and 1.5 percent in terms of real dollars. During the most recent five-year period, 1994 – 1999, nominal and real dollar aggregate tax receipts grew by 5.6 percent and 3.2 percent, respectively. It is important to note, however, that the recent growth in sales tax receipts has been quite uneven. In 1995, nominal receipts stood at \$82,740 (the peak year), whereas 1999 tax receipts amounted to \$43,765. Per capita tax collections during the most recent five-year period decreased by 5.2 percent in nominal terms and 7.3 percent in real terms. Much of the variation in tax receipts during the recent period is attributable to the vagaries of the construction industry, which has been a major contributor to total sales tax receipts

Table 2-8: Sales Tax Receipts

<i>Year</i>	<i>Tax Collections (Nominal \$)</i>	<i>Tax Collections Per Capita (Nominal \$)</i>	<i>Tax Collections (Real 1999 \$)</i>	<i>Tax Collections Per Capita (Real 1999 \$)</i>
1973	\$6,025	\$15.77	\$22,775	\$ 59.62
1974	\$6,052	\$15.48	\$20,456	\$ 52.32
1975	N/A	-	N/A	\$ -
1976	N/A	-	N/A	\$ -
1977	N/A	-	N/A	\$ -
1978	N/A	-	N/A	\$ -
1979	N/A	-	N/A	\$ -
1980	N/A	-	N/A	\$ -
1981	\$9,086	\$19.46	\$16,627	\$ 35.60
1982	\$28,355	\$60.98	\$49,054	\$ 105.49
1983	N/A	-	N/A	\$ -
1984	N/A	-	N/A	\$ -
1985	\$5,831	\$11.85	\$9,038	\$ 18.37
1986	\$15,420	\$31.15	\$23,438	\$ 47.35
1987	\$20,226	\$41.70	\$29,732	\$ 61.30
1988	\$10,940	\$25.27	\$15,425	\$ 35.62
1989	\$15,758	\$36.23	\$21,116	\$ 48.54
1990	\$13,368	\$29.77	\$16,977	\$ 37.81
1991	\$15,685	\$34.86	\$19,136	\$ 42.52
1992	\$17,760	\$39.03	\$21,134	\$ 46.45
1993	\$19,703	\$42.37	\$22,658	\$ 48.73
1994	\$33,362	\$61.21	\$37,365	\$ 68.56
1995	\$82,740	\$149.08	\$90,187	\$ 162.50
1996	\$51,856	\$76.82	\$54,967	\$ 81.43
1997	\$52,956	\$66.11	\$55,074	\$ 68.76
1998	\$41,300	\$47.75	\$42,126	\$ 48.70
1999	\$43,765	\$46.81	\$43,765	\$ 46.81
AARG 1973-1981	5.3%	2.7%	-3.8%	-6.2%
AARG 1981-1999	8.6%	5.0%	5.5%	1.5%
AARG 1994-1999	5.6%	-5.2%	3.2%	-7.3%

Source: City of Entiat, April 2000.

2.3.8 Project-related Revenue Sources

2.3.8.1 PUD Privilege Tax (RCW 54.28)

Since 1941 public utility districts (PUDs) have been subject to an excise tax, which is in lieu of normal property taxes.³⁸ PUDs are exempt from taxes by virtue of their status as municipal corporations. The tax is levied on PUDs as a privilege of operating facilities for generating and distributing electric energy. The current rate is 2.14 percent of gross revenues plus 5.35 percent of the first 4 mills per kilowatt-hour derived from the sale or distribution of power. The yield from the PUD privilege tax (formerly the PUD excise tax) is shared between the State of Washington and local taxing districts, with 37.6 percent retained by the state and 62.4 percent returned to local taxing districts on the same basis as other property taxes. PUDs may make a voluntary payment to local taxing districts for the removal of property from the tax rolls.

The amount budgeted for the PUD Privilege Tax in 1999 was \$3,000 (see 1999 City Budget, Current Expense Fund). This budget estimate may be somewhat conservative, as the actual amounts distributed from this state-shared revenue source amounted to \$3,515.28 in 1998 and \$3,210.57 in 1997. Nonetheless, this tax source contributes only about 1.5 percent of total current revenues.³⁹

2.3.8.2 Other Taxes and Payments

There are no other revenues directly attributable to the Rocky Reach Project. However, park fees from Entiat Park users (the city maintains and operates Entiat Park) were budgeted at \$49,700 in 1999. Actual revenues to the City Park Department (which may include minor amounts from Kiwanis Park) from Entiat Park may be slightly lower. In 1998 and 1997, actual revenues generated from the city's parks amounted to \$52,141.01 and \$48,327.25, respectively. It is also worth noting that the revenues generated from park operations are substantially lower than outlays. In 1999, the amount budgeted for park operations was \$96,581, with revenues generated from fees representing only 51.5 percent of total outlays. In 1998 and 1997, actual park outlays were \$78,463.36 and \$72,415.12, respectively. Revenues from park fees and charges in those years represented about two-thirds of total outlays.

38 Public utility districts are also obligated to pay the Public Utility Tax (RCW 82.16), which is similar to the B & O Tax in that it also applies to the PUDs gross income. The current rate is 3.873 percent of gross revenues, all of which is retained by the state as a general fund source. In computing the public utility tax, certain deductions are allowed from gross income in arriving at the taxable amount. Utilities are allowed to deduct the value of power sold out-of-state from their gross income for public utility tax purposes. These sales are taxable under the manufacturing classification of the B & O Tax. Other allowable deductions are quite minor.

39 Total current fund revenues budgeted for 1999 were approximately \$242,000 exclusive of beginning fund balance.

SECTION 3: POTENTIAL FOR EXPANDING NEW MARKETS

3.1 Agriculture

Expansion of agriculture is unlikely in the Entiat area due to lack of available land suitable for orchard fruit growing and limited water capacity available for irrigation, due to regulatory constraints on uninterrupted water withdrawal permits. However, the Chelan County PUD No. 1 continues to pay for a substantial number of unutilized irrigation water shares, some 350 shares out of 1,250 shares that were available before the Project was developed. The remainder are maintained and paid for by the Entiat Irrigation District. It is important to note, however, that the district cannot extend its irrigation boundaries. The current boundary is conterminous with the city limits of Entiat on the west side and to the Entiat River on the south side of the city and to Ribbon Cliff approximately one and a half miles to the north of the city.

Irrigated land on the west side of the Rocky Reach Dam reservoir consists of approximately 900 acres, a major portion of which are located north of Entiat.

3.2 Recreation & Tourism Industries

There appears to be substantial opportunity for expanding existing and developing new markets in the recreation and tourism industries. Growth in recreation visitors to facilities located at the Rocky Reach Project reservoir averaged 2.5 percent per annum during the past five years, which is comparable to the state average. While the number of visitors at Entiat Park has fluctuated substantially during the period (possibly because of the need to provide camping facilities for fire fighters at various times) the potential for accommodating the goods and services needs of visitors to that facility is substantial, along with the opportunities associated with attracting tourism/recreation visitors en route to other nearby areas. A major share (probably in excess of 50%) of traffic going to Lake Chelan for tourism/recreational purposes passes through Entiat. State Route 97a is on the Cascade Loop, an important tourism corridor in the State of Washington.

3.3 Manufacturing Industries

There is reported interest by manufacturing firms to establish operations in the Entiat area. The lack of adequate sewerage treatment facilities in the city of Entiat has apparently delayed the establishment of new manufacturing industries. It is also important to note that several manufacturing firms, including food processing and storage, have gone out of business in recent years. The lack of a large agricultural base in the immediate area accounts for the loss of the latter business enterprises. It is likely that all food processing firms will relocate to major agriculture producing areas in the foreseeable future. Reduced harvest levels from the Wenatchee National Forest and uncertainty regarding limitations on logging in the future have dampened the potential for attracting and retaining firms engaged in wood products manufacturing.

3.4 Construction Industries

Construction has been robust in the latter half of the 1990s, particularly of residential and some commercial structures. This is likely to continue as there is high demand for part-time use or recreational, particularly, waterfront properties by out-of-town residents.

3.5 Relevant Constraints

There are a number of constraints, not least of which, is the lack of adequate sewerage treatment capacity, that have limited economic development in the Entiat area. Another shortcoming is the lack of a town center with adequate shopping facilities that attract tourists. Other constraints have to do with an inadequate land base in waterfront area for both commercial development and public facilities, including park lands.

3.5.1 Land Use Planning

Comprehensive land use plans have been developed that ensure an adequate supply of land for residential development. Industrial lands are somewhat constrained by the current lack of available land and infrastructure in the existing commercial/industrial area east of SR 97A within the city.

Adequate land is available for residential development within the UGA for the city of Entiat. Commercial lands are also available, particularly in the area near the city hall, which forms the current town center. Industrial land is available to satisfy current and near-term future needs. However, much of the land in the area paralleling the waterfront currently in industrial use is constrained by land use regulations and right-of-way limitations.

3.5.2 Water and Sewage Facilities

Recent (1991 and 1994) water system upgrades have ensured adequate sources. The city has adequate water resources; however, there is some confusion on the status of water permits. Currently, the city has a water certificate; however, it is seeking to have the status of its rights to water changed to that of permit-holder. The city is currently conducting a water filtration study that is required to meet state health regulation.

The city indicates a desperate need for an upgrade to the sewage treatment system, which was last upgraded (from a lagoon system to a treatment plant) in 1972. Subsequent extensions of sewer lines to areas of the city that were previously unserved or recently annexed have created a shortfall in treatment capacity. The system must be upgraded to accommodate additional growth. The lack of an adequate sewage treatment system is a particularly difficult problem for attracting new industry to the community.

3.5.3 Land and Other Infrastructure

Most considerations involve adequate park facilities and community meeting locations to serve the needs of residents as well as trails and public spaces for pedestrians in the uplands area. The latter issue is particularly important for attracting tourists to the townsite from those who visit the waterfront parks (Entiat Park) as well as tourists driving through the area. A trail system has been proposed.

A trail system connecting Entiat Park with the town center (area near City Hall) is needed to encourage tourism/recreation visitors to spend time and money in the community. A trail system was discussed in the *1992 Master Plan Entiat Park* prepared by DOH Associates, PS, December 1992. According to the plan, the system includes a waterfront trail with a possible extension to the south, which would include a trail head just beyond the south end turnaround and pass under SR 97A to access other public lands along the Entiat River to the west. In addition, a trail extension would continue north from the museum area to public riverfront lands just east of the town center designated for a mixture of development. Adequate signage to help direct tourism-related visitors should also be provided. There is also a general lack of boat launch facilities in Entiat.

The waterfront lands immediately to the north of Entiat Park are owned by Chelan County PUD No. 1. This major parcel was considered unstable for development, but recently under an agreement with the city of Entiat, the property is being mined to retrieve extensive gravel deposits. Upon completion of the mining operation, it has been noted by city officials that the property would provide an excellent opportunity for development of city parklands and related community facilities (a community meeting center has been proposed). In addition, part of the property could conceivably be utilized for commercial and residential development. It is worth noting that the community does not have adequate common facilities for public meetings and other gatherings. Similarly, because of the heavy use of Entiat Park by nonresident visitors, the city has limited park resources (only Kiwanis Park, which is operated by the city for organized sports) for residents. A new city park would represent an important contribution to public facilities and services for the benefit of local residents.

The lack of commercial retail and services businesses in the city of Entiat is a major concern of local officials and residents. In light of the fact that the commercial center of the city was dislocated as a result of developing the Rocky Reach Project (as discussed in the next section below), there is a sense that the single most important constraint on the development of new commercial markets is the lack of a town identity. There is a need for an improved town center with an attractive business district. Long-term residents have treasured memories about walking along a sidewalk, while undertaking errands and exchanging greetings with other people. Thus, the current layout of the town impedes development of a commercial district that encourages pedestrian access to stores and other shopping opportunities. The common theme of discussions by city officials and other residents is the need for concentrated planning of basic facilities, such as a trail system connecting the waterfront area, particularly Entiat Park, to the site of the existing, if incomplete, upland town center.

SECTION 4: HISTORICAL ECONOMIC IMPACTS - ROCKY REACH PROJECT

4.1 Brief History of the City of Entiat

4.1.1 Early History for City Relocation Required for the Rocky Reach Project

The first non-Indian settlement was established adjacent to the confluence of the Entiat and Columbia Rivers in the late 1880s. The number of inhabitants reached 80 by 1894. Two lumber mills were built in the early 1890s; the first located upstream on the Entiat, the second near the mouth of the river. A commercial orchard was also planted at this time. The first settlement was situated adjacent to the mill along the Entiat River, just upstream from the point at which it flows into the Columbia River. This settlement was destroyed by fire shortly after the turn of the century and a new town was rebuilt near the track of the Great Northern Railroad along the Columbia River. The community moved to the second site in order to benefit from the commerce of the railroad. The area around the town and up the Entiat River continued to grow as a lumbering and fruit producing area. The town of Entiat was incorporated at its second location in 1944. The first Mayor was Will Risk, a local retailer for whom the northern portion of the Entiat Park is named; the southern portion is named for another early day native, Chief Silico Saska.

From the early part of the 20th century, commercial riverboats operated on the Columbia River and a ferry operated across the Columbia River between the town of Entiat and the Orondo community in Douglas County. Ferry service continued until shortly after the Rocky Reach Dam began operations in 1961, even though a new ferry dock site had been established, because the cost of operations became prohibitive. (There is discussion today about re-instituting passenger tour service on the river using a modern, but traditional looking commercial riverboat operated by a private vendor.)

In 1955, officials from the Chelan County PUD began preliminary discussions with officials and citizens of the town of Entiat relative to the effects of the proposed Rocky Reach Project on the Entiat area. These meetings were aimed at setting tentative procedures for settlement with individual property owners whose land and buildings would be affected. In 1956, the city leaders recognized the need for an overall plan of relocation and the (then) mayor appointed a citizen's committee to assist the Town Council in coordinating the relocation of the town. The committee was composed of representatives of the Commercial Club, Women's Club, local merchants, warehouse managers, churches, and lodges. The discussions of this committee concluded that the community could not plan its relocations without first being informed of highway and railroad relocation plans; and that professional planning and engineering assistance was needed. A meeting between this committee and the PUD commissioners in early May 1957 resulted in the decision by the PUD to assign its attorney and chief engineer to lay the groundwork for a conference regarding highway and railroad relocation. This led to formation of an interagency coordinating committee, consisting of the PUD, the Great Northern Railroad and State Highway Department along with representatives from the city of Entiat. Subsequently, tentative plans for

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the highway and rail line relocation were agreed upon. In the fall of 1957, the PUD agreed to finance professional planning for the city of Entiat and a planning consultant was retained in February 1958 to begin the preliminary surveys for a relocation study. In addition, application was made for federal matching funds for urban planning assistance. In May 1958, final approval was given by the federal agency in charge (Housing and Home Finance Agency) and an agreement was concluded between the (then) Washington State Department of Commerce and Economic Development and Chelan County commissioners authorizing the planning staff of Chelan County to prepare the relocation and future development plans. (The planning consultant retained earlier by the PUD joined the staff of the Joint Planning Office was assigned to the Entiat project.)

The general approach for developing a relocation and future development plan consisted of three major elements. The first was to obtain information from the citizens of the town of Entiat. Survey questionnaires were distributed to all residents of the community requesting information on location of residence, household characteristics, housing structure type and condition, employment and income, shopping patterns, and preferences for the future town site. In addition, interviews were conducted of merchants, warehouse managers, and civic leaders, public meetings were held, and all available relevant information gathered from agencies connected with the relocation or from the field.

The second phase consisted of preparing supporting studies and development of several generalized schemes for the relocation of the town. These schemes were presented to groups in the town in order to elicit the opinions and suggestions of resident stakeholders and incorporate many of them in the various proposals. Ultimately one scheme appeared to have the approval of the majority and was endorsed by both the County Planning Commission and the Town Council. The scheme was adopted (see Figure 4-1) and became the basis for developing the comprehensive plan for the relocation and development of the town. Developing the comprehensive plan and the proposed regulatory ordinances constituted the third and final phase of the planning project, culminating in the report *Relocation Plan for Entiat Washington, 1958*, prepared by the Joint Planning Office, Chelan County, Washington.

4.1.2 Relocation and Development Efforts

During the period 1958 through 1961, when Rocky Reach Dam began operations, efforts were undertaken to compensate land owners affected by the dam construction and subsequent inundation from the filling of the reservoir and, in addition, to provide infrastructure at the uplands area of the town site. Chelan PUD paid approximately \$3.1 million to property owners in the area adjacent to the Columbia River (Sections 4, 9, 16, in Township 25 N Range 21). Transactions for direct transfer of ownership or purchase of easements by the PUD were evaluated as part of this study. There were 100+ transactions ranging in transactions outlays ranging from \$8,500 to \$300,000. All of the transactions were negotiated. None involved condemnation proceedings. (Refer to Table 4-1 for documentation of these transactions.)

Chelan PUD also provided planning assistance (mentioned above) to the city of Entiat and, in addition, made payments for legal assistance and infrastructure development totaling \$425,977.11. The funds were allocated by year and function as follows:

1958 --	Planning Assistance	\$5,612.50
	Payment for Dumping	5,000.00
	Advance for Legal Services	2,500.00
	Total Received	\$13,112.50
1959 --	General Fund – Settlement	\$195,071.02
	Water Fund – Settlement	129,793.59
	Street Fund – Settlement	88,000.00
	Total Received	\$412,864.61

Major portions of the downtown area were subject to inundation as a result of the Project. (See Figures 4-2, 4-3, and 4-4, which are representations of aerial photographs taken prior to the inundation of the city of Entiat and several years subsequently.) In 1958 the city limits of Entiat encompassed an area that is only a fraction of current land area of the city. One of the initiatives in advance of relocating the downtown was to propose the annexation of large areas of agricultural lands to the north along the Columbia River and west of the town site including a substantial area along Entiat Avenue (now Hedding Street) paralleling Entiat River. During the period 1958 and 1959, there were three annexations (lots on the corner of Dunn Street and Entiat Way; an area east of SR 97A from Lakeshore Drive north to Kiwanis Park; and, the Town Hill area (Auvil Avenue, Brown Avenue, and Entiat Way), although none of these were extensive as compared to subsequent annexations. It took about 10 more years before there were further

annexations involving extensive land areas.⁴⁰ Nonetheless, the city of Entiat would have a substantially different character after the transfer of properties and relocation and demolition of dwellings and commercial buildings in the area that ultimately would be submerged. Moreover, according to current city officials, some of whom have lived in the area since the relocation of the main town site, the subsequent annexations of large land areas made development of infrastructure and delivery of municipal services difficult and expensive compared to the previous era when the town site was relatively compact.

Existing homes were either demolished or moved to a new site on high ground to the west of the old town site, sometimes called the third town. Apparently only one commercial building was moved to a new location – the Entiat IOOF Hall, which houses the Community Church. One building from the original town site remains standing inside Entiat Park, a former garage that is currently used as storage building. According to knowledgeable local residents there were 11 businesses that were dislocated in the downtown area. These consisted of an auto repair shop (the building that remains standing), hardware store, metal fabrication shop, meat market, two taverns, 2 grocery stores, drug store and soda fountain, and a barbershop. In addition, there were five fruit packing and storage warehouses that were located in the flooded area of which three were rebuilt in the “third” town.

Beyond the dislocations of residential and commercial property already noted, there was a substantial loss of land area suitable for fruit growing. According to the Relocation Plan for the Town of Entiat (op., cit., 1958), an estimated 520 acres of orchard lands (out of 2,335 acres in production at that time) were expected to be lost through inundation and, in addition, because of relocation of the railroad, highway, and town site. According to a local source interviewed for this study, the loss of orchard lands included 400 irrigated acres.

In addition, Chelan PUD purchased about 20,000 acres of land in the area, which was subsequently turned over to the Washington State Department of Fish and Wildlife (formerly Department of Game) as game range and wildlife recreation areas as required as restitution under the FERC license to operate the Rocky Reach Dam. A portion of these lands were purchased from private owners and, as such, exempted from the property tax.

Several of the homes in the old town site were moved to higher ground, and a few of the business establishments continued to operate. However, according to several longtime residents interviewed for this study, many businesses located in Entiat before the dam was built were owned by people nearing retirement. This may explain why owners of many businesses decided to cease business activities and use the proceeds from PUD property disbursements for other purposes, rather than rebuilding at the new town site. As the dam neared completion, several

⁴⁰ In 1970 the land area from the 1958 north boundary to the current northern city limits east of SR 97A was annexed. In 1972, there was a small annexation. In 1973 the area north of the Entiat River and south of Entiat Way was annexed. The Burkey Warehouse on SR 97A and a portion of Dunn Street and Sunset Court were annexed in 1974 and 1979, respectively. During the 1980s there were three annexations: a park area located south of River Road in 1980; an area north of Entiat in 1985; and an area northwest of second street in 1987. During the 1990s, there were extensive annexations with proposed land use development: Stoneridge with plans for 77 lots and Stoneridge North with plans for 28 lots, both in 1992; an area near Hedding Street – Westcott Hills with 76 lots proposed - in 1993; Shadow Ridge with plans for 28 lots in 1995; Columbia Breaks northwest of Davis Street and between Cammack and Entiat Way, also in 1995; and Treasure Haven with 85 proposed lots, located between Howe Avenue and Stoneridge, in 1999.

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businesses, government agencies, and other organizations built on the bluff overlooking the old town site. These included the present City Hall and Fire Station, Post Office and Grange Building, U.S. Forest Service Complex, Federated and Friends churches, Entiat Food Center, two service stations, Chamber of Commerce building (now North Central Credit Union), and a building used in metal work. These buildings and businesses/government offices constituted the core of the new town site, which was intended to replace the downtown area that was completely flooded. The Entiat School District school building complex (housing kindergarten through high school classes) was one of the first new buildings constructed in the area overlooking the old town site, although it was situated southwest of the new core business area.

Other businesses were located in the northern portion of the town near the relocated highway and railroad. These included the J.P. McDonald Building, which housed a lumber business, Cathy's Cafe, and a hardware store (now Branding Iron Restaurant, McClellan Trucking facility, and office of Entiat Valley Explorer Newspaper). Other nearby buildings included the locations for Hawley's Automotive (now Amarillo Wind Machine), Town's Feed and Grocery Store (now vacant), Hogland's TV & Appliance (now vacant), Columbia Cafe (which burned down), Mobil gas station (now Lucky's Texaco & Taco Maker), a laundromat and liquor store and gift shop. Three fruit warehouses of the six located in the area to be inundated were rebuilt in the third town – Mad River Company (most recently Tenneco Packaging), Entiat Warehouse Company (now occupied by Aeromet America) and Taplett Fruit Company (destroyed).⁴¹ The other warehouse businesses did not rebuild.⁴²

The residences, business establishments, and warehouses that had not been moved from the old town site were removed. After the move and subsequent inundation, Entiat no longer had a hotel, drugstore, and the hardware, auto and farm equipment dealers also shut down. As will be documented in greater detail below, among the dramatic changes that resulted from the dislocation of the old town site was the rapid decrease in population and equally sharp decline in the property tax base of the city.

41 The specific businesses and other organizations and related buildings cited were based in part on the newspaper article Nuggets from Entiat's Past, by Phyllis Griffith, Entiat Valley Explorer, August 12, 1999.

42 Nonetheless, in subsequent years several additional warehouses were constructed: Coxes Warehouse, Packing Line (2 structures), Wewoka, Keystone, and another independent firm.

Table 4-1 Purchases by the PUD for Properties or Easement (1956-61)

File Number	Date	Title	Section	Lot /blocks	Payment
rr-229	3/3/59	Overflow Easement	9	4 & 5	58,500
rr-72.4/87	4/16/58	Quick Claim Deed	9	6	25,600
rr-229.4	1/28/63	Quick Claim Deed	9	4	1,000
rr-230	1/28/58	Overflow Easement	9	4	14,048
rr-88.43	5/16/61	Quick Claim Deed	9	5	
rr-88.43	5/16/61	Warranty Deed	9	5	
rr-88.44	7/5/61	Quick Claim Deed	9	5	1,000
rr-93.2	1/29/59	Warranty Deed	9	2&3	10,000
rr-92.2	6/2/59	Warranty Deed	9	1-7, blk 2	2,000
rr-92.41	2/11/61	Overflow Easement	9	1-5, blk 1	1,000
rr-92.42	1/29/59	Overflow Easement	9	6-10, blk 1	1,000
rr-18.2	10/28/63	Decree of Appropriation	9	various	398,071
rr-92.4	10/3/58	Warranty Deed	9	various	3,000
rr tr-85	1/10/78	Lease & Oper. Agree	9	various	
rr-exh-r-6	10/11/79	Corps permit -floats		various	
rr-96.2	7/27/58	Warranty Deed	9	1-4, blk 2	7,500
rr-96.4	3/25/58	Warranty Deed	9	1-4, blk 2	
rr-97	4/1/58	Warranty Deed	9	1-4, blk 2	8,850
rr-96	3/19/58	Warranty Deed	9	5, blk 2	17,200
rr-82.4	3/13/58	Warranty Deed	9	6, blk 2	19,000
rr-82.2	4/4/58	Warranty Deed	9	7&8, blk 2	27,000
rr tr-88	11/10/77	Overflow Easement	9	7-10, blk 3	1
rr-95.2	3/11/58	Warranty Deed	9	8, blk 2	25,600
rr-95	3/18/58	Warranty Deed	9	9-11, blk 2	40,000
rr-95	8/30/77	Overflow Easement	9	11, blk 2	1
rr-32	1/20/58	Warranty Deed	9	2,3	56,250
rr-94.4	10/14/58	Warranty Deed	9	1&2, blk 3	15,500
rr-94.2	6/30/59	Quick Claim Deed	9	3,4,&13, blk 3	1
rr-94.25	3/7/60	Quick Claim Deed	9	4, blk 3	1,000
rr-91	4/30/59	Overflow Easement	9	6, blk 3	10
rr-89	8/30/77	Overflow Easement	9	7, blk 3	1
mp-164	6/8/76	Permit - Entiat Comm. Museum	9	7&8, blk 3	
rr-89	8/22/58	Warranty Deed	9	7&8, blk 3	13,250
rr-90	1/24/58	Warranty Deed	9	7&8, blk 3	14,000
rr-88	3/12/58	Warranty Deed	9	7-10, blk 3	29,910
tr-86	1/16/58	Warranty Deed	9	track 8, blk 3	42,000
rr-92	1/14/58	Warranty Deed	9	8, blk 3	9,400
rr-85.4	4/21/58	Warranty Deed	9	9., blk 3	250
rr-93	2/6/58	Warranty Deed	9	8, blk 3	8,725
rr-85	4/1/58	Warranty Deed	9	8&9, blk 3	75,000
rr-exh-r-5	7/19/79	Lease & Oper. Agree	16	7	
rr-44	10/28/63	Decree of Appropriation	16	various	398,071
rr-28	4/26/58	Various Deeds	16	Entiat Ferry Corp.	37,500
rr-39	6/2/59	Special Conveyance	16	RR Co. R/W Station Grounds	10

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Table 4-1 (Cont.) Purchases by the PUD for Properties or Easement (1956-61)

File Number	Date	Title	Section	Lot /blocks	Payment
rr-33.5	1/16/59	Special Conveyance	16	26, 27	1,300
rr-33	2/20/58	Special Conveyance	16	28-32	67,000
rr-34	10/30/58	Special Conveyance	16	33-37	200,000
rr-35	1/29/59	Special Conveyance	16	38-45, part 46	399,500
rr-35.2	10/1/58	Special Conveyance	16	46-48, 50-52	6,371
rr-23a	5/10/58	Quick Claim Deed	16	part 1, blk 1	17,000
rr-23/23b	3/25/58	Warrantee Deed	16	part 1, blk 1	35,000
rr-23.2	1/22/58	Warrantee Deed	16	part 1, blk 1	15,860
rr-24	1/13/58	Warrantee Deed	16	part 1, blk 1	17,750
rr-25	1/24/58	Warrantee Deed	16	part 1, blk 1	2,500
rr-27	3/5/58	Warrantee Deed	16	part 1, blk 1	18,000
rr-29	1/15/58	Warrantee Deed	16	part 1, blk 1	8,700
rr-30	1/13/58	Warrantee Deed	16	part 1, blk 1	11,528
rr-31	1/13/58	Warrantee Deed	16	part 1, blk 1	10,500
rr-32	1/20/58	Warrantee Deed	16	part 1, blk 1	56,250
rr-exh-r-6	8/22/77	Fish & Game Hydraulics Proj. Approv.	16	NW1/4	
rr-226	11/25/59	Overflow Easement	16	N-1/2, SW-1/4, NE-1/4	87,250
rr-tr-85	1/10/78	Lease & Oper. Agree	16	exhibit R, site #6	
rr-ex-r-6	11/21/77	Lake Entiat, Columbia River, Entiat Permit #071	16	part of NW-1/4	
rr-225	12/5/59	Overflow Easement	16	NW-1/4, SE-1/4	17,400
rr-227	2/3/58	Overflow Easement	16	SE-1/4, NE-1/4 & Gov. lots 1&2	19,500
rr-228	12/8/59	Warrantee Deed	16	part of gov. lot 2	8,000
rr-36	1/17/59	Special Conveyance	16	part of gov. lot 3&4	254,000
rr-85.5	8/3/59	Special Conveyance	16	part of gov. lot 3&4	28,100
rr-224	6/10/59	Overflow Easement	16	1/2, SW -1/4, NE-1/4 & Gov. l	102,500
rr-exh-r-5	2/21/78	Quick Claim Deed	16	gov. lot 6	1
rr-223	1/2/58	Warrantee Deed	16	gov. lot 6	124,600
rr-221	1/22/58	Overflow Easement	16	part of gov lot 7	125,000
rr-exh-r-5	3/17/78	Warrantee Deed	16	gov. lot 7	10 & other
rr-exh-r-5	2/15/78	Warrantee Deed	16	gov. lot 7	10
rr-74.2	2/1/58	Warrantee Deed	16	8-10, blk 4	2,800
rr-27	3/5/58	Warrantee Deed	16	11-20, blk 4	18,000
rr-94	8/30/77	Overflow Easement	16	part of blk 3	1
rr-81	1/16/58	Warrantee Deed	16	1&2, blk 4	6,200
rr-80	1/13/58	Warrantee Deed	16	11&12, blk 3	2,500
rr-94	2/25/58	Warrantee Deed	16	part of blk 3&4	7,130
rr-76	2/23/58	Warrantee Deed	16	5, blk 3	10,700
rr-75	2/22/58	Warrantee Deed	16	6, blk 3	14,900
rr-78	1/9/58	Warrantee Deed	16	2&3, blk 3	12,700
rr-77	1/28/58	Warrantee Deed	16	4, blk 3	12,800
rr-55.2/82	3/4/58	Warrantee Deed	16	4&5, blk 2	16,200
rr-79	1/13/58	Warrantee Deed	16	1&2, blk 3	18,300
rr-83	2/27/58	Warrantee Deed	16	2, blk 2	16,000

Table 4-1 (Cont.) Purchases by the PUD for Properties or Easement (1956-61)

File Number	Date	Title	Section	Lot /blocks	Payment
rr-66	3/25/58	Warranty Deed	16	2, blk 3	70,000
rr-43	1/13/58	Warranty Deed	16	9&10, blk 10	31,000
rr-84	2/7/58	Warranty Deed	16	1, blk 2	14,000
rr-23/23b	3/25/58	Warranty Deed	16	9, blk 10	35,000
rr-45	3/10/58	Warranty Deed	16	4-7, blk 10	35,000
rr-46.1	1/23/58	Warranty Deed	16	1-3, blk 10	35,800
rr-68	1/23/58	Warranty Deed	16	5&6, blk 9	17,000
mp-58	5/23/72	permit for campgrounds & rec.	16	prt blks 2-4 & 9	Mutal benefits
rr-70	1/24/58	Warranty Deed	16	2, blk 9	4,600
rr-55.2/82	3/4/58	Warranty Deed	16	19&20, blk 3	16,200
rr-72.2	4/14/58	Warranty Deed	16	1-3, blk 3	3,400
rr-70.4	4/23/58	Warranty Deed	16-17	4-8, blk 3	4,130
rr-85	4/1/58	Warranty Deed	16	16-20, blk 2	75,000
rr-85.2	2/7/58	Warranty Deed	16	14&15, blk 2	800
rr-73	2/14/58	Warranty Deed	16	11, blk 2	3,600
rr-71.2	1/31/58	Warranty Deed	16	12&13, blk 2	7,720
rr-27	3/5/58	Warranty Deed	16	3&4, blk 2	18,000
rr-71.2	2/28/58	Warranty Deed	16	9&10, blk 2	18,750
rr-70.2	1/7/58	Warranty Deed	16	part of blk 2&9	10,700
rr-66.4	4/10/58	Warranty Deed	16	1&2, blk 2	7,100
rr-49	1/13/58	Warranty Deed	16	part of blk 1&2	31,250
rr-94	8/30/77	Overflow Easement	16	part blk 2	1
rr-47	1/15/58	Warranty Deed	16	9&10, blk 10	7,300
rr-356	10/28/63	Decree of Appropriation	4	various	398,071
rr-16	10/28/63	Decree of Appropriation	4	various	398,071
rr-103	2/12/58	Warranty Deed	4	3	64,000
rr-tr-237		permit underground & submarine tele cable	4	6	
rr-235	1/13/58	Warranty Deed	4	1&6	84,000
rr-102	3/12/58	Overflow Easement	4	E-1/4, NE-1/4 & Gov. lots 2,3&	29,910
rr-96.4	3/25/58	Warranty Deed	4	8, blk 1	
rr-97.6	3/12/58	Warranty Deed	4	8, blk 1	8,500
mp-136	6/6/72	permit, little league baseball field	4	6&7, blk 1	
rr-98	5/8/58	Warranty Deed	4	6&7, blk 1	30,150
rr-99	4/7/58	Warranty Deed	4	5, blk 1	23,000
mp-147	9/25/73	permit, for parking vehicles	4	5, blk 1	
rr-100.1	10/24/78	Overflow Easement	4	3, blk 1	
rr-99	5/8/91	Quick Claim Deed	4	3-5, blk 1	
rr100/101	4/25/91	real estate contract	4	2&3, blk 1	
rr-100	4/1/58	Warranty Deed	4	3&4, blk 1	37,100
rr-101	4/25/91	real estate contract	4	1, blk 1	
rr-101	5/20/67	Warranty Deed	4	1&2, blk 1	26,000
rr-231.4	1/6/60	Quick Claim Deed	4	7	625

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Table 4-1 (Cont.) Purchases by the PUD for Properties or Easement (1956-61)

File Number	Date	Title	Section	Lot /blocks	Payment
rr-66	3/25/58	Warranty Deed	16	2, blk 3	70,000
rr-43	1/13/58	Warranty Deed	16	9&10, blk 10	31,000
rr-84	2/7/58	Warranty Deed	16	1, blk 2	14,000
rr-23/23b	3/25/58	Warranty Deed	16	9, blk 10	35,000
rr-45	3/10/58	Warranty Deed	16	4-7, blk 10	35,000
rr-46.1	1/23/58	Warranty Deed	16	1-3, blk 10	35,800
rr-68	1/23/58	Warranty Deed	16	5&6, blk 9	17,000
mp-58	5/23/72	permit for campgrounds & rec.	16	prt blks 2-4 & 9	Mutal benefits
rr-70	1/24/58	Warranty Deed	16	2, blk 9	4,600
rr-55.2/82	3/4/58	Warranty Deed	16	19&20, blk 3	16,200
rr-72.2	4/14/58	Warranty Deed	16	1-3, blk 3	3,400
rr-70.4	4/23/58	Warranty Deed	16-17	4-8, blk 3	4,130
rr-85	4/1/58	Warranty Deed	16	16-20, blk 2	75,000
rr-85.2	2/7/58	Warranty Deed	16	14&15, blk 2	800
rr-73	2/14/58	Warranty Deed	16	11, blk 2	3,600
rr-71.2	1/31/58	Warranty Deed	16	12&13, blk 2	7,720
rr-27	3/5/58	Warranty Deed	16	3&4, blk 2	18,000
rr-71.2	2/28/58	Warranty Deed	16	9&10, blk 2	18,750
rr-70.2	1/7/58	Warranty Deed	16	part of blk 2&9	10,700
rr-66.4	4/10/58	Warranty Deed	16	1&2, blk 2	7,100
rr-49	1/13/58	Warranty Deed	16	part of blk 1&2	31,250
rr-94	8/30/77	Overflow Easement	16	part blk 2	1
rr-47	1/15/58	Warranty Deed	16	9&10, blk 10	7,300
rr-356	10/28/63	Decree of Appropriation	4	various	398,071
rr-16	10/28/63	Decree of Appropriation	4	various	398,071
rr-103	2/12/58	Warranty Deed	4	3	64,000
rr-tr-237		permit underground & submarine tele cable	4	6	
rr-235	1/13/58	Warranty Deed	4	1&6	84,000
rr-102	3/12/58	Overflow Easement	4	E-1/4, NE-1/4 & Gov. lots 2,3&	29,910
rr-96.4	3/25/58	Warranty Deed	4	8, blk 1	
rr-97.6	3/12/58	Warranty Deed	4	8, blk 1	8,500
mp-136	6/6/72	permit, little league baseball field	4	6&7, blk 1	
rr-98	5/8/58	Warranty Deed	4	6&7, blk 1	30,150
rr-99	4/7/58	Warranty Deed	4	5, blk 1	23,000
mp-147	9/25/73	permit, for parking vehicles	4	5, blk 1	
rr-100.1	10/24/78	Overflow Easement	4	3, blk 1	
rr-99	5/8/91	Quick Claim Deed	4	3-5, blk 1	
rr100/101	4/25/91	real estate contract	4	2&3, blk 1	
rr-100	4/1/58	Warranty Deed	4	3&4, blk 1	37,100
rr-101	4/25/91	real estate contract	4	1, blk 1	
rr-101	5/20/67	Warranty Deed	4	1&2, blk 1	26,000
rr-231.4	1/6/60	Quick Claim Deed	4	7	625

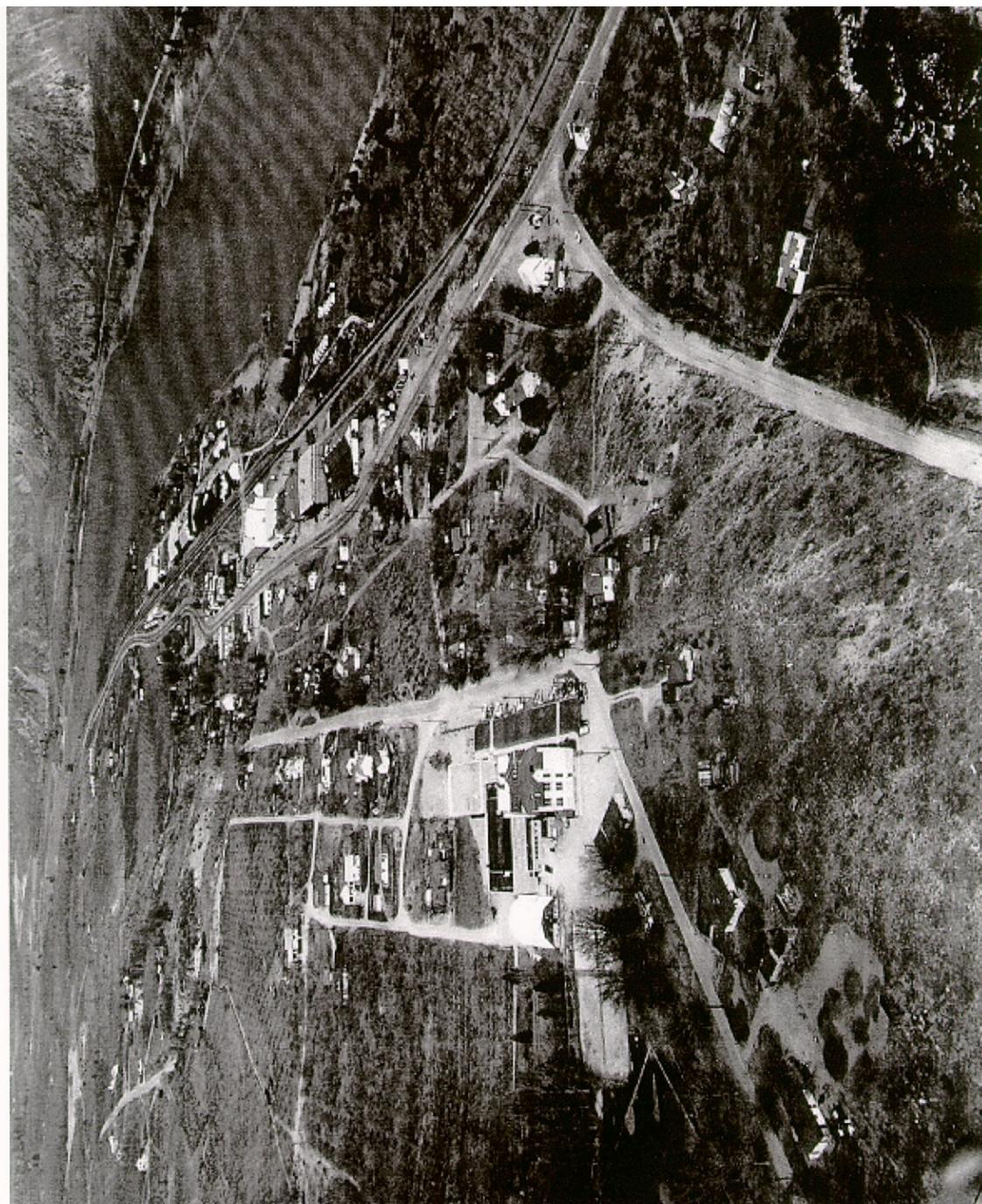


Figure 4-2: Entiat – Pre-Rocky Reach - Mid 1950's

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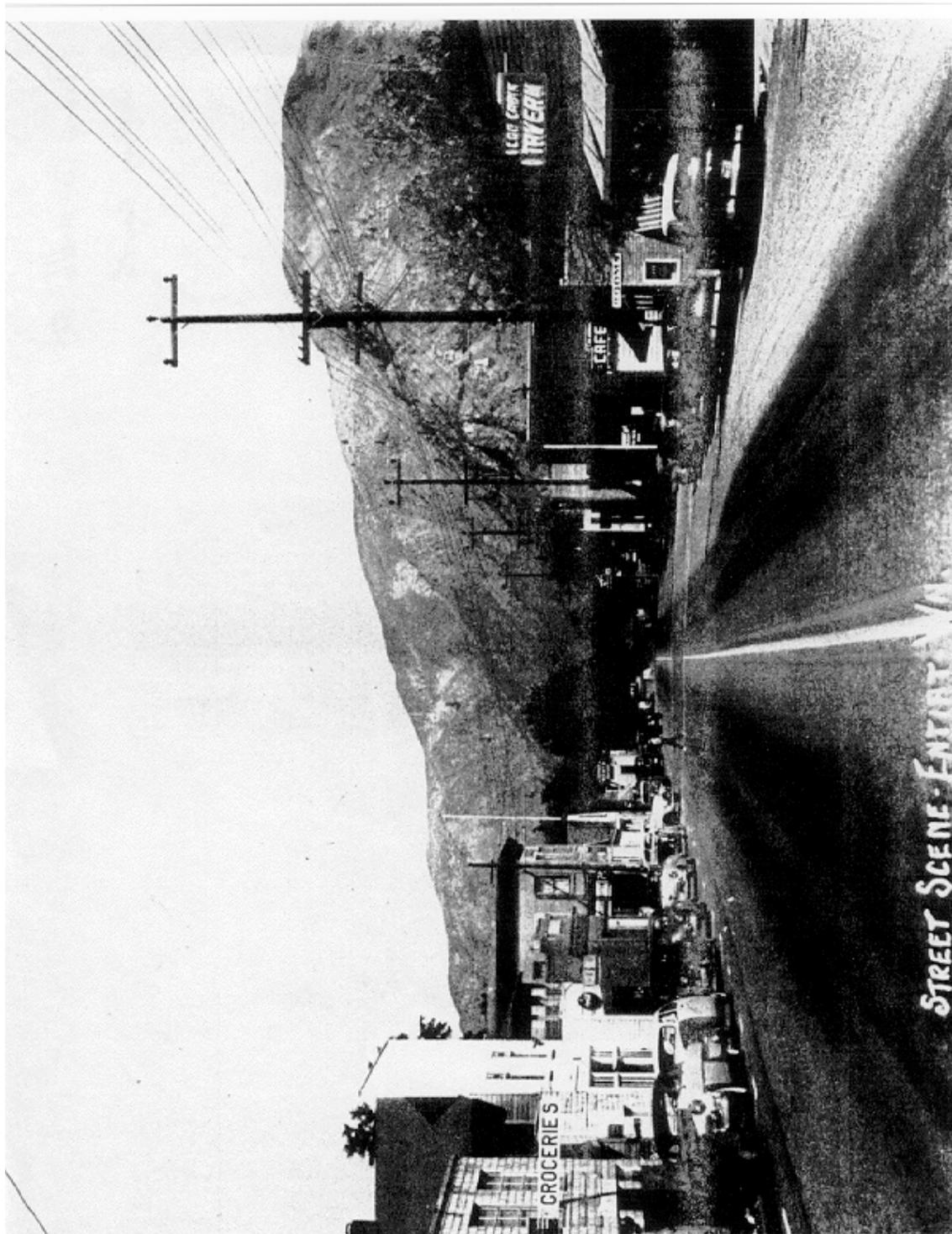


Figure 4-3: Downtown Entiat - Pre-Rocky Reach - Mid 1950's



Figure 4-4: Entiat – Summer 1998

4.1.3 Post-Relocation Era

While the loss of population was immediate and quite substantial – dropping from about 420 people prior to the city’s relocation to 350 people, or about 17 percent, in the post-dam operations aftermath, the changes in the city’s physical character and social composition as well as fiscal condition were equally dramatic. The city no longer had an urban character with a downtown core and surrounding neighborhoods. Moreover, since many of the previous residents elected to move, the social connections that had been built up over the years were interrupted, if not terminated in some instances. The loss of half of the property tax base, along with reduced sales activity resulted in substantially diminished tax revenues.

Because of the annexations that occurred over the years, particularly in early 1970s with the large annexation of the land area to the north, but also in the 1980s when a large area along the Entiat River was annexed, the city evolved into a spatially large, low-density semi-urban settlement. Along with the disruption of community life caused by the removal of the Entiat downtown core, this has contributed to the potential for lower levels of social contacts (or diminished density of acquaintanceship, a concept that is discussed under the section titled Social Impacts).

Population in the city of Entiat remained at the post-relocation levels of about 350 people until 1980 when the city’s population grew to 445 people, where it stabilized until the mid-1990s. Several annexations recent annexations along with a resurgence of growth resulted in a doubling of the population from 449 people in 1990 to 935 people in 1999. As noted in the text previously, a one-third share of population growth attributable to annexations. It is worth noting, however, that some of the areas annexed involved recent subdivisions that have attracted new in-migrants. Clearly, the recent upsurge in population growth in the area, along with recent and proposed annexations of new subdivisions, argues for a renaissance of interest in development and community progress in the years to come.

With the major exception of the timber industry, employment opportunities in agriculture-related manufacturing and transportation sectors as well as other manufacturing have improved over the years since the relocation of the community to the third town site. Forest-based resources once played a significant role in the economy of Entiat; however, closure of the sawmill in Ardenvoir, which employed about 120 workers, in 1979, along with curtailments in timber harvest in the Entiat Ranger District, suggests an uncertain future for this industry, even at current low levels of activity.

Several fruit packing and storage warehouse operations have been established over the years. These include Coxes, Packing Line, Wewoka, Keystone, and another private warehouse, in addition to two (of the original three) warehouses that were built immediately after the town site dislocation in the late 1950s. Areomet America, an aerospace manufacturing company that established operations in Entiat in 1994 and currently employs 127 workers, occupies one of those warehouses –Entiat warehouse –. Two fruit packing and storage operations currently exist. According to local sources interviewed for this study, some (eventually perhaps all) of the fruit packing and storage operations are likely to move closer to Wenatchee.

Generally the opportunities for economic development, particularly associated with residential land use for both permanent and vacationing households, is quite promising. The city still has no town center and lacks retail trade and services capacity. Nonetheless, rising interest in residential properties and growth of population points to improved economic and social conditions for the future.

4.2 Population Impacts of Dam Development

4.2.1 Population in Entiat

As discussed above, the population of the city of Entiat declined substantially during the immediate period when the town was partially inundated as a result of the development of the Rocky Reach Project. In 1955, the population stood at 404 residents; it declined according to one source (op. cit., 1958) to 286 people in 1958/59, with perhaps 365 people located within the city limits and fringe area for a net loss of perhaps 39 persons or 9.6 percent. The 1960 Census population stood at 357 people, and remained at that level during the ensuing years, indicating a further modest decline in the city's population for a total net loss attributable to the development of the dam of 47 persons or 11.6 percent. During the next decade the population essentially stagnated with the 1970 Census count at 355 people. The pattern of population decline and stagnation reversed during the 1970s when the city's population finally in 1976 reached the pre-dam development level of 409 people and in 1980 the Census population count totaled 445 for an overall increase of 90 persons or 25 percent during the decade. Population growth experienced an upswing in the early 1980s, reaching 500 people in 1985, but declined thereafter with the 1990 Census figure indicated at 449 people, or slightly more than existed in 1980. The 1990s reflected a totally different trend, however, with the population growing at an AARG of 4.3 percent between 1990 and 1995, when it reached 555 people, and 13.9 percent between 1995 and 1999, when the population totaled 935 people, or more than double the 1990 population level.

The county's population amounted to about 40,000 people in 1955, increasing to 40,744 people in 1960 or a modest 1.86 percent during the five-year period. The population rose at an even slower rate during the 1960s, with the 1970 Census population count at 41,355 people for a gain of 1.5 percent over the decade. During the 1970s, the population grew substantially with the 1980 Census population at 45,061 people for a gain of 9.0 percent over the decade. The population gains were even more dramatic over the next two decades. The 1990 Census count for the county stood at 52,250 people and the 1999 estimate stood at 63,000 people, reflecting gains of 16.0 percent during the 1980s and 20.5 percent between 1990 and 1999.

4.2.2 School Enrollment

Entiat School District No. 127 had a total enrollment of 474 pupils in 1956. The number decreased to 375 pupils in 1960, then further declined to 331 (projected figure) in 1965. The pattern of enrollment decline reversed itself slightly during the latter part of the decade, when in 1970 the total enrollment stood at 350 pupils. However, enrollment declined again during the 1970s. By 1980, the enrollment stood at 261 pupils, but then increased slightly to 265 pupils in 1989. In 1990 there was an abrupt increase in enrollment to 297 pupils. Recent pupil counts

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indicated that enrollment during the 1990s has ranged between 300 and 402 pupils (the latter represents school year 1999 – 2000 enrollment).

4.3 Economic Impacts

4.3.1 Private Sector Impacts

As noted above, Chelan PUD No. 1 property records indicating transactions made in the 1958 through 1961 period (prior to inundation of the downtown area of Entiat) were examined to determine the number and value of the properties acquired by the PUD in the Entiat area to accommodate the Rocky Reach Project. The total value of the parcels purchased from private property owners in the immediate area amounted to \$3.1 million (see Table 4-1 for details on purchases made by the PUD for properties or easements). Discussion with local residents indicated that owners were satisfied with the settlements negotiated at the time.

4.3.2 Public Sector Impacts

4.3.2.1 Property Base and Tax Changes

4.3.2.1.1 City of Entiat

Total taxable assessed valuation for the city of Entiat amounted to \$478,981 in 1956, about the time of the initial planning for the development of the Rocky Reach Project. The assessed valuation figure increased modestly until 1959 when it reached \$509,697. Then, with the relocation of the downtown area in preparation for the inundation of the area upstream of the dam site, total assessed valuation fell dramatically. In 1960, the city's taxable assessed valuation stood at \$298,922 or 58.6 percent of the level of the previous year. It remained at that level in 1961(\$300,012); however, the taxable assessed value of real and personal property quickly recovered to pre-inundation levels. In 1962, taxable assessed valuation stood at \$470,730, increasing to \$510,021 in 1963, \$539,932 in 1964, until reaching \$721,882 by 1970. During this period, the convention for assessing properties for purposes of taxation was to apply a 25-percent assessed-to-full-market valuation ratio. As shown in Table 4-2, full-market valuation of taxable property for the city of Entiat was \$1,915,924 in 1956 and \$2,887,528 in 1970. The average annual rate of growth (AARG) taxable property valuation between 1956 and 1970 was 2.8 percent. The nominal levy applied against assessed valuation during the period was 15 mills or 0.015 percent for all years except 1970, when the levy rate was increased to 18 mills. The effective tax rate (tax collections divided by full-market property valuation) ranged from 3.7 mills to 5.6 mills during the period. There was no change in millage during the two years when property values fell (1960 and 1961); rather, tax revenues declined in proportion to assessed property value.

The ratio of assessed-to-full-market valuation applied in the county was 50 percent between 1971 and 1974. In 1972, the state Legislature passed a law requiring property assessments to reflect full-market valuation beginning in the 1975 tax year (i.e., 1974 assessments for 1975 tax year). As shown in Table 4-2 full-market property value for the city of Entiat increased from \$2,887,528 in 1970 to \$5,915,855 in 1980, for an AARG of 7.4 percent, \$11,197,925 in 1990, or

at an AARG of 6.6 percent for the 10-year period 1980 - 1990, and \$38,868,572 in 1999, or at an AARG of 14.8 percent for the nine-year period 1990 – 1999.⁴³

Per capita full-market property valuation is shown to have increased in most years of the historical period analyzed, with the exceptions of 1960 and 1961, due to the loss of property valuation associated with the dislocation of the Entiat downtown area, as well as reductions consisting of a small amount in 1972, a fairly substantial amount in 1984, a small amount in 1990, and relatively small amounts in 1997 and 1998. The largest single year increase in taxable property valuation, both in absolute and relative magnitudes, occurred in 1999.

Tax levies followed a similar pattern, with year-to-year increases for most years and steep declines for the years 1960 and 1961. Over the 43-year historical period, the levy amounts increased from \$7,185 to \$75,293 per annum in nominal dollars.

4.3.2.1.2 Entiat School District

Taxable property valuation, levy rates, and tax levies are shown for Entiat School District No. 127 in Table 4-3 covering the 43-year historical period: 1956 – 1999. As shown in the table full-market valuation in nominal dollars for the district increased from \$6,747,060 in 1956 to \$10,751,344 in 1970 for an AARG of 3.8 percent⁴⁴. As in the case of the city of Entiat, the district experienced substantial losses in property valuation in 1960 and 1961, before recovering slowly to pre-dam development levels in 1970. Between 1970 and 1980, full-market property valuation increased from \$10,751,344 to \$32,274,417 for an AARG of 8.1 percent. Similar rapid growth in property valuations was experienced during the next two decades. Between 1980 and 1990 the district's property valuation grew to \$39,479,283 for an AARG of 8.7 percent. Between 1990 and 1999 the district's taxable property valuation increased to \$95,859,792 for an AARG of 9.3 percent.

Levy rates for the district are shown in the table to have increased during the period of the Rocky Reach Project development (1958 – 1960), possibly to maintain funding levels in the face of losses in assessed property valuation.

⁴³ The following table entries are based on rates of average annual rates of change from Table 4-1.

	Entiat Population	Full Market Property Valuation	Per Capita Property Valuation
AARG:			
1956-1970	-0.7%	2.8%	3.8%
1970-1980	2.5%	7.4%	5.4%
1980-1990	0.1%	6.6%	6.8%
1990-1999	8.5%	14.8%	5.8%

⁴⁴ The following table entries are based on rates of average annual rates of change from Table 4-2.

	District Enrollment	Full Market Property Valuation
AARG:		
1956-1970	-2.1%	3.8%
1970-1980	-2.9%	8.1%
1980-1990	1.3%	8.7%
1990-1999	3.2%	9.3%

*Socioeconomic Study**4.3.2.2 PUD Taxes or Redistributions**4.3.2.2.1 City of Entiat*

The city of Entiat received modest distributions of PUD privilege taxes over the period. Table 4-4 indicates the annual allocations received from 1956 through 1990, based on information provided by the city. Between 1956 and 1970, the nominal dollar amounts received increased by 9.5 percent; between 1970 and 1990, the annual allocations grew by 5.3 percent; and, between 1990 and 1999, the annual allocations grew by 9.7 percent, all measured in terms of average annual rates of growth. As shown in the table, real dollar growth rates are shown to be strongly positive in the early and late periods, but modestly negative during the 1970 – 1990 period.

4.3.2.2.2 Entiat School District

Since 1981, school districts have not been provided direct allocations of PUD privilege tax revenues under RCW 54.28. The State retains a portion of PUD privilege tax proceeds that are allocated to the General Fund and earmarked for primary and secondary schools purposes. All school districts share in the revenue stream generated from this source. Prior to 1981, the percentage retained by the State amounted to 4 percent, and the remainder was returned to local taxing districts on the same basis as other property taxes. Of the local portion, school districts were allocated at least 35 percent. PUD excise tax revenues are retained by the State for general purposes.

A review of documents from the period during which the Rocky Reach Project was developed indicates that Chelan PUD No. 1 intended to make public utility privilege tax payments to Entiat School District (January 27, 1959 communication from Sig Schertel, Commissioners' Representative, Chelan County PUD No. 1). The hand-written document stated that the district was paid \$2,412 in 1958 for 1957 Chelan PUD No. 1 production from Rocky Reach Dam. Further, it stated that on the basis of estimated Rocky Reach dam production, payments representing 35 percent of the local share was expected to go to schools and about \$3,500 would be allocated to Entiat School District in 1963, \$6,961 in 1964, and \$9,373 thereafter, with escalation for normal load growth or power sales to be added.

Entiat School District records indicate that PUD privilege tax payments were received, at least intermittently, over the years beginning 1957 and presumably running through 1980. Recorded amounts received during that time frame are as follows: 1958 - \$2,412; 1961 - \$0; 1962 - \$4,352; and 1963 - \$4,362.

4.3.2.2.3 Fiscal Impact of Reduced Taxable Property Base

The record of payments made to private owners by the PUD indicates that the negotiated financial settlements regarding the purchase of properties that would be inundated, or otherwise needed for the development of the Project, were entered into in good faith and acceptable to all parties. It follows, therefore, that impacts on private sector stakeholders associated with development of the Rocky Reach Project are not at issue.

The principle issue involving the fiscal condition of both the city of Entiat and Entiat School District in the aftermath of developing the Rocky Reach Project is whether the actions taken by

Chelan PUD No. 1, which were carried out for the benefit of the region, were likely to generate adverse fiscal consequences for the affected entities; and, if so, whether adequate provisions were made to address those consequences through financial mitigation or other measures. The primary local revenue source for current operations of both city and school district is the property tax. Indeed, property taxes contributed a higher share of total actual revenues to these jurisdictions prior to the development of the Rocky Reach Project than currently. The principal focus of the fiscal impact analysis is on changes in the taxable property base in the two jurisdictions and consideration of the potential revenue loss due to actual reductions in the property base as well as foregone opportunities for economic activity that could have potentially resulted in growth of the property tax base as a result of the relocation of the Entiat town site.⁴⁵ It is important to note that levy rates refer to the regular levy; no bond levies were imposed during the historical period of analysis. Thus, the proceeds of property tax revenues generated were designated for current operations of city government.

4.3.2.2.4 City of Entiat

The methodology for considering possible fiscal impacts on the city of Entiat is based on a comparative analysis of property tax base changes for Chelan County as a whole and the city of Cashmere. The city was chosen because it was the smallest city in the county with a similar economic base (mostly agriculture-related industries) enjoyed by Entiat prior to the development of the Rocky Reach Project. Per capita property valuation for collections in 1959 was \$5,586 in the City of Entiat, \$4,128 in the City of Cashmere, and \$4,949 countywide, when measured in terms of full-market value. By 1960 per capita property values had dropped to \$3,349 in the city of Entiat, but increased slightly to \$4,170 in the city of Cashmere and \$4,978 countywide. Clearly, on a comparative basis, Entiat's property base had lost "ground" in both absolute and relative terms during the intervening years. In 1959, the city of Entiat's per capita valuation was 135.3 percent of the city of Cashmere's per capita valuation and 112.2 percent of the countywide figure. In 1960, Entiat's per capita valuation had fallen to 80.3 percent of the city of Cashmere's per capita property valuation and 67.3 percent of the county's per capita property valuation. However, by 1970 the relative differences in per capita property valuations between the city of Entiat and the other two jurisdictions had changed dramatically, reflecting disproportionately higher values for the city of Entiat relative to the other jurisdictions. The city of Entiat's per capita property value in 1970 was \$8,134 compared to \$5,935 for Cashmere and \$7,259 countywide. Thus, the city of Entiat's per capita property valuation was 137.1 percent of that for the city of Cashmere and 112.1 percent of the countywide figure. As shown below, the city of Entiat's average annual rate of growth of per capita property valuation was greater than indicated for the city of Cashmere and the entire county between 1956 and 1970.

Average annual growth rates in per capita property valuations for the for the cities of Entiat and Cashmere and the county during the periods: 1959 – 1970; 1970 – 1980; 1980 – 1990; and, 1990 – 1999 are shown as follows:

⁴⁵ Cities were not authorized to impose sales tax prior to 1973. According to the 1999 City Budget, sales and use tax revenues are the second largest (after property taxes) source of local revenues, representing 9.1 percent of Current Expense Fund total actual revenues and 34.3 percent of Street and Arterial Fund total actual revenues.

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Years	City of Entiat	City of Cashmere	Chelan County
1959 – 1970	3.5%	3.4%	3.5%
1970 – 1980	5.4%	11.1	10.6%
1980 – 1990	6.8%	5.0%	6.3%
1990 – 1999	5.8%	5.9%	6.8%

There were substantial differences in growth rates between the city of Entiat and the other jurisdictions evaluated in subsequent decades, particularly the decade of the 1970s, when the AARG for Entiat was 5.4 percent, 11.1 percent for the city of Cashmere, and 10.6 percent countywide. For whatever reasons, growth in property valuations stagnated in the city of Entiat compared to its closest comparable city as well as countywide. It is possible that the lack of a downtown core, exacerbated by several decades of slow population growth, contributed to the lackluster growth of the city's property base during the same decade when the county was experiencing rapid growth in property valuations.

By 1980, the city of Entiat's per capita property valuation stood at \$13,294, which was 78.3 percent and 66.8 percent of the corresponding per capita figures for the city of Cashmere and the entire county. The relative difference in per capita property values was somewhat lower at 89.9 percent and 68.3 percent of valuations for the city of Cashmere and the entire county in 1990. By 1999 the relative differences of the city of Entiat's per capita property valuation compared to the valuations for city of Cashmere was 89.3 percent and 63.2 percent for the entire county. Clearly, over time, the city of Entiat has seen a worsening of its property base relative to what it might have been, if conditions in the economy and property market had followed the pattern experienced by the city of Cashmere and, even more so, by the county as a whole.

On the assumption that growth rates in per capita property valuations in the city of Entiat followed the patterns exhibited for the other jurisdictions evaluated, adjusted property valuations were generated for the city of Entiat for all years during the historical period 1959 through 1999. Table 4-5 presents actual full-market property valuations for the city by year and adjusted full-market valuations based on compounded annual growth rates for the periods 1959 – 1970, 1970 – 1980, 1980 – 1990, and 1990 – 1999 (see columns 2 and 3 in the table). The growth rates represent the average of the actual rates calculated for the city of Cashmere and Chelan County and are presented in the text table above.

The total adjusted property valuation of the city of Entiat in 1999, as shown in the table, is almost twice the actual figure. The net property valuation difference (see column 4 in the table) is \$35.8 million in 1999. After converting net property valuation differences to 1999 dollars, the differences in tax collections (also in 1999 dollars) were determined. These are shown to be \$69,343 in 1999 and sum to \$1.1 million over the 40-year historical period. The net present value (NPV) of this sum, calculated on the basis of a 3.0 percent real rate of interest, is \$506,847.⁴⁶ This would be the hypothetical value of revenues, calculated in 1999 dollars, generated from the additional taxable property that would have accrued to the city of Entiat's

⁴⁶ The NPV is 271,034, based on a 6.0 percent real rate of interest.

property base, assuming that growth rates in per capita property values followed trends indicated for the city of Cashmere as well as countywide.

A case could be made that the NPV figure of \$506,847 represents the fiscal loss, in terms of operating revenues, to the city of Entiat as a result of the economic dislocations caused by the inundation of the downtown area. The property tax was the primary source of revenue to the Current Expense Fund and Street Fund prior to the development of the Rocky Reach Project, representing some 49 percent of total actual revenues in 1956 and 1958, but declining to about 20 percent in 1960 (the first year of the full effect of relocating the town site). The share of total revenues for these funds represented by property taxes continues to be less than during the pre-dam development. According to the *1999 City Budget*, property tax revenues represented 23.3 percent of total actual revenues in the Current Expense Fund and 29.8 percent of total actual revenues in the Street and Arterial Fund.

4.3.2.2.5 Entiat School District

As discussed in the section above dealing with the school district's property tax base, Entiat School District experienced an immediate loss of assessed valuation of approximately \$225 thousand in 1959 (for taxes paid in 1960). The assessed valuation dropped from \$1,899,743 in 1959 to \$1,673,984 in 1960 and did not return to pre-dam development levels until 1970, when it was \$1,964,138 for an AARG between 1959 and 1970 of 0.3 percent, compared to 3.7 percent countywide. After 1970, the growth in assessed valuation more or less reflected the overall county average. Between 1970 and 1980, the school district's property base grew at an AARG of 8.1 percent versus 11.6 percent for the entire county; between 1980 and 1990 the growth rates for the district and countywide were 8.7 percent and 7.8 percent, respectively; and between 1990 and 1999 the corresponding growth rates were 9.3 percent and 9.0 percent, respectively.

Entiat School District has a history of passing regular maintenance and operations property tax levies. During the period 1977 through 1999 the district passed 18 levy initiatives, failing only four, out of 22 attempts. The most recent passed levies were in 1997, amounting to \$115 thousand, and 1999, amounting to \$150,000. Interestingly, the district passed special levies in 1959 through 1961, when taxable property values were falling due the relocation of the Entiat townsite and, also, the purchase by Chelan PUD No. 1 of orchard lands located in the district. The regular levy of 14 mills that had been in effect in 1958 was augmented with special levies of 16.7 mills in 1959, 21.7 mills in 1960, and 27.50 in 1961. Clearly, the School Board of Entiat School District was aware of the affect of reductions in the taxable property base and took measures to address the consequences, with support from the voters. Essentially, the residence who remained in the Entiat area assumed a higher property tax burden as a consequence of the Rocky Reach project development. It is also worth noting that pupil teacher ratios remained stable during the period leading up to the development of the Rocky Reach Project and in the aftermath. The number of pupils per teacher amounted to 21.24 in the 1956-1957 school year, just at the time when the Rocky Reach Project commenced; during the 1957-1958 school year, the ratio fell to 19.4 pupils per teacher, then rose again to 20.2 in 1958-1959 and 21.9 in 1959-1960. The ratio fell slightly during the next two years, when in 1962, as the Project began operations, it amounted to 21.0 pupils per teacher. In 1970, the pupil-teacher ratio stood at 20.6.

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In 1980 the pupil-teacher ratio had declined to 16.3 and in 1990 it stood at 17.5 pupils per teacher.

As stated previously, Entiat School District No. 127 has experienced a high rate of voter approved special levies during the last several decades. The levies, however, have yielded relatively small dollar amounts, in terms of absolute or relative magnitudes. For school year 1997-1998, the levy collected by the district amounted to \$92,512 or \$244.84 per pupil, which was far lower than the average for districts in the region. For example, the yield for Wenatchee School District was \$5,606,371 or \$818.65 per pupil; Manson School District collected \$435,331 or \$698.38 per pupil. All other school districts (with the exception of Stehekin School District) in Chelan County had levy amounts that were more than twice the amount collected by Entiat School District, both in absolute and relative terms. The closest districts in terms of tax yield were Pateros School District in Okanogan County, with collections of \$159,855 or \$474.91 per pupil, and Waterville School District in Douglas County, with collections of \$185,303 or \$463.08 per pupil. The reason for the relatively low levy yield generated in Entiat School District is in part caused by a relatively low (on a per pupil basis) property tax base. Assessed Valuation per pupil for the district was \$206,992 per pupil in 1997 (for 1998 collections), compared to \$200,572 per pupil for Cashmere School District (which also has relatively low assessed property value per pupil); \$269,314 per pupil for Wenatchee School District; \$370,732 per pupil for Manson School District; \$480,669 per pupil for Lake Chelan School District; and, \$482,860 per pupil for Cascade School District. The levy rate imposed by Entiat School District for tax collections in 1998, at \$1.21417 per \$1,000 assessed valuation, was modestly lower than the median of the eight school districts in Chelan County, which has also contributed to the relatively low tax collections from the special levy imposed by Entiat School District.

There are manifold reasons for the relatively low assessed valuations in the district; of course the loss of assessed valuation in the city of Entiat during the late 1950s, due to the inundation of the town site, and subsequent slow growth in the property base for the city, contributed substantially to the low level of the district's taxable assessed valuation. Other reasons include loss of orchard lands outside the city limits of Entiat, because of the purchase of those lands for other public purposes – a licensing requirement imposed on Chelan County PUD No.1 as an environmental mitigation measure; closure of the sawmill at Ardenvoir, which employed about 120 workers, in 1979; along with curtailments in timber harvest in the Entiat Ranger District.

An examination of property valuation differentials among Chelan County school districts, as well as countywide, over the period 1956 through 1999, suggests that Entiat School District experienced relatively slow growth in taxable assessed valuations, compared to the other jurisdictions. For example, full-market valuations countywide increased between 1956 and 1970 at an AARG of 3.1 percent, while the district's assessed valuation grew at an AARG of 1.1 percent. The closest school district to that of Entiat School District in terms of assessed valuation in 1956 (before development of the Rocky Reach Project) and school enrollment was Manson School District. In that year Entiat School District had a full-market taxable property valuation of \$6.7 million; Manson School District had a taxable full-market valuation of \$6.3 million. By 1970 Entiat School District's full-market valuation stood at \$7.9 million for an AARG during the period of 8.1 percent, compared to \$10.8 million for Manson School District,

which experienced an AARG of 11.6 percent.⁴⁷ Similarly, by 1980, Entiat School District's full-market property base had grown to \$17.2 million for an AARG during the period of 8.1 percent, compared to \$32.3 million for Manson School District, which experienced an AARG of 11.6 percent. Again, by 1990 the property base for Entiat School District had grown to \$39.5 million for an AARG during the period of 8.7 percent, while Manson School District's property base had increased to \$103.1 million for an AARG of 12.3 percent. Finally, by 1999 the property base of Entiat School District grew to \$95.9 million for an AARG during the most recent nine-year period of 9.3 percent, while the property base for Manson School District grew to \$239.0 million for an AARG of 8.7 percent. The figures show that the compound effects of growth during the earlier years of the series considered by this analysis, which was quite slow in the case of Entiat School District, had a major effect on the full-market valuations in the most recent period. Whereas both school districts had similar taxable property bases in 1956, full-market property valuations diverged dramatically over time.

A case can be made, similar to that presented for the city of Entiat, that property valuations stagnated in Entiat School District compared to its closest comparable district as well as countywide at least to the extent that the loss of the downtown core of the city of Entiat (which comprised a portion of the district's property tax base), exacerbated by several decades of slow population growth, contributed to the lackluster growth of the district's property base during the same decades when the county and other school district within the county were experiencing rapid growth in property valuations. As noted, there were other reasons for stagnation in the growth of the district's taxable property base; however, none of these were necessarily the direct result of the Rocky Reach Project. (The loss of orchard lands was associated with the development of the Project, but the decision involved subordination of private for putatively higher public interests.)

The methodology for establishing the potential financial loss to Entiat School District involves a similar procedure to that used in the case of the city of Entiat. The additional taxable base that was determined for the city of Entiat over the 40-year period was assumed to represent a hypothetical source of special levy revenue for the district. Actual M&O levy rates (converted to effective tax rates against full-market valuations) were applied to estimate the additional revenue generated over the period in 1999 dollars. The net property valuation difference, as was determined for the city of Entiat, is \$35.8 million in 1999. After converting net property valuation differences to 1999 dollars, the differences in tax collections (also in 1999 dollars) were determined. These are shown to be \$42,945 in 1999 and sum to \$1.1 million over the 40-year historical period. The net present value (NPV) of this sum, calculated on the basis of a 3.0 percent real rate of interest, is \$568,021.⁴⁸ This would be the hypothetical value of revenues, calculated in 1999 dollars, generated from the additional taxable property that would have accrued to Entiat School District's property base, assuming that growth rates in per capita property values followed trends indicated for other jurisdictions within the county.

47 The AARG countywide during the period 1956 – 1970 was 3.1 percent; between 1970 – 1980 the AARG was 11.6 percent; between 1980 – 1990 the AARG was 7.8 percent; and between 1990 – 1999 the AARG was 9.0 percent.

48 The NPV is \$342,157, based on a 6.0 percent real rate of interest.

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The city of Entiat's per capita property value was 89.3% and 63.2% of the per capita values for the city of Cashmere and Chelan County, respectively. Thus the disparities continue to quite wide.

Table 4-2: Entiat Property Valuation Changes

Year	Population	Full-Market Property Value	Per Capita Property Value	Tax Collections	Effective Levy Rate (\$/Thous. Property Value)
1956	394	\$1,915,924	\$4,863	\$7,185	3.7501
1957	384	\$2,001,492	\$5,212	\$7,506	3.7502
1958	375	\$2,014,436	\$5,372	\$7,554	3.7499
1959	365	\$2,038,788	\$5,586	\$7,645	3.7498
1960	357	\$1,195,688	\$3,349	\$4,484	3.7501
1961	357	\$1,200,048	\$3,361	\$4,500	3.7500
1962	357	\$1,882,920	\$5,274	\$9,415	5.0000
1963	357	\$2,040,084	\$5,715	\$11,475	5.6250
1964	357	\$2,159,728	\$6,050	\$12,148	5.6250
1965	357	\$2,166,296	\$6,068	\$12,185	5.6250
1966	356	\$2,166,952	\$6,087	\$12,189	5.6250
1967	356	\$2,252,308	\$6,327	\$12,669	5.6250
1968	356	\$2,263,744	\$6,359	\$12,734	5.6250
1969	356	\$2,341,100	\$6,576	\$13,169	5.6250
1970	355	\$2,887,528	\$8,134	\$12,994	4.5000
1971	364	\$2,690,056	\$7,390	\$12,105	4.4999
1972	373	\$2,750,188	\$7,373	\$12,769	4.6430
1973	382	\$3,194,000	\$8,361	\$14,299	4.4768
1974	391	\$4,137,858	\$10,583	\$16,481	3.9830
1975	400	\$4,580,231	\$11,451	\$14,976	3.2697
1976	409	\$4,975,065	\$12,164	\$17,676	3.5529
1977	418	\$5,339,880	\$12,775	\$19,486	3.6491
1978	427	\$5,497,613	\$12,875	\$21,064	3.8315
1979	436	\$5,637,829	\$12,931	\$21,685	3.8463
1980	445	\$5,915,855	\$13,294	\$19,687	3.3278
1981	467	\$8,780,108	\$18,801	\$23,966	2.7296
1982	465	\$8,949,119	\$19,245	\$27,705	3.0958
1983	425	\$9,204,461	\$21,658	\$28,977	3.1481
1984	500	\$8,787,555	\$17,575	\$23,966	2.7273
1985	492	\$10,036,035	\$20,398	\$23,966	2.3880
1986	495	\$10,146,138	\$20,497	\$33,065	3.2589
1987	485	\$10,058,243	\$20,739	\$32,710	3.2521
1988	433	\$10,416,610	\$24,057	\$34,858	3.3464
1989	435	\$11,055,854	\$25,416	\$36,500	3.3014
1990	449	\$11,197,925	\$24,940	\$34,095	3.0448
1991	450	\$11,406,249	\$25,347	\$34,259	3.0035
1992	455	\$11,289,875	\$24,813	\$33,351	2.9541
1993	465	\$11,926,593	\$25,649	\$34,969	2.9320
1994	545	\$12,349,298	\$22,659	\$35,684	2.8896
1995	555	\$18,901,213	\$34,056	\$43,141	2.2824
1996	675	\$24,731,220	\$36,639	\$50,031	2.0230
1997	801	\$28,672,658	\$35,796	\$60,783	2.1199
1998	865	\$30,361,810	\$35,100	\$67,129	2.2110
1999	935	\$38,868,572	\$41,571	\$75,293	1.9371

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Table 4-3: Entiat School District Enrollment and Property Tax Base

Year	District Enrollment	Full-Market Property Value	Estimated Tax Collections	Effective Levy Rate (\$/Thous .in Property Value)
1956	474	\$6,747,060	\$62,073	9.2000
1957	403	\$6,953,700	\$28,684	4.1250
1958	404	\$7,517,740	\$62,397	8.3000
1959	420	\$7,598,972	\$79,219	10.4250
1960	375	\$6,695,936	\$85,373	12.7500
1961	332	\$6,445,416	\$39,317	6.1000
1962	337	\$6,485,076	\$39,721	6.1250
1963	351	\$6,709,160	\$59,712	8.9000
1964	337	\$6,985,196	\$40,863	5.8500
1965	331	\$7,079,748	\$41,594	5.8750
1966	N/A	\$7,135,564	\$65,273	9.1475
1967	299	\$7,211,636	\$35,878	4.9750
1968	N/A	\$7,271,220	\$79,438	10.9250
1969	N/A	\$7,256,084	\$82,719	11.4000
1970	350	\$7,856,552	\$46,864	5.9650
1971	N/A	\$8,440,144	\$104,025	12.3250
1972	N/A	\$8,424,830	\$84,122	9.9850
1973	N/A	\$11,973,472	\$154,254	12.8830
1974	N/A	\$12,593,152	\$67,553	5.3643
1975	N/A	\$13,078,828	\$165,660	12.6663
1976	N/A	\$13,614,959	\$192,910	14.1690
1977	N/A	\$15,845,092	\$8,722	0.5505
1978	N/A	\$16,126,614	\$114,778	7.1173
1979	N/A	\$17,057,906	\$56,004	3.2832
1980	261	\$17,162,473	\$91,914	5.3555
1981	N/A	\$25,735,235	\$92,499	3.5942
1982	N/A	\$26,924,384	\$119,214	4.4278
1983	N/A	\$26,777,961	\$113,298	4.2310
1984	N/A	\$26,062,610	\$62,271	2.3893
1985	N/A	\$31,680,923	\$120,088	3.7906
1986	N/A	\$32,457,334	\$121,460	3.7421
1987	N/A	\$32,411,232	\$109,660	3.3834
1988	N/A	\$33,151,949	\$119,566	3.6066
1989	265	\$39,489,719	\$73,593	1.8636
1990	297	\$39,479,283	\$103,859	2.6307
1991	297	\$40,105,892	\$118,554	2.9560
1992	321	\$39,558,583	\$128,718	3.2539
1993	336	\$41,048,573	\$125,689	3.0620
1994	331	\$42,543,256	\$240,146	5.6448
1995	376	\$65,182,915	\$224,115	3.4382
1996	379	\$72,569,407	\$277,260	3.8206
1997	383	\$76,054,958	\$298,380	3.9232
1998	392	\$78,242,983	\$312,084	3.9887
1999	393	\$95,859,792	\$332,956	3.4734

Table 4-4: City of Entiat Historical PUD Privilege Tax Distributions

Year	Tax Distributions (Nominal Dollars)	Tax Distributions (Real Dollars)
1956	\$157	\$922
1957	\$425	\$2,478
1958	\$321	\$1,849
1959	\$338	\$1,937
1960	\$341	\$1,920
1961	N/A	-
1962	N/A	-
1963	N/A	-
1964	N/A	-
1965	N/A	-
1966	N/A	-
1967	N/A	-
1968	N/A	-
1969	N/A	-
1970	\$562	\$2,411
1971	N/A	-
1972	N/A	-
1973	\$590	\$2,230
1974	\$608	\$2,055
1975	N/A	-
1976	N/A	-
1977	N/A	-
1978	N/A	-
1979	N/A	-
1980	N/A	-
1981	\$1,167	\$2,136
1982	\$1,366	\$2,363
1983	\$1,541	\$2,574
1984	\$1,500	\$2,400
1985	\$1,575	\$2,441
1986	N/A	-
1987	\$1,607	\$2,362
1988	\$1,294	\$1,825
1989	\$1,514	\$2,029

*Socioeconomic Study***Table 4-4: City of Entiat Historical PUD Privilege Tax Distributions**

Year	Tax Distributions (Nominal Dollars)	Tax Distributions (Real Dollars)
1990	\$1,502	\$1,908
1991	\$1,591	\$1,941
1992	\$1,580	\$1,880
1993	\$1,257	\$1,446
1994	\$1,399	\$1,567
1995	\$1,638	\$1,785
1996	\$2,733	\$2,897
1997	\$3,211	\$3,339
1998	\$3,515	\$3,585
1999	\$3,463	\$3,463
AARG 1956-1970	9.5%	7.1%
AARG 1970-1990	5.3%	-1.2
AARG 1990-1999	9.7%	6.8%

Table 4-5: City of Entiat Property Tax Base Impacts

Year	Full-Market Property Value	Adjusted Full-Market Property Value	Property Value Difference	Property Value Difference in 1999 Dollars	Difference in Tax Collections in 1999 Dollars
1959	\$2,038,788	\$2,045,916	\$7,128	\$40,809	\$153
1960	\$1,195,688	\$2,077,115	\$881,427	\$4,961,005	\$18,604
1961	\$1,200,048	\$2,156,045	\$955,997	\$5,326,728	\$19,975
1962	\$1,882,920	\$2,237,975	\$355,055	\$1,958,681	\$9,793
1963	\$2,040,084	\$2,323,018	\$282,934	\$1,540,419	\$8,665
1964	\$2,159,728	\$2,411,293	\$251,565	\$1,351,958	\$7,605
1965	\$2,166,296	\$2,502,922	\$336,626	\$1,780,377	\$10,015
1966	\$2,166,952	\$2,590,756	\$423,804	\$2,179,188	\$12,258
1967	\$2,252,308	\$2,689,204	\$436,896	\$2,179,249	\$12,258
1968	\$2,263,744	\$2,791,394	\$527,650	\$2,526,049	\$14,209
1969	\$2,341,100	\$2,897,467	\$556,367	\$2,525,633	\$14,207
1970	\$2,887,528	\$2,999,123	\$111,595	\$479,166	\$2,156
1971	\$2,690,056	\$3,408,811	\$718,755	\$2,956,657	\$13,305
1972	\$2,750,188	\$3,872,096	\$1,121,908	\$4,471,527	\$20,761
1973	\$3,194,000	\$4,395,784	\$1,201,784	\$4,546,257	\$20,353
1974	\$4,137,858	\$4,987,529	\$849,671	\$2,871,301	\$11,436
1975	\$4,580,231	\$5,655,934	\$1,075,703	\$3,331,080	\$10,892
1976	\$4,975,065	\$6,410,669	\$1,435,604	\$4,203,368	\$14,934
1977	\$5,339,880	\$7,262,598	\$1,922,718	\$5,285,889	\$19,289
1978	\$5,497,613	\$8,223,928	\$2,726,315	\$6,966,321	\$26,691
1979	\$5,637,829	\$9,308,370	\$3,670,541	\$8,423,032	\$32,398
1980	\$5,915,855	\$10,531,321	\$4,615,466	\$9,331,755	\$31,055
1981	\$8,780,108	\$11,803,504	\$3,023,396	\$5,541,230	\$15,125
1982	\$8,949,119	\$12,552,155	\$3,603,036	\$6,220,371	\$19,257
1983	\$9,204,461	\$12,252,523	\$3,048,062	\$5,098,465	\$16,051
1984	\$8,787,555	\$15,394,935	\$6,607,380	\$10,594,701	\$28,895
1985	\$10,036,035	\$16,178,722	\$6,142,687	\$9,510,888	\$22,712
1986	\$10,146,138	\$17,384,234	\$7,238,096	\$11,002,434	\$35,856
1987	\$10,058,243	\$18,191,283	\$8,133,040	\$11,927,505	\$38,789
1988	\$10,416,610	\$17,345,258	\$6,928,648	\$9,757,504	\$32,652
1989	\$11,055,854	\$18,610,300	\$7,554,446	\$10,149,763	\$33,509
1990	\$11,197,925	\$20,515,481	\$9,317,556	\$11,876,854	\$36,162
1991	\$11,406,249	\$21,877,087	\$10,470,838	\$12,807,942	\$38,469
1992	\$11,289,875	\$23,535,857	\$12,245,982	\$14,541,558	\$42,957
1993	\$11,926,593	\$25,592,529	\$13,665,936	\$15,756,020	\$46,197
1994	\$12,349,298	\$31,915,259	\$19,565,961	\$21,995,203	\$63,556
1995	\$18,901,213	\$34,580,915	\$15,679,702	\$17,140,672	\$39,123
1996	\$24,731,220	\$44,749,574	\$20,018,354	\$21,255,945	\$43,001
1997	\$28,672,658	\$56,501,408	\$27,828,750	\$28,886,416	\$61,236
1998	\$30,361,810	\$64,920,894	\$34,559,084	\$35,322,352	\$78,097
1999	\$38,868,572	\$74,665,783	\$35,797,211	\$35,797,211	\$69,343

4.4 Social Impacts

The socio-economic literature on communities undergoing rapid change, particularly in regard to rapid growth due to industrial development, is quite lengthy. A selected bibliography concerning such communities is contained in the report President's Economic Adjustment Committee, Office of Economic Adjustment, *Managing Rapid Growth*, prepared by the authors of this study.

However, more to the point, there are numerous studies on the socioeconomic impacts of natural resource mega-projects, including large dam developments, focusing on the Canadian experience, which are listed in an annotated bibliography published by the University of British Columbia and available on the internet at Dam-Reservoir Info & Impact Archive, July 2000. Many of these studies discuss and document the link between ecological changes and impacts on the local economy. Others point to the positive benefits from flood control, irrigation, electrical generation, and short-term effects of major construction activities.

The international literature on the planning, construction, and operation of dams is truly voluminous. There are many articles and books that present information on both sides of the issue as to the effectiveness and advantages and disadvantages of dam developments; however, the preponderance of recent studies and journalistic discussions is critical, in terms of both ecological/environmental and socio-economic outcomes. Some of the articles involve discussions of prospective dams, such as a CNN Interactive article on China's Three Gorges Dam, which is the subject of great international scrutiny. Other articles present evaluations of the impacts of existing large dam projects. A recent article submitted to the newly formed World Commission on Dams, by Roman Havlicek, Pavaol Zilincik, Lenka Zentkova, and Juraj Zamkovsky of the Friends of the Earth, titled *Destruction of Rural Communities as an Inseparable Part of the Construction of Large Dams in Slovakia* reflects many years of monitoring the relationship of state institutions and corporations toward citizens of rural communities in Slovakia in the process of the construction of large dams.

The World Dam Commission (noted above) formed under World Bank sponsorship in 1997 is currently undertaking studies of the effectiveness of dams and is also undertaking development of internationally accepted standards, guidelines, and criteria for decision-making in the planning, design, construction, monitoring, and decommissioning of dams. According to an article by Dan Hansen, titled *Grand Coulee Joins Study List, International Group Plans to Examine Effects of Dams World Wide*, [The Spokesman Review](#), Spokane, Washington, March 1, 1999, the World Dam Commission has formed an independent multidisciplinary team to study the Grand Coulee Dam and related aspects of the Columbia River Basin. This is one of up to 10 case studies of dams in major river basins around the world to be undertaken by the Commission in preparation of a final report, which is to provide a framework for future decision-making on dams, to be published in 2000.

Two studies conducted by leading researchers in the United States suggest a number of relevant points that may apply to a community undergoing a major dislocation, such as Entiat in the late 1950s. One concept, density of acquaintanceship, was mentioned above in regard to the historical changes experienced by the Entiat community. Density of acquaintanceship, was first described by rural sociology professor, formerly of Washington State University, William R.

Freudenberg in *The Density of Acquaintanceship: An Overlooked Variable in Community Research?*, *The American Journal of Sociology*, Vol. 92, No. 1, July 1986, p. 27 – 63, and refers to the extent to which people in a neighborhood or town know each other. The percentage of people knowing each other tends to be very high in communities that undergo modest rates of growth or decline or are not subject to shocks from external events. Communities that undergo rapid change, such as occurred in Entiat in the late 1950s, may experience a breakdown in relationships for a variety of reasons. People who know one another may work out informal agreements for achieving desired goals. This helps to control deviance, such as criminal behavior, in socialization of the young, and in caring for those in need. However, where there has been some division or social separation, this may contribute to social dissatisfaction on the part of residents with consequences that are socially undesirable.

The dislocations of a community undergoing a major change such as occurred at Entiat may also be similar to cases of community disruption caused by a sudden catastrophe, although this would likely reflect an extreme case. Such is described in a study of the effects of a major disaster on a narrow mountain hollow, titled *Everything in Its Path: Destruction of Community in the Buffalo Creek Flood*, Simon and Shuster, New York, 1976, written by Yale University sociology professor Kai T. Erickson. A large mine waste impoundment located on Buffalo Creek in Logan County, West Virginia collapsed, resulting in a flood and debris flow rushing down a hollow inhabited by many households that left 4,000 people homeless and 125 dead. In the aftermath of the disastrous flood, the company that owned the mine was perceived to have violated its obligations to the people in the community, first, by building a poor structure and, second, by reacting like a remote bureaucracy, with holdings to protect. There was a loss of community, that is, the network of relationships was disrupted. People of Buffalo Creek were neighborhood people. Before the disaster, people were there to help each other when a family had a hardship. People experienced loss of initiative, substance abuse, loneliness, uneasiness, depression, anger, fear, and forgetfulness. People were disoriented and untrusting. Many had physical illnesses. Some had lost faith and continually felt insecure. Clearly, the conditions associated with this disaster were far more extreme than the situation in Entiat, nonetheless, the study shows how community displacement can result in harmful psychological and social consequences that have enduring if not irrevocable adverse effects.

Contacts with local officials and other residents of the Entiat area, many of which resided in the area prior to development of the Rocky Reach Project, suggested that there were harmful effects associated with the relocation of the Entiat townsite, although most indicated support for development of the dam, both then and now. Contacts were made directly in meetings with members of a specially formed focus group as well as individually. In addition, telephone contacts were made with individuals identified as having firsthand experience with the relocation process. A questionnaire was developed to provide structure for the telephone interviews. A summary of the results of the telephone interviews and comments made by members of the focus group and others in the community is provided, as follows:

- Participation in the planning process prior to the relocation of the townsite was limited. Most respondents, who resided in the Entiat area at the time, indicated that they had little involvement in the decisions regarding the relocation of the downtown

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- area; however, many were aware of the effort lead by the county to develop a plan that was intended to incorporate the expressions of interest of local citizens as well as the Chelan County PUD No. 1, the then existing Great Northern Railroad and the State Department of Highways.
- Most respondents felt that the relocation effort was a failure; however, a major reason for the failure was the inability of local residents, particularly land owners and local public decision-makers to resolve their basic conflicts regarding the development of a new urban center on the uplands (near the existing City Hall) or developing commercial facilities along the new highway (SR 97A). Ultimately, the failure of the city to re-establish a central core commercial area appeared to be market driven, although political factors, including decisions regarding extending the city's boundaries and associated infrastructure improvements played a significant role.
 - Most respondents, who resided in the Entiat area at the time of the relocation of the downtown area, were affected personally by the relocation decision. Many were employed in the storage, processing, and dehydration plants that were forced to relocate. Some continued working on the same jobs at the relocated facilities in Wenatchee, requiring extended commutes. Others were residents of the original downtown site and owned or worked in businesses that were subsequently relocated or ceased operations. All members of the community apparently changed their shopping patterns, with major purchases subsequently made in either Wenatchee or Lake Chelan.
 - Most respondents, who resided in the Entiat area before and after the relocation of the townsite, felt that social contacts were diminished substantially, particularly, the sort that involved casual conversations and courtesies, while shopping or stopping in at eating and drinking places. At the same time, conflicts over land use decisions led to some stratification of residents into opposing groups, thereby causing uneasiness in relationships generally.
 - All respondents indicated that there was no evidence of increased alcoholism, family breakdowns, child abuse, or mental illness, as a result of the relocation of the townsite.
 - All respondents indicated that there was no evidence of a breakdown in social cohesion as measured by support for local churches, other community organizations, and the Entiat School District. Indeed, two churches in the original downtown area (Federated and Friends churches) were relocated to the uplands. However, some residents decided to attend church in Wenatchee and elsewhere after the relocation. The school district continued to receive enthusiastic support from the local populace.
 - All respondents indicated that the Entiat area has improved in recent years; there is a reservoir of support for community objectives, including prosaic issues of planning for an improved downtown core near the City Hall, food center, and other businesses; development of trails linking the downtown core to Entiat Park; development of new park facilities and community hall; etc. A part of the change in perception stems from improved economic conditions associated with residential land use development and in-migration of population.
 - All respondents were supportive of measures that could be done to improve the city of Entiat, which suggests considerable optimism for the future.

4.5 Summary: Cumulative Social, Economic & Fiscal Impacts

Taken together, social, economic, and fiscal impacts attributable to the dislocation of the downtown core of the city of Entiat as well as other actions that diminished the tax base of the area have resulted in long-term significant adverse consequences for the residents of Entiat. Nonetheless, it must be stressed that the changes in social and economic conditions brought about by the dislocation of the downtown core resulted from a combination of influences including decisions by private property owners and community leaders with respect to land use planning, infrastructure development, and investment in commercial development in addition to the actions taken by the Chelan County PUD, namely, the building of the dam.

Individual residents and business owners directly affected by the dislocation of the downtown core were adequately compensated for their properties, based on arms-length transactions entered into individually by the PUD and the affected property owners. As noted above, the PUD paid \$3.1 million for properties and rights-of-way required for the Rocky Reach Project during the 1958 – 1961 period. Also, in 1958 and 1959 the PUD provided about \$426,000 in direct payments to the city of Entiat for planning, legal services, and infrastructure development. Most of this was provided to support development of a new city downtown core. The PUD also provided funding for development of Entiat Park, which is maintained and operated by the city and continues to represent an important community asset. The PUD has also leased the land to the city occupied by the Kiwanis baseball field. Overtime the residents of Entiat have also benefited from low electric power rates associated with power generated at the project.

Despite the payments made by the Chelan County PUD to private property owners and to the public sector, the dislocation of the downtown core has had severe consequences. Many individuals and business owners decided to locate elsewhere rather than invest in development of a new downtown core. Also, existing owners of upland properties at locations that could have formed the basis for a new downtown center had varying levels of interest in selling to recently displaced property owners. Apparently, some key properties in the upland area were offered at above-market prices, and thus, remained undeveloped. Decisions by the city in the 1960s and 1970s to annex extensive areas and, thus, expand the city limits, particularly, to the north, contributed to scattered development; it also resulted in extension of city services (roads, water, and sewer) to low-density areas, with potentially adverse fiscal consequences to the city associated with high costs of maintaining the systems.

Other economic problems, such as reductions in timber harvests and closure of the Ardenvoir sawmill in 1979, as well as a general shift of fruit orchard operations and storage/processing activities from Entiat to Wenatchee, have contributed to the economic stagnation of the Entiat area. Nonetheless, the loss of population and property valuation, associated with the dislocation of the downtown core as a result of developing the Rocky Reach Project, was a major turning point in the economic and social history of Entiat leading to long-term economic stagnation. Fortunately, recent trends suggest improvements in the local economy, resulting in increased population in-migration and substantial growth in property valuations.

Clearly, the population of the Entiat area (city of Entiat and Entiat Valley) has been shown to be quite resilient in adapting to the changes brought about by the dislocation, even the effects of

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economic stagnation and the related consequences on public services. Nonetheless, it has suffered the consequences of diminished opportunities to improve overall welfare of the community.

It is equally clear that other communities within the two-county region have benefited from opportunities brought about by a stable and growing economic base, adequately funded public services (importantly schools), and generally harmonious social conditions. The loss of an economic base consisting of a vital downtown area as well as stable employment opportunities within a viable industrial structure has led to depressed economic conditions within the Entiat area. A major consequence of this has been the diminished capacity of the public sector to provide adequate services to the area population.

For the city of Entiat and Entiat School District No. 127 this has meant lower property tax collections and resulting smaller available resources to fund necessary expenditures. Public utility excise tax receipts received by the city over the years were insufficient to make up the difference for the loss of the property tax base. The School District has not received direct allocations from the PUD privilege tax since the early 1980s, when the Legislature revised the allocation mechanism with respect to this tax.

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Abstract

The City of Entiat and Entiat School District #127 asked ECONorthwest to evaluate the economic impacts that the Rocky Reach Dam and Reservoir (owned by the Chelan PUD) has had on them. The evaluation is on the impacts on the municipality and school district as public institutions. It does not attempt to evaluate the regional benefits and costs of the dam or the impacts on all residents or businesses located in Entiat since the dam was built in 1960. Rather, this analysis addresses only the impact that the creation of the Rocky Reach has had on the economic foundations of the City of Entiat and the Entiat School District.

The analysis begins by showing that the City and School District were negatively affected by the dam. The economic base on which they depended for revenue was uprooted, and the one-time compensation paid to them by PUD did not begin to cover the stream of revenues that they have foregone for almost 50 years and will continue to forego. The analysis describes why that stream of lost revenue is a reasonable measure of the damage they have suffered, and estimates the present value of past and potential future lost revenue. The lost revenues result, directly or indirectly, from losses of economic activity and tax base in Entiat.

The City loses revenues (revenues that it otherwise would have expected if the dam had not been built) from four sources: property tax, sales tax, real estate excise tax, and hotel/motel tax. The School District loses revenues from property tax and from State general-fund education revenue. To estimate those losses, ECO compared the growth rates of those revenue sources (or the factor on which the revenue depends) in Entiat to those of other jurisdictions in the Entiat region. The assumption (discussed and justified in the report) is that, but for the dam, Entiat would have grown at the average rate for all comparable jurisdictions.

Our estimates of the present value (2002 dollars) of the past and future lost revenues are \$13.4 million for the City of Entiat and \$20 million for the School District. These estimates are of *real*—not speculative—economic damage to the City and School District. They are specific only to the items addressed in this analysis and are not intended as estimates of all damages incurred by the City and School District of Entiat from the construction of the Rocky Reach Dam. Further, though it may be appropriate to do so, for the purpose of maintaining a conservative analysis we do not assume any diseconomies of scale in the operations of the City and School District from the abrupt loss of population in Entiat or the less condensed geography of the relocated town site.

There is substantial variability around these estimates. Their reliability depends on the strength of the theory, data, and analytical techniques used to generate them. The following report and accompanying appendices provide documentation on these topics.

BACKGROUND

In August 2002, representatives of the City of Entiat City and Entiat School District #127 asked ECONorthwest to evaluate the economic impacts the Rocky Reach Dam and Reservoir has on them. Their conclusion, which they asked ECO to evaluate, is that the fiscal impacts on the City and the District have been negative. The impetus for the evaluation is the upcoming re-licensing of the Rocky Reach Dam (owned by the Chelan PUD) by Federal Energy Regulatory Commission (FERC) in 2006. The process of re-licensing provides the City and the District with an opportunity to negotiate reimbursement for ongoing and cumulative economic damages.

ECO's preliminary evaluation of the facts of the case found ample reason to support the conclusion that the dam has had a net negative impact on the fiscal situation of the City and the District. The reservoir flooded a large area of productive agricultural and potential commercial and industrial land. It flooded Entiat's downtown business core and adjacent residential neighborhoods: attempts to re-create the downtown on higher ground have yet to produce, almost 50 years later, what existed before the dam. The dam also eliminated miles of native fish and wildlife habitat and recreational sites.

These impacts affected a large part of the small town of Entiat. It would be hard, in our opinion, to credibly support the argument that Entiat was no different in 1965, and is no different now, from what it would have been if the dam had not been built. The dam changed Entiat's future in significant ways. Planning and socioeconomic evaluations done for the Chelan PUD at the time of the flooding and recently come to the same conclusions.

The issue here is not whether the dam has, over a large area and the long run, been, on net, positive. That is a question requiring a much larger analysis than the one attempted here, and the answer is not critical to the case being made for the City and the School District. For big public investments—even the most beneficial ones—it is almost always the case that some people are made worse off by the investment and are not fully compensated for their losses. The citizens and institutions of Entiat got less from the dam than what it took.¹

Thus, this report attempts to describe and estimate the extraordinary and uncompensated costs borne by the City and the School District that resulted

¹ Decisions to proceed with big projects that have negative impacts on some groups are made based on the assessment that, overall, they are beneficial for a larger society. Part of that decisionmaking process requires, both morally and legally, an accurate assessment of who is paying the costs, and a fair reimbursement for those costs. Such reimbursement should be possible if the project does in fact generate net benefits for a larger group.

from the dam. The hope of the City and School District is that this analysis will provide a base of facts that can inform their negotiations with the Chelan PUD on compensation for past and ongoing costs that they incur.

ORGANIZATION OF THIS REPORT

The rest of this report has two main sections, and several appendices that provide the more detailed analysis from which those two sections summarize:

- **Section 2, Evaluation Framework**, describes the economic theory on which our evaluation is built. The obvious point is that looking back almost 50 years to estimate economic impacts is difficult. Just because impacts are hard to measure, however, does not mean that they did not occur. They did occur. We have spent considerable time thinking about the proper theory of evaluation. This chapter summarizes the principles and assumptions we used. Any reasoned discussion about the size of the damages we estimate must be primarily about the theory, methods, data, and assumptions that we describe in this section (and in more detail in Appendix A).

This section also summarizes key events in Entiat that relate the activities associated with the dam to changes in the economy of Entiat. We must establish that connection between the dam and economic change is necessary because our analysis assumes that those economic changes are largely responsible for the lost revenues to the City and the School District. Others in Entiat have written at more length on the history of the damages, and on the failure, in their assessment, of the PUD to carry through on various promises for capital investment and cost sharing.

- **Section 3, Estimates of Lost Revenues**, summarizes the assumptions and analytical methods used, and shows the results of the analysis. Appendices B, C, and D provide more detail.
- **Appendix A, Evaluation Framework**, provides the details that are summarized in Section 2 of the report.
- **Appendix B, Detailed Description of Steps in Analysis**, provides the details that are summarized in Section 3 of the report.
- **Appendix C: Data Tables**, provides the details that are summarized in Section 3 of the report.
- **Appendix D, Comparison to Methods in the McHugh Report**, provides a brief summary of how the methods used in this analysis are similar to or different from the ones used in the recent Socioeconomic Analysis (2000) completed for the Chelan PUD by McHugh Associates.
- **Appendix E: Limitations of the Analysis**, provides a brief statement about the inherent uncertainties in this type of analysis, and the implications for how the analysis should be used.
- **Appendix F: About the Authors**, describes the experience of ECONorthwest and the principal authors of this report.

INTRODUCTION

The public purpose of a dam—the reason a public agency will champion its construction—is to create economic opportunity, not to cause economic harm. Our charge is not to evaluate the extent to which the Rocky Reach Dam has provided economic benefits for the greater area of central Washington and for the entire Northwest. Certainly its electricity, recreation opportunities, and employment have value for many people.

Whether the dam has, in the aggregate, provided benefits to society in excess of its costs is not a question that we have been asked to address. Nor is it one that we need to address to answer the question we have been asked, which is about the *distribution* of those impacts. Even if *most* people and jurisdictions got more benefit from the dam than they paid in cost (net benefits), it is almost a certainty that not *all* people and jurisdictions received a net benefit. The evidence we have evaluated supports the contention of the institutions and residents of Entiat: that whatever the aggregate impacts of the Rocky Reach Dam, the local impacts in Entiat have been, on net, negative.

Our task is to put some numbers to the impacts. What have been the costs to the City and School District of Entiat? Was the town and school district damaged in the process of creating this regionally beneficial project? If so, is the damage ongoing, or did it end at some point between 1960 and now?

Though the research questions are easily stated, the research needed to answer them is very difficult. Consider:

- Construction of the dam occurred over 40 years ago.
- Some of the impacts in Entiat occurred before the dam was built; some of them continue on through today.
- Some property owners were compensated for the estimated value of lost property that was directly taken (by flooding, for other PUD purposes, for the highway and railroad relocation); other property and business owners lost property or business value for which they were not compensated.
- The City and Entiat School District are composed of, represent, and serve people in their boundaries, but they also have a separate set of rights, obligations, and assets that must be considered.
- Other factors besides the dam had an impact on the economy of Entiat—how does one isolate the unique effects of the dam?

The questions and the research challenges they imply go on. Estimating the initial and on-going impacts on a municipal government of a construction

project that occurred over 40 years ago requires assumptions. Those assumptions have to be defensible. They will be more defensible if they are consistent with the practices and theory of economic and fiscal evaluation, and if they make intuitive sense to people who are not economists by training.

This chapter explains the basic economic principles and assumptions that are fundamental to any research effort of this type. It summarizes from Appendix A, where all these points are described in more detail.

THE FUNDAMENTAL ASSUMPTION

The reason that the City and School District asked ECONorthwest to conduct this research is that they believe the construction and operation of the dam caused them to incur uncompensated costs, reductions in revenue, or reductions in the quantity or quality of the services they provided to their constituents. Our assessment is that the chain of cause and effect supports that belief:

- The construction of the dam impacted the City directly (by flooding) and indirectly by uprooting the local economy.
- The impacts on Entiat economy were so great that the economy never fully recovers to what it would have been without the dam.
- The revenues to the City and the School District are highly correlated to health of local economy.
- The revenues lost to the City and the School District are a measure of the costs they have incurred as a result of the dam's construction and operation, and can be estimated by comparing their fiscal performance to that of other cities and school districts in the region around Entiat.

The main task for this report is to produce the evidence to support those conclusions and to provide estimates of the damages to the City and the District. The rest of this chapter provides a summary of the principles, methods, and assumptions that are necessary to get to reasonable and defensible estimates of uncompensated costs to the City and the School District. See Appendix A for more detail.

PRINCIPLES AND METHODS FOR ESTIMATING LOST REVENUE TO THE CITY AND SCHOOL DISTRICT

OVERVIEW OF EVALUATION ISSUES

In concept, an evaluation like this one must describe how a particular group (which may be defined by demographics, affiliation, geography, or some combination) found itself facing different costs and benefits as a result of some past action. The group in this case, for reasons discussed later, is the City and the School District. The action in this case is the planning,

construction, and operation of Rocky Reach Dam. Any analysis of *differences* caused by the dam must try to address: (1) all impacts, (2) over all time.

Behind that simple statement of the goals of this analysis are thousands of pages of reports and journal articles that describe how the analysis should be done. Economists and policy analysts have attempted to add detail and practical techniques for measurement and comparison to the general principle of good decisionmaking just described. We refer to those techniques collectively in this report as *benefit-cost analysis*.

KEY PRINCIPLES FOR THE EVALUATION

The analysis in this report is *not* a full benefit-cost analysis, but it is consistent with the principles and techniques of benefit-cost analysis. In their attempts to find practical ways to approximate the ideal of assessing "all benefits and costs, on all people, over all relevant areas and time periods," practitioners of benefit-cost typically adhere to some fundamental principles, even though their measurements and methods of measurement and comparison may vary substantially. There are many such principles; we discuss here six of the most important ones (see Appendix A for more details):

- **Principle 1: Define the perspective: benefits and costs from whose point of view?** That perspective must address not only "who," but also over what geographic area, and over what time period.
- **Principle 2: Describe what is different, and then estimate the extent of the differences.** What *actually* happened and what we can observe now must be compared to an estimate of what *would have* happened but for the actions being evaluated (in this case, the development and operation of the dam). In the jargon of policy evaluation, what would have happened is called the counter-factual scenario. Describing that scenario is the key technical challenge of this report.
- **Principle 3: Identify and attempt to measure all significant impacts.** The analysis must not ignore impacts because they are not readily measured in dollars, or are difficult to quantify at all. That point must be balanced, however, against the real complexities of the problem and the potential costs of the analysis. In the end, one must look for reliable measurements with available data that seem to capture, at least approximately, the major impacts.
- **Principle 4: The distribution of impacts can be as important as their totals.** In this case, distributional issues are very important. Even if from a national, state, or regional perspective, a dam was, on net, beneficial, some entities may have paid more in costs than they received as benefits.
- **Principle 5: A benefit or cost in the future has less value than the same one now.** This conclusion is one that people understand intuitively: a dollar invested in something with low risk like government bonds will grow at an interest rate and be worth more in

the future than it is today. Or, a related example: a dollar today doesn't buy what it did 40 years ago.

- **Principle 6: Average and marginal costs are different, and the difference matters.** The costs of having to add capacity to public services can be very much different than the average cost of constructing and operating existing capacity.

HOW THE PRINCIPLES APPLY IN THIS ANALYSIS

WHAT PERSPECTIVE?

The question about perspective has several components. The question, "Who was impacted?" cannot be answered independent of a specification of space and time: what area is being considered, and for what period?

The question about area is the easiest to answer: the analysis in this report is to look at the City of Entiat and the Entiat School District. But even here there are some complications. First, the boundaries of the City and District are different. Second, at least for the City, those boundaries have changed over time. These are resolvable problems, however, and not major obstacles to the analysis.

Regarding time, the answer is also clear: the analysis in this report will look at the period that begins when the dam project can reasonably be expected to have first caused changes in the City or the District. There is ample evidence to show that the impacts on the City and the District began *before* construction on the dam began. That is, households and businesses began relocating and changing operations several years prior to the beginning of dam construction. The analysis period continues to the present day. It continues on to the foreseeable future: if, as our analysis will demonstrate, the events around the construction of the dam have caused the City or the School District to incur ongoing annual costs, those costs do not stop in 2002 just because that's when we did our analysis.

The question about "Impacts on Whom?" is the most difficult to answer. A question fundamental to this evaluation is: Are the City of Entiat and the School District something more than all the individuals that live or work within their boundaries? Stated another way, if all the individuals were compensated as individuals, would there be anything left to that needed to be paid to the City and the District?

The question may sound odd at first, but it is real and not easily answered. Appendix A (pages 6-9) examines the question in more detail. The conclusion is that the City and the District can be treated, for purposes of compensation, just like any other business that produces goods and services. The planning, construction, and operation of the dam damaged the abilities of the City and the District to supply those goods and services efficiently and to a desired level of quality.

Local governments and special districts are voluntary associations created to enhance the well-being of their citizens in their capacities as households, employees, business owners, and property owners. Municipalities and special districts exist to provide their citizens with goods and services. They suffer economic damages when an action:

- Reduces the value of the goods and services they provide for the benefit of its constituents.
- Increases the costs of providing a level of goods and services to its constituents.
- Diminishes or eliminates the value of the private capital within the their tax boundaries.

Thus, for the purpose of this analysis a municipal corporation or school district is similar in key ways to a business. It is trying to provide goods and services at a quality and price that attracts customers. If, in the interest of a larger public purpose, some higher level of government reduces the capacity of the municipal corporation to supply its products at current levels of quality and price, then the municipality or district is damaged and should be compensated. Later in this report we describe the reasons for using *lost revenues* as a measure of that damage.

WHAT'S DIFFERENT?

The Entiat one can observe today is different from the Entiat one would observe if the dam had not been built and the City not relocated. The correct way, in concept, to evaluate the impact of the dam on the City is to describe *what is different* between the things that happened to the City since the dam was built and *the best estimates of what would have happened* if the dam had not been built.

But how can one estimate with any precision what Entiat would have become, *but for the dam*? The Entiat one observes now is the result of many events that played out over the last 40 years; the dam is only one of those events. How can an evaluation control for all those other events to estimate the unique contribution of the dam to a hypothetically different Entiat?

That question is a difficult one, but *the technical difficulties of answering that question do not justify giving up on attempts to answer it*. It is the essential question to this analysis: what changes did the dam cause in Entiat? That question cannot be answered without some description of what would have happened in Entiat if the dam had not been built.

Overview: how the dam had impacts on the City and the School District

We reviewed written accounts of, and discussed with City and District representatives, chronology of events that relate the planning and operation of the dam to economic and fiscal conditions in Entiat. Our main conclusions are that:

- The dam was a big investment in a small economy and had big economic impacts, both positive and negative.
 - The positive impacts include lower-cost and more reliable power for all people in Eastern Washington and the Northwest (and even California) and reservoir-related recreation. The negative impacts include, but are not limited to, the loss of the Entiat downtown, the loss of area businesses, the loss of valuable agricultural land, the loss of different kinds of recreation opportunities associated with a free-flowing river, and environmental costs (e.g., impacts on salmon runs and wildlife habitat).
 - Among the beneficiaries of the dam is the Chelan PUD. It has grown in size and community stature; it pays employees good wages with good benefits; it has accumulated a substantial surplus. Because it is a public utility, it cannot continue indefinitely to accumulate surpluses: its "profits" must be returned to the benefit of the people in its jurisdiction.
 - The fiscal position of the City and the School District, and their abilities to continue to provide public services to people in their service area, was diminished by the reduced economic conditions in their service areas that the dam caused.
- Thus, Entiat and the School District absorbed a disproportionately large share of the local costs associated with the dam, and have received a disproportionately small share of the benefits (which have been spread out across the western states as lower power costs, and concentrated mainly in Wenatchee as economic development and public services benefits).

Marginal versus average costs

For Entiat and the Entiat School District, it is not the case that the loss of property value and tax revenue is offset by decreased cost of services. The economic issues here are ones of marginal costs vs. average costs; of fixed cost vs. variable cost; and of economies of scale.

Suppose the City, for example, had sized its facilities for 500 people and a reasonable expectation of expanding to 800 in 10 years. But the dam then cuts the population to less than 400, takes out the concentration of activity in the downtown, requires expenditures not fully covered by compensation to reorganize the services, and sets back growth such that the planned population of 800 (the efficient service capacity) is not reached for 30 years instead of 10. In that case, the City is going to be operating less efficiently than it had been. The cost per person (or per household, per business, per student, or per any other unit of measurement) will be greater than it had been. That is an economic loss to the City or the District.

Another way to say that is that the City and the School District had some fixed costs and variable costs before the dam. After the dam it might be able to reduce some of its variable costs, because it has fewer households and

businesses to serve. But its fixed costs—the costs of the things that do not change very rapidly—are now paid for by fewer people, who must pay more per person for the same service (or have less service for the same cost).

Moreover, the decentralization of services is likely to result in greater per capita variable costs (e.g., on average, the amount of roads per capita has increased, so the per capita maintenance costs increase), which raises the possibility that the *total* variable cost will actually increase, despite the fact that fewer people are being served.

What impacts are relevant and possible to measure in this analysis?

After our preliminary evaluation of the issues and the data, we discussed our conclusions about possible impacts and measurement methods with staff at the City and the School District. We agreed that on the following points regarding our approach to measuring economic impacts:

- Focus on the City and School District as independent entities that suffered their own damages (analogous to corporations), not as proxies for individual damages to households and businesses located inside their boundaries.
- The economic impacts on the City and the District are largely the result of *economic impacts* on citizens and business in and around Entiat.
- Given the focus on the City and the School District as entities whose ability to provide services desired by the people who formed and support these entities, it is appropriate for the analysis to focus on the *fiscal impacts* on the City and the District. The perspective is that these public institutions are like corporations: they have a life and rights of their own, independent of their individual stockholders (citizens). From that perspective, the question about impacts becomes: What new costs did Entiat have to incur, or what revenues did it have to do without, as it tried to supply its citizens with a given level of public services?
- There are many impacts on the City and the District that might be classified under the heading of fiscal impacts. Trying to measure all of those aspects of fiscal impacts is complicated and beyond the scope of this report. For this report, we use what we believe to be the best measure of fiscal impacts: lost revenue. It has the advantage of being theoretically related to all the impacts of concern in the sense that (1) the lost revenue is directly correlated to losses of service quantity and quality, or increased cost of service delivery, or both, and (2) under the assumption that the value of services people get are at least as great as what their willingness to levy taxes on themselves suggest they are willing to pay for those services, then lost revenues are a proxy for lost welfare.

- The focus of the analysis on fiscal impacts (lost revenues) to the City and the School District means that this does not try to evaluate, for example, the net impacts of Rocky Reach Dam on the nation, state, or region, or the fairness of the compensation paid to private parties for property taken as part of dam construction and the filling of the reservoir.

TIME VALUE OF MONEY

The value of money changes over time: a dollar bought more in 1990 than it does today—it's worth less. If that dollar had been invested in 1990, however, it might have grown to a larger amount at the same time inflation was eroding its value. Depending on the rate of return of the investment, the invested dollar could be worth more today than the original dollar (the dollar plus the return can purchase more goods than the original dollar could).

These issues are important in this study because many of the impacts occurred a long time ago. Take a simple example. Assume that the dam construction required a property and building, and that for some reason the original property owner abandoned the property but never received compensation. Assume the intent now is to just compensate her by giving her enough money to replace now what she lost in 1960 (i.e., assume no punitive damages). Assume the value of the property in 1960 was \$30,000. Because of inflation and (potentially) real increases in the relative value of real estate, replacement of that property now might take \$150,000. It is the latter, larger estimate that is the correct estimate of payment due.

OVERVIEW

Section 2 (and, in more detail, Appendix A) provides a framework for the evaluation method. This section, Section 3, implements that method to arrive at estimates of damages (as measured by lost revenues) to the City and the School District.

This section has three subsections:

- **Analytical Issues** goes beyond the general issues in Section 2 and discusses specific issues related to data and methods.
- **Impacts on Revenues by Type** provides estimates and a description of estimating technique for the main types of revenue that the City and the School District would have received.
- **Summary of Impacts by Jurisdiction** reorganizes the impacts in the previous subsection to summarize them for the City and the School District.

ANALYTICAL ISSUES

The previous section (Section 2) already described many of the broad issues of methods and economic principles that are relevant to this evaluation. This subsection goes into more detail on specific issues that apply in the case of Entiat and the School District. Appendix B provides yet more detail on the specific steps of the analysis used to get to estimates of lost revenue.

ESTIMATING LOSSES IN ANNUAL REVENUES TO THE CITY AND SCHOOL DISTRICT

Section 2 makes the case for using lost revenues as a measure of damages for the City and the School District. What are the sources of those lost revenues, and how would they be measured? The most reliable and useful economic records available include:

- Assessed property value and tax records
- General sales tax records
- Real estate excise tax records (REET)
- Hotel/motel tax records
- State revenues for students.

What can these data tell us? By looking at these data sources over time for Entiat and other Chelan County municipalities, we can describe how Entiat fared relative to its neighbors.

To the extent the data are available, we can begin our analysis at a point prior to construction of the dam. This provides a baseline in which to compare the economic growth of the municipalities. If Entiat was damaged by the dam, we would expect to see slower per capita economic growth, relative to the other cities in Chelan County.

More importantly, by deriving the differences between the yearly economic records for Entiat and the other cities, we can obtain estimates of the actual yearly economic damage to Entiat. By summing up these yearly damage estimates, we obtain the total damage to Entiat, to date. How this is done is explained more fully below and in detail in Appendix C. Finally, although there may be other data sources and methodologies available that can be used to get a picture of the impact of the Rocky Reach Dam, it is doubtful that they would provide as clear a picture or be so readily available.

ESTIMATES MUST BE BASED ON POPULATION

Integral to any analysis of damages to a public entity in its ability to serve its constituents is that it be based on *per capita* value.

The reason for conducting an analysis that accounts for population is simple. Normalizing by population accounts for changes in tax revenue beyond those that are caused by increases in population. In simple terms, a municipality generates property and sales-type tax revenue based on the value of the private property and the level of business activity within the municipality. A city also incurs cost, based largely on the number of citizens it must serve (note, population density may also be a factor in the costs a municipality will incur). Therefore, if assessed value rises slower than the population, then assessed value per capita (and tax revenues per capita) will actually decline (other things being equal). The public entity may have to raise the levy rate it imposes on property value (to the extent practicable) or cut services. In the case of a small municipality or school district that has lost much of its commercial sector, it may be extremely difficult or even impossible to raise levy rates on property, and sales tax rates on commercial activity. Most likely, the municipality or school district will have to cut services.

An analysis that is population based (i.e., based on per capita values) is theoretically consistent with the revenue-generating and cost-incurring nature of a municipality. Although it may be appropriate to do so, for the purpose of maintaining a conservative analysis we do not assume that any diseconomies of scale are caused by the initial loss of population in Entiat or the less condensed geography of the relocated town site. (Assuming some level of diseconomy would increase our estimates of damages, other things being equal.)

ENTIAT'S ALTERNATIVE FUTURES

What would Entiat have looked like, had not the dam been built? It is reasonable to expect that the town would still have its more concentrated and traditional downtown, its commercial district, and its neighborhoods lost to the reservoir. It would probably still lie within close proximity to orchards, other agricultural areas, and new industry. And, it probably would have maintained its role as a subregional commercial and cultural center.

In short, we would expect it to have grown and developed in a manner similar to other similar-sized municipalities in the county. The McHugh report (the only other recent analysis of the Entiat situation that we are aware of)² seems to have come to a similar conclusion, but it stopped short of looking at all the municipalities one might assume Entiat to have grown like. In fact, it stopped with the slowest-growing of similar sized municipalities, Cashmere.

Why not assume Entiat would have grown in a manner similar to Leavenworth or Chelan? In 1959, the first year in which the McHugh report analyzes economic damage to Entiat, the population of Entiat was 365. Comparatively, the population of Cashmere, Leavenworth, and Chelan were 1,879, 1,482, and 2,406, respectively. Likewise, the per capita assessed value of Entiat in 1959 was \$3,276. For Cashmere, Leavenworth, and Chelan, the per capita assessed values were \$4,198, \$2,268, and \$3,569, respectively. Based on city size and per capita assessed value, any of these three cities would have been suitable proxies for the "but-for-the-dam" growth rate of Entiat. By simulating alternative futures for Entiat by the growth rate of each of these three municipalities, one could obtain a degree of confidence in the range of property values and tax revenues that Entiat would have experienced, but for the dam. The difference between the alternate futures for each of the taxes serves as a form of sensitivity analysis. That is, how sensitive are the estimates of economic damage to each growth rate? If there is little difference, then it matters little which alternative future one assumes. If, on the other hand, there are great differences, then one should have strong evidence to support one alternative future over another.

Since we cannot say that Entiat would have grown exactly like one of these three cities, it is reasonable to average the growth of the three cities. This gives us estimates that include information from all of the cities we reasonably could have expected Entiat to have grown like, but for the dam. By using all available and relevant data, this methodology provides estimates that are more robust and defensible than those derived using information on a single city.

² "Socioeconomic Study, Rocky Reach Hydroelectric Project, FERC Project No. 2145," December 2000.

FUTURE DAMAGES

There is reason to believe that the per capita property tax shortfall will continue into the future. The difference in per capita property taxes, relative to other Chelan County municipalities has increased over the past 40 years and has accelerated over the past decade. The combined impact of rapid population growth in Entiat over the past decade and limited available commercial, industrial, and agricultural land in and around the City are likely to further a situation where Entiat serves as bedroom community for other cities. The fiscal impact to the City is that it will have a growing population to serve, but may have a tax base that grows at a slower rate.

Thus, in addition to being compensated for all past fiscal damages, the City and School District should be compensated for all future damages. If Entiat had been compensated in circa 1960 for the fiscal damage the Rocky Reach Dam caused to the City and School District, there would be no need for this current analysis. It follows that if the City and School District are compensated now for the ongoing damages, there will be no need to calculate, these damages at a future relicensing. Our conclusion, based on estimates of lost revenues, is that Entiat has been fiscally damaged each of the past 40+ years. Given our conclusion that the current economy is less than it would have been in the absence of the dam, it follows Entiat will be fiscally damaged for the indefinite future. If the City and School District are compensated today for these future damages, these entities will be able to use this money to help mitigate the ongoing damage.

In summary, if Entiat and the School District have been losing revenues in every year from around 1959 to 2002, then in the absence of any compensation by the PUD, they will continue to lose revenue (relative to what they would have had) into the future. Basic economic principles require that any current settlement needs to account for the present value of those future losses.

IMPACTS BY REVENUE SOURCE

PROPERTY TAX AND ASSESSED VALUE

We compare the changes in the per capita assessed value of land in Entiat and the Entiat School District to the per capita assessed value of land in other Chelan County cities and school districts. If creation of the Rocky Reach Dam adversely affected Entiat, one would expect the rate of growth in per capita property values to be lower (and even negative in the early years) in Entiat than in other Chelan County cities. Lower relative (per capita) property value increases (or even decreases in property values) translates directly into lower relative per capita City and School District tax collections.³ This means the City has less money to provide municipal services to its

³ Note, slower per capita property value increases may also lead to a higher levy rate, to the extent practicable.

citizens, and the School District has less money to educate its students. To the extent that the commercial tax base was damaged, the per capita impact on the City and School District will be particularly severe. This is because commercial tax-payers generally pay more in taxes than they consume in services.

Data on assessed property values for the City and School District of Entiat, and other Chelan County cities and school districts, were obtained from the County Assessor's Office. The data begin in 1955 and extend through 2001. The raw data, as well as the transformed data from each step of the analysis are provided in Appendix C. The steps required in our analysis are straightforward; Appendix B provides a more detailed description.

CITY OF ENTIAT

We compared the yearly per capita assessed value of Entiat to that of Cashmere, Chelan, and Leavenworth (Appendix C, Tables C1.1 through D1.11). In 1955, Entiat had a higher per capita assessed value than did any of the other three cities. However, that changed by 1959 when both Cashmere and Chelan had higher per capita assessed values. More importantly, whereas the per capita assessed value of Cashmere, Chelan, and Leavenworth increased, the per capita assessed value of Entiat decreased by 34 percent. Per capita assessed values did increase by 1961. However, this was due as much to population loss as to assessed value gain. Though Entiat's per capita assessed value grew through the 1960s, 70s, 80s, and 90s, it did so at a rate somewhat lower than Cashmere and substantially lower than Chelan and Leavenworth (see Appendix C, Tables C1.3 and C1.4). A very telling indicator of Entiat's economic condition is that it wasn't until 1977 that Entiat's population matched its population in 1950.

Over the period 1955 through 2001, Entiat's per capita assessed value grew by 5.0 percent per year. Comparatively, Cashmere, Chelan, and Leavenworth grew by 5.5, 7.7, and 8.4 percent, respectively. The net result is that, though Entiat started in 1955 with a per capita assessed property value greater than the three other cities (more than twice that of Leavenworth), by 2001, Entiat's per capita assessed value was equal to that of Cashmere, but half that of Chelan or Leavenworth.

What if Entiat had grown like one of these other cities? What would its per capita assessed values be today? What would be its per capita property tax today? And, most importantly, what is the total tax revenue over the entire period foregone because of the dam? Though we don't know exactly how Entiat would have grown, it is reasonable to assume that it would have grown like other similar-sized Chelan County cities. Since it is somewhat arbitrary to say which city Entiat would have been most like, it is reasonable to use information from all cities by assuming the average growth rate of the three cities. By following this methodology we estimate a total loss in property tax revenue for the period 1958 through 2002 of \$2.8 million (in

2002 dollars) and a total loss for the future of \$2.4 million (in 2002 dollars), for a total of \$5.2 million.

ENTIAT SCHOOL DISTRICT

Following the same methodology used in for the City of Entiat, we estimated the fiscal impact of the Rocky Reach Dam on the Entiat School District (See Appendix C, Tables C5.1 through C5.11 for detailed data tables). As proxies of how the Entiat School District would have grown, but for the dam, we looked at the Chelan, Cashmere, and Cascade school districts. As in the city of Entiat analysis, the data clearly showed that growth in assessed property value within the district lagged far behind assessed property values in the other districts. Even though student enrollment at Entiat dropped precipitously after 1958, per student assessed value in the Entiat District lagged behind other Chelan County school districts.⁴ For example, there were 420 students in the District in 1958, but by 1968 enrollment had dropped to 313—a 25 percent reduction. But it did not stop there. Rather, enrollment continued to decline at Entiat through most of the seventies, bottoming out at 224 in 1979.

Beginning with the 1959-1960 school year and continuing through the 2001-2002 year, we estimate the total loss in property tax revenue experienced by the Entiat School District to be \$2.4 million. The estimated NPV of future property tax losses to the School District is \$2.3 million (2002 dollars), for a total loss of \$4.7 million.

SALES TAX

Sales tax collection by municipalities was authorized by the Washington legislature in 1972, with 1973 being the first year of collection. For many Washington cities, sales tax is a major source of revenue.

Within Chelan County, the City of Leavenworth collected twice as much in sales tax as it did in property tax during the period 1992 through 2001. Likewise, in 1992, 1993, and 1997 Chelan collected more revenue through sales tax than through property tax, and for the decade of the 1990s property tax revenue was only 10 percent greater than sales tax revenue. For Entiat, sales tax revenue lagged property tax revenue by approximately 30 percent for the decade. Without a viable commercial center, residents of Entiat must travel to one of the larger regional cities for household goods. Moreover, there is little spending in Entiat from the surrounding region or from tourism.

The data used to estimate lost sales tax revenue to the City of Entiat were obtained from the State of Washington, Department of Audit. Data were available for only the years 1992 through 2001. A detailed description of how

⁴ Note: Per student assessed value is calculated as $(total\ assessed\ value)/(total\ students)$. Thus, as the number of *total students* drops – all else being equal – per student assessed value will rise. The fact that per-student assessed value rose very slowly shows that *total assessed value* was either growing very slowly or actually decreased.

we estimated sales tax revenue prior to 1992 can be found in Appendix B. Tables detailing the steps of data analysis are found in Appendix C, Tables C.2.1 through C.2.18.

As with the property tax estimates, we do not assume that any one of the comparison cities (Cashmere, Chelan, or Leavenworth) is the best match of how Entiat's sales tax revenue would have trended between 1973 and 2001. Therefore, we again use the average of the three cities. Following this methodology, we estimate that Entiat lost out on \$1.7 million (2002 dollars) in sales taxes between 1972 and 2001 because of the loss of commercial and other land in and around the City. We estimate that the net present value of future losses in sales tax to be \$2.2 million (2002 dollars), for a total loss (past and future) of \$3.9 million.

REAL ESTATE EXCISE TAX

Real estate excise tax (REET) is not a major source of income for most Washington municipalities. However, for a small town like Entiat, with little commercial activity and limited available land for commercial and industrial growth, all sources of revenue are important. REET is a 0.25 percent tax imposed on real estate transactions, the revenue from which is used to fund capital and [perhaps] road maintenance activities. It is our understanding that the authorizing statute was passed in 1980. The State of Washington passed legislation in 1990 allowing cities and counties to increase the REET by an additional 0.25 percent. It is our understanding, however, that Entiat, Cashmere, Chelan, and Leavenworth have not increased their REET above 0.25 percent.

The data used to estimate lost REET revenue to the City of Entiat were obtained from the State of Washington, Department of Audit. Data were available for only the years 1992 through 2001. A detailed description of how we estimated REET revenue prior to 1992 can be found in Appendix B. Tables detailing the steps of data analysis are found in Appendix C, Tables C.3.1 through C.3.6.

We do not assume that any one of the comparison cities (Cashmere, Chelan, or Leavenworth) is the best match of how Entiat's REET revenue would have trended between 1980 and 2001. Therefore, we again use the average of the three cities. Following this methodology, we estimate that Entiat lost out on between \$67,000 and \$91,000 (2002 dollars) in REET revenue between 1980 and 2001. We estimate that the net present value of future losses in REET revenue to be \$163,000 (2002 dollars), for a total loss of between \$230,000 and \$254,000.

HOTEL/MOTEL TAX

Created in 1973, the Hotel/Motel tax accounted for approximately 0.1 percent of Entiat's total revenue during the 1990s. Comparatively, for Chelan and Leavenworth, the Hotel/Motel tax accounted for 3.0 percent and 7.0 percent, respectively of their total revenue during the 1990s. Entiat did have

lodging facilities prior to the creation of the Rocky Reach Dam. However, the subsequent flooding of much of the residential, commercial, and industrial lands in and around Entiat, has left the town with little need for such facilities, and has left the City without a source of income that its neighboring cities enjoy.

The data used to estimate lost hotel/motel tax revenue to the City of Entiat were obtained from the State of Washington, Department of Audit. Data were available for only the years 1992 through 2001. A detailed description of how we estimated hotel/motel revenue prior to 1992 can be found in Appendix B. Tables detailing the steps of data analysis are found in Appendix C, Tables C.4.1 through C.4.10.

As with our other estimates of lost revenue, we do not assume that any one of the comparison cities (Cashmere, Chelan, or Leavenworth) is the best match of how Entiat's hotel/motel tax revenue would have trended between 1980 and 2001: we use the average of the three cities. Following this methodology, we estimate that Entiat lost out on between \$1.0 million and \$1.3 million (2002 dollars) in hotel/motel revenue between 1973 and 2001. We estimate that the net present value of future losses in hotel/motel revenue to be \$3.0 million (2002 dollars), for a total loss of between \$4.0 million and \$4.3 million.⁵

STATE EDUCATIONAL REVENUE

OVERVIEW OF THE IMPACTS

Rocky Reach Dam caused economic impacts that resulted in lost population and school enrollment in Entiat. The loss in student enrollment at Entiat School District translated into direct losses—year upon year—in the per-student revenue from the state. General-fund State funding is designated for school operations and maintenance and is directly related to the number of student in a school district. All else being equal, more students mean more money from the state. State revenue is also affected by such factors as the size of the district (the smaller the district, the greater the *per-student* payment) and the educational level and experience of the district's teachers.

Of course, as the number of students increases, the total cost incurred by a district would also increase. However, the rate at which revenues change and the rate at which costs change are quite different.

⁵ Regarding the hotel/motel tax, we considered the argument that Entiat is not the tourist destination that Leavenworth and Chelan are, so using those cities as comparables will overstate the losses to Entiat. But those cities did not have a tourism industry in 1958. They had to develop one based on the resources they had available. Consistent with our previous arguments (1) Entiat had no resources left to develop anything—its economy had been decimated, and (2) it lost a free flowing section of the Columbia (which, arguably, would have proved a greater tourism resource than another reservoir) and was cut off from access to the River. To stay consistent with the other calculations, we stayed with the averages here for our base estimates.

For example, assume that the State pays each school district \$3,000 per year for each student, and that a particular school district (the ABC School District, for this example) has 100 students spread evenly between 12 grades, with one teacher for each grade. Thus, the district will receive \$300,000 from the state. Now, assume ABC's enrollment increases by 12 students and the 12 students are evenly distributed between grades one through 12. The district's total yearly revenue from the State climbs by \$36,000 to \$336,000. With the additional students spread evenly among the 12 grades, ABC will not need to hire any additional teachers, nor will it need to build or rent additional space—the greatest expenses for a school district. There will be some additional expenses incurred by the District, such as (potentially) additional busing, classroom supplies, and administration. However, these additional costs will be far less than the \$36,000 in additional revenue the district will receive from the state.

Now assume that instead of ABC's enrollment increasing by 12 students, it decreases by 12 students—again one from each of 12 grades. Instead of receiving \$300,000 from the state, it will now receive \$264,000. Assuming the ABC School District's revenue and costs were approximately equal prior to the 12-student decrease, where will the additional revenue or decrease in costs come from? Since the District has only one teacher for each grade, the District cannot reduce its teachers. Further, the loss of the 12 students will have little or no impact on the maintenance and operating costs of its buildings and other capital. In the short run, ABC may have a reserve account it can draw from. After that, if enrollment does not increase, it will probably make up the difference by cutting extracurricular activities, not updating educational materials, reducing scheduled maintenance on its facilities (which will speed its depreciation), reducing non-teaching staff, or by hiring less experienced teachers when an existing teacher retires or leaves.

The point is that State *revenue* changes as soon as enrollment changes. Public school *costs*, however, cannot change nearly as quickly—it takes many years for a district to adjust its cost to a change in enrollment. For small districts, such as Entiat, there is probably a point beyond which costs simply cannot be further cut. According to one study:

“Schools cannot cut expenditures at the same rate their numbers are declining. Enrollment declines are usually haphazard: Seldom do enough students depart from a single grade or class to allow a teacher or an entire program to be eliminated. This is especially true in smaller districts where there is only a single section of each grade. In those districts it doesn't make any difference if there are 22 or 27 students in fourth grade, you still need the fourth grade.”⁶

⁶ Drenth, Kenneth. Districts often can't cut costs when budgets shrink. Michigan Education Report. <http://www.educationreport.org/pubs/mer/article.asp?ID=2871>

For a small district like Entiat, there is a base number of teachers that must be maintained regardless of enrollment reductions. In 1958 Entiat School District had 17 teachers and 420 students. In 1975 the number of students had dropped to 285, but teachers had only dropped to 15. Despite substantial losses in enrollment, the District still had to provide a quality education for its students. This could be done only by maintaining a teaching staff large enough to provide all courses required by state and federal laws.

In the mid-1950s the District began planning for a new high school to better serve the community. The high school was completed in 1960. Upon completion, the district had capacity for 600 students.⁷

METHOD FOR ESTIMATING LOST STATE REVENUE

What are the impacts on school financing from the lost enrollment? We know that:

- State education revenue is directly tied to district enrollment
- Entiat lost enrollment over the course of two decades because of the Rocky Reach Dam
- Today, unlike any other school district in Chelan County, Entiat's enrollment is lower than it was in 1959, just prior to the completion of the Rocky Reach Dam.

Note that as Entiat's enrollment fell after the dam was built, State education revenue paid to the District increased on a *per student* basis. The higher per-student payments from the state are an acknowledgment by the state that per student educational costs are higher for smaller schools. But the higher per-student payments are intended only to assist smaller districts in meeting their educational requirements: they are not sufficient to provide small districts the revenue needed to offer all the courses students in larger districts enjoy.

More critically, how does one measure lost state revenue *net* of variable costs that would have occurred had Entiat's enrollment increased over the past 40 years, as all other Chelan County district's enrollment has? Yes, reduced enrollment decreased State revenue, but it also decreased costs associated with educating those students (the ones that now do not exist). We describe below the general approach we followed estimate net impacts: Appendix B provides more detail.

- **Data.** We used actual enrollment, number of teachers, teacher compensation, and State revenue for the years 1956 through 2001. For other comparison districts, we needed to make some estimates. For

⁷ We could find no evidence of the Chelan PUD's having advised the Entiat School District not to expand its facilities based on the evaluations of socioeconomic impacts that it was conducting. In fact, the *Relocation Plan for Entiat Washington 1958* states that any negative impact on the Entiat tax base or population will be only temporary (see pages 25 and 39). The District, using the best information available, built a high school that it felt would best serve the growing population of the Entiat area.

State revenues, we used information from Washington State Office of Superintendent of Public Instruction

- **Analysis.** The analysis has four components:
 - **Foregone enrollment.** We estimate what Entiat's enrollment would have been, but for the dam. Estimates are based on the enrollment trends of other Chelan County districts, not adversely impacted by the Rocky Reach or other dam.
 - **Changes in State payments.** State payments to the Washington school districts are based primarily on enrollment. For small districts (less than 300 9th through 12th graders), additional per-student revenue is distributed to schools. Finally, Washington State dramatically changed its role in the local school district funding between the 1977 and 1978 school years. We take account of these changes.
 - **Changes in operating costs.** Operating costs change as enrollment increases. The largest additional cost is teacher salaries and benefits. In addition, administrative and miscellaneous costs change as enrollment changes.
 - **Net revenue impacts.** Finally, we estimate the net impact of foregone state revenue to the Entiat School District. This is equal to foregone revenue minus foregone costs – discounted to 2002 dollars.

STATE REVENUE LOSSES

State revenues lost to the Entiat School District because of the Rocky Reach Dam are substantial. Based on our analysis, between the 1960-1961 and 2001-2002 school years approximately \$11.4 million dollars in State revenue – net of additional costs – was lost to the Entiat School District. In addition, we estimate that the present value of all future foregone State revenue is \$3.9 million, for a total of \$15.3 million. Appendix Tables C6.13 and C6.14 display our yearly estimates in foregone State revenue in current year and 2002 dollars, respectively.

PRIVILEGE TAX DISTRIBUTIONS

PUDs are exempt from property taxes by virtue of their status as municipal corporations. Since 1941, public utility districts (PUDs) have been subject to an excise tax in lieu of normal property taxes.⁸ The excise tax is levied on PUDs as a privilege of operating facilities for generating and distributing electric energy, and is thus referred to as a “privilege tax.” The current rate is 2.14 percent of gross revenues plus 5.35% of the first 4 mills per kilowatt-hour derived from the sale or distribution of power. The revenue from the PUD privilege tax is shared between the State of Washington and

⁸ See Washington Revised Code 54.28.020 for more information on taxation of PUDs.

local taxing districts, with 37.6% retained by the state and 62.4% returned to local taxing districts on the basis of gross revenue from sales (of power) made within each county. PUDs may also make a voluntary payment to local taxing districts to reimburse them for the removal of property from the tax rolls.⁹

CITY OF ENTIAT

According to the McHugh report, Entiat received modest privilege tax payments from the Chelan PUD from 1956 through the present. Based on data provided in the McHugh Report, the NPV of these payments (in 2002 dollars) discounting by the 6-Month U.S. Treasury bill average yearly return is \$97,000.

These payments are also expected to continue into the future. Assuming future yearly payments will be an average of payments made between 1998 and 2002, the NPV of a perpetual series of future payments is \$103,000. Adding together the past and present payments gives a total privilege tax credit of \$200,000. In other words, the distributions to Entiat from the privilege tax are revenues that they *would not have received but for the dam* and therefore should be subtracted from our estimates of lost revenue.¹⁰

ENTIAT SCHOOL DISTRICT

Based on information from the McHugh Report (page A-44) the only recorded privilege tax payments to the School District were as follows: 1958 - \$2,412; 1961 - \$0; 1962 - \$4,352; 1963 - \$4,362. The NPV of these payments (in 2002 dollars) discounting by the 6-Month U.S. Treasury bill average yearly return is \$118,500. This amount should be viewed as a credit toward any estimated damage to the District from construction of the dam.

SUMMARY OF IMPACTS BY JURISDICTION

TOTAL REVENUES LOST TO THE CITY OF ENTIAT

The estimated total economic damage to the City of Entiat is large and the variance around the estimate is even larger (see Table 1). Though it is not possible to determine exactly how Entiat would have grown and prospered, had the dam not been built, the growth patterns of other Chelan County towns, unaffected by the dam, are the best indicators. Our methodology differs from that of the McHugh report only in that we compare Entiat's

⁹ See Washington Revised Code 54.28.110 for more information on voluntary payments by PUDs to local taxing districts.

¹⁰ Please note that Entiat, and other Chelan County municipalities receive privilege tax distributions from revenues earned by the Chelan PUD on not only the Rocky Reach Dam, but also the Chelan Falls and Rock Island dams. In other words, even if the Rocky Reach Dam had not been built, Entiat would still receive privilege tax distributions from the Chelan PUD. Because we do not know how much less the privilege tax distribution would have been (on a per capita basis), we make the very conservative assumption that none of the privilege tax would have been paid if the Rocky Reach Dam had not been built.

growth to the growth of the three most likely “proxy” cities, not just to one of them. Doing so gives us a range in total damage of between \$1.4 million and \$25.4 million. Coincidentally, the average total damage of the three cities, \$13.4 million, is the same as the estimated total damage from assuming Entiat would have grown like Chelan.

Table 1. Total lost revenue to City of Entiat from all tax sources, past & future (2002 dollars)

	Total Lost Revenue: Property Tax	Total Lost Revenue: Sales Tax	Total Lost Revenue: REET	Total Lost Revenue: Hotel/Motel Tax	Total Lost Revenue All Sources
Cashmere Growth Rate	\$974,282	\$467,324	-\$7,314	-\$11,985	\$1,422,307
Chelan Growth Rate	\$5,745,969	\$3,041,448	\$350,819	\$4,227,079	\$13,365,315
Leavenworth Growth Rate	\$8,819,329	\$8,186,693	\$346,771	\$7,998,332	\$25,351,125
Average	\$5,179,860	\$3,898,489	\$230,092	\$4,072,746	\$13,381,186

Source: ECONorthwest calculations based on data from the Washington Department of Audit, and Chelan County Assessor.

Note: All these numbers would be reduced by approximately \$200,000 to account for the revenues contributed to the City by the PUD through the privilege tax.

TOTAL REVENUES LOST TO THE ENTIAT SCHOOL DISTRICT

Like the City of Entiat, the total economic injury to the Entiat School District is large (see Table 2). The range in estimated total damage varies from a low of \$16.4 million to a high of \$22.4, with an average \$20 million. It is not possible to know for sure what the enrollment and wealth of the Entiat School District would have been, but for the dam. However, as is the case for the City of Entiat, we know that the enrollment and wealth of other Chelan County School Districts provide a pretty good indication.

Table 2. Total lost revenue to Entiat School District from foregone property taxes and State education revenue (2002 dollars)

	Total Lost Property Tax	Total Lost State Education Revenue	Total Lost Revenue
Chelan Growth Rate	\$5,311,347	\$17,101,694	\$22,413,041
Cashmere Growth Rate	\$597,523	\$15,763,386	\$16,360,909
Cascade Growth Rate	\$8,226,704	\$12,950,244	\$21,176,948
Average	\$4,711,858	\$15,271,775	\$19,983,633

Source: ECONorthwest calculations based on data from the Washington Department of Audit, and Chelan County Assessor, Washington Office of Superintendent of Instruction, Entiat School district, and Washington Department of Audits.

Note: All these numbers would be reduced by approximately \$120,000 to account for the revenues contributed to the City by the PUD through the privilege tax.

The estimated damage amount should be viewed as a **minimum** estimate. Prior to the construction of the Rocky Reach Dam the Entiat School District was growing. In the mid-1950s the District, basing its long-term capital investment plans on population projections that did not include the negative

effects of Rocky Reach Dam, began construction on a new high school. Completed in 1960, the District had capacity for 600 students – a reasonable expectation considering student growth over the past ten years. Of course, 1960 marked the beginning of 20 years of declining enrollment for the Entiat SD and stagnant economic activity for the Entiat region, due entirely to the Rocky Reach Dam. Regardless, the cost of the new high school had to be paid. Despite declining enrollment and substantial losses in the available tax base, the District still had to meet its debt obligation and still needed to maintain the integrity of the physical structures. The District also did not have the ability in the short-run to eliminate faculty and staff positions as enrollment dropped. This could be done only as contractual obligations expired and only to the extent that the District maintained its ability to offer classes required for graduation.

Estimating the initial and on-going impacts on a municipal government of a construction project that occurred over 40 years ago is challenging. It requires assumptions. Those assumptions have to be defensible. They will be more defensible if they are consistent with the practices and theory of economic and fiscal evaluation, and if they make intuitive sense to people who are not economists by training.

This chapter documents the logic. It is relatively long, and it is not easy reading. We believe that some of the details are essential to an understanding and interpretation of the analysis in Chapter 3.

OVERVIEW OF EVALUATION ISSUES

In concept, an evaluation like this one must describe how some group (which may be defined by demographics, affiliation, geography, or some combination) found itself facing different costs and benefits as a result of some past action. The group in this case, for reasons discussed later, is the City and the School District. The action in this case is the planning, construction, and operation of Rocky Reach Dam. Any analysis of *differences* caused by the dam must try to address: (1) all impacts, (2) over all time.

Behind that simple statement of the goals of this analysis are thousands of pages of reports and journal articles that describe how the analysis should be done. Economists and policy analysts have attempted to add detail and practical techniques for measurement and comparison to the general principle of good decisionmaking just described. We refer to those techniques collectively in this appendix as *benefit-cost analysis*.¹

The analysis in this report is *not* a full benefit-cost analysis, but it is consistent with the principles and techniques of benefit-cost analysis. In an attempt to find practical ways to approximate the ideal of assessing "all benefits and costs, on all people, over all relevant areas and time periods," practitioners of benefit-cost typically adhere to some fundamental principles, even though their measurements and methods of measurement and comparison may vary substantially. There are many such principles; we discuss here six of the most important ones:

- Defining the perspective of the evaluation.
- Comparing benefits and costs with and without the action.

¹ In the 1800s, economist Vilfredo Pareto offered the notion that a decision was clearly good for society if it made at least one person better off, without impairing the well being of others. This "Pareto principle" is not much help, though, in the real world where most projects create both winners and losers. About 60 years ago, two economists offered the more useful prescription that a project was worth doing if its benefits exceeded its costs, and the winners could (at least conceptually) compensate the losers (Kaldor 1939) (Hicks 1940). This principle, called the Hicks-Kaldor principle after its authors, has evolved over time into the formal field of *benefit-cost analysis*.

- Identifying, describing, and (whenever possible) quantifying the significant benefits and costs.
- Describing the distribution of benefits and costs as well as their totals.
- Accounting for the lower value of distant benefits and costs.
- Distinguishing between average and marginal costs.

PRINCIPLE 1: DEFINE THE PERSPECTIVE: BENEFITS AND COSTS FROM WHOSE POINT OF VIEW?

The answer to this question may seem easy, on the surface. For example, if our concern is the City of Entiat, then isn't the perspective that of the city, and therefore that of its citizens? That's a good place to start, but consider the complications:

- Who are the City's citizens? Certainly they are the people who reside in households inside its boundaries. Are businesses citizens? Probably, since they are likely to be taxpayers, but does that mean that the impacts on all their employees that are commuters from outside the city (i.e., not citizens) must be considered? Are non-profit, non-taxpaying organizations (e.g., churches) citizens?
- The impacts of the project may extend beyond the City. The dam has extended impacts that mean that other governments (cities, counties, states, national) have a stake in the outcome. Should the City consider their interests?
- Even if the geographic boundaries can be assumed to be those of the Entiat City limits, the passage of time creates complications. First, the City's boundaries change because of annexation. More important, its citizens change as people move in and out, die and are born.

Perspective clearly matters. If a city is getting most of the funding (say 80%) for a project from a higher level of government, and that funding is use-it-or-lose-it (i.e., if you do not build this kind of project, the money is not available for other types of projects), then it might legitimately consider that its costs are only 20% of total cost: even a very inefficient project might show net benefits if only 20% of its costs are included in the analysis.

This principle overlaps Principle 4, following. The most general advice is that the perspective of the analysis should include all individuals and entities that are significantly affected by the project. In a world of pervasive environmental impacts and national funding of big construction projects, however, that advice will usually lead to a larger perspective. Our general conclusion is that that is probably as it should be: the analysis should look at the full benefits and costs, independent of their incidence, to try to get an approximation of net benefits, and then should look at the distribution of benefits and costs (Principle 4).

PRINCIPLE 2: EACH PROJECT MUST BE COMPARED WITH AN APPROPRIATE COUNTER-FACTUAL SCENARIO

A cornerstone of the structure for rational policymaking is the comparison of alternative futures that one posits will result from alternative policies. Any evaluation of an action not yet taken is fundamentally about describing significant impacts in at least two different futures: one in which the action has been taken, and one in which it has not (or in which an alternative action has been taken). What *actually* happened and what we can observe now must be compared to an estimate of what *would have* happened but for the actions being evaluated (in this case, the development and operation of the dam). In the jargon of policy evaluation, what would have happened is called the counter-factual scenario. Describing that scenario is the key technical challenge of this report

This procedure is so common in policy evaluation² that its importance (and the possibilities for error) is often overlooked. For planning projects,³ analysts are asked to describe at least two future worlds, both hypothetical: one of which results from a continuation of today's policies, the other (or others) that result from a change in those policies, and both of which embody many assumptions about economic, demographic, and policy variables. An evaluation of policy options would then attempt to measure *differences* in outcomes (i.e., impacts: their amount and distribution) from different decisions (policies/investments).

PRINCIPLE 3: ALL SIGNIFICANT IMPACTS SHOULD BE ADDRESSED

Though noted earlier, this point is so important that it bears repeating here. Benefit-cost analysis, properly done, does not limit itself to a financial accounting of direct costs. It must evaluate costs and benefits in the broadest sense: what are the *impacts* that one can reasonably attribute to taking the action being evaluated: all types, on all people, over time. That means that the analysis must incorporate in some way an evaluation of things like environmental, social, economic development, and distributional (equity) impacts.

Included under this principle is the economic idea of *opportunity cost*: what does one give up by a particular choice? A city might, for example, already own part of a right-of-way that it is considering for a new highway, and might be tempted to ignore the cost of that right-of-way because the public already owns it. But economic principles suggest the value of the right-of-way should be counted as a cost because the city has an opportunity and

² It is used, for example, in Environmental Impact Statements (the "No Action" alternative compared to the "Build" alternatives).

³ As opposed to *ex post* ("after-the-fact") evaluation projects, where the analyst is typically working with historical data about what *did* happen, not forecasts about what *might* happen.

choice: it could sell the land, or use it for other purposes. In a very real sense, land is a resource that the public is giving up to get new transportation capacity, and its value should be counted as a cost of pursuing that transportation option that uses it.

Benefits are negative costs; costs are negative benefits. For example, an investment that increases parkland compared to an alternative has the benefit of more recreation opportunity, while the alternative can be viewed as having the cost of less recreation opportunity.

But benefits and costs should be defined, to the extent possible, in a way that is both comprehensive and mutually exclusive: in the previous example the differences in recreation opportunity can be counted with either alternative as either a cost or a benefit, but cannot be counted in both places.

Finally, measuring all benefits and costs means considering some that do not have obvious market prices. A dam may have the direct and measurable benefits of providing electric power, but society has also found that it had much greater costs than anticipated on populations of native fish. These are real costs that must be considered in any full evaluation of the costs of investment in the dam.

PRINCIPLE 4: THE DISTRIBUTION OF IMPACTS CAN BE AS IMPORTANT AS THEIR TOTALS

The roll-up of all the analysis into a single, aggregate measure of net benefit (impact) is always at the center of any benefit-cost analysis: it should be. But the distribution of benefits and costs is also important for decision making: by neighborhood, income, race, gender, or other characteristics. It may be that from a national, state, or regional perspective, Rocky Reach Dam was, on net, beneficial. But Entiat has paid more in costs than it has received as benefits. Analysts know this, but the difficulty of measurement and the normative nature of evaluations of equity often mean that this type of analysis gets little attention.

In concept, measuring the distribution of impacts is technical and objective: if one can measure the impacts in the aggregate, then dealing with the distribution of impacts just requires finer subdivisions of measurement. In practice, at least three problems exist.

- The finer measurement is difficult because of (a) data limitations, and (b) the added cost of the analysis (e.g., at the simplest level the amount of reporting of impacts doubles if for every impact one must report the unique impacts on).
- Decision makers usually want and are accustomed to a summary discussion under the heading of equity, not an independent discussion of distributional issues for each type of impact.

- The technical exercise of measuring distribution inevitably gets mixed with the normative exercise of deciding whether the measured distribution is fair or equitable.

PRINCIPLE 5: A BENEFIT OR COST IN THE FUTURE HAS LESS VALUE THAN THE SAME ONE NOW

This conclusion is one that people understand intuitively: a dollar invested in something with low risk like government bonds will grow at an interest rate and be worth more in the future than it is today. Or, a related example: a dollar today doesn't buy what it did 40 years ago.

There are three reasons: (1) inflation reduces future buying power, (2) even if there were no inflation, money is a resource with an opportunity cost. In economic terms, there is a time-value to money; in common language, any lender wants a rate of return that exceeds the rate of inflation; and (3) there is risk.

Assume that all costs and benefits have been identified, categorized properly to reduce double-counting and transfers, quantified, and expressed in dollars. It is not enough to simply add them up. Benefits and costs that occur at some time in the future are worth less to most people than are the same benefits and costs occurring today. Benefit-cost analysis incorporates this preference for present consumption.

This point is critical for the analysis here since the lost revenues are occurring over an 80-year period: past and future dollars have to be brought to a present value using standard techniques.

PRINCIPLE 6: AVERAGE AND MARGINAL COSTS ARE DIFFERENT, AND THE DIFFERENCE MATTERS

The distinction here is more than fussy economics: it is important to the methods used in this report because of the limitations of the data available.

Average cost is calculated by dividing total costs (all fixed and variable costs—whether for capital, operation, or maintenance—over some time period) by some measure of output for that time period. In general, an operation's average cost usually will decline as output is increased (over a wide range of output) because the fixed costs (the ones the public entity or business must incur even if it has no output) get spread over more and more output.

Marginal cost looks at the cost of adding or subtracting one more unit of output. For a City that could mean, for example, the additional cost of providing sewage collection and treatment for one more household. But the investments in treatment capacity are typically big and lumpy: a "marginal addition to a sewage treatment plant may add capacity for hundreds or

thousands of households. So the term "marginal" does not necessarily mean "small." It usually means "adding the next increment of capacity."

The rest of this appendix discusses these and related points in the context of this evaluation.

HOW THE PRINCIPLES APPLY IN THIS ANALYSIS

WHAT PERSPECTIVE?

The question about perspective has several components. The question, "Who was impacted?" cannot be answered independent of a specification of space and time: what area is being considered, and for what period?

The question about area is the easiest to answer: the analysis in this report is to look at the City of Entiat and the Entiat School District. But even here there are some complications. First, the boundaries of the City and District are different. Second, at least for the City, those boundaries have changed over time. These are resolvable problems, however, and not major obstacles to the analysis.

Regarding time, the answer is also clear: the analysis in this report will look at the period that begins when the dam project can reasonably be expected to have first caused changes in the City or the District. There is ample evidence to show that the impacts on the City and the District began *before* construction on the dam began. That is, households and businesses began relocating and changing operations several years prior to the beginning of dam construction. The analysis period continues to the present day. It continues on to the foreseeable future: if, as our analysis will demonstrate, the events around the construction of the dam have caused the City or the School District to incur annual costs, those costs do not stop in 2002 just because that's when we did our analysis.

The question about "Impacts on Whom?" is the most difficult to answer. Consider:

- The most direct impacts of the dam were on properties flooded. Businesses, residences, and the City were paid amounts that they agreed to by the PUD for that property. One theory—the one we understand to be the position of the Chelan PUD—is that those people have been fully compensated. Though that point could be argued,⁴ it is not one that we debate here.
- But not everyone left Entiat: most households did not. The property that these people owned or used not flooded or taken for

⁴ Among the arguments: (1) businesses compensated for the value of property may not have received full compensation for losses to business profits; and (2) full relocation cost might not have been paid, as they would be today.

transportation improvements. Did they suffer damages that were uncompensated?

Our answer is: They almost certainly sustained losses. Assume, as the PUD claims, all properties that were taken from citizens (and either flooded, held by the PUD, or used for a new road right-of-way) were compensated at full market value. Full market value would have to be based on what a willing buyer and seller would agree on as a selling price. An estimation of that price would have to be based on the assumption that the City would continue to function as it had, and would provide urban services at a quality and price that would allow urban land to have the value it does. Without those urban services, the land cannot have urban value.

That assumption is acceptable in large urban areas, where the loss of a few houses has no noticeable impact on the cost or quality of urban services. But in Entiat, as other parts of the report show, the flooding to create the reservoir meant the loss of the downtown, and the cutting off of the remaining town from the river and reservoir by a new highway. That loss of service quality and amenity meant a loss of property value, which meant a loss of revenue to the City and the District. In short, even if *displaced* property owners received adequate compensation for their property, the *remaining* property owners did not receive compensation for the losses to their property values.

- If people in Entiat around 1960 suffered uncompensated losses, what can be done for them now? Some of them may still be in Entiat. Others have moved or died. For some of those, their children or grandchildren may be in Entiat or the District.
- Moreover, some people have moved into Entiat since the relocation and the building of the dam. Are they to be included as damaged parties?

These questions about perspective lead to one that is fundamental to this evaluation: Are the City of Entiat and the School District something more than all the individuals that live or work within their boundaries? Stated another way, if all the individuals were compensated as individuals, would there be anything left to that needed to be paid to the City and the District?

The question may sound odd at first, but it is real and not easily answered. One possibility is that the value of City and District services are largely capitalized into the value of land. Land prices are higher in Entiat (and in any city) because certain public services are provided that allow more intensive, efficient, and value land uses. Paying for the land pays for the capitalized value of the services. If the entire town had been bought at fair market value (and relocation costs had been paid), then all citizens might have been fairly compensated, and that compensation could be construed as including a payout for the value of the City and special districts

A key problem with that theory is that the *whole* town was *not* bought. What remained was substantial, but what had been taken left the remainder

at an economic disadvantage. In an analogy to a business, it would be as if the government bought a small but critical part of some production line for a "fair market price," but ignored the fact that the part was no longer for sale anywhere. For want of the part, the entire production process shuts down. The downtown of the old Entiat may have been that part. A few owners got paid for the part; the rest got nothing and were left with an unfixable machine.

We believe there is a case to be made that City and the District should be treated, for purposes of compensation, just like any other business that produces goods and services. The planning, construction, and operation of the dam damaged the abilities of the City and the District to supply those goods and services efficiently and to a desired level of quality.

Municipalities play an essential role in determining the economic well-being of their citizens. We will describe this role, building the foundation for understanding how municipalities function and how they can suffer economic damages from events such as those that accompanied the construction of the Rocky Reach Reservoir.⁵

Governments are created in large part to solve resource allocation problems that markets are not good at solving. Obvious examples of the role of government in resource allocation are national and domestic defense, transportation infrastructure, and social services. Beyond these needs are literally thousands of resource allocation problems solved by the various levels of government. In a country such as the United States, many services (e.g. national defense) are provided independent of where an individual lives.

Moreover, people and business have a lot of choice about where to locate. Local governments must serve citizens well or risk not only their disapproval: they may vote at elections or "vote with their feet" by moving. Local governments compete with each other to attract and keep residents.

Local governments are voluntary associations created to enhance the well-being of their citizens in their capacities as households, employees, business owners, and property owners. Municipalities exist to provide their citizens with goods and services. A municipality suffers economic damages when an action:

- Reduces the value of the goods and services provided by the municipal corporation for the benefit of its citizens.
- Increases the costs to the municipality of providing a level of goods and services to its citizens.
- Diminishes or eliminates the value of the private capital within the tax-boundary of the municipality.

⁵ The discussion draws from an analysis ECONorthwest conducted in 1993 for southeast Alaskan municipalities adversely impacted by the Exxon Valdez oil spill: *Economic Damages to Seven Municipalities Stemming from the Exxon Valdez Oil Spill*, Paul N. Courant, Michael D. Gleason, W. Ed Whitelaw. February 28, 1993.

Thus, for the purpose of this analysis a municipal corporation or school district is similar in key ways to a business. It is trying to provide goods and services at a quality and price that attracts customers. If, in the interest of a larger public purpose, some higher level of government reduces the capacity of the municipal corporation to supply its products at current levels of quality and price, then the municipality is damaged and should be compensated.

There is yet a broader definition of damage that we are *not* using in this report, though it does have some legal standing. It is best explained by an example. The current problems for utilities, municipalities, and citizens in the wake of the Enron debacle provide that example.

Assume that Enron is culpable: that it did things that the justice system will eventually decide broke the law, and that compensation is due. But to whom? Public utilities got damaged because they had to buy power at inflated prices. But they passed much of that higher cost on to customers: businesses, residences, and government. In order to make due, however, some utilities tried to cut cost—some canceled contracts for power, which gave them the additional potential cost of legal liability and damages.

Assume the utilities will file suits against Enron claiming damages based on the inflated prices they had to pay for power that they had contracts to deliver. Meanwhile, however, various businesses and consumer groups may sue Enron. Their claims, potentially to a large extent, are a double-count of the claims of the utilities: they are claiming damage for the higher prices that the utility passed on to them.

Now assume (there is ample precedent) that any cash payment from Enron or its insurers is years out. In the meantime, some businesses close and new ones open, and residents go and come. Is Enron going to pay damages to them as individuals, or as part of a utility that was damaged? If the later, then it is clearly the case that some damaged parties get no benefit, and some undamaged parties get a windfall (i.e., people that move into the utility district now find that their power rates are lower because of compensation for damages that they themselves did not incur).

The more direct the impact and the quicker the payment, the easier it is to see the public institution as the logical nexus of damage claims. But in the case of Entiat, the damages have been spread over more than 40 years; people have come and gone. Are the City and the School District on firm legal and economic ground if they claim to be the representatives of all the individual people and businesses that have been damaged over that period?

That question is not an abstract one that we have invented for this case. It is the same question that had to be addressed when the Exxon Valdez damaged property and caused municipalities in Alaska to incur extraordinary costs. At the extreme, it underlies any discussion about compensation to Native Americans for damages suffered generations ago: there is no doubt that people were damaged, but who, exactly, should be paid?

We do not think there is a definitive answer to these questions, but we have to take a position for this analysis. Our position is that we will *not* try to enumerate all the damages suffered by all individuals who have been members, at one time or another, of the City of Entiat or the Entiat School District. We will not try to evaluate businesses losses, lost income that might have resulted from fewer educational opportunities, suffering associated with relocation and loss of community, and so on. Those damages may be real, but the City and School District are not trying to recover for those damages on the part of their current and former constituents. Instead, we focus more narrowly *damages to the City and District as institutions*: on their ability to provide a range of services at a desired level of quality to their constituents. Later in this report we describe the reasons for using *lost revenues* as a measure of that damage.

WHAT'S DIFFERENT?

The Entiat one can observe today is different from the Entiat one would observe if the dam had not been built and the City not relocated. The correct way, in concept, to evaluate the impact of the dam on the City is to describe *what is different* between the things that happened to the City since the dam was built and *the best estimates of what would have happened* if the dam had not been built. Obviously, this type of retrospective analysis is speculative, but it is essential.

That analysis requires, among other things, an identification and justification of cause and effects: how did the planning, construction, and operation of the dam (the causes) lead to changes in the economic and fiscal conditions in Entiat (the effects)?

But how can one estimate with any precision what Entiat would have become, *but for the dam*? The Entiat one observes now is the result of many events that played out over the last 40 years; the dam is only one of those events. How can an evaluation control for all those other events to estimate the unique contribution of the dam to a hypothetically different Entiat?

That question is a difficult one, but *the technical difficulties of answering that question do not justify giving up on attempts to answer it*. It is the essential question to this analysis: what changes did the dam cause in Entiat? That question cannot be answered without some description of what would have happened in Entiat if the dam had not been built.

OVERVIEW: HOW THE DAM HAD IMPACTS ON THE CITY AND THE SCHOOL DISTRICT

We reviewed written accounts of, and discussed with City and District representatives, chronology of events that relate the planning and operation of the dam to economic and fiscal conditions in Entiat. Our main conclusions are that:

- The dam was a big investment in a small economy and had big economic impacts, both positive and negative.
 - The positive impacts include lower-cost and more reliable power for all people in Eastern Washington and the Northwest (and even California), flood control downstream, and reservoir-related recreation. The negative impacts include, but are not limited to, the loss of the Entiat downtown, the loss of area businesses, the loss of valuable agricultural land, the loss of different kinds of recreation opportunities associated with a free-flowing river, and environmental costs (e.g., impacts on salmon runs).
 - Among the beneficiaries of the dam is the Chelan PUD. It has grown in size and community stature; it pays employees good wages with good benefits; it has accumulated a substantial surplus. Because it is a public utility, it cannot continue indefinitely to accumulate surpluses: its “profits” must be returned to the benefit of the people in its jurisdiction.
- The fiscal position of the City and the School District, and their abilities to continue to provide public services to people in their service area, was reduced by the reduced economic conditions in their service areas that the dam caused.
- Thus, Entiat and the School District absorbed a disproportionately large share of the local costs associated with the dam, and have received a disproportionately small share of the benefits (which have been spread out across the western states as lower power costs, and concentrated in Wenatchee as economic development and public services benefits).

The idea that one has to describe the differences caused by the dam has many implications for the analysis. In other words, impacts may be both positive and negative: net impacts are what matter.

A good example of this point is found in the 2000 evaluation of the Entiat socioeconomic situation sponsored by the Chelan PUD.⁶ The flooding of Entiat clearly resulted in decreases in assessed value and tax revenues. That study made estimates of the changes caused by the dam, and implied that those changes were estimates of damages to the City and the District. But the flooding also decreased the number of households and businesses requiring City and District services, which should decrease public costs (other things being equal).

What is needed is an estimate of the *net* effect of the dam. Simply using changes in assessed value or tax revenues as a measure of impacts on the City or the District may over- or underestimate damages.⁷ Changes in tax

⁶ McHugh and Associates, *Socioeconomic Study*, 2000.

⁷ This, by the way, is the method used to estimate impacts in Entiat in *Socioeconomic Impacts*, McHugh and Associates, 2000.

revenue are an incomplete measure of damage because they do not incorporate changes in the population (number of residents and businesses that must be served), Nor does it incorporate changes in the physical dimensions of the new city (per capita service costs). For example, if a town loses 10 percent of its population, then it saves on the costs of serving those citizens (though it will probably have the same fixed costs that it must pay). But if remaining residents, because of relocation, are more spread out than they were prior to the population loss, then the service costs per resident will probably rise (e.g. this smaller population will require more sewer pipes and roads).

This is the case with Entiat. Though the city lost residences and business that it no longer had to serve, it was relocated to a place in which the remaining population and businesses were less concentrated, and thus, more costly to serve. Certainly private capital and the tax revenue derived from it dropped precipitously upon conception of dam construction. Further, the McHugh analysis finds that private capital, as measured by appraised property value, has not fully recovered in Entiat or the District and probably never will. But what is the net effect? Did losing population and businesses in the early years and foregoing economic development over all years (including future years) save Entiat enough money to offset the greater cost of serving the population and business that remained after dam construction was begun? What economies of scale would have accrued to Entiat had the dam not been built and the town was capable of prospering like the rest of the County?

Those are the right questions to ask, but any answers require assumptions and speculations. The next section gives some of our reasoning regarding our conclusions about the likely net impacts.

MARGINAL VERSUS AVERAGE COSTS

It is also not likely to be the case that the loss of property value and tax revenue is exactly offset by decreased cost of services. The economic issues here are ones marginal costs vs. average costs; of fixed cost vs. variable cost; and of economies of scale.

Suppose the City, for example, had sized its facilities for 500 people and a reasonable expectation of expanding to 800 in 10 years. But the dam then cuts the population to less than 400, takes out the concentration of activity in the downtown, requires expenditures not fully covered by compensation to reorganize the services, and sets back growth such that the planned population of 800 (the efficient service capacity) is not reached for 30 years instead of 10. In that case, the City is going to be operating less efficiently than it had been. The cost per person (or per household, per business, per student, or per any other unit of measurement) will be greater than it had been. That is an economic loss to the City or the District.

Another way to say that is that the City and the School District had some fixed costs and variable costs before the dam. After the dam it might be able

to reduce some of its variable costs, because it has fewer households and businesses to serve. But its fixed costs—the costs of the things that do not change very rapidly—are now paid for by fewer people, who must pay more per person for the same service (or have less service for the same cost).

Moreover, the decentralization of services is likely to result in greater per capita variable costs (e.g., on average, the amount of roads per capita has increased, so the per capita maintenance costs increase), which raises the possibility that the *total* variable cost will actually increase, despite the fact that fewer people are being served.

WHAT IMPACTS ARE RELEVANT AND POSSIBLE TO MEASURE IN THIS ANALYSIS?

After our preliminary evaluation of the issues and the data, we discussed our conclusions about possible impacts and measurement methods with staff at the City and the School District. We agreed that on the following points regarding our approach to measuring economic impacts:

- Focus on the City and School District as independent entities that suffered their own damages (analogous to corporations), not as proxies for individual damages to households and businesses located inside their boundaries.
- The economic impacts on the City and the District are largely the result of *economic impacts* on citizens and business in and around Entiat. Some of the impacts may be positive. Thus, the analysis must strive for some estimate of *net impacts*, which it presumes are negative (i.e., the negative impacts are greater than the positive ones). The analysis must deal with the fact that the City and the District not only lost revenues, but they also no longer had to serve as many people: it has to look at the *net* impact on them (e.g., did the cost per citizen or per student increase?).
- Given the focus on the City and the School District as entities whose ability to provide services desired by the people who formed and support these entities, it is appropriate for the analysis to focus on the *fiscal impacts* on the City and the District. The perspective is that these public institutions are like corporations: they have a life and rights of their own, independent of their individual stockholders (citizens). From that perspective, the question about impacts becomes: What new costs did Entiat have to incur, or what revenues did it have to do without, as it tried to supply its citizens with a given level of public services?
- There are many impacts on the City and the District that might be classified under the heading of fiscal impacts. In concept, these impacts include:
 - *Changes in annual revenues to the City or School District.* First, there is a loss of assessed value (flooded or otherwise removed). Second, there are changes in the economy that could lead to

changes in local impact, which might be reflected in tax revenues. Those changes could be positive or negative. For example, the construction of the dam might, in theory, have created direct local jobs in Entiat and expenditures at local businesses. But anecdotal evidence is that few residents of Entiat got those construction jobs, and the typical positive spillovers to merchants were probably nonexistent because almost all of the commercial businesses in the downtown had closed. It seems clear that the negative impacts dominated: the orchard industry in Entiat lost orchards and packing facilities; downtown businesses were eliminated; residents of Entiat and surrounding area lost jobs; and for all these reasons, residents and businesses experienced a reduction in ability to pay for services and tax base.

- *Changes in the cost of providing services.* We have already described several reasons that the per capita cost of service provision could increase.
- *Mismatch of infrastructure and service to a reduced population.* Also noted above, is impact is a variation on the argument of lost economies of scale. For example, the school district or City might find itself with fixed costs that are spread over a smaller rate base.
- *Inefficient patterns of land use and public services.* The City was operating under duress. It did not have time to plan. The relocation study done in 1958 notes this problem. It is very likely that the City's choices (which were not solely its choices: they were strongly influenced by decisions made by the PUD, Burlington Northern, and WSDOT) regarding reconstruction were not the most efficient or desirable ones.
- *Increased maintenance costs of new assets.* Our understanding from the City is what used to be a small, local river-front park for local citizens became a larger regional park, but that the City does not get funding from the PUD to cover the cost of operating the park. In other words, Entiat citizens pay the cost. That might be reasonable if Entiat believed that the park was an important park of an economic development strategy, but the City has very little in the way of retail businesses that benefit from sales to tourists and thus contribute more to City revenues to support the maintenance of the park.
- *Damaged social fabric.* Uprooting a downtown—the focus of Entiat's commercial and civic activities—affects more than the economy. It can affect a sense of place and community. That can potentially lead to increased service delivery requirements, and increase delivery costs, because of reduction in volunteerism.
- Trying to measure all of those aspects of fiscal impacts is complicated and beyond the scope of this phase of the project. For this phase, we use what we believe to be the best measure of fiscal impacts: *lost revenue*. It has the advantage of being theoretically related to all the impacts of concern in the sense that (1) the lost revenue is directly

correlated to losses of service quantity and quality, or increased cost of service delivery, or both, and (2) under the assumption that the value of services people get are at least as great as what their willingness to levy taxes on themselves suggest they are willing to pay for those services, then lost revenues are a proxy for lost welfare.

- The focus of the analysis on fiscal impacts (lost revenues) to the City and the School District means that this study takes a *narrow* view of damages. It does *not* evaluate, for example:
 - The net impacts of Rocky Reach Dam on the nation, state, or region. It is typical for dam construction projects to be justified based on benefit-cost analysis. Many of the same principles discussed above apply, but the scope of the inquiry (including the perspective) is different. This report does not try to evaluate whether the dam has been, on net, a beneficial investment. In fact, whether it has been or not, in a full economic sense, is irrelevant to Entiat's case.⁸
 - The fairness of the compensation paid to private parties for property taken as part of dam construction and the filling of the reservoir. Other studies have asserted that the compensation was fair. This report does not evaluate that assertion. It does assume, however, that any potential underpayment to private parties who received compensation around the time of dam construction are *not* part of this analysis.⁹

TIME VALUE OF MONEY?

The value of money changes over time: a dollar bought more in 1990 than it does today—it's worth less. If that dollar had been invested in 1990, however, it might have grown to a larger amount at the same time inflation was eroding its value. Depending on the rate of return of the investment, the invested dollar could be worth more today than the original dollar (the dollar plus the return can purchase more goods than the original dollar could).

These issues are important in this study because many of the impacts occurred a long time ago. Take a simple example. Assume that the dam construction required a property and building, and that for some reason the original property owner abandoned the property but never received compensation. Assume the intent now is to just compensate her by giving her enough money to replace now what she lost in 1960 (i.e., assume no punitive damages). Assume the value of the property in 1960 was \$30,000. Because of inflation and (potentially) real increases in the relative value of real estate,

⁸ In a *fiscal* sense the performance of the dam is relevant, because it affects the PUD's ability to pay compensation to the City and the District. But the fiscal capacity of the PUD is not part of the evaluation in this report either.

⁹ We note that a claim of fair compensation typically requires the assumption of informed and willing buyers and sellers. One could make the case that some of the sellers in Entiat were neither informed nor willing; they had little information and were negotiating under duress.

replacement of that property now might take \$150,000. It is the latter, larger estimate that is the correct estimate of payment due.

Appendix B **Details of Steps of the Analysis**

Because municipalities in Washington generate revenue from multiple local sources, estimating economic damages to the City of Entiat is a complex, data intensive task. Washington municipalities receive revenue from property tax, sales tax, real estate excise tax (REET), and hotel/motel taxes. Although not equally so, these are all important revenue sources for municipalities. Conversely, the only major local source of school district revenue in Washington is from property taxes. Though an important component of a district's overall finances, local property tax revenue account for less than 10 percent of a district's total revenue.

The main source of school district revenue—accounting for approximately 75 percent of a school's general fund—is the State. The amount of revenue a district receives from the State is conditional upon many factors, however the main driver is enrollment. All else equal, the more students a district has, the more money it receives from the State.

The revenue impact to a district from a change in enrollment is immediate. Each district is required to submit to the Washington Office of Superintendent of Public Instruction on the first of every month its enrollment. If enrollment changes, revenue changes beginning with the next monthly payment from the State. Costs incurred by a district from a change in student enrollment, however, do not adjust nearly as quickly as revenue.

There are many reasons for this inability to adjust costs to match revenues. Because of collective bargaining agreements, teachers can not be let go just because enrollment has dropped. Nor can school districts immediately reduce the operational costs of its capital. In short, classes still must be taught, the building still must be heated, cooled, and maintained, and buses must still run their routes. A district may realize some cost savings in certain operational areas, but it requires many years for the savings in costs to equal the loss in revenue. This may not be a big problem for a large district or to any district that loses only a few students in occasional years. However, for a small district, such as Entiat, that loses a large number of students over the course of many years, the impact can be severe.

This appendix is organized by revenue source. For each source it describes whether the source is applicable to the City of Entiat, the Entiat School District, or both; the steps for deriving estimates of economic damage; and where to find more detailed tables displaying the output of the steps of the analysis.

PROPERTY TAX AND ASSESSED VALUE (CITY & DISTRICT)

Property taxes are an integral part of the total tax revenues a Washington municipality or school district receives each year. We describe below an eight-step process for deriving estimates of the economic damage that Entiat has suffered because of the construction of the Rocky Reach Dam. The ten-step process is stated in terms of the municipality of Entiat. For the School District, simply replace "city" with "district," "population" with "students" and the names of Chelan County towns with their accompanying school districts.

1. The analysis begins with two tables:
 - a. Population estimates of Entiat, Cashmere, Leavenworth, and Chelan for the years 1950 through 2001 (City: C1.1, District: C5.1).
 - b. Private property assessed value estimates of Entiat, Cashmere, Leavenworth, and Chelan for the years 1955 through 2001 (City: C1.2, District: C5.2).
2. Per capita assessed values were created by dividing each city's total assessed value by its population. This was done for each year of the analysis (City C1.3, District: C5.3).
3. Growth indices were created for each city by dividing each year's per capita assessed value by the average assessed value of 1955, 1956, and 1957 (City: C1.4, District: C5.4). The growth indices can be interpreted as the change (growth) in per capita assessed value each city experienced since the base period (1955, 1956, 1957). A three-year base period was selected in order to create more robust growth indices. Using a single year base period may lead to unrepresentative growth rate estimates. Since the growth index of each city begins with the same base period, the growth indices are directly comparable.
4. The growth index of Cashmere, Chelan, and Leavenworth were imposed upon Entiat's average assessed value for the years 1955, 1956, and 1957. What this does is provides three separate estimates of how Entiat's per capita assessed value would have grown, but for the dam (City C1.5, District: C5.5). For example assume that we believe Entiat would have grown at a rate similar to Chelan, but for the dam. Then, we multiply Entiat's average assessed value for 1955 through 1957 by each year of the growth index. This will provide a yearly estimate of Entiat's per capita assessed value, "*but for the dam*".
5. For each of the study years, Entiat's actual assessed value is subtracted from the "*but for the dam*" assessed values (City C1.6, District: C5.6). These provide estimates of the difference in assessed value between what Entiat did experience and what Entiat would have experienced had the dam not been built.
6. The assessed value differences derived in Step 5 are multiplied by Entiat's tax rate (City: C1.7, C1.8, District: C5.7, C5.8). These provide

estimates of the per capita shortfall in property tax revenue that the city of Entiat experienced. These are dollars Entiat did not have to serve its residents.

7. The per capita shortfalls in property tax revenue are multiplied by the population of Entiat for each of the study years (City C1.9, District C5.9). This is the total (nominal) shortfall in services (measured in dollars) that Entiat had each year to serve its residents.
8. The nominal yearly shortfall estimates are discounted by the 6-Month Treasury bill rate (City: C1.10, District: C5.10), to change the yearly shortfall estimates to 2002 dollars (Table C1.11). The discounted amounts are summed to provide the total property tax damage suffered by Entiat 1958 through 2001.

The damage suffered by the City and District, due to the dam, will continue into the future. Therefore, the net present value of future damage must also be added to the past damages. This amount represents the total property taxes foregone by the City of Entiat from the present into the perpetual future. We could base our estimates of future damage on expected population growth and expected growth in assessed value. However, we will simplify our analysis by conservatively estimating future damages as the average yearly damage over the past five years divided by the average discount rate (6-Month Treasury Bill rate) over the past five years. This will give us the present value of a perpetual series of yearly property tax collection shortfalls.

Finally, we add our estimate of past damages to our estimate of future damages to derive estimated total damages.

SALES TAX REVENUE (CITY)

For many Washington cities, sales tax is a major source of revenue. Within Chelan County, the city of Leavenworth collected twice as much in sales tax as it did in property tax during the period 1992 through 2001. Likewise, in 1992, 1993, and 1997 Chelan collected more revenue through sales tax than through property tax, and for the decade property tax revenue was only 10 percent greater than sales tax revenue. For Entiat, sales tax revenue lagged property tax revenue by approximately 30 percent for the decade. Without a viable commercial center, residents of Entiat must travel to one of the larger regional cities for household goods.

We describe below the steps we underwent to derive estimates of the sales tax lost to the city of Entiat because of the Rocky Reach Dam.

- 1 We begin with per capita estimates of sales tax revenue (Table C2.1) and sales tax equalization revenue (Table C2.2) for the cities of Entiat, Cashmere, Chelan, and Leavenworth for the years 1992 through 2001. These estimates were obtained from the State of Washington, Department of Audit. We sum the yearly per capita revenue each city received from these two sources in Table C2.3.

- 2 In Table C2.4, we subtract Entiat's per capita sales tax revenue from the per capita sales tax revenue of Cashmere, Chelan, and Leavenworth. This gives us estimates of the yearly, per capita shortfall in Entiat's sales tax revenue.
- 3 Table C2.5 shows the population of Entiat for the years 1992 through 2001.
- 4 Table C2.6 shows the annual return on 6-month U.S. Treasury Bills for the years 1992 through 2001. From these data, we created an index to discount yearly estimates to 2002 dollars.
- 5 Table C2.7 is the population adjusted (yearly) discounted difference in sales tax revenue between Entiat and the other cities. This table was derived by multiplying the yearly per capita differences by the population of Entiat and then by the discount rate. Note, these differences are only for the 1992 through 2001 period.
- 6 Tables C2.8 and C2.13 display per capita sales tax revenue for the periods (1983 through 1991) and (1973 through 1982), respectively. The data are separated into these two time periods to reflect the point (1983) when sales tax equalization began in Washington. The data for Entiat were obtained from the McHugh Report, with missing data estimated by linear extrapolation. Because average per capita sales tax revenue for Entiat and Cashmere were equal for the 1990s, we assumed estimated Cashmere's per capita sales tax revenue for 1973 through 1991 as equal to Entiat's. Estimated per capita sales tax revenue for Chelan and Leavenworth were estimated with a simple linear regression model explained in detail in the Table notes in Appendix C.
- 7 We repeat steps 2, 3, 4, and 5 above to obtain population adjusted differences in sales tax for the periods (1973 through 1982: Table C2.12) and (1983 through 1991: Table C2.17).
- 8 Finally, Table C.18 sums-up the all foregone sales tax revenue for the entire period 1973 through 2001, as well as the NPV of future foregone tax revenue.

REAL ESTATE EXCISE TAX (CITY)

Real estate excise tax (REET) is not a major source of income for most Washington municipalities. However, for a small town like Entiat, with little commercial activity and limited available land for commercial and industrial growth, all sources of revenue are important. REET is a 0.25 percent tax imposed on real estate transactions, the revenue from which is used to fund capital and [perhaps] road maintenance activities. It is our understanding that the authorizing statute was passed in 1980. The State of Washington passed legislation in 1990 allowing cities and counties to increase the REET by an additional 0.25 percent. It is our understanding, however, that Entiat, Cashmere, Chelan, and Leavenworth have not increased their REET above 0.25 percent.

We describe below the steps we underwent to derive estimates of the REET lost to the city of Entiat because of the Rocky Reach Dam.

- 1 We begin with per capita estimates of REET revenue for the cities of Entiat, Cashmere, Chelan, and Leavenworth for the years 1992 through 2001. These estimates were obtained from the State of Washington, Department of Audit (Table C3.1).
- 2 In Table C3.2, we subtract Entiat's per capita REET revenue from the per capita REET revenue of Cashmere, Chelan, and Leavenworth. This gives us estimates of the yearly, per capita shortfall in Entiat's REET revenue.
- 3 Table C3.3 shows the population of Entiat for the years 1992 through 2001.
- 4 Table C3.4 shows the annual return on 6-month U.S. Treasury Bills for the years 1992 through 2001. From these data, we created an index to discount yearly estimates to 2002 dollars.
- 5 Table C3.5 is the population adjusted (yearly) discounted difference in REET revenue between Entiat and the other cities. This table was derived by multiplying the yearly per capita differences by the population of Entiat and then by the discount rate.
- 6 Table C3.6 provides the total discounted differences in REET revenue between Entiat and the other cities.
 - a, The first two columns of data are the lower- and upper-bound estimates of the total REET difference between Entiat and each of the comparable cities for the years 1980 through 1991. The upper-bound estimate was derived by assuming that for each of the years 1980 through 1991 the REET difference was equal to the average difference of 1992, 1993, and 1994. The lower-bound estimate is simply one-half the upper-bound estimate. Note: these values are discounted to 2002 dollars.
 - b, The third column of data contains the sums of the discounted differences for the years 1992 through 2001, presented in Table C4.5.
 - c, The fourth column of data contains the sums of the discounted differences for the perpetual future. These estimates were derived by first averaging the differences for the years 1999, 2000, and 2001. This is assumed to be the average yearly difference (into perpetuity) between Entiat's REET collection and the REET collection of each of the other cities. To derive the net present value of a perpetual series of these differences, we divided by the average yearly return of the 6-Month U.S. Treasury Bill over the 1999 through 2001 period.
 - d, The fifth column is the total past and future damage assuming the lower bound estimate for the 1973 through 1991 period. It is simply the first column + the third column + the fourth column.

- e, The sixth column is the total past and future damage assuming the upper bound estimate for the 1973 through 1991 period. It is simply the second column + the third column + the fourth column.

HOTEL/MOTEL TAX (CITY)

Created in 1973, the hotel/motel tax accounted for approximately 0.1 percent of Entiat's total revenue during the 1990s. Comparatively, for Chelan and Leavenworth, the hotel/motel tax accounted for 3.0 percent and 7.0 percent, respectively of their total revenue during the 1990s. Entiat did have lodging facilities prior to the creation of the Rocky Reach Dam. However, the subsequent flooding of much of the residential, commercial, and industrial lands in and around Entiat, has left the town with little need for such facilities, and has left the City without a source of income that its neighboring cities enjoy.

We describe below the steps we underwent to derive estimates of the hotel/motel tax lost to the city of Entiat because of the Rocky Reach Dam.

- 1 We begin with per capita estimates of hotel/motel tax revenue for the cities of Entiat, Cashmere, Chelan, and Leavenworth for the years 1992 through 2001. These estimates were obtained from the State of Washington, Department of Audit (Table C4.1).
- 2 In Table C4.2, we subtract Entiat's per capita hotel/motel tax revenue from the per capita hotel/motel tax revenue of Cashmere, Chelan, and Leavenworth. This gives us estimates of the yearly, per capita shortfall in Entiat's hotel/motel tax revenue.
- 3 Table C4.3 shows the population of Entiat for the years 1992 through 2001.
- 4 Table C4.4 shows the annual return on 6-month U.S. Treasury Bills for the years 1992 through 2001. From these data, we created an index to discount yearly estimates to 2002 dollars.
- 5 Table C4.5 is the population adjusted (yearly) discounted difference in hotel/motel tax revenue between Entiat and the other cities. This table was derived by multiplying the yearly per capita differences by the population of Entiat and then by the discount rate.
- 6 Table C2.6 provides the total discounted differences in hotel/motel tax revenue between Entiat and the other cities.
 - a, The first column of data are the lower- and upper-bound estimates of the total hotel/motel tax difference between Entiat and each of the comparable cities for the years 1973 through 1991. The upper-bound estimate was derived by assuming that for each of the years 1973 through 1991 the hotel/motel difference was equal to the average difference of 1992, 1993, and 1994. The lower-bound estimate is simply one-half the upper-bound estimate. Note: these values are discounted to 2002 dollars.

- b, The third column of data contains the sums of the discounted differences for the years 1992 through 2001, presented in Table C4.5.
- c, The fourth column of data contains the sums of the discounted differences for the perpetual future. These estimates were derived by first averaging the differences for the years 1999, 2000, and 2001. This is assumed to be the average yearly difference (into perpetuity) between Entiat's hotel/motel tax collection and the tax collection of each of the other cities. To derive the net present value of a perpetual series of these differences, we divided by the average yearly return of the 6-Month U.S. Treasury Bill over the 1999 through 2001 period.
- d, The fifth column is the total past and future damage assuming the lower bound estimate for the 1973 through 1991 period. It is simply the first column + the third column + the fourth column.
- e, The sixth column is the total past and future damage assuming the upper bound estimate for the 1973 through 1991 period. It is simply the second column + the third column + the fourth column.

STATE K-12 EDUCATION REVENUE (DISTRICT)

What are the impacts on school financing from the lost enrollment? We know that:

- State education revenue is directly tied to district enrollment
- Entiat lost enrollment over the course of two decades because of the Rocky Reach Dam
- Today, unlike any other school district in Chelan County, Entiat's enrollment is lower than it was in 1959, just prior to the completion of the Rocky Reach Dam.

Note that as Entiat's enrollment fell after the dam was built, State education revenue paid to the District increased on a *per student* basis. The higher per-student payments from the state are an acknowledgment by the state that per student educational costs are higher for smaller schools. But the higher per-student payments are intended only to assist smaller districts in meeting their educational requirements: they are not sufficient to provide small districts the revenue needed to offer all the courses students in larger districts enjoy.

DATA

From the Entiat School District we received student enrollment, number of teachers, teacher compensation and state revenue for the years 1956 through 2001.

For the Cascade, Chelan Lake, and Cashmere school districts we estimated student enrollment for the years 1956 through 1988 from actual enrollment and city population number for 1989 through 2001 (methodology described below).

From the Washington State OSPI, we received “small-high” factors used by the State through 1977 to determine State funding to school districts. In addition, OSPI provided us with the current State funding model, which we used to estimate State funding for the years 1978 through 2001. Though the State funding model has changed in its complexity over this period, the basic formula is the same—more students equal more dollars.

Using data on enrollment by grade for Chelan County for the years 1996 through 2002, we created approximations of the proportions of district students by grade grouping (e.g. grades 9 through 12 were grouped together). Enrollment by grade-group is an important variable in the State funding model.

ANALYSIS

Enrollment (Table: C6.2)

Actual enrollment numbers for Entiat for the years 1950 through 2001 were obtained from the Entiat School District.

Actual enrollment numbers for comparative Chelan County districts for the years 1989 through 2001 was obtained from the Washington OSPI.

Earlier year enrollment estimates for comparative Chelan County districts were derived using a *fixed-effects* regression model (Table: C6.1). Enrollment numbers for Entiat, Chelan Lake, Cashmere, and Leavenworth for the years 1989 through 2001 were regressed on the population of each district’s corresponding city (e.g., Cascade on Leavenworth). Regression coefficients and historic city populations were then used to estimate district enrollment for the years 1958 through 1988.

Enrollment Growth Rates (Table: C6.3)

Student enrollment growth indices were created for each district, using 1958-1959 enrollment as the base.

Entiat’s Alternative Enrollment Growth (Table: C6.4)

Growth indices from Table C6.3 were used to “grow-out” Entiat’s student enrollment from 1956 through 2001. These “alternative enrollments” are estimates of what Entiat’s yearly enrollment would have been had the Rocky Reach Dam not been built.

Grade-level Distribution of Students (Table C6.5)

Estimates of the percent of students by grade-level “grouping” were derived from Chelan County data covering the years 1995 through 2001. Percent of students by grade-level grouping are required to estimate revenue from the State for alternative enrollment projections.

Estimate of “base” Per-Student State Revenue Payment for Years 1956 through 1977 (Table: C6.6a)

Prior to the 1978-1979 school year, per-student state revenue payments were based on a simple “small-high” factor. The small-high factor was a multiplier used to increase the per-student state revenue payment to schools with less than 300 total students in grades 9 through 12. The fewer the students in these grades, the greater the small-high factor.

Using Entiat enrollment for the years 1956 through 1977, total State general-fund revenue paid to Entiat for each of these years, and the OSPI small-high factors, we were able to estimate the *base* per student State funding using the following formula:

$$\text{Yearly Revenue} = (\text{Base Funding}) * (\text{Small-High}) * (\text{Enrollment})$$

Where:

Yearly Revenue = Revenue paid to Entiat by the State

Base Funding = Unknown per-student base payment from State

Small-High = Enrollment-based premium in per-student payment

Enrollment = Entiat’s enrollment

The *base* per student State funding is the standard amount the State pays each district for each student. For small school districts (defined as having less than 300 total students in grades 9 through 12), the base funding is augmented by a small-high factor corresponding to a district’s grade 9-12 student enrollment.

Mathematical representation of OSPI small-high factors (Table: C6.6b)

Table C6.6b are regression results (namely, coefficients) that we used to estimate small-high factors for alternative Entiat enrollments.

Entiat’s Actual and Alternative Revenue from the State (Table: C6.7)

State Revenue Payments 1956 - 1977

For each of the years 1956 through 1977, state revenue estimates are based on per-student *base* funding adjusted by the appropriate *Small-High* factor to get per student state revenue payment. This was then multiplied by

our estimate of Entiat's alternative student enrollment to obtain total yearly state revenue.

State Revenue Payments 1978 - 2001

For the years 1978 through 2001 state revenue estimates are based on the OSPI funding model. The OSPI funding model considers factors such as teacher education and tenure, but enrollment is the main driver. Like the "small-high" factors that preceded the funding model, per-student payments are adjusted based on 9th through 12th grade enrollment. Since the funding formula produces estimates in 2002 dollars, each year's estimates were discounted back to current year dollars using the *All Urban Consumers, Consumer Price Index*.

Difference in Entiat's Actual and Alternative State Revenue (Table: C6.8)

Table C6.8 displays the difference in state revenue between what Entiat would have received from the State had its enrollment been able to grow like other Chelan County districts, and what it actually received.

Entiat's Number of Teachers: Actual & Alternative (Table: C6.9)

Realizing that much of the differences in state revenue derived in Table C6.8 would have gone to increases in costs associated with increased enrollment, we estimate the additional costs associated with each of the alternative enrollment scenarios. As a logical first-step, we estimate the number of teachers Entiat would have required had its enrollment grown like other districts,

Entiat's Average Annual Teacher Salary (Table: C6.10)

Using data received from the Entiat School District, we calculate actual average teacher salary for Entiat for every fifth year beginning in 1956. For intervening years, we use a simple linear interpolation.

Entiat's Estimated Average Annual Teacher Benefit costs (Table: C6.11)

Benefit costs were estimated as follows: Based on data and analysis from ECONorthwest (2002)¹, we estimated that health care and other benefits represented approximately 27 percent of Washington teacher salaries for the 1999-2000 school year. By multiplying 0.27 by average Entiat teacher salary for 1999, we derived an estimate of the cost of teacher benefits for Entiat for that year. Finally, by inflation adjusting the 1999 benefit cost estimate, using the Medical Care U.S. Consumer Price Index, we estimated the per-teacher cost of benefits for all years.

¹ ECONorthwest, Comprehensive Analysis of K-12 Education Finance in Oregon, prepared for Oregon School Boards Association. (November, 2002)

Entiat's Total Additional Costs (Table C6.12)

Table C6.12 is the sum of all additional (variable) costs that we estimate Entiat would have incurred had its student enrollment been able to grow like other Chelan County districts. Besides teacher salary and benefits (see Tables C6.10 & .11), we estimate that Entiat would have experience a great many other costs—what we refer to as “administrative and miscellaneous.”

Though we recognize that additional students translates into additional costs beyond teacher costs, estimating these additional costs is difficult. Buchanan (1997)² estimates that administrative and central services account for approximately 16 percent of spending per student. Though this may be a good benchmark of additional costs, we felt we should account for the phenomenon that costs change much slower than enrollment. For example, one additional student probably has no impact on administrative and miscellaneous costs, but 200 additional students may have a greater than 16 percent impact on such costs. Therefore, to account for this phenomenon, we grew administrative and miscellaneous costs throughout the study period (1958 through 2001) by one percentage point per year (beginning with one percent), capping these costs at 25 percent. In other words, we assumed that in 1958, one percent of the additional state revenue that Entiat would have received had it grown like other Chelan County districts, would have gone to additional administrative costs. For each subsequent year, this increases by one percentage point, up to 25 percent in 1982 (where it stayed for each subsequent year). We feel that this is a conservative, but appropriate means to estimate these costs. Though it would be very difficult to actually observe these costs, we are confident they would likely be substantially lower than our estimates.

Foregone State Revenue, Net of Additional Costs (Tables: C6.13 & C6.14)

Finally, for each year (1958–2001)³ we tally-up the additional state revenue Entiat would have received, but for the Dam and subtract the additional costs Entiat would have incurred, but for the Dam. The difference is the net state revenue foregone to Entiat because of the Dam—in nominal dollars (Table: C6.13). We adjust each years estimate by the indexed return of 6-month U.S. Treasury bills to obtain total *past* damages in 2002 dollars. Finally, based on the average damage over the most recent five years and the average 6-month Treasure bill return over the same period, we estimate total future damage as the present value of a perpetual series (Table: C6.14).

² Buchanan, Martin L. Oregon K-12 Education Spending: Stable After Measure 5. Cascade Policy Institute, April 1997 – Insight No. 102

³ Note, though we include the 1958 and 1959 school years in our analysis, we do not include these years in our estimation of damages. In other words, our sum of damages begins with the 1960 school year.

Please Note, all *discounted values* in the appendix are presented in 2002 dollars, based on the annual return of 6-Month U.S. Treasury Bill.

Table C1.1: Population of Entiat, Cashmere, Chelan, Leavenworth

Year	Entiat	Cashmere	Chelan	Leavenworth
1950	420	1,768	2,445	1,503
1951	414	1,780	2,441	1,501
1952	407	1,793	2,436	1,498
1953	401	1,805	2,432	1,496
1954	395	1,817	2,428	1,494
1955	389	1,830	2,424	1,492
1956	394	1,842	2,419	1,489
1957	384	1,854	2,415	1,487
1958	375	1,866	2,411	1,485
1959	365	1,879	2,406	1,482
1960	357	1,891	2,402	1,480
1961	357	1,900	2,446	1,464
1962	357	1,908	2,489	1,448
1963	357	1,917	2,533	1,433
1964	357	1,925	2,576	1,417
1965	357	1,934	2,620	1,401
1966	357	1,942	2,663	1,385
1967	356	1,951	2,707	1,369
1968	356	1,959	2,750	1,354
1969	356	1,968	2,794	1,338
1970	355	1,976	2,837	1,322
1971	364	2,002	2,834	1,342
1972	373	2,029	2,830	1,363
1973	382	2,055	2,827	1,383
1974	391	2,082	2,823	1,404
1975	400	2,108	2,820	1,424
1976	409	2,134	2,816	1,444
1977	418	2,161	2,813	1,465
1978	427	2,187	2,809	1,485
1979	436	2,214	2,806	1,506
1980	445	2,240	2,802	1,526
1981	467	2,267	2,907	1,527
1982	479	2,315	2,927	1,520
1983	488	2,328	2,918	1,517
1984	500	2,350	2,945	1,519
1985	492	2,365	3,018	1,579
1986	475	2,430	3,009	1,571
1987	452	2,445	3,015	1,583
1988	433	2,428	2,970	1,570
1989	441	2,484	2,977	1,675
1990	449	2,544	2,976	1,692
1991	453	2,572	3,012	1,694
1992	466	2,600	3,080	1,717
1993	479	2,654	3,125	1,767
1994	563	2,770	3,153	1,921
1995	595	2,804	3,182	1,946
1996	732	2,861	3,195	1,979
1997	801	2,881	3,283	2,085
1998	877	2,903	3,355	2,082
1999	947	2,990	3,470	2,085
2000	957	2,965	3,526	2,074
2001	975	3,070	3,535	2,080

Table C1.2: Nominal assessed property value for Entiat, Cashmere, Chelan, Leavenworth

Year	Entiat	Cashmere	Chelan	Leavenworth
1955	\$1,915,804	\$7,245,396	\$7,143,176	\$3,152,228
1956	\$2,001,492	\$7,699,500	\$8,376,456	\$3,433,420
1957	\$2,014,436	\$7,637,072	\$8,652,144	\$3,440,936
1958	\$2,038,788	\$7,757,296	\$8,451,020	\$3,600,504
1959	\$1,195,688	\$7,886,212	\$8,588,892	\$3,362,320
1960	\$1,200,048	\$8,268,744	\$8,693,008	\$3,410,224
1961	\$1,882,920	\$8,800,104	\$9,141,920	\$3,587,180
1962	\$2,039,044	\$9,049,092	\$9,215,000	\$3,799,412
1963	\$2,158,272	\$9,321,140	\$9,460,904	\$3,887,716
1964	\$2,164,948	\$9,585,940	\$10,093,016	\$3,929,656
1965	\$2,165,760	\$9,476,560	\$10,364,668	\$3,975,604
1966	\$2,252,308	\$9,780,964	\$11,165,528	\$4,128,952
1967	\$2,282,612	\$11,071,668	\$12,830,268	\$4,766,328
1968	\$2,341,100	\$11,507,376	\$14,036,504	\$5,120,168
1969	\$2,887,528	\$11,728,480	\$14,763,416	\$5,326,612
1970	\$2,690,056	\$11,701,290	\$16,611,866	\$5,531,092
1971	\$2,750,188	\$14,122,844	\$17,813,334	\$6,744,036
1972	\$3,194,000	\$15,287,528	\$25,694,000	\$7,166,804
1973	\$4,137,858	\$15,787,078	\$26,885,286	\$9,821,242
1974	\$4,580,231	\$16,807,141	\$27,928,249	\$10,694,956
1975	\$4,975,065	\$21,473,884	\$28,335,302	\$12,513,444
1976	\$5,339,880	\$23,063,404	\$34,759,227	\$13,253,001
1977	\$5,497,613	\$24,116,891	\$37,327,569	\$14,031,416
1978	\$5,637,829	\$26,132,138	\$39,546,281	\$15,521,312
1979	\$5,915,855	\$38,034,631	\$40,692,052	\$29,406,193
1980	\$8,780,108	\$39,787,631	\$63,518,517	\$29,865,920
1981	\$8,946,119	\$41,320,117	\$67,465,597	\$31,359,681
1982	\$9,204,461	\$53,963,452	\$68,566,118	\$32,257,696
1983	\$8,787,555	\$55,797,142	\$67,054,446	\$40,493,334
1984	\$10,038,035	\$56,828,723	\$83,181,913	\$43,360,946
1985	\$10,146,138	\$57,522,404	\$88,002,382	\$49,937,405
1986	\$10,058,243	\$58,548,552	\$91,562,101	\$45,667,859
1987	\$10,416,610	\$68,801,415	\$93,922,118	\$58,507,101
1988	\$11,055,854	\$68,259,630	\$115,010,337	\$59,259,208
1989	\$11,197,925	\$70,580,068	\$117,942,958	\$61,817,311
1990	\$11,406,249	\$73,645,947	\$122,555,780	\$64,068,990
1991	\$11,289,875	\$74,439,721	\$126,739,468	\$79,070,155
1992	\$11,926,593	\$77,063,721	\$176,806,928	\$86,729,336
1993	\$12,349,298	\$100,804,042	\$183,254,424	\$97,339,692
1994	\$18,901,213	\$102,086,354	\$189,415,900	\$104,558,467
1995	\$24,731,220	\$102,948,306	\$199,173,862	\$154,102,598
1996	\$28,672,658	\$105,792,793	\$263,494,131	\$158,172,133
1997	\$30,361,810	\$125,808,053	\$267,345,978	\$167,401,650
1998	\$38,868,572	\$124,887,477	\$271,677,491	\$183,989,729
1999	\$41,585,629	\$128,294,584	\$283,874,814	\$174,039,517
2000	\$43,169,961	\$131,333,201	\$311,409,149	\$177,414,280
2001	\$44,450,951	\$140,565,912	\$315,724,481	\$181,314,201

Table C1.3 Nominal per capita assessed property values for Entiat, Cashmere, Chelan, Leavenworth

Year	Entiat	Cashmere	Chelan	Leavenworth
1955	\$4,931	\$3,960	\$2,947	\$2,113
1956	\$5,080	\$4,180	\$3,462	\$2,306
1957	\$5,246	\$4,119	\$3,583	\$2,314
1958	\$5,437	\$4,156	\$3,506	\$2,425
1959	\$3,276	\$4,198	\$3,569	\$2,268
1960	\$3,361	\$4,373	\$3,619	\$2,304
1961	\$5,277	\$4,633	\$3,738	\$2,450
1962	\$5,718	\$4,743	\$3,702	\$2,623
1963	\$6,046	\$4,864	\$3,736	\$2,714
1964	\$6,064	\$4,980	\$3,918	\$2,774
1965	\$6,070	\$4,901	\$3,957	\$2,838
1966	\$6,316	\$5,037	\$4,193	\$2,981
1967	\$6,349	\$5,676	\$4,741	\$3,481
1968	\$6,572	\$5,874	\$5,104	\$3,783
1969	\$8,111	\$5,961	\$5,285	\$3,982
1970	\$7,578	\$5,922	\$5,855	\$4,184
1971	\$7,555	\$7,053	\$6,287	\$5,024
1972	\$8,563	\$7,535	\$9,079	\$5,259
1973	\$10,832	\$7,682	\$9,512	\$7,100
1974	\$11,714	\$8,074	\$9,893	\$7,620
1975	\$12,438	\$10,187	\$10,050	\$8,788
1976	\$13,056	\$10,806	\$12,343	\$9,175
1977	\$13,152	\$11,161	\$13,272	\$9,579
1978	\$13,203	\$11,948	\$14,078	\$10,451
1979	\$13,568	\$17,182	\$14,504	\$19,531
1980	\$19,731	\$17,762	\$22,669	\$19,571
1981	\$19,157	\$18,227	\$23,208	\$20,537
1982	\$19,216	\$23,310	\$23,425	\$21,222
1983	\$18,007	\$23,968	\$22,980	\$26,693
1984	\$20,072	\$24,182	\$28,245	\$28,546
1985	\$20,622	\$24,322	\$29,159	\$31,626
1986	\$21,175	\$24,094	\$30,429	\$29,069
1987	\$23,046	\$28,140	\$31,152	\$36,960
1988	\$25,533	\$28,114	\$38,724	\$37,745
1989	\$25,392	\$28,414	\$39,618	\$36,906
1990	\$25,404	\$28,949	\$41,181	\$37,866
1991	\$24,922	\$28,942	\$42,078	\$46,677
1992	\$25,594	\$29,640	\$57,340	\$50,512
1993	\$25,781	\$37,982	\$58,641	\$55,088
1994	\$33,572	\$36,854	\$60,075	\$54,429
1995	\$41,565	\$36,715	\$62,594	\$79,189
1996	\$39,170	\$36,978	\$82,471	\$79,925
1997	\$37,905	\$43,668	\$81,433	\$80,289
1998	\$44,320	\$43,020	\$80,977	\$88,372
1999	\$43,913	\$42,908	\$81,808	\$83,472
2000	\$45,110	\$44,295	\$88,318	\$85,542
2001	\$45,591	\$45,787	\$89,314	\$87,170

Table C1.4: Nominal per capita assessed value growth indices for Entiat, Cashmere, Chelan, Leavenworth

Year	Entiat	Cashmere	Chelan	Leavenworth
1955	0.97	0.97	0.88	0.94
1956	1.00	1.02	1.04	1.03
1957	1.03	1.01	1.08	1.03
1958	1.07	1.02	1.05	1.08
1959	0.64	1.03	1.07	1.01
1960	0.66	1.07	1.09	1.03
1961	1.04	1.13	1.12	1.09
1962	1.12	1.16	1.11	1.17
1963	1.19	1.19	1.12	1.21
1964	1.19	1.22	1.18	1.24
1965	1.19	1.20	1.19	1.26
1966	1.24	1.23	1.26	1.33
1967	1.25	1.39	1.42	1.55
1968	1.29	1.44	1.53	1.69
1969	1.59	1.46	1.59	1.77
1970	1.49	1.45	1.76	1.86
1971	1.49	1.73	1.89	2.24
1972	1.68	1.84	2.73	2.34
1973	2.13	1.88	2.86	3.16
1974	2.30	1.98	2.97	3.39
1975	2.45	2.49	3.02	3.92
1976	2.57	2.64	3.71	4.09
1977	2.59	2.73	3.98	4.27
1978	2.60	2.92	4.23	4.66
1979	2.67	4.20	4.35	8.70
1980	3.88	4.35	6.81	8.72
1981	3.77	4.46	6.97	9.15
1982	3.78	5.70	7.03	9.46
1983	3.54	5.87	6.90	11.89
1984	3.95	5.92	8.48	12.72
1985	4.05	5.95	8.75	14.09
1986	4.16	5.90	9.14	12.95
1987	4.53	6.89	9.35	16.47
1988	5.02	6.88	11.63	16.82
1989	4.99	6.95	11.89	16.44
1990	5.00	7.08	12.36	16.87
1991	4.90	7.08	12.63	20.80
1992	5.03	7.25	17.21	22.51
1993	5.07	9.29	17.61	24.54
1994	6.60	9.02	18.04	24.25
1995	8.17	8.98	18.79	35.28
1996	7.70	9.05	24.76	35.61
1997	7.45	10.69	24.45	35.77
1998	8.71	10.53	24.31	39.37
1999	8.63	10.50	24.56	37.19
2000	8.87	10.84	26.51	38.11
2001	8.96	11.20	26.81	38.84

Table C1.5: Entiat's alternative nominal per capita assessed property values

Year	Actual Entiat Assessed Values	Assessed Values had	Assessed Values had	Assessed Values had
		Entiat Grown at same Rate as Cashmere	Entiat Grown at same Rate as Chelan	Entiat Grown at same Rate as Leavenworth
1955	\$4,931	\$4,931	\$4,931	\$4,931
1956	\$5,080	\$5,205	\$5,793	\$5,379
1957	\$5,246	\$5,129	\$5,994	\$5,400
1958	\$5,437	\$5,175	\$5,865	\$5,659
1959	\$3,276	\$5,227	\$5,972	\$5,293
1960	\$3,361	\$5,445	\$6,055	\$5,376
1961	\$5,277	\$5,769	\$6,254	\$5,716
1962	\$5,718	\$5,906	\$6,194	\$6,121
1963	\$6,046	\$6,056	\$6,250	\$6,332
1964	\$6,064	\$6,201	\$6,555	\$6,472
1965	\$6,070	\$6,103	\$6,620	\$6,621
1966	\$6,316	\$6,271	\$7,015	\$6,955
1967	\$6,349	\$7,068	\$7,931	\$8,121
1968	\$6,572	\$7,314	\$8,540	\$8,826
1969	\$8,111	\$7,423	\$8,842	\$9,290
1970	\$7,578	\$7,374	\$9,796	\$9,762
1971	\$7,555	\$8,782	\$10,518	\$11,722
1972	\$8,563	\$9,383	\$15,190	\$12,270
1973	\$10,832	\$9,565	\$15,914	\$16,567
1974	\$11,714	\$10,054	\$16,552	\$17,779
1975	\$12,438	\$12,684	\$16,814	\$20,504
1976	\$13,056	\$13,455	\$20,651	\$21,409
1977	\$13,152	\$13,898	\$22,205	\$22,351
1978	\$13,203	\$14,877	\$23,554	\$24,384
1979	\$13,568	\$21,395	\$24,267	\$45,572
1980	\$19,731	\$22,117	\$37,927	\$45,665
1981	\$19,157	\$22,696	\$38,828	\$47,918
1982	\$19,216	\$29,025	\$39,192	\$49,517
1983	\$18,007	\$29,844	\$38,446	\$62,282
1984	\$20,072	\$30,111	\$47,256	\$66,605
1985	\$20,622	\$30,286	\$48,785	\$73,792
1986	\$21,175	\$30,001	\$50,910	\$67,827
1987	\$23,046	\$35,039	\$52,119	\$86,237
1988	\$25,533	\$35,006	\$64,788	\$88,069
1989	\$25,392	\$35,380	\$66,283	\$86,111
1990	\$25,404	\$36,046	\$68,899	\$88,351
1991	\$24,922	\$36,038	\$70,399	\$108,909
1992	\$25,594	\$36,907	\$95,933	\$117,859
1993	\$25,781	\$47,294	\$98,111	\$128,534
1994	\$33,572	\$45,890	\$100,509	\$126,998
1995	\$41,565	\$45,716	\$104,723	\$184,771
1996	\$39,170	\$46,044	\$137,979	\$186,488
1997	\$37,905	\$54,375	\$136,243	\$187,335
1998	\$44,320	\$53,568	\$135,479	\$206,195
1999	\$43,913	\$53,428	\$136,870	\$194,763
2000	\$45,110	\$55,154	\$147,761	\$199,593
2001	\$45,591	\$57,013	\$149,428	\$203,392

Table C1.6: Differences in alternative nominal per capita assessed values

Year	Per Capita Assessed Value Difference Between Entiat Growing at Cashmere Rate and actual Entiat	Per Capita Assessed Value Difference Between Entiat Growing at Chelan Rate and actual Entiat	Per Capita Assessed Value Difference Between Entiat Growing at Leavenworth Rate and actual Entiat
1955	\$0	\$0	\$0
1956	\$125	\$713	\$300
1957	(\$117)	\$748	\$154
1958	(\$261)	\$429	\$222
1959	\$1,951	\$2,696	\$2,017
1960	\$2,083	\$2,693	\$2,015
1961	\$491	\$977	\$439
1962	\$187	\$476	\$403
1963	\$10	\$205	\$286
1964	\$136	\$491	\$407
1965	\$33	\$550	\$551
1966	(\$45)	\$699	\$639
1967	\$719	\$1,583	\$1,773
1968	\$742	\$1,967	\$2,253
1969	(\$688)	\$731	\$1,179
1970	(\$204)	\$2,219	\$2,185
1971	\$1,227	\$2,963	\$4,167
1972	\$820	\$6,627	\$3,707
1973	(\$1,267)	\$5,082	\$5,735
1974	(\$1,660)	\$4,838	\$6,065
1975	\$247	\$4,376	\$8,066
1976	\$399	\$7,595	\$8,353
1977	\$745	\$9,053	\$9,198
1978	\$1,674	\$10,351	\$11,181
1979	\$7,826	\$10,698	\$32,003
1980	\$2,387	\$18,196	\$25,935
1981	\$3,539	\$19,672	\$28,761
1982	\$9,809	\$19,976	\$30,301
1983	\$11,837	\$20,439	\$44,275
1984	\$10,039	\$27,184	\$46,533
1985	\$9,663	\$28,163	\$53,170
1986	\$8,826	\$29,735	\$46,651
1987	\$11,993	\$29,073	\$63,191
1988	\$9,473	\$39,254	\$62,536
1989	\$9,988	\$40,891	\$60,719
1990	\$10,643	\$43,495	\$62,948
1991	\$11,116	\$45,477	\$83,987
1992	\$11,313	\$70,340	\$92,265
1993	\$21,513	\$72,329	\$102,753
1994	\$12,318	\$66,937	\$93,426
1995	\$4,151	\$63,158	\$143,206
1996	\$6,873	\$98,808	\$147,317
1997	\$16,470	\$98,338	\$149,430
1998	\$9,248	\$91,159	\$161,875
1999	\$9,515	\$92,957	\$150,850
2000	\$10,045	\$102,652	\$154,483
2001	\$11,422	\$103,837	\$157,801

Table C1.7: Entiat property tax levy rates per \$1000 assessed value

Year	Levy Rate
1955	3.75
1956	3.75
1957	3.75
1958	3.75
1959	3.75
1960	3.75
1961	3.75
1962	3.75
1963	3.75
1964	3.75
1965	3.75
1966	3.75
1967	3.75
1968	3.75
1969	4.50
1970	4.50
1971	4.67
1972	4.50
1973	3.98
1974	3.30
1975	3.58
1976	3.68
1977	3.87
1978	3.88
1979	3.38
1980	2.73
1981	3.10
1982	3.15
1983	3.00
1984	2.91
1985	3.06
1986	3.05
1987	3.02
1988	3.02
1989	3.04
1990	3.00
1991	2.95
1992	2.93
1993	2.89
1994	2.28
1995	2.02
1996	2.12
1997	2.21
1998	1.94
1999	2.04
2000	2.15
2001	2.16

Table C1.8: Nominal per capita property tax differences between alternative and actual Entiat assessed value

Year	Difference in Property Tax Paid Between Entiat Growing at Cashmere Rate and actual	Difference in Property Tax Paid Between Entiat Growing at Chelan Rate and actual	Difference in Property Tax Paid Between Entiat Growing at Leavenworth Rate and actual Entiat
	Entiat	Entiat	actual Entiat
1955	\$0	\$0	\$0
1956	\$0	\$3	\$1
1957	(\$0)	\$3	\$1
1958	(\$1)	\$2	\$1
1959	\$7	\$10	\$8
1960	\$8	\$10	\$8
1961	\$2	\$4	\$2
1962	\$1	\$2	\$2
1963	\$0	\$1	\$1
1964	\$1	\$2	\$2
1965	\$0	\$2	\$2
1966	(\$0)	\$3	\$2
1967	\$3	\$6	\$7
1968	\$3	\$7	\$8
1969	(\$3)	\$3	\$5
1970	(\$1)	\$10	\$10
1971	\$6	\$14	\$19
1972	\$4	\$30	\$17
1973	(\$5)	\$20	\$23
1974	(\$5)	\$16	\$20
1975	\$1	\$16	\$29
1976	\$1	\$28	\$31
1977	\$3	\$35	\$36
1978	\$6	\$40	\$43
1979	\$26	\$36	\$108
1980	\$7	\$50	\$71
1981	\$11	\$61	\$89
1982	\$31	\$63	\$95
1983	\$35	\$61	\$133
1984	\$29	\$79	\$135
1985	\$30	\$86	\$163
1986	\$27	\$91	\$142
1987	\$36	\$88	\$191
1988	\$29	\$119	\$189
1989	\$30	\$125	\$185
1990	\$32	\$131	\$189
1991	\$33	\$134	\$248
1992	\$33	\$206	\$271
1993	\$62	\$209	\$297
1994	\$28	\$153	\$213
1995	\$8	\$128	\$290
1996	\$15	\$209	\$312
1997	\$36	\$217	\$330
1998	\$18	\$177	\$314
1999	\$19	\$189	\$307
2000	\$22	\$221	\$332
2001	\$25	\$225	\$342

Table C1.9: Total difference between actual Entiat property tax collections and alternative property tax collections

Year	Total Difference in Property Tax Paid Between Entiat Growing at Cashmere Rate and actual Entiat	Total Difference in Property Tax Paid Between Entiat Growing at Chelan Rate and actual Entiat	Total Difference in Property Tax Paid Between Entiat Growing at Leavenworth Rate and actual Entiat
1955	\$0	\$0	\$0
1956	\$195	\$1,106	\$465
1957	(\$179)	\$1,143	\$235
1958	(\$393)	\$645	\$334
1959	\$2,888	\$3,991	\$2,986
1960	\$3,035	\$3,924	\$2,935
1961	\$726	\$1,444	\$649
1962	\$270	\$686	\$580
1963	\$15	\$288	\$403
1964	\$187	\$672	\$558
1965	\$44	\$736	\$738
1966	(\$60)	\$935	\$855
1967	\$962	\$2,116	\$2,370
1968	\$993	\$2,634	\$3,017
1969	(\$1,105)	\$1,174	\$1,894
1970	(\$328)	\$3,563	\$3,507
1971	\$2,041	\$4,928	\$6,931
1972	\$1,315	\$10,628	\$5,946
1973	(\$1,798)	\$7,212	\$8,139
1974	(\$1,949)	\$5,677	\$7,117
1975	\$314	\$5,560	\$10,248
1976	\$534	\$10,161	\$11,174
1977	\$1,076	\$13,073	\$13,283
1978	\$2,481	\$15,344	\$16,575
1979	\$10,328	\$14,118	\$42,232
1980	\$2,606	\$19,866	\$28,315
1981	\$4,487	\$24,942	\$36,466
1982	\$12,916	\$26,303	\$39,899
1983	\$15,149	\$26,158	\$56,664
1984	\$12,731	\$34,473	\$59,011
1985	\$13,166	\$38,371	\$72,443
1986	\$12,585	\$42,397	\$66,517
1987	\$17,351	\$42,060	\$91,420
1988	\$13,962	\$57,854	\$92,166
1989	\$15,206	\$62,252	\$92,438
1990	\$15,727	\$64,275	\$93,021
1991	\$15,597	\$63,811	\$117,847
1992	\$14,993	\$93,220	\$122,278
1993	\$26,916	\$90,496	\$128,561
1994	\$12,399	\$67,376	\$94,039
1995	\$3,771	\$57,368	\$130,077
1996	\$6,600	\$94,886	\$141,470
1997	\$16,969	\$101,319	\$153,959
1998	\$8,581	\$84,585	\$150,201
1999	\$10,906	\$106,553	\$172,913
2000	\$12,849	\$131,305	\$197,605
2001	\$18,098	\$164,528	\$250,034

**Table C1.10: 6-Month U.S. Treasury bill, secondary market
yearly return and discounting index**

Year	Average Return	Indexed Return (2002 Dollars)
1955	3.8%	13.90
1956	3.8%	13.39
1957	3.8%	12.89
1958	3.8%	12.42
1959	3.8%	11.96
1960	3.2%	11.59
1961	2.6%	11.30
1962	2.9%	10.98
1963	3.3%	10.63
1964	3.7%	10.26
1965	4.1%	9.86
1966	5.1%	9.38
1967	4.6%	8.97
1968	5.5%	8.50
1969	6.9%	7.96
1970	6.5%	7.47
1971	4.5%	7.15
1972	4.5%	6.84
1973	7.2%	6.38
1974	7.9%	5.91
1975	6.1%	5.57
1976	5.3%	5.29
1977	5.5%	5.02
1978	7.6%	4.66
1979	10.1%	4.24
1980	11.4%	3.81
1981	13.8%	3.34
1982	11.1%	3.01
1983	8.7%	2.77
1984	9.8%	2.52
1985	7.7%	2.34
1986	6.0%	2.21
1987	6.0%	2.08
1988	6.9%	1.95
1989	8.0%	1.80
1990	7.5%	1.68
1991	5.4%	1.59
1992	3.5%	1.54
1993	3.1%	1.49
1994	4.6%	1.43
1995	5.6%	1.35
1996	5.1%	1.29
1997	5.2%	1.22
1998	4.8%	1.17
1999	4.7%	1.11
2000	5.9%	1.05
2001	3.3%	1.02
2002	1.7%	1.00

Note: returns for 1955 – 1958 are estimated.

Table C1.11: Discounted differences in actual Entiat property tax collections and alternative property tax collections (2002 Dollars)

Year	Total Difference in Property Tax Paid Between Entiat Growing at Cashmere Rate and actual Entiat	Total Difference in Property Tax Paid Between Entiat Growing at Chelan Rate and actual Entiat	Total Difference in Property Tax Paid Between Entiat Growing at Leavenworth Rate and actual Entiat
1958	(\$4,884)	\$8,007	\$4,147
1959	\$34,557	\$47,749	\$35,721
1960	\$35,181	\$45,485	\$34,025
1961	\$8,204	\$16,311	\$7,330
1962	\$2,964	\$7,529	\$6,365
1963	\$157	\$3,060	\$4,282
1964	\$1,914	\$6,892	\$5,718
1965	\$435	\$7,256	\$7,273
1966	(\$561)	\$8,772	\$8,020
1967	\$8,628	\$18,979	\$21,257
1968	\$8,444	\$22,391	\$25,650
1969	(\$8,799)	\$9,343	\$15,072
1970	(\$2,448)	\$26,613	\$26,201
1971	\$14,586	\$35,226	\$49,543
1972	\$8,993	\$72,708	\$40,676
1973	(\$11,476)	\$46,021	\$51,936
1974	(\$11,520)	\$33,564	\$42,078
1975	\$1,747	\$30,987	\$57,114
1976	\$2,825	\$53,802	\$59,168
1977	\$5,400	\$65,594	\$66,649
1978	\$11,572	\$71,565	\$77,305
1979	\$43,766	\$59,826	\$178,966
1980	\$9,915	\$75,596	\$107,746
1981	\$15,004	\$83,400	\$121,937
1982	\$38,887	\$79,190	\$120,121
1983	\$41,946	\$72,429	\$156,896
1984	\$32,118	\$86,968	\$148,871
1985	\$30,854	\$89,921	\$169,766
1986	\$27,814	\$93,705	\$147,015
1987	\$36,167	\$87,674	\$190,563
1988	\$27,221	\$112,797	\$179,695
1989	\$27,443	\$112,350	\$166,828
1990	\$26,415	\$107,955	\$156,235
1991	\$24,845	\$101,645	\$187,718
1992	\$23,065	\$143,404	\$188,105
1993	\$40,152	\$134,998	\$191,782
1994	\$17,677	\$96,058	\$134,072
1995	\$5,092	\$77,478	\$175,674
1996	\$8,483	\$121,952	\$181,823
1997	\$20,736	\$123,810	\$188,136
1998	\$10,003	\$98,601	\$175,089
1999	\$12,138	\$118,582	\$192,434
2000	\$13,503	\$137,989	\$207,664
2001	\$18,406	\$167,325	\$254,285
Total Past	\$662,453	\$3,051,057	\$4,576,198
Total Future	\$311,828.34	\$2,694,911.95	\$4,243,130.37
Total Lost Taxes	\$974,282	\$5,745,969	\$8,819,329

Tables C2.1 through C2.18: Analysis of sales tax revenue

Table C2.1: Per Capita Sales Tax Revenue * (nominal dollars)

All Revenues	1992	1993	1994	1995	1996	1997	1998	1999	2000**	2001
Entiat	\$39	\$42	\$61	\$149	\$77	\$66	\$48	\$47	\$41	\$35
Cashmere	\$62	\$75	\$74	\$78	\$73	\$77	\$86	\$85	\$83	\$81
Chelan	\$139	\$144	\$145	\$159	\$155	\$187	\$172	\$187	\$180	\$184
Leavenworth	\$250	\$265	\$240	\$267	\$287	\$270	\$282	\$329	\$360	\$310

*Source: State of Washington, Department of Audit

**2000 Data for Entiat & Cashmere were estimated as average between 1999 and 2001 values

Table C2.2: Per Capita Sales Tax Equalization Revenue (nominal dollars)

City	1992	1993	1994	1995	1996	1997	1998	1999	2000**	2001
Entiat	\$59	\$64	\$57	\$49	\$0	\$27	\$42	\$63	\$62	\$60
Cashmere	\$17	\$36	\$32	\$37	\$29	\$46	\$48	\$46	\$29	\$11
Chelan	\$1	\$1	\$1	\$1	\$1	\$0	\$0	\$0	\$0	\$0
Leavenworth	\$1	\$1	\$1	\$1	\$1	\$0	\$0	\$0	\$0	\$0

*Source: State of Washington, Department of Audit

**2000 Data for Entiat & Cashmere were estimated as average between 1999 and 2001 values

Table C2.3: Per Capita Sales Tax Revenue (Including Sales Tax Equalization Revenue)

City	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Entiat	\$98	\$106	\$118	\$198	\$77	\$93	\$90	\$110	\$103	\$95
Cashmere	\$79	\$111	\$106	\$115	\$102	\$123	\$134	\$131	\$112	\$92
Chelan	\$140	\$145	\$146	\$160	\$156	\$187	\$172	\$187	\$180	\$184
Leavenworth	\$251	\$266	\$241	\$268	\$288	\$270	\$282	\$329	\$360	\$310

Notes: Sum of Tables D2.1 and D2.2

Table C2.4: Per Capita Difference in Sales Tax Revenue Between Entiat and Other Cities* (nominal dollars)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Difference w/Cashmere	-\$19	\$5	-\$12	-\$83	\$25	\$30	\$44	\$21	\$9	-\$3
Difference w/Chelan	\$42	\$39	\$28	-\$38	\$79	\$94	\$82	\$77	\$78	\$89
Difference w/Leavenworth	\$153	\$160	\$123	\$70	\$211	\$177	\$192	\$219	\$258	\$215
Average	\$59	\$68	\$46	-\$17	\$105	\$100	\$106	\$106	\$115	\$100

Table C2.5: Entiat Population for the Years 1992 Through 2001

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Entiat Population	466	479	563	595	732	801	877	947	957	975

Table C2.6: Six-Month U.S. Treasury Bill, Secondary Market Rate

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Yearly Return	3.55%	3.12%	4.63%	5.57%	5.08%	5.18%	4.83%	4.75%	5.90%	3.33%
As an Index (2002 = 1)	1.54	1.49	1.43	1.35	1.29	1.22	1.17	1.11	1.05	1.02

Table C2.7: Population Adjusted Difference in Sales Tax Revenue Between Entiat and Other Cities* (2002 dollars)**

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
With Cashmere	-\$13,620	\$3,573	-\$9,632	-\$66,697	\$23,520	\$29,364	\$44,982	\$22,132	\$9,051	-\$2,975
With Chelan	\$30,108	\$27,868	\$22,475	-\$30,536	\$74,323	\$92,008	\$83,830	\$81,151	\$77,943	\$88,250
With Leavenworth	\$109,681	\$114,328	\$98,729	\$56,250	\$198,508	\$173,249	\$196,285	\$230,807	\$258,973	\$213,189
Average	\$42,056	\$48,590	\$37,191	-\$13,661	\$98,784	\$98,207	\$108,366	\$111,363	\$115,322	\$99,488

*Discounted by the 6-Month U.S. Treasury Bill Rate (Secondary Market Return)

Table C2.4 Notes : Per capita differences in sales tax revenue were derived by subtracting Entiat's per capita sales tax revenue from each comparison city's per capita sales tax revenue. For Example, the 1973 difference between Entiat and Chelan was \$36 - \$16 = \$20

Table C2.7 Notes: Population adjusted differences in sales tax revenue were derived by multiplying the per capita sales tax revenue difference by the population of Entiat and then adjusting (multiplying) by the 6-Month U.S. Treasury Bill rate index. This provides a total population impact estimate for Entiat for each year. For example, the per capita difference between Cashmere and Entiat in 1992 was \$19, the population of Entiat in 1992 was 466, and the 6-Month Tbill index for 1992 (to discount to 2002 dollars) is 1.46. Therefore, \$2 * 466 * 1.46 = \$13,620.

Table C2.8 Estimated Per Capita Sales Tax Revenue For the Years 1983 Through 1991* (nominal dollars)

	1983	1984	1985	1986	1987	1988	1989	1990	1991
Entiat (actual sales tax + estimated equalization)	\$91	\$91	\$70	\$119	\$111	\$84	\$111	\$94	\$105
Cashmere (estimated)	\$91	\$91	\$70	\$119	\$111	\$84	\$111	\$94	\$105
Chelan (estimated)	\$91	\$97	\$102	\$108	\$113	\$119	\$124	\$130	\$135
Leavenworth (estimated)	\$151	\$161	\$171	\$181	\$191	\$201	\$211	\$221	\$231

* Sales tax equalization was in effect during this entire period

Table C2.9: Per Capita Difference in Sales Tax Revenue Between Entiat and Other Cities* (nominal dollars)

	1983	1984	1985	1986	1987	1988	1989	1990	1991
Cashmere	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Chelan	\$0	\$6	\$32	-\$12	\$3	\$35	\$13	\$36	\$30
Leavenworth	\$61	\$71	\$102	\$62	\$81	\$118	\$100	\$128	\$126

*Differences are calculated by subtracting Entiat per capita yearly REET revenue from comparison city per capita yearly REET revenue.

Table C2.10: Six-Month U.S. Treasury Bill, Secondary Market Rate

	1983	1984	1985	1986	1987	1988	1989	1990	1991
Yearly Return	8.7%	9.8%	7.7%	6.0%	6.0%	6.9%	8.0%	7.5%	5.4%
As an Index (2002 = 1)	2.77	2.52	2.34	2.21	2.08	1.95	1.80	1.68	1.59

Table C2.11: Entiat Population for the Years 1992 Through 2002

	1983	1984	1985	1986	1987	1988	1989	1990	1991
Entiat Population	488	500	492	475	452	433	441	449	453

Table C2.12: Population Adjusted Difference in Sales Tax Revenue Between Entiat and Other Cities* (2002 dollars)**

	1983	1984	1985	1986	1987	1988	1989	1990	1991
Cashmere	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Chelan	\$480	\$7,427	\$37,433	-\$12,283	\$2,434	\$29,629	\$10,538	\$27,294	\$21,775
Leavenworth	\$81,896	\$89,088	\$117,247	\$65,099	\$76,107	\$99,428	\$79,911	\$96,409	\$91,143
Average	\$27,459	\$32,172	\$51,560	\$17,605	\$26,180	\$43,019	\$30,149	\$41,234	\$37,639

Table C2.8 Notes: Per Capita sales tax revenue data for Chelan and Leavenworth for the period 1992 through 2001 were regressed on a simple timeline. The mean absolute deviation, a measure of forecasting model fit, for Chelan was \$5.72 (about 3% of average annual sales tax revenue) and for Leavenworth was \$17.31 (about 6% of average annual sales tax revenue). The R2 for the two models were .68 and .82, respectively, and the F-statistics were both significant. The coefficients from this model were used to backcast per capita sales tax for these two cities for the period 1973 through 1991. Per capita sales tax revenue for Cashmere for the period 1973 through 1991 were assumed to be equal to Entia's over the same period. This seemed a reasonable assumption because Entiat and Cashmere had virtually identical average annual sales tax revenue over the 1992 through 2001.

Table C2.9 Notes: Per capita differences in sales tax revenue were derived by subtracting Entiat's per capita sales tax revenue from each comparison city's per capita sales tax revenue. For Example, the 1973 difference between Entiat and Chelan was \$36 - \$16 = \$20

Table C2.12 Notes: See Table C2.7 notes

Table C2.13 Per Capita Sales Tax Revenue For the Years 1973 Through 1982* (nominal dollars)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Entiat (actual)	\$16	\$15	\$20	\$24	\$28	\$32	\$36	\$40	\$19	\$61
Cashmere (estimated)	\$16	\$15	\$20	\$24	\$28	\$32	\$36	\$40	\$19	\$61
Chelan (estimated)	\$36	\$41	\$47	\$52	\$58	\$63	\$69	\$74	\$80	\$85
Leavenworth (estimated)	\$51	\$61	\$71	\$81	\$91	\$101	\$111	\$121	\$131	\$141

* Sales tax equalization was not in effect during this period

Table C2.14: Per Capita Difference in Sales Tax Revenue Between Entiat and Other Cities* (nominal dollars)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Cashmere	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Chelan	\$20	\$26	\$27	\$29	\$30	\$31	\$33	\$34	\$60	\$25
Leavenworth	\$35	\$46	\$52	\$57	\$63	\$69	\$75	\$81	\$112	\$80

*Differences are calculated by subtracting Entiat per capita yearly REET revenue from comparison city per capita yearly REET revenue.

Table C2.15: Six-Month U.S. Treasury Bill, Secondary Market Rate

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Yearly Return	7.2%	7.9%	6.1%	5.3%	5.5%	7.6%	10.1%	11.4%	13.8%	11.1%
As an Index (2002 = 1)	6.38	5.91	5.57	5.29	5.02	4.66	4.24	3.81	3.34	3.01

Table C2.16: Entiat Population

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Entiat Population	382	391	400	409	418	427	436	445	467	479

Table C2.17: Population Adjusted Difference in Sales Tax Revenue Between Entiat and Other Cities* (2002 dollars)**

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Cashmere	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Chelan	\$48,503	\$59,457	\$60,536	\$61,918	\$62,978	\$62,658	\$60,785	\$58,140	\$94,433	\$35,341
Leavenworth	\$86,059	\$105,439	\$114,874	\$124,419	\$132,914	\$137,996	\$138,968	\$137,388	\$174,517	\$115,767
Average	\$44,854	\$54,966	\$58,470	\$62,113	\$65,297	\$66,885	\$66,584	\$65,176	\$89,650	\$50,369

Table C2.13 Notes: See Table C2.8 notes

Table C2.14 Notes: See Table C2.9 notes

Table C2.17 Notes: See Table C2.7 notes

Summary

Table C2.18: Total Foregone Sales Tax Revenue* (2002 dollars)

	Total Discounted Difference (1973-1982)	Total Discounted Difference (1983-1991)	Total Discounted Difference (1992-2001)	Discounted Difference Future*	Total Discounted Difference (1973-2001)
Difference w/Cashmere	\$0	\$0	\$39,699	\$427,625	\$467,324
Difference w/Chelan	\$604,750	\$124,727	\$547,421	\$1,764,549	\$3,041,448
Difference w/Leavenworth	\$1,268,343	\$796,328	\$1,650,000	\$4,472,023	\$8,186,693
Average	\$624,365	\$307,018	\$745,707	\$2,221,399	\$3,898,489

* Average difference 1997 through 2001 divided by the average 6Month Tbill yearly return for 1997 through 2001

Tables C3.1 through C3.6: Analysis of Real Estate Excise Tax Revenue

Table C3.1: Per Capita REET Revenue Received Each Year, 1992 Through 2001 (nominal dollars received per resident)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Entiat	\$3	\$3	\$9	\$10	\$8	\$8	\$9	\$6	\$6	\$5
Cashmere	\$5	\$6	\$5	\$7	\$8	\$5	\$6	\$6	\$6	\$5
Chelan	\$11	\$11	\$11	\$10	\$12	\$13	\$17	\$18	\$20	\$14
Leavenworth	\$11	\$14	\$20	\$13	\$12	\$10	\$17	\$21	\$13	\$14

Source: State of Washington, Department of Audit

Table C3.2: Per Capita Difference in REET Revenue Between Entiat and Other Cities (nominal dollars per resident)*

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Difference w/Cashmere	\$2	\$3	-\$4	-\$3	\$0	-\$3	-\$3	\$0	\$0	\$0
Difference w/Chelan	\$8	\$8	\$2	\$0	\$4	\$5	\$8	\$12	\$15	\$9
Difference w/Leavenworth	\$8	\$11	\$11	\$3	\$4	\$2	\$8	\$15	\$8	\$9
Average	\$6	\$7	\$3	\$0	\$3	\$1	\$4	\$9	\$7	\$6

*Differences are calculated by subtracting Entiat per capita yearly REET revenue from comparison city per capita yearly REET revenue.

Table C3.3: Entiat Population for the Years 1992 Through 2001

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Entiat Population	466	479	563	595	732	801	877	947	957	975

Source: U.S. Census Bureau

Table C3.4: Six-Month U.S. Treasury Bill, Secondary Market Rate

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Yearly Return	3.55%	3.12%	4.63%	5.57%	5.08%	5.18%	4.83%	4.75%	5.90%	3.33%
As an Index (2002 = 1)	1.54	1.49	1.43	1.35	1.29	1.22	1.17	1.11	1.05	1.02

Table C3.5: Population Adjusted Difference in REET Revenue Between Entiat and Other Cities* (adjusted to 2002 dollars)**

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Difference w/Cashmere	\$1,434	\$2,144	-\$3,211	-\$2,411	\$0	-\$2,936	-\$3,067	\$0	\$0	\$0
Difference w/Chelan	\$5,735	\$5,716	\$1,605	\$0	\$3,763	\$4,894	\$8,179	\$12,647	\$14,583	\$8,924
Difference w/Leavenworth	\$5,735	\$7,860	\$8,829	\$2,411	\$3,763	\$1,958	\$8,179	\$15,809	\$7,543	\$8,924
Average	\$4,301	\$5,240	\$2,408	\$0	\$2,509	\$1,305	\$4,430	\$9,485	\$7,375	\$5,949

* Population adjusted differences are calculated by multiplying per capita differences by Entiat's population and then discounting to 2002 \$

** Discounted by the 6-Month U.S. Treasury Bill Rate (Secondary Market Return)

Table C3.6: Total Discounted Difference in REET Revenue (2002 Dollars)

	Discounted Difference (1980- 1991) LOW	Discounted Difference (1980- 1991) HIGH	Discounted Difference (1992- 2001)	Discounted Difference (FUTURE)	Total Discounted Difference (LOW)	Total Discounted Difference (HIGH)
Difference w/Cashmere	\$733	\$1,467	-\$8,047	\$0	-\$7,314	-\$6,581
Difference w/Chelan	\$26,113	\$52,227	\$66,047	\$258,659	\$350,819	\$376,932
Difference w/Leavenworth	\$44,849	\$89,698	\$71,010	\$230,912	\$346,771	\$391,620
Average	\$23,899	\$47,797	\$48,003	\$163,190	\$230,092	\$253,991

Table C3.2 Notes: Per capita differences in REET were derived by subtracting Entiat's per capita REET revenue from each comparison city's per capita REET revenue. For Example, the 1992 difference between Entiat and Cashmere was \$5 - \$3 = \$2.

Table C3.5 Notes: Population adjusted differences in REET revenue were derived by multiplying the per capita REET revenue difference by the population of Entiat and then adjusting (multiplying) by the 6-Month U.S. Treasury Bill rate index. This provides a total population impact estimate of Entiat for each year. For example, the per capita difference between Cashmere and Entiat in 1992 was \$2, the population of Entiat in 1992 was 466, and the 6-Month Tbill index for 1992 (to discount to 2002 dollars) is 1.46. Therefore, $\$2 * 466 * 1.46 = \$1,364$.

Table C3.6 Notes: Total discounted differences in REET revenue were derived as follows:

Discounted Difference (1980-1991) LOW: We assume that REET revenue began in 1980 and that there was no difference in population adjusted REET revenue between the four Chelan County Cities (i.e., per capita difference for 1980 = 0). We then assume that the difference in 199 (the year prior to our first year of hard data) was equal to the average difference for the years 1992 through 1994. Finally, we linearly interpolate between the 1980 estimate (0) and the 1991 estimate and sum up the differences for these 12 years. Note, these estimates are already adjusted to 2002 dollars.

Discounted Difference (1980-1991) HIGH: Again, we assume that REET revenue began in 1980. However, we assume that the difference in the population adjusted REET revenue in 1980 through 1991 was equal to the average difference for the years 1992 through 1994. Therefore, our "HIGH" estimate is the average population adjusted difference between 1990 and 1992 multiplied by 12. Note, these estimates are already adjusted to 2002 dollars.

Discounted Difference (1992-2001): This is simply the sum of the population adjusted yearly differences in REET revenue from Table Y4. Note these estimates are already adjusted to 2002 dollars.

Discounted Difference (FUTURE): We assume that the population adjusted difference for each year into perpetuity is equal to the average difference for the years 1999 through 2001. We also assume that the correct discounting rate for the all future years is the average of the 6-Month Tbill rate for the years 1999 through 2001. To obtain the present value of a perpetual series of equal payments, one simply divides the discounting rate into the average yearly payment amount.

Total Discounted Difference (LOW): Sum of **Discounted Difference (1980-1991) LOW** , **Discounted Difference (1992-2001)** , **Discounted Difference (FUTURE)**. This represents a lower bound estimate of the total past and future loss in REET revenue to Entiat due to the construction of the Rocky Reach Dam and subsequent flooding and acquisition by the PUD, WDOT, and the railroad of valuable commercial, agricultural, industrial, and residential lands in and around Entiat.

Total Discounted Difference (HIGH): Sum of **Discounted Difference (1980-1991) HIGH** , **Discounted Difference (1992-2001)** , **Discounted Difference (FUTURE)**. This represents a lower bound estimate of the total past and future loss in REET revenue to Entiat due to the construction of the Rocky Reach Dam and subsequent flooding and acquisition by the PUD, WDOT, and the railroad of valuable commercial, agricultural, industrial, and residential lands in and around Entiat.

Tables C4.1 through D4.6: Analysis of hotel/motel tax revenue

Table C4.1: Per Capita Hotel/Motel Stay Tax Revenue Received Each Year, 1992 through 2001 (nominal dollars received per resident)

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Entiat	\$2	\$2	\$2	\$2	\$0	\$2	\$1	\$1	\$1
Cahmere	\$1	\$2	\$1	\$1	\$1	\$1	\$1	\$1	\$1
Chelan	\$41	\$44	\$34	\$52	\$91	\$99	\$137	\$131	\$142
Leavenworth	\$70	\$80	\$63	\$80	\$107	\$125	\$196	\$221	\$320

Source: State of Washington, Department of Audit

Table C4.2: Per Capita Difference in Hotel/Motel Stay Tax Revenue Between Entiat and Other Cities (nominal dollars received per

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Difference w/Cashmere	-\$1	\$0	-\$1	-\$1	\$1	-\$1	\$0	\$0	\$0
Difference w/Chelan	\$39	\$42	\$32	\$50	\$91	\$97	\$136	\$130	\$141
Difference w/Leavenworth	\$68	\$78	\$61	\$78	\$107	\$123	\$195	\$220	\$319
Average	\$35	\$40	\$31	\$42	\$66	\$73	\$110	\$117	\$153

*Differences are calculated by subtracting Entiat per capita yearly Hotel/Motel tax revenue from comparison city per capita yearly Hotel/Motel tax

Table C4.3: Entiat Population for the Years 1992 Through 2001

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Entiat Population	466	479	563	595	732	801	877	947	957

Table C4.4: Six-Month U.S. Treasury Bill, Secondary Market Rate

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Yearly Return	3.55%	3.12%	4.63%	5.57%	5.08%	5.18%	4.83%	4.75%	5.90%
As an Index (2002 = 1)	1.54	1.49	1.43	1.35	1.29	1.22	1.17	1.11	1.05

Table C4.5: Population Adjusted Difference in Hotel/Motel Stay Tax Revenue Between Entiat and Other Cities* (2002 dollars)**

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Difference w/Cashmere	-\$717	\$0	-\$803	-\$804	\$941	-\$979	\$0	\$0	\$0
Difference w/Chelan	\$27,958	\$30,011	\$25,686	\$40,179	\$85,613	\$94,945	\$139,036	\$137,008	\$141,806
Difference w/Leavenworth	\$48,747	\$55,735	\$48,963	\$62,679	\$100,665	\$120,394	\$199,352	\$231,860	\$320,824
Average	\$25,329	\$28,582	\$24,615	\$34,018	\$62,406	\$71,453	\$112,796	\$122,956	\$154,210

* Population adjusted differences are calculated by multiplying per capita differences by Entiat's population and then discounting to 2000 \$\$

**Discounted by 6-Month U.S. Treasury Bill Rate (Secondary Market Return)

Table C4.6: Total Discounted Difference in Hotel/Motel Stay Tax Revenue (2002 Dollars)

	Discounted Difference (1973- 1991) LOW	Discounted Difference (1973- 1991) HIGH	Discounted Difference (1992- 2001)	Discounted Difference (FUTURE)	Total Discounted Difference (LOW)	Total Discounted Difference (HIGH)
Difference w/Cashmere	-\$9,624	-\$9,624	-2,361	\$0	-\$11,985	-\$11,985
Difference w/Chelan	\$264,906	\$529,813	874,944	\$3,087,229	\$4,227,079	\$4,491,986
Difference w/Leavenworth	\$485,910	\$971,820	1,479,752	\$6,032,670	\$7,998,332	\$8,484,242
Average	\$248,668	\$497,337	784,111	\$3,039,966	\$4,072,746	\$4,321,414

Table C4.2 Notes: Per capita differences in Hotel/Motel tax were derived by subtracting Entiat's per capita Hotel/Motel tax revenue from each comparison city's per capita Hotel/Motel tax revenue. For Example, the 1992 difference between Entiat and Cashmere was \$5 - \$3 = \$2.

Table C4.5 Notes: Population adjusted differences in Hotel/Motel tax revenue were derived by multiplying the per capita Hotel/Motel tax revenue difference by the population of Entiat and then adjusting (multiplying) by the 6-Month U.S. Treasury Bill rate index. This provides a total population impact estimate for Entiat for each year. For example, the per capita difference between Cashmere and Entiat in 1992 was \$2, the population of Entiat in 1992 was 466, and the 6-Month Tbill index for 1992 (to discount to 2000 dollars) is 1.46. Therefore, $\$2 * 466 * 1.46 = \$1,384$.

Table C4.6 Notes: Total discounted differences in Hotel/Motel tax revenue were derived as follows:

Discounted Difference (1973-1991) LOW: We assume that Hotel/Motel tax revenue began in 1980 and that there was no difference in population adjusted Hotel/Motel tax revenue between the four Chelan County Cities (i.e., per capita difference for 1980 = 0). We then assume that the difference in 1991 (the year prior to our first year of hard data) was equal to the average difference for the years 1992 through 1994. Finally, we linearly interpolate between the 1980 estimate (0) and the 1991 estimate and sum up the differences for these 12 years. Note, these estimates are already adjusted to 2000 dollars.

Discounted Difference (1973-1991) HIGH: Again, we assume that Hotel/Motel tax revenue began in 1980. However, we assume that the difference in the population adjusted Hotel/Motel tax revenue in 1980 through 1991 was equal to the average difference for the years 1992 through 1994. Therefore, our "HIGH" estimate is the average population adjusted difference between 1990 and 1992 multiplied by 12. Note, these estimates are already adjusted to 2000 dollars.

Discounted Difference (1992-2001): This is simply the sum of the population adjusted yearly differences in Hotel/Motel tax revenue from Table Z4. Note, these estimates are already adjusted to 2000 dollars.

Discounted Difference (FUTURE): We assume that the population adjusted difference for each year into perpetuity is equal to the average difference for the years 1999 through 2001. We also assume that the correct discounting rate for the all future years is the average of the 6-Month Tbill rate for the years 1999 through 2001. To obtain the present value of a perpetual series of equal payments, one simply divides the discounting rate into the average yearly payment amount.

Total Discounted Difference (LOW): Sum of Discounted Difference (1973-1991) LOW , Discounted Difference (1992-2001) , Discounted Difference (FUTURE). This represents a lower bound estimate of the total past and future loss in Hotel/Motel tax revenue to Entiat due to the construction of the Rocky Reach Dam and subsequent flooding and acquisition by the PUD, WDOT, and the railroad of valuable commercial, agricultural, industrial, and residential lands in and around Entiat.

Total Discounted Difference (HIGH): Sum of Discounted Difference (1973-1991) HIGH , Discounted Difference (1992-2001) , Discounted Difference (FUTURE). This represents a lower bound estimate of the total past and future loss in Hotel/Motel tax revenue to Entiat due to the construction of the Rocky Reach Dam and subsequent flooding and acquisition by the PUD, WDOT, and the railroad of valuable commercial, agricultural, industrial, and residential lands in and around Entiat.

Table C5.1: Estimated FTE enrollment for Entiat, Chelan, Cashmere, Cascade school districts

Year	Entiat (actual)	Chelan	Cashmere	Cascade
1950-1951	420	873	1,049	1,184
1951-1952	416	876	1,056	1,187
1952-1953	411	880	1,063	1,191
1953-1954	407	883	1,069	1,195
1954-1955	402	887	1,076	1,199
1955-1956	398	890	1,083	1,203
1956-1957	401	893	1,089	1,206
1957-1958	375	897	1,096	1,210
1958-1959	420	900	1,103	1,214
1959-1960	415	904	1,110	1,218
1960-1961	375	907	1,116	1,222
1961-1962	374	920	1,122	1,223
1962-1963	392	933	1,128	1,224
1963-1964	351	946	1,134	1,225
1964-1965	337	959	1,140	1,226
1965-1966	331	972	1,146	1,227
1966-1967	315	985	1,152	1,228
1967-1968	299	998	1,158	1,229
1968-1969	313	1,011	1,164	1,230
1969-1970	330	1,024	1,170	1,232
1970-1971	323	1,037	1,176	1,233
1971-1972	305	1,041	1,186	1,241
1972-1973	298	1,044	1,195	1,249
1973-1974	288	1,048	1,205	1,258
1974-1975	289	1,051	1,215	1,266
1975-1976	285	1,055	1,224	1,274
1976-1977	276	1,059	1,234	1,283
1977-1978	253	1,062	1,243	1,291
1978-1979	244	1,066	1,253	1,300
1979-1980	224	1,069	1,262	1,308
1980-1981	247	1,073	1,272	1,316
1981-1982	238	1,098	1,282	1,321
1982-1983	234	1,106	1,296	1,324
1983-1984	255	1,109	1,302	1,327
1984-1985	243	1,119	1,311	1,332
1985-1986	246	1,138	1,318	1,348
1986-1987	247	1,140	1,336	1,351
1987-1988	251	1,145	1,343	1,358
1988-1989	262	1,141	1,344	1,359
1989-1990	271	1,146	1,359	1,385
1990-1991	285	1,150	1,376	1,392
1991-1992	309	1,107	1,272	1,267
1992-1993	319	1,105	1,319	1,334
1993-1994	359	1,197	1,434	1,475
1994-1995	359	1,193	1,440	1,485
1995-1996	364	1,270	1,473	1,559
1996-1997	365	1,287	1,537	1,537
1997-1998	379	1,311	1,552	1,543
1998-1999	383	1,310	1,542	1,543
1999-2000	388	1,257	1,514	1,497
2000-2001	382	1,274	1,462	1,450
2001-2002	369	1,265	1,488	1,474

Table C5.2: Nominal Assessed Property Value for Entiat, Chelan, Cashmere, Cascade school districts

Year	Entiat	Chelan	Cashmere	Cascade
1955	\$6,762,624	\$19,131,972	\$16,131,992	\$19,837,764
1956	\$6,973,700	\$19,592,696	\$16,598,756	\$19,841,152
1957	\$7,536,992	\$18,609,724	\$17,475,924	\$20,366,360
1958	\$7,635,972	\$17,510,764	\$17,614,580	\$20,443,864
1959	\$6,695,936	\$17,535,240	\$17,815,740	\$20,521,368
1960	\$6,445,416	\$18,095,148	\$18,473,180	\$21,954,468
1961	\$6,485,076	\$18,454,896	\$19,292,388	\$20,120,844
1962	\$6,714,340	\$18,429,088	\$19,866,264	\$20,105,872
1963	\$6,992,480	\$19,788,736	\$20,591,648	\$20,234,728
1964	\$7,086,364	\$20,988,368	\$17,566,768	\$20,414,764
1965	\$7,141,520	\$21,835,560	\$21,356,284	\$20,274,120
1966	\$7,211,636	\$22,823,400	\$22,138,036	\$21,467,404
1967	\$7,271,220	\$25,251,424	\$36,148,736	\$22,752,880
1968	\$7,378,324	\$27,623,600	\$25,269,508	\$24,843,496
1969	\$7,857,752	\$28,133,048	\$25,474,592	\$26,613,104
1970	\$8,440,144	\$31,064,060	\$25,746,794	\$29,662,330
1971	\$8,424,830	\$33,876,894	\$36,085,396	\$47,781,808
1972	\$11,973,472	\$57,546,286	\$39,963,280	\$52,800,066
1973	\$12,593,152	\$60,078,172	\$40,207,530	\$57,180,034
1974	\$13,078,828	\$62,496,254	\$43,206,043	\$59,593,741
1975	\$13,614,959	\$63,885,865	\$56,055,540	\$71,570,953
1976	\$15,845,092	\$79,162,932	\$58,039,376	\$74,648,042
1977	\$16,126,614	\$86,047,531	\$60,061,183	\$80,185,890
1978	\$17,057,906	\$93,381,944	\$64,573,228	\$84,302,499
1979	\$17,162,473	\$96,317,350	\$102,624,841	\$133,096,962
1980	\$25,735,235	\$144,085,422	\$112,230,985	\$142,621,661
1981	\$26,924,384	\$151,903,438	\$113,268,029	\$148,879,246
1982	\$26,777,961	\$158,082,449	\$117,383,820	\$153,354,794
1983	\$26,062,610	\$157,812,928	\$127,341,662	\$203,605,853
1984	\$31,680,923	\$206,226,713	\$129,918,426	\$212,655,022
1985	\$32,457,334	\$213,680,799	\$131,971,198	\$223,023,141
1986	\$32,411,232	\$218,332,432	\$133,973,719	\$234,925,301
1987	\$33,151,949	\$223,375,693	\$151,533,157	\$275,157,669
1988	\$39,489,719	\$282,573,562	\$152,033,679	\$277,676,704
1989	\$39,479,283	\$286,555,851	\$157,014,856	\$293,330,873
1990	\$40,105,892	\$298,638,744	\$162,077,678	\$302,504,439
1991	\$39,558,583	\$302,284,900	\$163,502,070	\$372,130,928
1992	\$41,048,573	\$432,081,175	\$170,476,453	\$406,595,575
1993	\$42,543,256	\$448,956,667	\$226,368,169	\$432,381,022
1994	\$65,182,915	\$477,959,521	\$232,661,841	\$462,459,338
1995	\$72,569,407	\$466,661,168	\$236,645,884	\$731,348,070
1996	\$76,054,958	\$627,695,132	\$245,459,323	\$750,334,724
1997	\$78,242,983	\$644,578,253	\$314,899,286	\$757,123,978
1998	\$95,859,782	\$654,172,398	\$320,536,748	\$774,180,528
1999	\$99,935,895	\$672,298,279	\$327,772,808	\$898,102,261
2000	\$103,029,659	\$775,373,080	\$332,699,440	\$912,249,000
2001	\$104,674,402	\$786,656,535	\$359,558,358	\$933,746,504

Table C5.3 Nominal per capita assessed property values for Entiat, Chelan, Cashmere, Cascade school districts

School Year	Entiat	Chelan	Cashmere	Cascade
1956-1957	17,391	21,929	15,235	16,447
1957-1958	20,099	20,750	15,942	16,829
1958-1959	18,181	19,451	15,970	16,840
1959-1960	16,135	19,404	16,054	16,851
1960-1961	17,188	19,949	16,546	17,971
1961-1962	17,319	20,058	17,188	16,456
1962-1963	17,120	19,751	17,606	16,429
1963-1964	19,922	20,916	18,152	16,519
1964-1965	21,028	21,883	15,405	16,651
1965-1966	21,576	22,462	18,630	16,522
1966-1967	22,894	23,168	19,212	17,478
1967-1968	24,318	25,299	31,208	18,508
1968-1969	23,576	27,320	21,704	20,028
1969-1970	23,778	27,471	21,768	21,610
1970-1971	26,130	29,952	21,889	24,064
1971-1972	27,639	32,552	30,431	38,503
1972-1973	40,134	55,107	33,432	42,261
1973-1974	43,738	57,336	33,369	45,463
1974-1975	45,296	59,441	35,575	47,069
1975-1976	47,772	60,557	45,794	56,157
1976-1977	57,443	74,785	47,047	58,190
1977-1978	63,840	81,016	48,311	62,102
1978-1979	69,909	87,627	51,543	64,870
1979-1980	76,618	90,080	81,295	101,761
1980-1981	104,212	134,306	88,236	108,350
1981-1982	113,285	138,325	88,378	112,721
1982-1983	114,411	142,874	90,606	115,858
1983-1984	102,034	142,313	97,773	153,397
1984-1985	130,294	184,361	99,091	159,653
1985-1986	131,871	187,847	100,100	165,411
1986-1987	131,331	191,521	100,301	173,894
1987-1988	132,022	195,008	112,832	202,673
1988-1989	150,563	247,717	113,133	204,278
1989-1990	145,734	249,965	115,506	211,844
1990-1991	140,722	259,583	117,816	217,263
1991-1992	128,021	273,067	128,539	293,710
1992-1993	128,679	391,024	129,247	304,794
1993-1994	118,505	375,068	157,858	293,140
1994-1995	181,568	400,637	161,571	311,420
1995-1996	199,367	367,450	160,656	469,114
1996-1997	208,370	487,852	159,690	488,239
1997-1998	206,446	491,755	202,845	490,810
1998-1999	250,287	499,315	207,828	501,630
1999-2000	257,567	534,895	216,489	599,802
2000-2001	269,711	608,809	227,569	629,259
2001-2002	283,670	621,747	241,638	633,682

Table C5.4: Nominal per capita assessed value growth indices for Entiat, Chelan, Cashmere, Cascade school districts

School Year	Entiat	Chelan	Cashmere	Cascade
1956-1957	0.9	1.1	1.0	1.0
1957-1958	1.1	1.0	1.0	1.0
1958-1959	1.0	0.9	1.0	1.0
1959-1960	0.9	0.9	1.0	1.0
1960-1961	0.9	1.0	1.1	1.1
1961-1962	0.9	1.0	1.1	1.0
1962-1963	0.9	1.0	1.1	1.0
1963-1964	1.1	1.0	1.2	1.0
1964-1965	1.1	1.1	1.0	1.0
1965-1966	1.2	1.1	1.2	1.0
1966-1967	1.2	1.1	1.2	1.0
1967-1968	1.3	1.2	2.0	1.1
1968-1969	1.3	1.3	1.4	1.2
1969-1970	1.3	1.3	1.4	1.3
1970-1971	1.4	1.4	1.4	1.4
1971-1972	1.5	1.6	1.9	2.3
1972-1973	2.2	2.7	2.1	2.5
1973-1974	2.4	2.8	2.1	2.7
1974-1975	2.4	2.9	2.3	2.8
1975-1976	2.6	2.9	2.9	3.4
1976-1977	3.1	3.6	3.0	3.5
1977-1978	3.4	3.9	3.1	3.7
1978-1979	3.8	4.2	3.3	3.9
1979-1980	4.1	4.3	5.2	6.1
1980-1981	5.6	6.5	5.6	6.5
1981-1982	6.1	6.7	5.6	6.7
1982-1983	6.2	6.9	5.8	6.9
1983-1984	5.5	6.9	6.2	9.2
1984-1985	7.0	8.9	6.3	9.6
1985-1986	7.1	9.1	6.4	9.9
1986-1987	7.1	9.2	6.4	10.4
1987-1988	7.1	9.4	7.2	12.1
1988-1989	8.1	12.0	7.2	12.2
1989-1990	7.9	12.1	7.3	12.7
1990-1991	7.6	12.5	7.5	13.0
1991-1992	6.9	13.2	8.2	17.6
1992-1993	6.9	18.9	8.2	18.2
1993-1994	6.4	18.1	10.0	17.5
1994-1995	9.8	19.3	10.3	18.6
1995-1996	10.7	17.7	10.2	28.1
1996-1997	11.2	23.6	10.2	29.2
1997-1998	11.1	23.7	12.9	29.4
1998-1999	13.5	24.1	13.2	30.0
1999-2000	13.9	25.8	13.8	35.9
2000-2001	14.5	29.4	14.5	37.7
2001-2002	15.3	30.0	15.4	37.9

Table C5.5: Entiat School District's alternative nominal per capita assessed property values

School Year	Entiat (actual)	Entiat (growing at Chelan rate)	Entiat (growing at Cashmere rate)	Entiat (growing at Cascade rate)
1956-1957	17,391	18,415	16,859	17,122
1957-1958	20,099	17,424	17,641	17,520
1958-1959	18,181	17,075	18,475	18,328
1959-1960	16,135	17,035	18,573	18,339
1960-1961	17,188	17,513	19,142	19,559
1961-1962	17,319	17,608	19,884	17,909
1962-1963	17,120	17,339	20,367	17,880
1963-1964	19,922	18,362	21,000	17,978
1964-1965	21,028	19,211	17,821	18,122
1965-1966	21,576	19,719	21,552	17,981
1966-1967	22,894	20,339	22,225	19,022
1967-1968	24,318	22,210	36,104	20,143
1968-1969	23,576	23,984	25,108	21,798
1969-1970	23,778	24,116	25,183	23,519
1970-1971	26,130	26,295	25,323	26,190
1971-1972	27,639	28,577	35,204	41,904
1972-1973	40,134	48,378	38,676	45,995
1973-1974	43,738	50,334	38,603	49,479
1974-1975	45,296	52,182	41,155	51,227
1975-1976	47,772	53,162	52,977	61,118
1976-1977	57,443	65,653	54,426	63,330
1977-1978	63,840	71,123	55,888	67,588
1978-1979	69,909	76,926	59,628	70,600
1979-1980	76,618	79,080	94,047	110,750
1980-1981	104,212	117,905	102,076	117,921
1981-1982	113,285	121,434	102,240	122,678
1982-1983	114,411	125,427	104,818	126,093
1983-1984	102,034	124,935	113,109	166,948
1984-1985	130,294	161,847	114,633	173,756
1985-1986	131,871	164,908	115,801	180,022
1986-1987	131,331	168,133	116,034	189,255
1987-1988	132,022	171,194	130,531	220,576
1988-1989	150,563	217,467	130,878	222,323
1989-1990	145,734	219,440	133,624	230,557
1990-1991	140,722	227,883	136,297	236,455
1991-1992	128,021	239,721	148,701	319,655
1992-1993	128,679	343,273	149,520	331,719
1993-1994	118,505	329,266	182,619	319,034
1994-1995	181,568	351,712	186,914	338,930
1995-1996	199,367	322,578	185,855	510,553
1996-1997	208,370	428,277	184,738	531,368
1997-1998	206,446	431,704	234,663	534,167
1998-1999	250,287	438,340	240,427	545,942
1999-2000	257,567	469,575	250,446	652,787
2000-2001	269,711	534,463	263,265	684,845
2001-2002	283,670	545,822	279,540	689,659

Table C5.6: Differences in alternative nominal per student assessed values

School Year	Per Student Assessed Value Difference Between Entiat Growing at Chelan Rate and Actual Entiat	Per Student Assessed Value Difference Between Entiat Growing at Cashmere Rate and Actual Entiat	Per Student Assessed Value Difference Between Entiat Growing at Cascade Rate and Actual Entiat
1956-1957	1,024	-532	-269
1957-1958	-2,674	-2,458	-2,579
1958-1959	-1,106	294	147
1959-1960	900	2,438	2,205
1960-1961	325	1,954	2,371
1961-1962	289	2,565	590
1962-1963	219	3,247	760
1963-1964	-1,560	1,078	-1,943
1964-1965	-1,817	-3,207	-2,906
1965-1966	-1,856	-23	-3,595
1966-1967	-2,555	-669	-3,872
1967-1968	-2,109	11,785	-4,175
1968-1969	408	1,533	-1,778
1969-1970	338	1,405	-260
1970-1971	164	-808	59
1971-1972	939	7,566	14,265
1972-1973	8,244	-1,458	5,861
1973-1974	6,596	-5,136	5,740
1974-1975	6,886	-4,141	5,930
1975-1976	5,390	5,205	13,346
1976-1977	8,210	-3,017	5,887
1977-1978	7,283	-7,952	3,748
1978-1979	7,017	-10,282	690
1979-1980	2,461	17,429	34,132
1980-1981	13,693	-2,136	13,709
1981-1982	8,149	-11,044	9,394
1982-1983	11,015	-9,593	11,681
1983-1984	22,900	11,075	64,913
1984-1985	31,554	-15,660	43,462
1985-1986	33,037	-16,069	48,152
1986-1987	36,802	-15,297	57,924
1987-1988	39,173	-1,491	88,554
1988-1989	66,904	-19,685	71,760
1989-1990	73,706	-12,110	84,823
1990-1991	87,161	-4,426	95,733
1991-1992	111,699	20,680	191,634
1992-1993	214,594	20,841	203,040
1993-1994	210,761	64,114	200,530
1994-1995	170,144	5,346	157,362
1995-1996	123,212	-13,511	311,187
1996-1997	219,908	-23,632	322,998
1997-1998	225,258	28,217	327,721
1998-1999	188,054	-9,860	295,655
1999-2000	212,008	-7,120	395,220
2000-2001	264,752	-6,446	415,134
2001-2002	262,151	-4,130	405,989

Table C5.7: Entiat School District property tax levy rates per \$1,000 assessed value

Year	Entiat School District Bond Rate
1955	5.10
1956	9.20
1957	4.13
1958	8.30
1959	10.43
1960	12.75
1961	6.10
1962	6.13
1963	9.13
1964	5.85
1965	5.88
1966	9.15
1967	4.98
1968	3.75
1969	11.40
1970	11.93
1971	12.33
1972	9.99
1973	12.88
1974	10.73
1975	12.67
1976	14.17
1977	0.55
1978	7.18
1979	3.28
1980	2.70
1981	3.59
1982	4.43
1983	4.23
1984	2.91
1985	2.28
1986	2.16
1987	2.11
1988	1.19
1989	1.52
1990	1.87
1991	2.02
1992	1.95
1993	2.00
1994	1.30
1995	1.17
1996	1.12
1997	1.21
1998	1.20
1999	1.15
2000	1.46
2001	1.43

Table C5.8: Nominal per capita property tax differences between Entiat School District and alternative assessed values

School Year	Per Student Assessed Value Difference Between Entiat Growing at Chelan Rate and Actual Entiat	Per Student Assessed Value Difference Between Entiat Growing at Cashmere Rate and Actual Entiat	Per Student Assessed Value Difference Between Entiat Growing at Cascade Rate and Actual Entiat
1956-1957	5	-3	-1
1957-1958	-25	-23	-24
1958-1959	-5	1	1
1959-1960	7	20	18
1960-1961	3	20	25
1961-1962	4	33	8
1962-1963	1	20	5
1963-1964	-10	7	-12
1964-1965	-17	-29	-27
1965-1966	-11	0	-21
1966-1967	-15	-4	-23
1967-1968	-19	108	-38
1968-1969	2	8	-9
1969-1970	1	5	-1
1970-1971	2	-9	1
1971-1972	11	90	170
1972-1973	102	-18	72
1973-1974	66	-51	57
1974-1975	89	-53	76
1975-1976	58	56	143
1976-1977	104	-38	75
1977-1978	103	-113	53
1978-1979	4	-6	0
1979-1980	18	125	245
1980-1981	45	-7	45
1981-1982	22	-30	25
1982-1983	40	-34	42
1983-1984	101	49	287
1984-1985	134	-66	184
1985-1986	96	-47	140
1986-1987	84	-35	132
1987-1988	85	-3	191
1988-1989	141	-42	152
1989-1990	87	-14	101
1990-1991	132	-7	145
1991-1992	209	39	358
1992-1993	434	42	411
1993-1994	411	125	391
1994-1995	340	11	314
1995-1996	161	-18	406
1996-1997	258	-28	378
1997-1998	252	32	366
1998-1999	228	-12	359
1999-2000	254	-9	474
2000-2001	305	-7	478
2001-2002	382	-6	591

Table C5.9: Total nominal difference between actual Entiat School District property tax collections and alternative property tax collections

School Year	Total Difference in Property Tax Paid Between Entiat Growing at Chelan Rate and actual Entiat	Total Difference in Property Tax Paid Between Entiat Growing at Cashmere Rate and actual Entiat	Total Difference in Property Tax Paid Between Entiat Growing at Cascade Rate and actual Entiat
1959-1960	3,003	8,134	7,356
1960-1961	1,346	8,097	9,826
1961-1962	1,480	13,115	3,018
1962-1963	501	7,428	1,739
1963-1964	-4,012	2,773	-4,999
1964-1965	-6,880	-12,144	-11,004
1965-1966	-4,072	-51	-7,886
1966-1967	-5,620	-1,472	-8,518
1967-1968	-7,565	42,281	-14,979
1968-1969	712	2,676	-3,106
1969-1970	427	1,775	-328
1970-1971	619	-3,048	224
1971-1972	3,527	28,432	53,607
1972-1973	30,381	-5,373	21,599
1973-1974	20,612	-16,048	17,938
1974-1975	29,317	-17,631	25,247
1975-1976	18,680	18,037	46,250
1976-1977	31,698	-11,648	22,730
1977-1978	30,785	-33,613	15,842
1978-1979	1,112	-1,629	109
1979-1980	5,101	36,119	70,734
1980-1981	12,813	-1,999	12,828
1981-1982	6,076	-8,235	7,004
1982-1983	10,001	-8,710	10,606
1983-1984	24,741	11,965	70,131
1984-1985	29,905	-14,842	41,191
1985-1986	23,730	-11,542	34,587
1986-1987	19,942	-8,289	31,387
1987-1988	19,801	-754	44,763
1988-1989	36,084	-10,617	38,703
1989-1990	21,261	-3,493	24,468
1990-1991	32,604	-1,656	35,810
1991-1992	51,550	9,544	88,441
1992-1993	108,976	10,584	103,109
1993-1994	107,733	32,772	102,503
1994-1995	92,091	2,894	85,172
1995-1996	45,791	-5,021	115,651
1996-1997	79,591	-8,553	116,902
1997-1998	80,308	10,060	116,838
1998-1999	81,970	-4,298	128,872
1999-2000	91,308	-3,067	170,214
2000-2001	110,897	-2,700	173,887
2001-2002	141,675	-2,232	219,410

Table C5.10: 6-Month U.S. Treasury bill, secondary market yearly return and discounting index

Year	Average Return	Indexed Return (2002 = 1)
1955	3.8%	13.9
1956	3.8%	13.4
1957	3.8%	12.9
1958	3.8%	12.4
1959	3.8%	12.0
1960	3.2%	11.6
1961	2.6%	11.3
1962	2.9%	11.0
1963	3.3%	10.6
1964	3.7%	10.3
1965	4.1%	9.9
1966	5.1%	9.4
1967	4.6%	9.0
1968	5.5%	8.5
1969	6.9%	8.0
1970	6.5%	7.5
1971	4.5%	7.1
1972	4.5%	6.8
1973	7.2%	6.4
1974	7.9%	5.9
1975	6.1%	5.6
1976	5.3%	5.3
1977	5.5%	5.0
1978	7.6%	4.7
1979	10.1%	4.2
1980	11.4%	3.8
1981	13.8%	3.3
1982	11.1%	3.0
1983	8.7%	2.8
1984	9.8%	2.5
1985	7.7%	2.3
1986	6.0%	2.2
1987	6.0%	2.1
1988	6.9%	1.9
1989	8.0%	1.8
1990	7.5%	1.7
1991	5.4%	1.6
1992	3.5%	1.5
1993	3.1%	1.5
1994	4.6%	1.4
1995	5.6%	1.4
1996	5.1%	1.3
1997	5.2%	1.2
1998	4.8%	1.2
1999	4.7%	1.1
2000	5.9%	1.1
2001	3.3%	1.0
2002	1.7%	1.0

Note: returns for 1955 – 1958 are estimated

Table C5.11: Discounted differences in actual Entiat School District property tax collections and alternative property tax collections (2000 Dollars)

School Year	Total Difference in Property Tax Paid Between Entiat Growing at Cheilan Rate and actual Entiat	Total Difference in Property Tax Paid Between Entiat Growing at Cashmere Rate and actual Entiat	Total Difference in Property Tax Paid Between Entiat Growing at Cascade Rate and actual Entiat
1959-1960	35,924	97,313	88,006
1960-1961	15,602	93,855	113,898
1961-1962	16,718	148,180	34,103
1962-1963	5,501	81,566	19,094
1963-1964	-42,663	29,487	-53,159
1964-1965	-70,558	-124,555	-112,858
1965-1966	-40,140	-507	-77,726
1966-1967	-52,729	-13,806	-79,911
1967-1968	-67,839	379,154	-134,325
1968-1969	6,056	22,753	-26,404
1969-1970	3,396	14,124	-2,610
1970-1971	4,627	-22,771	1,674
1971-1972	25,209	203,221	383,168
1972-1973	207,837	-36,759	147,754
1973-1974	131,534	-102,411	114,471
1974-1975	173,331	-104,242	149,269
1975-1976	104,103	100,520	257,751
1976-1977	167,835	-61,677	120,351
1977-1978	154,467	-168,653	79,487
1978-1979	5,187	-7,600	510
1979-1980	21,617	153,060	299,749
1980-1981	48,755	-7,606	48,813
1981-1982	20,317	-27,536	23,421
1982-1983	30,111	-26,223	31,931
1983-1984	68,504	33,130	194,183
1984-1985	75,443	-37,443	103,915
1985-1986	55,609	-27,049	81,052
1986-1987	44,075	-18,320	69,371
1987-1988	41,275	-1,571	93,308
1988-1989	70,352	-20,700	75,458
1989-1990	38,372	-6,305	44,159
1990-1991	54,760	-2,781	60,146
1991-1992	82,114	15,203	140,877
1992-1993	167,643	16,281	158,616
1993-1994	160,711	48,889	152,909
1994-1995	131,295	4,125	121,431
1995-1996	61,843	-6,782	156,192
1996-1997	102,294	-10,993	150,248
1997-1998	98,136	12,293	142,775
1998-1999	95,553	-5,010	150,227
1999-2000	101,616	-3,413	189,430
2000-2001	116,542	-2,838	182,739
2001-2002	141,675	-2,232	219,410
Total Past	2,612,006	603,374	3,912,905
Total Future	2,699,341	-5,851	4,313,799
Total Lost Property Taxes	5,311,347	597,523	8,226,704

Table C6.1: Regression results from district enrollment (backward) forecasting model (fixed effects model)

Dependent Variable: District Enrollment				
Method: Pooled Least Squares				
Date: 03/07/03 Time: 12:44				
Sample: 1991 2001				
Included observations: 11				
Total panel (balanced) observations 66				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
City Population	0.20	0.01	12.78	0.00
Time Trend	4.27	4.01	2.14	0.04
Fixed Effects				
Entiat Constant	192.6743			
Chelan Constant	553.1206			
Cashmere Constant	865.0533			
Cascade Constant	1052.726			
R-squared	0.9996	Mean dependent var		2,968
Adjusted R-squared	0.9996	S.D. dependent var		4,403
S.E. of regression	90.43	Sum squared resid		474,308
Log likelihood	-313.65	F-statistic		154,035
Durbin-Watson stat	0.5437	Prob(F-statistic)		0.00

Table C6.2: Actual FTE enrollment for Entiat; estimated FTE enrollment for Chelan, Cashmere, Cascade school districts for 1950 through 1990, actual enrollment for 1991 through 2001

Year	Entiat	Chelan	Cashmere	Cascade
1950 - 1951	420	873	1,049	1,184
1951 - 1952	416	876	1,056	1,187
1952 - 1953	411	880	1,063	1,191
1953 - 1954	407	883	1,069	1,195
1954 - 1955	402	887	1,076	1,199
1955 - 1956	398	890	1,083	1,203
1956 - 1957	401	893	1,089	1,206
1957 - 1958	375	897	1,096	1,210
1958 - 1959	420	900	1,103	1,214
1959 - 1960	415	904	1,110	1,218
1960 - 1961	375	907	1,116	1,222
1961 - 1962	374	920	1,122	1,223
1962 - 1963	392	933	1,128	1,224
1963 - 1964	351	946	1,134	1,225
1964 - 1965	337	959	1,140	1,226
1965 - 1966	331	972	1,146	1,227
1966 - 1967	315	985	1,152	1,228
1967 - 1968	299	998	1,158	1,229
1968 - 1969	313	1,011	1,164	1,230
1969 - 1970	330	1,024	1,170	1,232
1970 - 1971	323	1,037	1,176	1,233
1971 - 1972	305	1,041	1,186	1,241
1972 - 1973	298	1,044	1,195	1,249
1973 - 1974	288	1,048	1,205	1,258
1974 - 1975	289	1,051	1,215	1,266
1975 - 1976	285	1,055	1,224	1,274
1976 - 1977	276	1,059	1,234	1,283
1977 - 1978	253	1,062	1,243	1,291
1978 - 1979	244	1,066	1,253	1,300
1979 - 1980	224	1,069	1,262	1,308
1980 - 1981	247	1,073	1,272	1,316
1981 - 1982	238	1,098	1,282	1,321
1982 - 1983	234	1,106	1,296	1,324
1983 - 1984	255	1,109	1,302	1,327
1984 - 1985	243	1,119	1,311	1,332
1985 - 1986	246	1,138	1,318	1,348
1986 - 1987	247	1,140	1,336	1,351
1987 - 1988	251	1,145	1,343	1,358
1988 - 1989	262	1,141	1,344	1,359
1989 - 1990	271	1,146	1,359	1,385
1990 - 1991	285	1,150	1,376	1,392
1991 - 1992	309	1,107	1,272	1,267
1992 - 1993	319	1,105	1,319	1,334
1993 - 1994	359	1,197	1,434	1,475
1994 - 1995	359	1,193	1,440	1,485
1995 - 1996	364	1,270	1,473	1,559
1996 - 1997	365	1,287	1,537	1,537
1997 - 1998	379	1,311	1,552	1,543
1998 - 1999	383	1,310	1,542	1,543
1999 - 2000	388	1,257	1,514	1,497
2000 - 2001	382	1,274	1,462	1,450
2001 - 2002	369	1,265	1,488	1,474

Table C6.3: Student enrollment growth rates for Chelan, Cashmere, and Cascade School Districts

Year	Chelan Student Growth Rate	Cashmere Student Growth Rate	Cascade Student Growth Rate
1958-1959	1.00	1.00	1.00
1959-1960	1.00	1.01	1.00
1960-1961	1.01	1.01	1.01
1961-1962	1.02	1.02	1.01
1962-1963	1.04	1.02	1.01
1963-1964	1.05	1.03	1.01
1964-1965	1.07	1.03	1.01
1965-1966	1.08	1.04	1.01
1966-1967	1.09	1.04	1.01
1967-1968	1.11	1.05	1.01
1968-1969	1.12	1.06	1.01
1969-1970	1.14	1.06	1.01
1970-1971	1.15	1.07	1.02
1971-1972	1.16	1.08	1.02
1972-1973	1.16	1.08	1.03
1973-1974	1.16	1.09	1.04
1974-1975	1.17	1.10	1.04
1975-1976	1.17	1.11	1.05
1976-1977	1.18	1.12	1.06
1977-1978	1.18	1.13	1.06
1978-1979	1.18	1.14	1.07
1979-1980	1.19	1.14	1.08
1980-1981	1.19	1.15	1.08
1981-1982	1.22	1.16	1.09
1982-1983	1.23	1.17	1.09
1983-1984	1.23	1.18	1.09
1984-1985	1.24	1.19	1.10
1985-1986	1.26	1.20	1.11
1986-1987	1.27	1.21	1.11
1987-1988	1.27	1.22	1.12
1988-1989	1.27	1.22	1.12
1989-1990	1.27	1.23	1.14
1990-1991	1.28	1.25	1.15
1991-1992	1.23	1.15	1.04
1992-1993	1.23	1.20	1.10
1993-1994	1.33	1.30	1.21
1994-1995	1.33	1.31	1.22
1995-1996	1.41	1.34	1.28
1996-1997	1.43	1.39	1.27
1997-1998	1.46	1.41	1.27
1998-1999	1.46	1.40	1.27
1999-2000	1.40	1.37	1.23
2000-2001	1.41	1.33	1.19
2001-2002	1.41	1.35	1.21

Table C6.4 Actual Entiat student enrollment and alternative “but for the dam” enrollments

Year	Actual Entiat Enrollment	Entiat Enrollment Had Entiat Grown Like Chelan	Entiat Enrollment Had Entiat Grown Like Cashmere	Entiat Enrollment Had Entiat Grown Like Cascade
1958-1959	420	420	420	420
1959-1960	415	422	423	421
1960-1961	375	423	425	423
1961-1962	374	429	427	423
1962-1963	392	435	430	423
1963-1964	351	441	432	424
1964-1965	337	447	434	424
1965-1966	331	454	437	425
1966-1967	315	460	439	425
1967-1968	299	466	441	425
1968-1969	313	472	443	426
1969-1970	330	478	446	426
1970-1971	323	484	448	426
1971-1972	305	486	452	429
1972-1973	298	487	455	432
1973-1974	288	489	459	435
1974-1975	289	491	462	438
1975-1976	285	492	466	441
1976-1977	276	494	470	444
1977-1978	253	496	473	447
1978-1979	244	497	477	450
1979-1980	224	499	481	452
1980-1981	247	500	484	455
1981-1982	238	512	488	457
1982-1983	234	516	493	458
1983-1984	255	517	496	459
1984-1985	243	522	499	461
1985-1986	246	531	502	466
1986-1987	247	532	509	467
1987-1988	251	534	511	470
1988-1989	262	532	512	470
1989-1990	271	535	518	479
1990-1991	285	537	524	482
1991-1992	309	516	484	438
1992-1993	319	516	502	462
1993-1994	359	558	546	510
1994-1995	359	557	548	514
1995-1996	364	592	561	539
1996-1997	365	600	585	532
1997-1998	379	612	591	534
1998-1999	383	611	587	534
1999-2000	388	586	577	518
2000-2001	382	594	557	502
2001-2002	369	590	567	510

Table C6.5: Chelan County students by grade level (1996 – 2001)

Chelan County: Students by Grade Level

Year	K	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
1996	969	987	945	936	963	1020	1006	1035	1036	1141	1035	830	744
1997	913	1014	981	960	941	965	1047	1027	1057	1285	961	944	768
1998	909	993	1009	952	949	936	972	1076	1011	1287	1088	895	844
1999	970	928	986	1021	958	986	977	977	1071	1276	1074	962	802
2000	858	971	901	956	1004	952	993	975	1007	1311	1044	991	858
2001	888	928	944	909	967	1005	1013	1006	965	1229	1083	948	884
Proportion	7%	8%	8%	7%	8%	8%	8%	8%	8%	10%	8%	7%	6%

Grades K-3	Grade 4	Grades 5-6	Grades 7-8	Grades 9-12
30%	8%	15%	16%	32%

Table C6.6a: Estimated per-student State revenue base, 1956 through 1977

School Year	Actual State Revenue Received by Entiat (a)	Actual Entiat Enrollment (b)	Estimated Entiat Grades 9-12 Enrollment (c)	Washington OSPI Small-High Factor (d)	Estimated Per-Student State Revenue BASE (e)
1956-1957	\$95,052	401	127	1.37	\$173
1957-1958	\$97,847	375	118	1.42	\$184
1958-1959	\$107,078	420	133	1.34	\$191
1959-1960	\$118,010	415	131	1.34	\$208
1960-1961	\$118,144	375	118	1.42	\$222
1961-1962	\$120,279	374	118	1.42	\$226
1962-1963	\$122,413	382	124	1.36	\$225
1963-1964	\$124,547	351	111	1.46	\$241
1964-1965	\$126,681	337	106	1.51	\$249
1965-1966	\$128,815	331	104	1.53	\$254
1966-1967	\$130,949	315	99	1.58	\$263
1967-1968	\$138,132	299	94	1.63	\$283
1968-1969	\$151,820	313	99	1.58	\$306
1969-1970	\$171,448	330	104	1.53	\$339
1970-1971	\$189,284	323	102	1.55	\$377
1971-1972	\$176,875	305	96	1.61	\$360
1972-1973	\$174,499	298	94	1.63	\$358
1973-1974	\$179,702	288	91	1.67	\$373
1974-1975	\$201,409	289	91	1.67	\$418
1975-1976	\$269,786	285	90	1.68	\$563
1976-1977	\$276,058	276	87	1.72	\$582
1977-1978	\$279,769	253	80	1.82	\$609

Notes: (c) = (b) * 0.316

(d) = 5.464+0.029*(c)-0.779*sqrt(c)

(e) = (a)/[(b)*(d)]

Table C6.6b: Conversion of small-high factor into mathematical formula

Estimation of Mathematical Function of "Small-High" Weightings			
Washington provides higher per-student revenue to small school districts. These additional Weights are based on the number of students in grades 9 through 12.			
This regression allows us to convert the small-high table into a mathematical formula.			
Regression Data			
Small-High Weights	9-12 Enrollment	Sqrt(9-12 Enrol)	Predicted Weight
0.98	70	8.4	0.00
0.81	80	8.9	0.00
0.68	90	9.5	0.00
0.57	100	10.0	0.00
0.49	110	10.5	0.00
0.41	120	11.0	0.00
0.35	130	11.4	0.00
0.30	140	11.8	0.00
Regression Statistics			
Multiple R	0.9998		
St. Error	0.0053		
Obs.	8		
	Coefficients	St. Error	t Stat
Intercept	5.464	0.169	32.306
9-12 Enrollment	0.029	0.002	17.388
Sqrt(9-12 Enrollment)	-0.779	0.034	-23.083

Table C6.7: Entiat actual and alternative revenue from the State, 1956 – 2001 (not inflation adjusted)

Year	Actual Entiat Revenue from State	Revenue from State Had Entiat Grown Like Chelan	Revenue from State Had Entiat Grown Like Cashmere	Revenue from State Had Entiat Grown Like Cascade
1958-1959	\$107,078	\$107,078	\$107,078	\$107,078
1959-1960	\$116,010	\$116,956	\$117,098	\$116,917
1960-1961	\$118,144	\$125,126	\$125,431	\$125,041
1961-1962	\$120,279	\$128,439	\$128,142	\$127,441
1962-1963	\$122,413	\$129,040	\$128,121	\$127,115
1963-1964	\$124,547	\$138,730	\$137,066	\$135,663
1964-1965	\$126,681	\$144,501	\$142,053	\$140,259
1965-1966	\$128,815	\$149,132	\$145,857	\$143,666
1966-1967	\$130,949	\$155,672	\$151,461	\$148,821
1967-1968	\$138,132	\$168,713	\$163,279	\$160,038
1968-1969	\$151,820	\$183,946	\$177,058	\$173,114
1969-1970	\$171,448	\$205,333	\$196,554	\$191,696
1970-1971	\$189,284	\$230,614	\$219,511	\$213,551
1971-1972	\$176,875	\$220,618	\$210,506	\$204,549
1972-1973	\$174,499	\$219,863	\$210,300	\$204,106
1973-1974	\$179,702	\$229,851	\$220,401	\$213,651
1974-1975	\$201,409	\$257,980	\$247,997	\$240,106
1975-1976	\$269,786	\$348,006	\$335,394	\$324,316
1976-1977	\$276,058	\$361,112	\$348,926	\$336,974
1977-1978	\$279,769	\$378,508	\$366,695	\$353,679
1978-1979	\$537,397	\$841,749	\$817,600	\$784,689
1979-1980	\$500,419	\$939,495	\$915,324	\$877,623
1980-1981	\$589,182	\$1,068,861	\$1,044,361	\$1,000,516
1981-1982	\$629,069	\$1,198,813	\$1,158,249	\$1,106,314
1982-1983	\$648,820	\$1,279,566	\$1,239,022	\$1,176,237
1983-1984	\$747,819	\$1,322,722	\$1,283,627	\$1,216,312
1984-1985	\$796,978	\$1,388,515	\$1,345,327	\$1,271,895
1985-1986	\$821,731	\$1,455,416	\$1,398,739	\$1,328,396
1986-1987	\$973,850	\$1,484,725	\$1,437,993	\$1,354,945
1987-1988	\$1,013,837	\$1,544,267	\$1,496,262	\$1,409,280
1988-1989	\$1,107,534	\$1,603,354	\$1,558,905	\$1,468,692
1989-1990	\$1,181,583	\$1,686,609	\$1,647,488	\$1,559,468
1990-1991	\$1,315,834	\$1,782,343	\$1,751,366	\$1,650,138
1991-1992	\$1,396,863	\$1,806,615	\$1,726,311	\$1,611,013
1992-1993	\$1,442,537	\$1,858,601	\$1,824,379	\$1,719,331
1993-1994	\$1,447,042	\$2,028,126	\$1,995,299	\$1,900,336
1994-1995	\$1,499,040	\$2,075,092	\$2,052,612	\$1,958,492
1995-1996	\$1,620,175	\$2,234,472	\$2,145,981	\$2,085,640
1996-1997	\$1,614,220	\$2,322,845	\$2,279,692	\$2,125,074
1997-1998	\$1,715,508	\$2,409,303	\$2,349,272	\$2,179,766
1998-1999	\$1,764,280	\$2,445,958	\$2,374,235	\$2,214,537
1999-2000	\$1,795,715	\$2,423,883	\$2,393,776	\$2,214,608
2000-2001	\$1,826,116	\$2,530,102	\$2,411,584	\$2,236,983
2001-2002	\$1,830,294	\$2,589,341	\$2,512,302	\$2,327,440

Table C6.8: Difference in State revenue Entiat would have received, but for the dam, and did receive (not inflation adjusted)

Year	State Revenue Under CHELAN Growth Scenario Minus Actual Revenue Received by Entiat	State Revenue Under CASHMERE Growth Scenario Minus Actual Revenue Received by Entiat	State Revenue Under CASCADE Growth Scenario Minus Actual Revenue Received by Entiat
1958-1959	\$0	\$0	\$0
1959-1960	\$946	\$1,088	\$906
1960-1961	\$6,981	\$7,286	\$6,897
1961-1962	\$8,160	\$7,864	\$7,162
1962-1963	\$6,627	\$5,708	\$4,702
1963-1964	\$14,183	\$12,519	\$11,116
1964-1965	\$17,820	\$15,372	\$13,578
1965-1966	\$20,317	\$17,042	\$14,851
1966-1967	\$24,722	\$20,512	\$17,872
1967-1968	\$30,581	\$25,148	\$21,906
1968-1969	\$32,126	\$25,238	\$21,293
1969-1970	\$33,885	\$25,105	\$20,248
1970-1971	\$41,330	\$30,227	\$24,267
1971-1972	\$43,743	\$33,631	\$27,674
1972-1973	\$45,364	\$35,801	\$29,607
1973-1974	\$50,149	\$40,699	\$33,948
1974-1975	\$56,571	\$46,588	\$38,697
1975-1976	\$78,220	\$65,608	\$54,531
1976-1977	\$85,054	\$72,869	\$60,917
1977-1978	\$98,739	\$86,926	\$73,909
1978-1979	\$304,352	\$280,203	\$247,292
1979-1980	\$439,076	\$414,905	\$377,204
1980-1981	\$479,680	\$455,179	\$411,335
1981-1982	\$569,745	\$529,180	\$477,245
1982-1983	\$630,746	\$590,201	\$527,417
1983-1984	\$574,903	\$535,808	\$468,492
1984-1985	\$591,537	\$548,349	\$474,917
1985-1986	\$633,685	\$577,008	\$506,666
1986-1987	\$510,875	\$464,143	\$381,095
1987-1988	\$530,430	\$482,425	\$395,443
1988-1989	\$495,820	\$451,371	\$361,157
1989-1990	\$505,026	\$465,905	\$377,885
1990-1991	\$466,509	\$435,532	\$334,304
1991-1992	\$409,752	\$329,448	\$214,150
1992-1993	\$416,064	\$381,842	\$276,794
1993-1994	\$581,084	\$548,257	\$453,294
1994-1995	\$576,052	\$553,572	\$459,452
1995-1996	\$614,297	\$525,805	\$465,465
1996-1997	\$708,625	\$665,471	\$510,853
1997-1998	\$693,795	\$633,764	\$464,258
1998-1999	\$681,677	\$609,955	\$450,256
1999-2000	\$628,167	\$598,061	\$418,893
2000-2001	\$703,986	\$585,468	\$410,867
2001-2002	\$759,046	\$682,008	\$497,146

Table C6.9: Entiat actual number of teachers and estimated number of teachers required for each scenario

Year	Entiat Actual Number Of Teachers	Number of Teachers Had Entiat Grown Like Chelan	Number of Teachers Had Entiat Grown Like Cashmere	Number of Teachers Had Entiat Grown Like Cascade
1958-1959	17	16	16	16
1959-1960	17	16	16	16
1960-1961	15	16	16	16
1961-1962	15	17	16	16
1962-1963	15	17	17	16
1963-1964	15	17	17	16
1964-1965	15	17	17	16
1965-1966	15	17	17	16
1966-1967	15	18	17	16
1967-1968	16	18	17	16
1968-1969	16	18	17	16
1969-1970	16	18	17	16
1970-1971	15	19	17	16
1971-1972	16	19	17	17
1972-1973	16	19	18	17
1973-1974	16	19	18	17
1974-1975	16	19	18	17
1975-1976	15	19	18	17
1976-1977	16	19	18	17
1977-1978	15	19	18	17
1978-1979	15	23	22	20
1979-1980	14	23	22	21
1980-1981	14	23	22	21
1981-1982	13	23	22	21
1982-1983	13	23	22	21
1983-1984	14	24	23	21
1984-1985	14	24	23	21
1985-1986	15	24	23	21
1986-1987	15	24	23	21
1987-1988	15	24	23	21
1988-1989	15	24	23	21
1989-1990	15	24	24	22
1990-1991	16	24	24	22
1991-1992	16	23	22	20
1992-1993	15	23	23	21
1993-1994	18	25	25	23
1994-1995	20	25	25	23
1995-1996	19	27	25	25
1996-1997	19	27	27	24
1997-1998	21	28	27	24
1998-1999	21	28	27	24
1999-2000	22	27	26	24
2000-2001	21	27	25	23
2001-2002	21	27	26	23

Table C6.10: Average annual Entiat teacher salary

Year	Average Annual Teacher Salary (nominal dollars)
1956-1957	\$4,183
1957-1958	\$4,413
1958-1959	\$4,643
1959-1960	\$4,873
1960-1961	\$5,089
1961-1962	\$5,305
1962-1963	\$5,521
1963-1964	\$5,737
1964-1965	\$5,953
1965-1966	\$6,381
1966-1967	\$6,809
1967-1968	\$7,237
1968-1969	\$7,666
1969-1970	\$8,094
1970-1971	\$8,843
1971-1972	\$9,593
1972-1973	\$10,342
1973-1974	\$11,092
1974-1975	\$11,841
1975-1976	\$11,841
1976-1977	\$11,841
1977-1978	\$11,841
1978-1979	\$11,841
1979-1980	\$14,527
1980-1981	\$16,353
1981-1982	\$18,178
1982-1983	\$20,003
1983-1984	\$21,829
1984-1985	\$23,654
1985-1986	\$25,060
1986-1987	\$26,466
1987-1988	\$27,871
1988-1989	\$29,277
1989-1990	\$30,683
1990-1991	\$31,910
1991-1992	\$33,137
1992-1993	\$34,365
1993-1994	\$35,592
1994-1995	\$36,819
1995-1996	\$37,115
1996-1997	\$37,411
1997-1998	\$37,707
1998-1999	\$38,003
1999-2000	\$38,299
2000-2001	\$41,774
2001-2002	\$45,250

Table C6.11: Average annual Entiat teacher benefits costs

Year	Medical Care Consumer Price Index Annual - All Urban Consumers, U.S. City Average	Medical Care CPI Index (2002 = 1)	Estimated Per Teacher Medical Care Cost
1956	18.9	0.07	\$680
1957	19.7	0.07	\$709
1958	20.6	0.07	\$741
1959	21.5	0.08	\$774
1960	22.3	0.08	\$802
1961	22.9	0.08	\$824
1962	23.5	0.08	\$845
1963	24.1	0.08	\$867
1964	24.6	0.09	\$885
1965	25.2	0.09	\$907
1966	26.3	0.09	\$946
1967	28.2	0.10	\$1,015
1968	29.9	0.10	\$1,076
1969	31.9	0.11	\$1,148
1970	34	0.12	\$1,223
1971	36.1	0.13	\$1,299
1972	37.3	0.13	\$1,342
1973	38.8	0.14	\$1,396
1974	42.4	0.15	\$1,525
1975	47.5	0.17	\$1,709
1976	52	0.18	\$1,871
1977	57	0.20	\$2,051
1978	61.8	0.22	\$2,223
1979	67.5	0.24	\$2,429
1980	74.9	0.26	\$2,695
1981	82.9	0.29	\$2,983
1982	92.5	0.32	\$3,328
1983	100.6	0.35	\$3,619
1984	106.8	0.37	\$3,842
1985	113.5	0.40	\$4,083
1986	122	0.43	\$4,389
1987	130.1	0.46	\$4,681
1988	138.6	0.49	\$4,987
1989	149.3	0.52	\$5,372
1990	162.8	0.57	\$5,857
1991	177	0.62	\$6,368
1992	190.1	0.67	\$6,839
1993	201.4	0.71	\$7,246
1994	211	0.74	\$7,591
1995	220.5	0.77	\$7,933
1996	228.2	0.80	\$8,210
1997	234.6	0.82	\$8,440
1998	242.1	0.85	\$8,710
1999	250.6	0.88	\$9,016
2000	260.8	0.91	\$9,383
2001	272.8	0.96	\$9,815
2002	285.6	1.00	\$10,275

Table C6.12: Estimated additional costs associated with alternative enrollment scenarios

Year	Additional Costs Under CHELAN Growth Scenario	Additional Costs Under CASHMERE Growth Scenario	Additional Costs Under CASCADE Growth Scenario
1958-1959	-\$4,115	-\$4,115	-\$4,115
1959-1960	-\$4,002	-\$3,809	-\$4,055
1960-1961	\$7,081	\$7,485	\$6,968
1961-1962	\$8,851	\$8,452	\$7,497
1962-1963	\$10,600	\$9,325	\$7,900
1963-1964	\$12,963	\$10,743	\$8,814
1964-1965	\$15,315	\$12,081	\$9,612
1965-1966	\$17,758	\$13,441	\$10,399
1966-1967	\$20,525	\$15,058	\$11,410
1967-1968	\$20,618	\$13,729	\$9,310
1968-1969	\$24,030	\$15,568	\$10,300
1969-1970	\$27,800	\$17,594	\$11,386
1970-1971	\$36,924	\$24,838	\$17,626
1971-1972	\$35,451	\$23,378	\$15,486
1972-1973	\$39,394	\$27,010	\$18,123
1973-1974	\$43,982	\$31,412	\$21,482
1974-1975	\$48,941	\$36,345	\$25,356
1975-1976	\$63,151	\$50,639	\$38,534
1976-1977	\$62,859	\$50,484	\$37,141
1977-1978	\$74,730	\$63,217	\$49,300
1978-1979	\$168,104	\$155,568	\$138,457
1979-1980	\$217,097	\$205,646	\$187,838
1980-1981	\$233,389	\$223,062	\$204,552
1981-1982	\$311,167	\$292,447	\$268,481
1982-1983	\$356,980	\$337,188	\$306,540
1983-1984	\$345,076	\$324,503	\$289,155
1984-1985	\$374,686	\$350,716	\$309,948
1985-1986	\$390,565	\$357,416	\$316,270
1986-1987	\$379,987	\$350,974	\$299,426
1987-1988	\$403,369	\$372,907	\$317,660
1988-1989	\$407,502	\$378,826	\$320,682
1989-1990	\$429,319	\$403,886	\$346,779
1990-1991	\$404,318	\$384,266	\$318,621
1991-1992	\$371,938	\$319,362	\$243,923
1992-1993	\$422,485	\$399,737	\$329,783
1993-1994	\$436,953	\$414,721	\$350,507
1994-1995	\$362,333	\$346,919	\$282,144
1995-1996	\$493,336	\$431,832	\$389,870
1996-1997	\$545,071	\$514,902	\$406,637
1997-1998	\$479,592	\$437,886	\$320,223
1998-1999	\$479,848	\$430,252	\$319,585
1999-2000	\$371,772	\$351,136	\$228,398
2000-2001	\$456,625	\$377,083	\$259,967
2001-2002	\$465,623	\$414,760	\$292,526

Table C6.13: Foregone revenue minus foregone costs (not inflation adjusted)

Year	Revenue from State Had Entiat Grown Like Chelan	Revenue from State Had Entiat Grown Like Cashmere	Revenue from State Had Entiat Grown Like Cascade
1958-1959	\$4,115	\$4,115	\$4,115
1959-1960	\$4,947	\$4,897	\$4,962
1960-1961	-\$100	-\$199	-\$72
1961-1962	-\$690	-\$588	-\$336
1962-1963	-\$3,973	-\$3,616	-\$3,197
1963-1964	\$1,220	\$1,776	\$2,302
1964-1965	\$2,505	\$3,291	\$3,966
1965-1966	\$2,558	\$3,601	\$4,452
1966-1967	\$4,197	\$5,454	\$6,462
1967-1968	\$9,963	\$11,419	\$12,597
1968-1969	\$8,096	\$9,669	\$10,993
1969-1970	\$6,085	\$7,512	\$8,862
1970-1971	\$4,407	\$5,389	\$6,641
1971-1972	\$8,293	\$10,253	\$12,189
1972-1973	\$5,970	\$8,792	\$11,484
1973-1974	\$6,167	\$9,287	\$12,466
1974-1975	\$7,630	\$10,243	\$13,341
1975-1976	\$15,069	\$14,969	\$15,996
1976-1977	\$22,196	\$22,385	\$23,775
1977-1978	\$24,009	\$23,709	\$24,609
1978-1979	\$136,248	\$124,635	\$108,834
1979-1980	\$221,979	\$209,258	\$189,366
1980-1981	\$246,291	\$232,118	\$206,783
1981-1982	\$258,578	\$236,733	\$208,764
1982-1983	\$273,766	\$253,013	\$220,877
1983-1984	\$229,826	\$211,304	\$179,337
1984-1985	\$216,851	\$197,633	\$164,970
1985-1986	\$243,120	\$219,592	\$190,396
1986-1987	\$130,887	\$113,169	\$81,668
1987-1988	\$127,061	\$109,518	\$77,783
1988-1989	\$88,317	\$72,545	\$40,476
1989-1990	\$75,708	\$62,018	\$31,106
1990-1991	\$62,191	\$51,266	\$15,683
1991-1992	\$37,814	\$10,086	-\$29,773
1992-1993	-\$6,422	-\$17,895	-\$52,989
1993-1994	\$144,131	\$133,536	\$102,787
1994-1995	\$213,719	\$206,653	\$177,308
1995-1996	\$120,961	\$93,973	\$75,594
1996-1997	\$163,553	\$150,570	\$104,216
1997-1998	\$214,202	\$195,878	\$144,035
1998-1999	\$201,830	\$179,702	\$130,672
1999-2000	\$256,395	\$246,925	\$190,494
2000-2001	\$247,360	\$208,385	\$150,899
2001-2002	\$293,424	\$267,248	\$204,620

Table C6.14: Foregone revenue minus foregone costs (discounted to 2002 dollars using 6-month U.S. Treasury-bill index)

Year	Revenue from State Had Entiat Grown Like Chelan	Revenue from State Had Entiat Grown Like Cashmere	Revenue from State Had Entiat Grown Like Cascade
1958-1959	\$57,180	\$57,180	\$57,180
1959-1960	\$66,226	\$65,550	\$66,415
1960-1961	-\$1,286	-\$2,567	-\$924
1961-1962	-\$8,576	-\$7,303	-\$4,167
1962-1963	-\$47,528	-\$43,263	-\$38,248
1963-1964	\$14,141	\$20,584	\$26,687
1964-1965	\$28,306	\$37,188	\$44,812
1965-1966	\$28,092	\$39,544	\$48,879
1966-1967	\$44,632	\$57,999	\$68,713
1967-1968	\$102,186	\$117,110	\$129,193
1968-1969	\$79,795	\$95,306	\$108,358
1969-1970	\$57,087	\$70,471	\$83,139
1970-1971	\$39,516	\$48,326	\$59,553
1971-1972	\$70,505	\$87,174	\$103,629
1972-1973	\$47,497	\$69,949	\$91,373
1973-1974	\$46,067	\$69,378	\$93,125
1974-1975	\$54,537	\$73,216	\$95,358
1975-1976	\$103,085	\$102,400	\$109,428
1976-1977	\$141,641	\$142,848	\$151,722
1977-1978	\$141,946	\$140,173	\$145,496
1978-1979	\$759,311	\$694,592	\$606,535
1979-1980	\$1,176,355	\$1,108,000	\$1,002,876
1980-1981	\$1,235,777	\$1,164,661	\$1,037,542
1981-1982	\$1,205,973	\$1,104,092	\$973,650
1982-1983	\$1,160,130	\$1,072,185	\$936,006
1983-1984	\$874,544	\$804,063	\$682,421
1984-1985	\$725,111	\$660,849	\$551,629
1985-1986	\$731,952	\$661,118	\$573,218
1986-1987	\$362,410	\$313,351	\$226,129
1987-1988	\$320,544	\$276,286	\$196,227
1988-1989	\$206,966	\$170,005	\$94,853
1989-1990	\$167,326	\$137,071	\$68,749
1990-1991	\$129,635	\$106,863	\$32,691
1991-1992	\$73,726	\$19,664	-\$58,048
1992-1993	-\$11,589	-\$32,296	-\$95,631
1993-1994	\$242,077	\$224,283	\$172,638
1994-1995	\$340,433	\$329,178	\$282,434
1995-1996	\$186,079	\$144,563	\$116,290
1996-1997	\$243,982	\$224,614	\$155,465
1997-1998	\$305,391	\$279,266	\$205,352
1998-1999	\$272,580	\$242,696	\$176,478
1999-2000	\$329,531	\$317,359	\$244,831
2000-2001	\$302,271	\$254,644	\$184,397
2001-2002	\$342,045	\$311,532	\$238,525
Total Past	\$12,623,203	\$11,707,171	\$9,921,182
Total Future	\$4,478,490	\$4,056,215	\$3,029,062
Total foregone state education revenue	\$17,101,694	\$15,763,386	\$12,950,244

Comparison of Methods to McHugh Report

In many ways our methodology is similar to that of the McHugh report, Like the McHugh report we use consistent and reliable measures of economic growth and municipal revenue such as assessed property values and property and sales-type taxes. However, tactically our methodology differs substantially from the McHugh report in many ways. These differences are described in the following points.

COMPARABLE ENTITIES

- The McHugh report compares the change over time in total assessed value of Entiat to that of the city of Cashmere and Chelan County.
- This analysis compares the changes over time in the per capita assessed value of Entiat to that of the most reasonably comparable Chelan County Municipalities; Leavenworth, Chelan, and Cashmere.

TRANSPARENCY

- The McHugh report includes a seemingly intractable formula that “adjusts” Entiat property values to what it might have been if the dam had not been built. The formula used in the McHugh analysis is (reportedly) based on the growth rates of Cashmere and Chelan County.
- This analysis adjusts Entiat property values for multiple scenarios of what it might have been had not the dam been built. Each scenario is based directly on the assessed value growth rate of Cashmere, Chelan, or Leavenworth (or associated school district). We do not believe that any one scenario is exactly correct, but we are confident that this method does result in a more robust estimate than does the McHugh analysis.

TIME VALUE OF MONEY

- The McHugh report includes an apparent error in its calculation of present value. It is stated in paragraph four, page A-46 of the McHugh report, that the differences in property tax collections between 1959 and 2001 sum to \$1.1 million in 1999 dollars (based on the All Urban CPI). The McHugh report could have stopped with this sum and attempted to defend the use of the CPI as the appropriate vehicle for discounting the yearly tax collection differences. However, the report goes on to state that the NPV of this already discounted sum of yearly differences is calculated by assuming a 3 percent real rate of return. Based on their calculations the NPV is \$506,847. The mistake is this: the real rate of return should be in addition to the nominal rate of

return (based on the CPI). The NPV assuming a 3 percent real rate of return is actually \$1.7 million.

- This is done when they discount values presented in 1999 dollars back to 1959 dollars. By doing so, they cut in half their estimated value of the damage to Entiat from the flooding of Entiat.

FUTURE DAMAGES

- The McHugh report neglects to include future damage to the City of Entiat from the flooding of the town. The damage estimate from the McHugh report includes only past damage. Making Entiat whole for the damages caused it by the reservoir requires compensation for all past and all future damages.
- This analysis includes compensation for future damages.

DISCOUNTING

- The McHugh report neglects to include any discounting rate of return for the tax revenue that Entiat has foregone.
- This analysis uses the 6-month Treasury bill Rate to discount the foregone tax revenue due to the construction of Rocky Reach Reservoir. The 6-month Treasury bill rate is a conservative estimate of the rate of return that the city of Entiat would have received had it invested the tax revenue in the city or in Treasury bills.

ALL DAMAGES

- The McHugh report apparently stops with estimated damage to the City from lost property tax collections.
- This analysis includes estimated damage to the City and School District from lost property tax collections, lost sales tax collections, lost real estate excise tax (REET), lost hotel / motel tax, and from lost state revenue for K-12 education..

Limitations of the Analysis

At several places in the body of this report we have made the same point: looking back over 40 years to estimate economic impacts, and then looking forward 40 years to estimate how those impacts might continue, is a difficult analytical task. One must admit that it is speculative: by definition, the analysis must describe a past that did not occur (the one that is the best estimate of what would have occurred, but for the impact of the dam) and a future that has not yet occurred.

The fact that such estimates are difficult and imprecise does not make the impacts being estimated, or the need for those estimates, any less real. It does mean, however, that the data and assumptions used to create any past or future estimates of impacts must be documented so that people trying to use the analysis can make decisions about the validity of the estimates based in part on their assessment of the validity of the analysis: the theory, data, analytical techniques, and assumptions.

ECONorthwest has made every effort to document those assumptions within the constraints of the schedule and budget we were given. Clearly, more technical work could be done—that is always the case.

More critical are the assumptions about how the damages to the City and School District should be measured in the first place. We have used lost revenues as a measure, and provided reasons to justify that decision. An alternative, beyond the scope of this analysis, would be to do much more detailed work to estimate how the dam created special costs to the City and District.

It is our opinion that the analysis we have presented meets or exceeds professional standards for this type of analysis, and exceeds the quality of any analysis to date of the impacts on Entiat. It must, nonetheless, be treated as an estimate, subject to the limitations we have listed here and discussed elsewhere in the report.

About the Authors

ECONorthwest specializes in the economic and financial analysis of public policy. In over 25 years of operation, ECO has completed over 1,500 projects for public and private clients. ECO has a staff of 35, with corporate headquarters in Eugene, Oregon and offices in Portland, Oregon and Seattle, Washington.

ECO's policy analysis is informed by an understanding of the local, regional, and national economy and by the principles and techniques of applied microeconomics. In addition to providing thorough technical analysis, ECO's staff also incorporates into its projects sensitivity toward procedural issues and works with advisory groups and the public to ensure that its recommendations are technically correct, institutionally feasible, and politically realistic. In all cases ECO's descriptive, explanatory, and predictive analyses are targeted toward helping clients plan for future growth, estimate the effects of proposed projects or policies, and take informed actions necessary to avert or mitigate potential difficulties.

Terry Moore, FAICP, has been a vice president and project manager at ECONorthwest since 1979. Moore received an undergraduate degree in Environmental Engineering from Stanford, and master's degrees in both Urban Planning and Public Administration from the University of Oregon. He is an adjunct professor in the Department of Planning, Public Policy, and management at the University of Oregon. Moore has managed projects in economic development, growth management, transportation, and land-use planning, policy analysis, and market and feasibility analysis for private and public clients.

Moore has managed large regional planning projects that have emphasized land use, growth management, economic development, and natural resources. His specialization is urban economics and benefit-cost analysis. He has written a book for the American Planning Association on urban economics (and how economic forces influence land use and transportation development in urban areas) and on the application of the economic principles of benefit-cost analysis to the evaluation of transit projects (for the National Academy of Sciences). He is a fellow of the Lincoln Institute of Land Policy, and a frequent speaker at Institute training sessions on "Land Market Monitoring" (as well as a contributor to a recent book published by the Institute on that topic).

His work is not limited to planning: it also includes dozens of projects relating to real estate market analysis. He has managed over 400 planning projects, has published an article on project management in the Journal of the American Planning Association, and has been invited by the American Planning Association to provide workshops on project management at national APA conferences.

Mike Gleason, an ECO associate since 1993, has 30 years of management experience in local government. He was awarded the 1995 International City/County Managers Association's Award for Career Excellence. He was City Manager of Eugene from 1981 to 1996, responsible for all day-to-day operations of the City including regional public works, the municipal airport, land use and transportation policy and planning, and economic development. Gleason has been executive director of two Urban Renewal Authorities, and was responsible for initiating and developing downtown plans for Eugene, Walla Walla, and Santa Rose (CA).

Ted Helvoigt joined ECONorthwest in 2002 as a research economist. He has a B.S. in Business Administration from Ashland University and a M.S. in Resource Economics from the University of Montana. Helvoigt previously worked as an economist for the State of Oregon, where he was responsible for survey design and analysis, econometric analyses of regional and state employment trends, and report writing. More recently, he worked as an economist/manager for American Express in their International Risk Management department. In this position he was responsible for all underwriting and risk analysis pertaining to consumer and small business card acquisition for Australia, New Zealand and Thailand.

ROCKY REACH SETTLEMENT AGREEMENT

Final

**ROCKY REACH HYDROELECTRIC PROJECT
FERC Project No. 2145**

February 3, 2006



**Public Utility District No. 1 of Chelan County
Wenatchee, Washington**

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Rocky Reach Hydroelectric Project Settlement Agreement

SECTION 1: Parties

- 1.1 This Settlement Agreement (Agreement) is entered into this 1st day of February, 2006, between and among Public Utility District No. 1 of Chelan County, Washington (Chelan PUD), the U.S. Fish and Wildlife Service (USFWS), the U.S. Bureau of Land Management (BLM), the Washington State Department of Fish and Wildlife (WDFW), the Washington State Department of Ecology (Ecology), the Washington State Parks and Recreation Commission, the Confederated Tribes of the Colville Reservation (CCT), the City of Entiat, and Alcoa Power Generating Inc.
- 1.2 The following entities are encouraged to sign this Agreement: the Columbia River Inter-Tribal Fish Commission (CRITFC), the Confederated Tribes and Bands of the Yakama Nation (YN), and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR). Any of these entities may become Parties to this Agreement by executing a signature page and submitting it to Chelan PUD and to the Federal Energy Regulatory Commission (FERC) within 60 days after the effective date of this Agreement. For the first 60 days after the effective date of this Agreement, each of these entities may participate as members of the forums in the same manner as Parties but shall have no other rights or remedies under this Agreement unless and until they execute a signature page and submit it to Chelan PUD and FERC.
- 1.3 No later than December 31, 2006, additional entities may become Parties to this Agreement with the unanimous consent of all Parties and by executing a signature page and submitting it to Chelan PUD and FERC.
- 1.4 This Agreement shall be binding on, and inure to the benefit of, the above-listed Parties and their successors and assigns, unless otherwise specified in this Agreement.

SECTION 2: Recitals

- 2.1 The Rocky Reach Hydroelectric Project (Project) is located on the Columbia River in Chelan and Douglas Counties, Washington, approximately seven miles upstream of Wenatchee, Washington. The Project generally consists of the Rocky Reach Dam, spillway, powerhouse, non-overflow structures; upstream and downstream fish passage facilities, visitor facilities at the dam, recreational facilities on the Project reservoir, and waters and lands within the Project boundary. The run-of-river concrete gravity dam is 130 feet high and includes a spillway with 12 gates, each 50 feet wide, which regulate the surface elevation of the reservoir. The powerhouse is 1,088 feet long, 210 feet wide

and 218 feet high and contains eleven generating units, with an installed capacity of 865.76 MW.

- 2.2 On July 11, 1957, the predecessor to the FERC, the Federal Power Commission, issued the existing 50-year Project license, made retroactive to July 1, 1956. The dam was completed and the initial seven generating units were placed in commercial operation on November 1, 1961. The license will remain in effect until June 30, 2006.
- 2.3 On September 1, 1966, Chelan PUD filed an application with the Federal Power Commission to amend the Project license for the addition of four generating units. The Federal Power Commission issued the license amendment on May 23, 1968. The second phase of construction was completed on December 1, 1971.
- 2.4 In March 1979, in response to petitions from tribes and other entities, FERC initiated a consolidated proceeding on juvenile fish protection for the Mid-Columbia hydroelectric projects, including the Project. Under the Mid-Columbia Proceeding, Chelan PUD agreed to a series of interim settlement agreements that provided for spill, hatchery compensation, and studies to improve fish protection. The last interim settlement for the Project, the Fourth Revised Interim Stipulation, expired on December 31, 1996. In 1993, Chelan PUD and others parties to the Mid-Columbia Proceeding began discussing the possibility of developing a long-term, comprehensive program for managing fish and wildlife in the Mid-Columbia River Basin. As a result, in April 2002, Chelan PUD, the National Marine Fisheries Service (NMFS), USFWS, WDFW, and the CCT signed the Rocky Reach Anadromous Fish Agreement and Habitat Conservation Plan (HCP Agreement).

The HCP Agreement was designed to protect Mid-Columbia River Basin spring Chinook and steelhead, summer and fall Chinook, sockeye, and coho salmon, and intended to “contribute to the rebuilding of tributary habitat production capacity and basic productivity and numerical abundance” of such species (HCP Agreement at 1). The HCP Agreement was submitted to FERC on November 24, 2003, and on June 21, 2004, FERC issued an order (HCP Order, 107 FERC ¶ 61,281) approving the HCP Agreement as an offer of settlement and adopting it as an amendment to the existing Project license. In doing so, FERC found the HCP Agreement “will serve the public interest by putting into place a long term program to aid in the recovery of threatened and endangered species and to help prevent other salmonids from becoming listed.” (HCP Order at 1).

- 2.5 On October 25, 1999, FERC approved Chelan PUD’s request to use the collaborative alternative relicensing procedures for the preparation of its license application for the Project, and to use an applicant-prepared preliminary draft environmental assessment (PDEA) in lieu of the Exhibit E environmental report. As part of the alternative licensing process, more than 1600 entities, including the Parties to this Agreement, have requested relicensing-related information from Chelan PUD, and over 60 individuals have directly participated to varying degrees in the settlement process. To manage the process, Chelan PUD and interested stakeholders formed technical working groups to address water quality issues, wildlife and botanical issues, recreation issues, cultural and

historic issues, and fisheries issues (including sub-working groups to address resident fish, bull trout, white sturgeon, and Pacific lamprey).

- 2.6 Settlement negotiations formally began on June 23, 2003. With the assistance of a facilitator selected and approved by the relicensing stakeholders, the Parties were actively engaged in settlement meetings on a regular and increasingly frequent basis throughout 2004 and 2005. In addition to settlement meetings, the technical working groups collectively have held more than 85 meetings since January, 2004, to identify and analyze ongoing Project-related impacts and develop comprehensive management plans to address such impacts.

Chelan PUD filed an application for a New License and a PDEA with FERC on June 29, 2004. On January 12, 2005, FERC issued a notice accepting Chelan PUD's application to relicense the Project. This notice set a 60-day period during which interventions and comments, as well as terms, conditions, prescriptions, and recommendations, could be filed. The following entities filed comments, terms and conditions, prescriptions, recommendations, and/or motions to intervene: U.S. Department of Agriculture, U.S. Department of the Interior, NMFS, WDFW, the Entiat School District No. 127, City of Entiat, Washington, Alcoa Power Generating Inc., American Rivers, Avista Corporation, CRITFC, Confederated Tribes of the Umatilla Indian Reservation, Ecology, YN, and Portland General Electric Company.

Chelan PUD filed responses to the comments, terms, conditions, prescriptions, and recommendations on April 27, 2005; May 11, 2005; and July 15, 2005, and FERC issued a Draft Environmental Impact Statement in August, 2005.

SECTION 3: Definitions

- 3.1 "Adaptive Management" means an iterative and rigorous process used to improve decision-making in the face of uncertainty. In the context of the Rocky Reach relicensing, it is intended to improve the management of natural resources affected by ongoing Project operations, in order to achieve desired goals and objectives as effectively and efficiently as possible, within the provisions of this Agreement. The process has seven steps:
- a) Develop initial hypotheses regarding any ongoing Project impacts and potential remedial measures;
 - b) Develop goals and objectives for addressing any such impacts;
 - c) Develop and implement appropriate and reasonable measures in accordance with an established schedule;
 - d) Develop or identify monitoring and evaluation methodologies for determining whether such goals and objectives have been achieved;
 - e) Monitor and evaluate the implementation of such measures and their effectiveness toward achieving such goals and objectives;
 - f) Review monitoring and evaluation efforts; and

- g) Confirm that such goals and objectives have been achieved or, if not achieved, evaluate additional or revised measures, including those previously considered in the Comprehensive Plan, and implement any additional or revised appropriate and reasonable measures, or explain why such goals and objectives cannot be achieved. If such goals and objectives have not been achieved, the Rocky Reach Fish Forum (RRFF; see Section 15) may reevaluate and revise such goals and objectives.
- 3.2 “Agency” or “Agencies” means USFWS, WDFW, BLM, and Ecology.
- 3.3 “Agreement” means this document, as well as the Proposed License Articles attached as Attachment A, the Comprehensive Plan, attached as Attachment B, and the Clean Water Act (CWA) Section 401 certification issued by Ecology. In the event of a conflict between this document and either the Proposed License Articles or the Comprehensive Plan, this document shall control. In the event of a conflict between the Proposed License Articles and the Comprehensive Plan, the Comprehensive Plan shall control.
- 3.4 “Comprehensive Plan” means the comprehensive plan proposed by the Parties to FERC in this Agreement, and contained in Attachment B hereto.
- 3.5 “Consensus” is defined in Section 15.1.6 and 15.6.6.
- 3.6 “Estimated Cost” means an amount of money that the Parties anticipate will be necessary to complete an identified activity or measure. The dollar figure provided shall be adjusted for inflation and serve as one of the guides to the scope of work intended by the Parties, in the event that the Parties disagree as to the intended scope of work during the term of this Agreement. The Estimated Cost does not define the total cost of the work, establish a limit on the costs necessary to accomplish the intended scope of work, or limit the Parties’ obligations to comply with this Agreement.
- 3.7 “FERC” means the Federal Energy Regulatory Commission.
- 3.8 “HCP Agreement” means the Rocky Reach Anadromous Fish Agreement and Habitat Conservation Plan approved by FERC on June 21, 2004, (HCP Order, 107 FERC ¶ 61,281) as an amendment to the original Project license.
- 3.9 “Licensee” means Public Utility District No. 1 of Chelan County, Washington or any successor to whom the New License is transferred.
- 3.10 “Make available” means that Chelan PUD shall provide funds to an Agency or other specified entity pursuant to a mutually acceptable payment agreement entered into pursuant to the requirements of Section 18.
- 3.11 “New License” means the license to be issued by FERC for the continued operation and maintenance of the Project, pursuant to the Federal Power Act (FPA).

- 3.12 “Parties” means the entities that sign this Agreement.
- 3.13 “Plan Species” means spring, summer and fall Chinook salmon (*Oncorhynchus tshawytscha*), sockeye salmon (*O. nerka*), coho salmon (*O. kisutch*), and steelhead (*O. mykiss*).
- 3.14 “Project” means the Rocky Reach Hydroelectric Project, licensed to Chelan PUD by FERC as Project No. 2145.
- 3.15 “Proposed License Articles” means license articles proposed by the Parties to FERC in this Agreement, and contained in Attachment A hereto.

SECTION 4: Purpose, Effect, and Limitations of this Agreement

- 4.1 **Purpose.** The Parties agree that the purpose of this Agreement is to resolve all issues related to compliance with all federal and state law applicable to the issuance of a New License for the Project. Subject to the reservations of authority in Section 11 of this Agreement, this Agreement establishes Chelan PUD’s obligations for the protection, mitigation, and enhancement of resources affected by ongoing Project operations under the New License and its obligations to comply with all federal and state law applicable to the issuance of the New License for the Project. It also specifies procedures to be used by the Parties to ensure that the New License is implemented consistent with this Agreement and other law. The Parties agree that this Agreement is fair, reasonable, and in the public interest within the meaning of FERC Rule 602, 18 C.F.R. § 385.602(g)(3).
- 4.2 **Effect: Satisfaction of Relicensing Requirements.** Subject to the reservations of authority in Section 11 of this Agreement, the Parties intend that Chelan PUD’s performance of its obligations under this Agreement and the CWA Section 401 certification will satisfy all federal and state law applicable to the issuance of a New License for the Project.
- 4.3 **Limitations.**
- 4.3.1 **No Precedent.** The terms of this Agreement establish no precedent regarding any other pending or future licensing proceeding in which any Party may participate, and this Agreement shall not be offered in evidence in any pending or future proceeding in which a Party participates, except in a proceeding to establish the existence or validity of, or to defend, implement, or enforce, this Agreement. This Section 4.3.1 shall be binding on any Party that withdraws from this Agreement, and shall survive termination of this Agreement.
- 4.3.2 **Federal Trust Responsibility and Treaty Rights.** Nothing in this Agreement abridges, limits, creates, expands, diminishes, abrogates, adjudicates, acknowledges, or resolves any Tribal or Indian right reserved or protected in any

treaty, executive order, statute, court decree, federal trust responsibility, or other federal law.

- 4.3.3 **Federal Water Rights.** Nothing in this Agreement affects any federal reserved or state-based water rights that the United States may have in the Columbia River or its tributaries.
- 4.3.4 **Disclaimer.** The Parties have conducted a sufficient review of the facts to execute and support this Agreement consistent with their statutory obligations. However, the Parties do not necessarily approve of all the statements or analyses (including, without limitation, interpretations of data, studies, and law) contained in the Comprehensive Plan and documents referenced therein. This disclaimer does not provide any Party a basis for withdrawing from or seeking to modify this Agreement.
- 4.3.5 **No Predetermination of Outcome.** This Agreement shall not be interpreted to predetermine the outcome of any Agency's environmental review or regulatory process.
- 4.3.6 **Trial-Type Hearing.** Each Party reserves any right it may have to a trial-type hearing pursuant to Sections 4(e) and 18 of the FPA, or to propose alternative conditions or prescriptions under Section 33 of the FPA, if an Agency (a) exercises any authority it may have under Sections 4(e) or 18 of the FPA in a manner that is materially inconsistent with this Agreement, or (b) exercises any reserved authority it may have under Sections 4(e) or 18 of the FPA after the New License is issued. However, no Party may propose alternative conditions or prescriptions pursuant to Section 33 of the FPA as to terms and conditions that are consistent with this Agreement. In addition, no Party may seek a trial-type hearing regarding material facts relating to any condition or prescription that is consistent with this Agreement. Upon submittal of this Agreement to FERC, Chelan PUD's Alternative Section 18 Prescription to the Department of the Interior, dated December 19, 2005, shall be deemed withdrawn.

SECTION 5: Term of License and this Agreement

Chelan PUD will seek a license term of 50 years. The Parties other than Chelan PUD agree to support a license term of 47 years, and to not oppose a license term longer than 47 years. The term of this Agreement shall be the same as the term of the New License (including any subsequent annual licenses), unless this Agreement is terminated sooner pursuant to Section 16.

SECTION 6: Effective Dates

- 6.1 **Effective Date of the Agreement.** Sections 8, 9, 15, 16.1 and 17 of this Agreement shall take effect immediately upon the signature of all Parties listed in Section 1.1, and

the remaining provisions of this Agreement shall take effect upon the effective date of the New License.

- 6.2 **Effective Date of the New License.** The effective date of the New License shall be the date that FERC issues the New License, unless the order issuing the New License or any part thereof is later stayed, in which case the effective date of the New License or that part which was stayed shall be the date such stay is lifted, unless otherwise specified by FERC.

SECTION 7: Parties Bound

The Parties shall be bound by this Agreement for the term of the New License, including any subsequent annual licenses, unless this Agreement is sooner terminated pursuant to Section 16. A Party that withdraws from this Agreement shall not be bound following such withdrawal, except as provided in Section 4.3.1.

SECTION 8: Licensee Obligations to Support this Agreement

Within 30 days after the effective date of this Agreement, Chelan PUD shall file with FERC an offer of settlement pursuant to Rule 602 consisting of a fully executed copy of this Agreement and an explanatory statement. Chelan PUD shall request that FERC incorporate, without modification, the Proposed License Articles contained in Attachment A to this Agreement as conditions of the New License. Chelan PUD shall use reasonable efforts to obtain a FERC order approving this Agreement and issuing the New License in a timely manner. Chelan PUD shall also: (a) submit a statement in support of this Agreement to NMFS and USFWS, as part of any comments in the ESA Section 7 consultation process; (b) ensure that any supplemental information, comments, or responses to comments filed by it with FERC in the context of the relicensing process are consistent with this Agreement; (c) in the event of an appeal of the Project's CWA Section 401 certification, submit a statement in support of this Agreement to the Washington Pollution Control Hearings Board (PCHB) and any court reviewing a decision of the PCHB; and (d) actively support incorporation of the Proposed License Articles into the New License in all other relevant regulatory proceedings.

SECTION 9: Party Obligations to Support this Agreement

- 9.1 Except as provided in Sections 4.3.5, 9.2, 9.3, 9.4 and 11.3, each Party shall support this Agreement by ensuring that all documents filed by it with FERC or any other agency or forum are consistent with this Agreement. Such documents include:
- (a) Any recommendations, conditions and/or prescriptions, or any terms and conditions;
 - (b) As to Parties other than the USFWS, any ESA Section 7 consultation documents or comments on such documents;

- (c) As to USFWS, any ESA Section 7 consultation documents, or comments on such documents, or any biological opinions, shall be consistent with Section 11.3; and
 - (d) Any supplemental information, comments, or responses to comments.
- 9.2 In the event that a Party receives or develops new information, data, or analyses that it intends to file with FERC or any other agency or administrative body, such Party shall consult with the appropriate forum pursuant to Section 15 of this Agreement, to the extent practicable, and shall notify all Parties as soon as practicable.
- 9.3 If, prior to the effective date of the New License, a Party proposes a condition and/or prescription based upon new information, data, or analyses that would create a material change to the terms of this Agreement, any affected Party may initiate dispute resolution pursuant to Section 17.
- 9.4 If, after the effective date of the New License, a Party proposes a license condition and/or prescription based upon new information, data, or analyses, the Party must comply with the procedures of Section 11.

SECTION 10: Relationship of this Agreement to the Habitat Conservation Plan

- 10.1 **Effect of Signing.** By signing this Agreement, the Parties agree to support the inclusion of proposed License Articles attached as Attachment A, including Proposed License Article 10, in the New License. However, signing this Agreement does not make such Party a signator to the HCP Agreement, nor does it confer on such Party any of the rights or responsibilities conferred on signators to the HCP Agreement.
- 10.2 **Decision-making Authority.** As provided in the HCP Agreement, the decision-making authority of the HCP Coordinating Committee, the HCP Tributary Committee, and the HCP Hatchery Committee shall be limited to matters relating to Plan Species (as defined in Section 13.20 of the HCP Agreement). Other species shall be the responsibility of the RRFF, pursuant to the provisions of this Agreement.
- 10.3 **Coordination.** The RRFF shall coordinate with the HCP Committees to achieve common objectives in any manner they deem appropriate.
- (a) In the event that a conflict arises between actions required under this Agreement for non-plan species and actions required under the HCP Agreement for Plan Species, the RRFF shall request to meet with the HCP Coordinating Committee as soon as practicable to address such conflict and seek to reach a resolution that is acceptable to both the RRFF and the HCP Coordinating Committee, and is consistent with applicable law.
 - (b) If a resolution between the HCP Coordinating Committee and the RRFF is not reached within 20 days of the initial meeting, any member of either entity may

- request that the matter be referred to a joint meeting of the RRPC and the HCP Policy Committee, which shall be convened within 30 days;
- (c) If a resolution between the RRPC and the HCP Policy Committee is not reached within 60 days of the initial meeting of the policy committees, any Party may pursue any other rights or remedies as may be available.

SECTION 11: Reservations of Agency Authority

11.1 Federal Power Act.

11.1.1 FPA Sections 4(e), 10(j), and 10(a). Each Party reserves any authority it may have pursuant to Sections 4(e), 10(j), and 10(a) of the FPA in the event that: (a) this Agreement is not filed with FERC; (b) the Party withdraws from this Agreement pursuant to the procedures set forth in Section 16; or (c) this Agreement is terminated pursuant to Section 16. Chelan PUD reserves the right to contest the existence and/or exercise of any such authority.

11.1.2 FPA Section 18.

- (a) USFWS may exercise its reserved authority under Section 18 of the FPA regarding Plan Species covered by the HCP Agreement only as provided in the HCP Agreement. In the event that the HCP Agreement is terminated and NMFS or USFWS exercise authority under Section 18 of the FPA regarding Plan Species, the RRFF shall consider whether the exercise of that authority is consistent with measures in this Agreement. In addition, the RRFF may make recommendations to NMFS and USFWS regarding how the exercise of such authority can be accomplished in a manner consistent with this Agreement. In the event that the RRFF does not reach consensus regarding such recommendations, the dispute resolution provisions of Section 17 of this Agreement shall apply.
- (b) To the extent practicable, USFWS shall provide notice to the RRFF before exercising any reserved authority under Section 18 of the FPA regarding species covered by this Agreement (i.e., species other than Plan Species), and the RRFF may then make recommendations to USFWS regarding how the exercise of such authority can be accomplished in a manner consistent with this Agreement. In the event that the RRFF does not reach consensus regarding such recommendations, the dispute resolution provisions of Section 17 of this Agreement shall apply.
- (c) In the event that either NMFS or USFWS exercises its authority under Section 18 of the FPA regarding Plan Species while the HCP Agreement remains in effect, or exercises such authority regarding either Plan Species or species other than Plan Species in a manner that is materially inconsistent with this Agreement, any other Party may withdraw pursuant to Section 16 of this Agreement.

11.2 Clean Water Act.

- 11.2.1 **Reservation of Authority.** Nothing in this Agreement affects any authority Ecology may have to enforce the CWA Section 401 certification, state water quality standards, or other appropriate requirements of state law, or to amend the Section 401 certification. Chelan PUD reserves the right to contest the existence and/or exercise of any such authority.
- 11.2.2 **Procedure for Exercise of Authority.** In exercising any authority reserved in Section 11.2.1, Ecology shall consider any conflicts that arise between or among designated and/or existing beneficial uses, and reconcile such conflicts consistent with applicable state and federal law. Prior to issuing an order exercising such authority, Ecology agrees to issue a notice of intent to exercise its authority unless it determines, in its sole discretion that the situation requires expeditious action to maintain and protect water quality, including existing, designated, or beneficial uses. An Agency with relevant authority or Chelan PUD may, within 30 days of the issuance of a notice of intent, or within 30 days of the issuance of an order if no notice of intent is issued, initiate dispute resolution pursuant to Section 17 of this Agreement. However, Ecology's authority to proceed with issuance and/or enforcement of an order shall not be affected by the dispute resolution process if it does not participate in, or withdraws from, such process pursuant to Section 17.9 of this Agreement. Prior to exercising any such authority, Ecology may seek public comment.
- 11.3 **Endangered Species Act.** This Agreement does not affect the terms of the HCP Agreement regarding the authority of NMFS or USFWS under the ESA regarding Plan Species, nor does it affect the authority of either Agency to take any action it may deem necessary to meet its obligations under the ESA regarding species other than Plan Species. However, the Parties have worked collaboratively to develop measures in this Agreement to address the specific needs of ESA-listed species. USFWS anticipates that the measures in this Agreement will be adequate to avoid a jeopardy finding, and to minimize incidental take of ESA-listed species covered by this Agreement. In addition, USFWS shall use reasonable efforts to exercise its authority under the ESA in a manner that allows this Agreement to be fulfilled. If FERC requests a draft biological opinion, the USFWS shall provide one to FERC. If, in its consultation with FERC pursuant to Section 7 of the ESA, the USFWS requests any measures that are materially inconsistent with the terms of this Agreement, any Party may invoke the dispute resolution provisions of Section 17 of this Agreement.
- 11.4 **Reservation of Authority.** In the event that FERC, on its own initiative, includes a standard reservation of authority for fishways for the Department of Interior, or includes the reservation of authority for the Department of the Interior submitted by USFWS in its June 1, 2005 fishway prescriptions, the inclusion of such a license article shall not be considered to be materially inconsistent with this Agreement; provided that each Party shall be deemed to have reserved the right to contest the exercise of such authority at any time in the future. If FERC includes such standard reservation of authority, USFWS shall exercise its reserved authority only in a manner consistent with its June 1, 2005 fishway prescriptions and this Agreement.

SECTION 12: Licensee Responsibility for Operations and Costs of Project

By signing this Agreement, none of the Parties, except for Chelan PUD, accept any responsibility for the operation or costs of the Project.

SECTION 13: Availability of Funds

Implementation of this Agreement by the federal Agencies is subject to the requirements of the Anti-Deficiency Act, 31 USC §§ 1341-1519, and the availability of appropriated funds. Nothing in this Agreement is intended or shall be construed to require the obligation, appropriation, or expenditure of any money from the U.S. Treasury. The Parties acknowledge that the federal Agencies shall not be required under this Agreement to expend any appropriated funds unless and until an authorized official of the relevant federal Agency affirmatively acts to commit to such expenditures in writing. Implementation of this Agreement by the state Agencies is subject to the availability of appropriated funds. Nothing in this Agreement is intended or shall be construed to require the obligation, appropriation, or expenditure of any money from the Treasury of the State of Washington. The Parties acknowledge that the state Agencies shall not be required under this Agreement to expend any appropriated funds unless and until an authorized official of the relevant state Agency affirmatively acts to commit to such expenditures in writing.

SECTION 14: Force Majeure

14.1 **No Liability for Force Majeure.** No Party shall be liable to any other Party for breach of this Agreement as a result of a failure to perform or for delay in performance of any provision of this Agreement if, based on evidence provided by the non-performing Party to the other Parties, such performance is delayed or prevented by Force Majeure. In the event of an enforcement action, the non-performing Party bears the burden of proving by a preponderance of the evidence the existence of Force Majeure, including the absence of negligence. The term "Force Majeure" means any cause reasonably beyond the performing Party's control, which could not be avoided with the exercise of due care, and which occurs without the fault or negligence of the Party whose performance is affected by the Force Majeure. Force Majeure events may be unforeseen, foreseen, foreseeable, or unforeseeable, including without limitation natural events; labor or civil disruption; breakdown or failure of Project works not caused by failure to properly design, construct, operate, or maintain; new regulations or laws that are applicable to the Project; orders of any court or agency having jurisdiction over the Party's actions; delay in a FERC order becoming final; or delay in issuance of any required permit. Ecology is

reviewing the use of Force Majeure in future agreements and this provision should not be viewed as precedent for other future agreements.

14.2 Process for Responding to Force Majeure Event.

- 14.2.1 **Notice.** The Party whose performance is affected by Force Majeure shall notify the other Parties in writing within 24 hours, or as soon thereafter as practicable, after becoming aware of any event that such Party contends constitutes Force Majeure. Such notice shall identify the event causing the delay or anticipated delay, estimate the anticipated length of delay, state the measures taken or to be taken to minimize the delay, and estimate the timetable for implementation of the measures. The affected Party shall make all reasonable efforts to promptly resume performance of this Agreement and, when able, resume performance of its obligations and give the other Parties written notice to that effect.
- 14.2.2 **Dispute Resolution.** Any Party may request that the Parties engage in dispute resolution under Section 17 of this Agreement to formulate an appropriate response to the circumstances created by the Force Majeure event.
- 14.2.3 **Chelan PUD to Confer with USFWS.** If Chelan PUD is unable to perform any obligation pursuant to any provision of this Agreement as a result of Force Majeure and that inability to perform has the potential to effect species listed as endangered or threatened, it shall, within three business days after notifying the other Parties of the existence of an event constituting Force Majeure, confer with USFWS to avoid jeopardy and minimize any incidental take of such listed species. In the event the circumstances resulting from the Force Majeure event cannot be resolved without amendment to this Agreement, amendment of the New License, or re-initiation of consultation pursuant to 50 C.F.R. § 402.16, Chelan PUD shall notify all Parties and seek agreement regarding actions or measures needed to address the circumstances arising from the Force Majeure event, using the dispute resolution procedures contained in Section 17 of this Agreement.

SECTION 15: Resource Forums & Policy Committee

- 15.1 **Rocky Reach Forums.** Within 90 days of the effective date of this Agreement, Chelan PUD shall establish four forums: the RRFF, the Rocky Reach Wildlife Forum (RRWF), the Rocky Reach Recreation Forum (RRRF), and the Rocky Reach Cultural Resources Forum (RRCRF).
- 15.1.1 **General Forum Responsibilities and Authorities.** The forums shall serve as the primary means of coordination between Chelan PUD and other Parties regarding the implementation of the Comprehensive Plan. The forums shall meet to share information, coordinate efforts, make recommendations and decisions, and periodically review the relevant chapters of the Comprehensive Plan as necessary to implement the Comprehensive Plan during the term of the New License and any subsequent annual licenses. Each forum shall also have the responsibility and

authority to resolve disputes, as provided for in Section 17 of this Agreement. After the effective date of the New License, Chelan PUD shall consult with each forum during development of the annual work plans, due by October 1st of each year. The annual work plans shall describe the scope of work for the following year, based on the relevant chapters of the Comprehensive Plan; establish the corresponding schedule for the proposed scope of work; and include a tentative forum meeting schedule for the upcoming year. Chelan PUD shall also consult with each forum during preparation of the annual progress reports, due by February 1st of each year following the first year after the effective date of the New License. The annual progress reports shall describe the progress toward meeting the objectives set forth in the Comprehensive Plan. Such annual progress reports shall be filed with FERC by Chelan PUD, and provided to Forum members.

- 15.1.2 **Membership.** Except as provided in Section 15.5 for the RRCRF, all Parties are eligible to be members of any forum. Each eligible Party that elects to participate in a forum shall designate a forum representative, and an alternate, to speak on behalf of its organization.
- 15.1.3 **Participation.** Except as provided in Section 15.5 for the RRCRF, all forum meetings shall be open to the public, and any individual may attend and participate in the discussions. Any member of the forum may request the opportunity to caucus in private with other forum members.
- 15.1.4 **Meetings.** The initial organizational meeting of each forum shall be convened by Chelan PUD within 180 days of the effective date of the Agreement. After the effective date of the New License, each forum shall meet as necessary to conduct its business and to resolve disputes, as provided for in Section 17 of this Agreement. Chelan PUD shall provide administrative staff support and space for forum meetings. At its initial meeting, each forum shall select an acting chair to conduct such meeting and any subsequent forum meetings until a chair is selected. Whenever requested by Chelan PUD or in writing by any other two members of the forum, the chair shall convene a meeting within 21 days or as soon thereafter as practicable. The chair shall be responsible for ensuring that agendas are distributed at least seven business days prior to each meeting. Agendas shall include a description of any issues upon which the forum members will be asked to make a decision or recommendation at the meeting. The chair shall be responsible for ensuring that meeting notes document all decisions, recommendations, assignments, scheduling matters, and action items discussed at forum meetings. The chair shall be responsible for preparing and distributing meeting notes to each member of the forum within 10 business days of the meeting. When a forum member is unable to have either its designated representative or alternate at a meeting, or needs additional time to determine its organization's position on a proposed decision or recommendation, the chair may reschedule final action, one time for each member, on any such decision or

recommendation. Each forum may adopt such additional procedural rules for conducting its business as it deems necessary and appropriate.

15.1.5 Decision-Making. The forums shall make such decisions or recommendations by consensus. For the purposes of the forums, consensus means the unanimous consent of all forum members. A member's abstention or non-participation regarding the decision or recommendation shall not preclude consensus. When the chair of a forum determines it would be helpful in reaching a consensus or avoiding a dispute, the chair may call a special meeting, or form subgroups, to develop recommendations for the full forum.

15.1.6 Initiation of Dispute Resolution Process.

(a) If the chair determines it is not possible to reach a consensus in a timely manner, the chair, after consulting with the forum members, shall declare an impasse, initiate the dispute resolution process provided in Section 17 of this Agreement, and prepare a written statement describing the disputed issue and the apparent differences among the forum members. The chair's statement shall be distributed to all members of the forum within 10 days of the declaration of an impasse.

(b) If any forum member is unable to join in a decision or recommendation concurred in by at least a majority of the forum when such action is formally called for by the chair, and is sufficiently concerned about, and impacted by, the issue, it may notify the chair within 10 business days of receiving the meeting notes. The notification must: (i) be in writing, on the organization's official letterhead; (ii) be addressed to the chair and distributed to all members of the forum; and (iii) set forth the reasons the organization is unable to join in such decision or recommendation concurred in by the majority. Upon receipt of such notice, the chair shall initiate the formal dispute resolution process as provided in Section 17 of this Agreement. The failure by any forum member to so notify the chair within 10 business days of receipt of the meeting notes shall be deemed to constitute consent to such decision or recommendation.

(c) Where there is a lack of consensus at the forum level, and Chelan PUD and the members of the forum who are also members of the Rocky Reach Policy Committee (RRPC) determine that delay could be deleterious to the achievement of one or more Comprehensive Plan objectives, Chelan PUD, or the Agency needing a proposed action to occur, may proceed with a proposed action pending the outcome of the dispute resolution process.

15.2 Rocky Reach Fish Forum (RRFF). In addition to the provisions of Section 15.1, the following requirements apply to the RRFF.

15.2.1 **Specific Responsibilities and Authorities.** The RRFF shall be responsible for meeting to share information, coordinate efforts, and make recommendations and decisions regarding implementation of Chapters 2, 3, 4, 5, and 6 of the Comprehensive Plan, relating to Water Quality, White Sturgeon, Bull Trout, Pacific Lamprey, and Resident Fish, respectively. The RRFF shall also assist Chelan PUD in coordinating Chelan PUD's work plans and efforts with the HCP Coordinating Committee through joint membership and/or other such arrangements as the RRFF and the HCP Coordinating Committee may mutually devise. The RRFF will be responsible for participating in and implementing the Adaptive Management approach employed in the applicable Chapters of the Comprehensive Plan.

In determining whether it is appropriate and reasonable for Chelan PUD to implement a measure, the RRFF shall consider, among other relevant factors: 1) the likelihood and degree to which the biological objectives, other objectives, or water quality or other regulatory standards will be met; 2) the time required to implement the measure; 3) the cost-effectiveness of the measure; and 4) the potential impact of the measure on other resources.

15.2.2 **Chair.** The RRFF shall select an independent third party to serve as chair. For the first 10 years of the New License, Chelan PUD shall fund the chair's position as a part-time position compensated on a time and materials basis. The RRFF shall evaluate the chair's performance at least once every three years and may agree, by consensus, to replace the chair as it deems necessary. At the end of 10 years, the RRFF may agree, by consensus, that a chair is still necessary; if that determination is made, the RRFF shall work together to determine how the chair's position should be funded. If the RRFF cannot agree on funding, the RRFF may select an unfunded, volunteer chair; however, if an unfunded, volunteer chair cannot be agreed upon or enlisted, the RRFF shall move forward without a chair or with an acting chair designated from among the RRFF's members.

15.3 **Rocky Reach Wildlife Forum (RRWF).** In addition to the provisions of Section 15.1, the RRWF shall be responsible for meeting to share information, coordinate efforts, and make recommendations and decisions regarding implementation of Chapter 7 of the Comprehensive Plan, relating to wildlife resources within and adjacent to the Project Boundary.

15.4 **Rocky Reach Recreation Forum (RRRF).** In addition to the provisions of Section 15.1, the RRRF shall be responsible for meeting to share information, coordinate efforts, and make recommendations and decisions regarding implementation of Chapter 9 of the Comprehensive Plan, relating to recreational resources within the Project reservoir and its tributaries.

15.5 **Rocky Reach Cultural Resources Forum (RRCRF).** In addition to the provisions of Section 15.1, the following requirements apply to the RRCRF:

- 15.5.1 **Specific Responsibilities and Authorities.** The RRCRF shall be responsible for meeting to share information, coordinate efforts, and make recommendations and decisions regarding implementation of Chapter 8 of the Comprehensive Plan, relating to historic properties and cultural resources within the area of potential effect defined in Chapter 8 of the Comprehensive Plan.
- 15.5.2 **Membership.** The following entities may designate a member to the RRCRF: National Park Service, USDA Forest Service, BLM, Bureau of Indian Affairs (BIA), Washington State Parks, YN, CCT, the Washington State Office of Archaeology and Historic Preservation, FERC, and Chelan PUD.
- 15.5.3 **Confidentiality.** Due to the confidential nature of the information discussed by the RRCRF, only members of the RRCRF may attend meetings. Nonmembers may attend with permission from the RRCRF and upon signing a confidentiality agreement. Meeting times and dates will be recorded and made available to the public; however the substance of the meeting will not be disclosed unless the RRCRF agrees to do so. All meeting minutes will be marked confidential.
- 15.6 **Rocky Reach Policy Committee (RRPC).** Within 180 days of the effective date of this Agreement, Chelan PUD shall establish a RRPC.
- 15.6.1 **Responsibilities and Authorities.** The RRPC shall be responsible for reviewing and commenting on the annual work plans and progress reports developed by each of the forums, and for reviewing the progress made in implementing the Comprehensive Plan. The RRPC shall serve as the policy-level forum for discussion and resolution of issues and problems that may arise during implementation of this Agreement, including (a) issues that cannot be resolved within the context of a forum; (b) issues arising outside the context of a specific forum; and (c) issues related to coordination with the HCP Policy Committee regarding actions that could have an impact on Plan Species and HCP Agreement programs. The RRPC's role in resolving disputes is provided in Section 17 of this Agreement.
- 15.6.2 **Membership.** The membership of RRPC shall be comprised of one designated representative from each of the following: (a) Chelan PUD; (b) each Agency; and (c) each Tribe that is a Party. Designated representatives shall be individuals more senior within their respective organizations than the representatives serving on the forums, and shall have the authority to direct necessary resources within their organizations to meaningfully participate in the implementation of this Agreement. Each member of the RRPC shall designate an alternate, who shall not be a member of a forum. Each member of the RRPC shall also designate a senior executive, who shall be an individual more senior within the organization than the RRPC representative, and who will be responsible for resolving disputes related to this Agreement should the RRPC fail to do so. Notice of all designations under this Section shall be provided in writing to all Parties.

- 15.6.3 **Participation.** Other entities may attend and, upon request, participate in discussions of the RRPC. The RRPC may also invite representatives of other governments, agencies, or entities to participate in its discussions as it deems necessary and appropriate. However, any member of the RRPC or the chair may request the opportunity to meet in private with other RRPC members. When the RRPC is acting in its dispute resolution capacity, it may, at the discretion of the chair, conduct its deliberations in a session closed to non-Parties.
- 15.6.4 **Meetings.** The initial organizational meeting of the RRPC shall be convened by Chelan PUD within 180 days of the effective date of this Agreement. After the effective date of the New License, the RRPC shall meet as necessary, but at least once per year in February, to review and comment on the annual work plans and progress reports specified in Section 15.1.1, to review the progress made in implementing the Comprehensive Plan, and to resolve disputes as provided for in Section 17 of this Agreement. Chelan PUD shall provide administrative staff support and space for meetings of the RRPC.
- 15.6.5 **Procedures.** At its initial meeting, the RRPC shall select an acting chair to: (a) conduct the initial meeting; (b) convene subsequent meetings until the RRPC chair is designated; and (c) receive any notices of disputes that may be forwarded by a forum to the RRPC prior to the designation of an RRPC chair. The RRPC may request that the chair of the RRF serve as the chair of the RRPC, in which case the funding provided by Chelan PUD for the RRF chair's position during the first 10 years of the New License shall also include sufficient funding to compensate for the activities of chairing the RRPC. The RRPC may adopt such additional procedural rules for conducting its business as it deems necessary and appropriate.
- 15.6.6 **Decision-Making.** The RRPC shall make decisions by consensus. For the purposes of the RRPC, consensus means the unanimous consent of all members of the RRPC. A member's abstention or non-participation regarding a decision shall not preclude consensus.

SECTION 16: Withdrawal Procedure If Agreement or Proposed License Articles Are Materially Changed.

- 16.1 **Right to Withdraw Prior to the Effective Date of the New License.** Prior to the effective date of the New License, a Party may withdraw from this Agreement under the following circumstances:
- 16.1.1 If any of the following actions occur and cannot be resolved after complying with the procedures set forth in section 16.3:

- a) FERC issues a New License that is materially inconsistent with this Agreement;
 - b) An Agency or NMFS files final terms and conditions under the Federal Power Act that are materially inconsistent with the Agreement;
 - c) The Clean Water Act Section 401 certification is appealed and/or amended, resulting in a certification that is materially inconsistent with this Agreement;
 - d) A biological opinion developed pursuant to the ESA requires measures materially inconsistent with this Agreement; or
 - e) A Total Maximum Daily Load determination is issued that has the effect of requiring measures that are materially inconsistent with this Agreement;
- 16.1.2 A Party takes any other action that is materially inconsistent with this Agreement and the inconsistency cannot be resolved after completion of the dispute resolution process provided in Section 17 of this Agreement; or
- 16.1.3 Unsuccessful completion of the dispute resolution process described in Section 17 of this Agreement regarding any other issue not related to a material inconsistency.
- 16.2 Right to Withdraw After the Effective Date of the New License.** After the effective date of the New License, a Party may withdraw from this Agreement under the following circumstances:
- 16.2.1 If any of the following actions occur and cannot be resolved after complying with the procedures set forth in Section 16.3:
- a) FERC issues a New License that is materially inconsistent with this Agreement;
 - b) A rehearing or judicial review regarding the FERC order issuing the New License results in an order that is materially inconsistent with this Agreement;
 - c) The CWA Section 401 certification is appealed and/or amended, resulting in a certification that is materially inconsistent with this Agreement;
 - d) A biological opinion developed pursuant to the ESA requires measures materially inconsistent with this Agreement;
 - e) A TMDL determination is issued that has the effect of requiring measures that are materially inconsistent with this Agreement; or
 - f) FERC, a federal or state agency other than FERC, or a federal or state court, issues an order that is materially inconsistent with this Agreement;
- 16.2.2 A Party takes any other action that is materially inconsistent with this Agreement or the New License and the inconsistency cannot be resolved after completion of the dispute resolution process provided in Section 17 of this Agreement;

- 16.2.3 Unsuccessful completion of the dispute resolution process described in Section 17 of this Agreement regarding any other issue not related to a material inconsistency; or
- 16.2.4 Alcoa Power Generating Inc. may withdraw from this Agreement effective 30 days after providing written notice to the Parties of its intent to do so. Alcoa Power Generating Inc.'s withdrawal from this Agreement shall not be grounds for any other Party to withdraw from this Agreement.
- 16.2.5 If FERC issues the New License for a term of between 47 and 50 years, such term shall not constitute a material inconsistency to this Agreement, and shall not provide a basis for withdrawal from this Agreement.
- 16.2.6 If FERC partially or wholly omits Proposed License Articles 7 (a) and (b) from the New License, or modifies the measures contained in such articles to reduce the level of protection, mitigation, or enhancement, such omission or modification shall not provide a basis for withdrawal from this Agreement.
- 16.3 **Procedures for Responding to Material Inconsistencies.** Subject to Section 16.4, if any of the actions listed in section 16.1 or 16.2 occur, this Agreement shall be deemed modified to conform to the action unless a Party provides written notice to the other Parties within 30 days that it objects to the material inconsistency and initiates the dispute resolution procedures under Section 17.
- 16.4 **Provisions Omitted from New License.** If FERC partially or wholly omits from the New License any of the protection, enhancement, or mitigation measures (including monitoring or studies that relate to such measures) included in the proposed License Articles, or modifies such measures to reduce the level of protection, mitigation, or enhancement, the Parties agree to be bound by the entire Agreement, including the provisions omitted or modified by FERC, unless a Party provides written notice within 15 days that the omitted or modified measures create a material inconsistency with this Agreement or, in the case of Chelan PUD, that it lacks authority under state law to implement measures omitted from the New License. If such notice is given and a Party requests that a rehearing petition be filed, Chelan PUD and the affected Parties shall work together in an effort to restore the omitted or modified measures through a request for rehearing to FERC. Upon the request of one or more members of the RRPC, Chelan PUD shall participate in a further appeal of a rehearing order to the court of appeals to restore the omitted or modified measures. Such participation shall include, at Chelan PUD's option, joining in such appeal and/or providing a brief in support of such appeal. Upon the request of one or more members of the RRPC, a Party other than Chelan PUD shall also participate in a further appeal of a rehearing order to the court of appeals to the extent practicable. Such participation shall include, at a minimum, making reasonable efforts to obtain the necessary authorization to register its official support for the appeal through a joint or separate filing at the court of appeals. If, at the conclusion of such effort, any such measures (other than those identified in Section 16.2.6) remain omitted or modified, any Party may withdraw from this Agreement after completion of the

dispute resolution process provided in Section 17, and this Agreement shall be deemed modified for the remaining Parties.

16.5 Stay of New License or Extension of Time to Resolve Material Inconsistency.

Except as provided in Section 16.6, in the event FERC issues a New License that is materially inconsistent with this Agreement, any Party that has filed or intends to file a motion to stay such New License, or any part thereof, or an extension of time to perform any obligation under the New License, may request in writing that other Parties confer (either in person or by phone) with such Party within 10 business days regarding the willingness of such other Parties to support such motion for stay or for extension of time.

16.6 Deferral of Capital Expenditures Pending Rehearing or Judicial Review.

If FERC issues a New License but the order issuing the New License is the subject of rehearing or judicial review, and such rehearing or judicial review could result in a material inconsistency with this Agreement, the Parties shall, at the request of Chelan PUD, work together to agree on a plan to defer major capital expenditures by Chelan PUD (as well as associated annual funding made available by Chelan PUD) during the pendency of such rehearing or judicial review. The deferral plan shall be limited to Chelan PUD expenditures in an amount approximately equal to the additional costs that could reasonably be expected to be imposed as a result of the rehearing or judicial review, and such deferral plan shall continue in effect until such rehearing or judicial review is concluded. If the Parties cannot reach agreement on a deferral plan within 30 days of such request, the matter shall be subject to dispute resolution pursuant to Section 17. If, pending such rehearing or judicial review, Chelan PUD has filed or intends to file a motion to stay the New License, or to extend the time to perform any obligation under the New License, the Parties shall support such motion with respect to deferrals agreed to in the plan.

16.7 CWA Section 401 Certification Issued; With Appeal.

If Ecology's CWA Section 401 certification, or an amendment thereto, is appealed to the Pollution Control Hearing Board (PCHB), and such appeal, or any subsequent court appeal, leads to a result that is materially inconsistent with this Agreement, the Parties shall then work together in an effort to resolve the issue through the dispute resolution process provided in Section 17. During this process, a Party may seek reconsideration of the PCHB order, or rehearing of a court order, to meet procedural time limits; however, the request for such reconsideration or rehearing shall be withdrawn if consensus is reached on modifying this Agreement to conform to the order. Any Party may also seek judicial review of a PCHB decision that is materially inconsistent with this Agreement.

16.8 Effect of Withdrawal.

In the event that a Party other than Chelan PUD withdraws from this Agreement, the remaining Parties may choose to continue to be bound by this Agreement. Alternatively, except as provided in Section 16.2.4, any remaining Party may choose to withdraw from this Agreement, following: (1) written notice to the other Parties of the intention to withdraw and, (2) if requested by any other Party, completion of the dispute resolution process provided in Section 17. If Chelan PUD withdraws, this Agreement shall be deemed null and void.

SECTION 17: Dispute Resolution

17.1 **Good Faith Commitment to Resolving Disputes.** The Parties agree to devote such time, resources, and attention as are needed to attempt to resolve disagreements concerning this Agreement at the earliest time possible. In the event that any disagreement arises among the Parties concerning this Agreement, including disagreements regarding the meaning of, or any Party's compliance with, this Agreement, or any proposed decision or recommendation pending before a forum, the Parties shall first attempt to resolve such disagreements on an informal basis. Each Party participating in formal dispute resolution shall cooperate in good faith to promptly schedule, attend, and participate in the dispute resolution process to the extent resources allow.

17.2 Dispute Resolution Process.

17.2.1 **Disagreements Arising Within a Forum.** In the case of disagreements arising within a forum, the dispute resolution process may be initiated as provided in Section 15.1.7 of this Agreement. Once initiated pursuant to such Section, the forum chair may convene one or more meetings within 21 days, open only to forum members, in a focused attempt to resolve the dispute. If the chair determines that the forum is unable to reach consensus in resolving a dispute after such meeting or meetings, or if the chair, after consulting with the forum members, elects to not hold such a meeting because the chair determines that the RRPC is the appropriate entity to consider and resolve the dispute, the disagreeing Party or Parties shall provide notice to all Parties within three business days after such determination by the chair. The notice must: (a) be in writing, on the organization's official letterhead; (b) be addressed to the chair of the RRPC and distributed to all members of the RRPC and all other Parties; and (c) describe the issues in dispute.

17.2.2 **Disagreements Arising Outside a Forum.** In the case of any other disagreement arising outside the context of a forum, any Party may initiate the formal dispute resolution process provided in this section if the relevant Parties cannot resolve the disagreement informally after good faith efforts to do so. To initiate the formal dispute resolution process, a requesting Party shall provide notice to all Parties. The notification must: (a) be in writing, on the organization's official letterhead; (b) be addressed to the chair of the RRPC and distributed to all members of the RRPC and all other Parties; and (c) describe the issues in dispute.

17.3 Elevated Formal Dispute Resolution Process.

17.3.1 **RRPC.** Upon receiving notice of a formal dispute, the chair of the RRPC shall convene a meeting of the RRPC within 30 days, or as soon thereafter as practicable, to consider the dispute. All Parties shall be allowed to participate in RRPC dispute resolution discussions, pursuant to Section 15.6.3, but decisions regarding resolution of disputes shall be made by consensus of the members of

the RRPC. At its initial meeting to consider the dispute, the RRPC may: (a) resolve any or all issues in dispute; (b) refer any or all issues in dispute back to the originating forum with specific instructions and a deadline for reporting back to the RRPC; or (c) institute any other alternative dispute resolution procedures it deems useful under the circumstances, including using a neutral mediator or facilitator, initiating a fact-finding process, or seeking the advice of consultant(s) and/or expert(s). The RRPC shall agree on the terms and a time limit for any such alternative dispute resolution procedures it undertakes. If the RRPC, or the forum to which it remanded the dispute, fails to resolve the dispute within 30 days of the meeting convened to consider the dispute, or within the time period designated by the RRPC, the RRPC shall prepare a revised statement of the outstanding issues for submission to the RRPC members' executives as soon as practicable.

17.3.2 RRPC Members' Executives. Upon receipt of the revised statement of the outstanding issues from the RRPC, or upon determination by the chair of the RRPC that no such revised statement will be forthcoming within a reasonable time period, the chair of the RRPC shall schedule a meeting or conference call of the RRPC members' designated executives, designated pursuant to Section 15.6.2, to be held within 30 days of referral from the RRPC, or as soon thereafter as practicable. The RRPC members' designated executives may: (a) resolve any or all issues in dispute by consensus; (b) refer any or all issues in dispute back to the RRPC with specific instructions and a deadline for reporting back to the designated executives; or (c) institute any other alternative dispute resolution procedures they deem useful under the circumstances. The designated executives shall agree on the terms and a time limit for any such alternative dispute resolution procedures they undertake. Abstention or non-participation by a designated executive in a decision resolving a dispute shall not preclude consensus of the remaining designated executives.

17.4 Completion of Dispute Resolution Process. In the event the RRPC members' designated executives fail to confer or schedule a meeting within 30 days of referral, or a dispute is not resolved within the time period established by the designated executives, the dispute resolution process shall then be deemed completed and any Party may withdraw from this Agreement. Upon completing the dispute resolution process, the designated executives shall prepare a joint statement of the remaining issues in dispute, which may also include a discussion of how to resolve such issues consistent with this Agreement.

17.5 Miscellaneous. In the event the chair of the RRPC fails to convene a meeting as required by Section 17.3.1, 17.3.2, or 17.8, any member or members of the RRPC may convene such meeting. Any of the time periods specified in this section may be reasonably extended or shortened by agreement of the disputing Parties, or as necessary to conform to the procedure of FERC or any court with jurisdiction over the dispute or to respond expeditiously to time-sensitive issues. Unless otherwise agreed among the Parties, each Party shall bear its costs for its own participation in any alternative dispute resolution process selected by the Parties and shall equally share the costs of any neutral

mediator, facilitator, or other consultant(s) and/or expert(s) engaged to assist in the resolution of disputes. Pending resolution of any dispute, and subject to the authority of FERC or other Agency to order otherwise, Chelan PUD may continue operating the Project in the manner it was operating prior to the time the dispute arose.

- 17.6 Actions after Dispute Resolution.** Each Party shall promptly implement all final agreements reached through the dispute resolution process, consistent with its applicable statutory and regulatory responsibilities. For disputes within FERC's jurisdiction that remain unresolved at the completion of the dispute resolution process, any Party may file such unresolved dispute with FERC. For disputes not within the jurisdiction of FERC (other than disputes arising under the CWA Section 401 certification) that remain unresolved after completion of the dispute resolution process, any Party may choose to seek judicial, administrative, or other enforcement of the terms of this Agreement. As to disputes arising under the CWA Section 401 certification or Ecology's reservation of authority under Section 11.2 of this Agreement, Chelan PUD and Ecology reserve their right to make their respective legal arguments regarding the entities or legal fora with authority or jurisdiction to resolve such disputes.
- 17.7 Relationship of Dispute Resolution to Rehearing or Judicial Review.** The dispute resolution process shall not preclude any Party from timely filing for and seeking administrative rehearing or judicial review if the New License, or any FERC order or action by an Agency, is materially inconsistent with this Agreement. However, the Parties shall follow the dispute resolution process provided in this section to the extent reasonably practicable while such rehearing or judicial review is being pursued. In the event the Parties subsequently agree unanimously to modify this Agreement to conform to the materially inconsistent New License or FERC order, or to resolve the inconsistency between this Agreement and the agency action, the filing Party or Parties shall withdraw the request for rehearing or judicial review, or shall recommend such withdrawal, as appropriate.
- 17.8 Expedited Dispute Resolution.** Any member of the RRPC may initiate an expedited review of a particular issue, by notifying the RRPC chair that an emergency condition exists. The requesting member must provide the chair a statement, on official letterhead, describing the outstanding issue and the basis of the emergency. This expedited review will be directed to and initiated by the chair to the RRPC Members' executives as constituted pursuant to Section 15.6.2. The chair will convene the executives to consider the outstanding issue expeditiously but no later than 10 business days after receiving the statement of the outstanding issue and the basis of the emergency from the requesting member. In the event the designated executives fail to convene and resolve the matter within 10 days of receiving such statement, or within such other time period established by the designated executives, the dispute resolution process shall be deemed completed and any Party may withdraw from this Agreement. Upon completing the dispute resolution process, the designated executives shall prepare a joint statement of the remaining issues in dispute, which may also include a discussion of how to resolve such issues consistent with this Agreement.

17.9 Ecology Right to Not Participate in or to Withdraw from Dispute Resolution.

Ecology reserves the right not to participate in, or to withdraw from, dispute resolution under this Agreement if it determines, in its sole discretion, that the situation requires expeditious action to maintain and protect water quality, including existing, designated, or beneficial uses. Ecology further reserves the option to not participate in, or to withdraw from, a dispute resolution initiated pursuant to Section 16.7 if it determines that the Parties have failed to reach agreement after previously completing the dispute resolution process regarding substantially the same issue, and no new significant information has become available since that time. A decision by Ecology not to participate in or to withdraw from, dispute resolution under this Agreement shall not be contested by the other Parties; however, all Parties (other than Ecology) reserve the right to contest any such action taken by Ecology. Ecology shall provide notice of its decision on letterhead, signed by its executive as designated under Section 15.6.2, to not participate in, or to withdraw from, dispute resolution to Chelan PUD prior to or contemporaneous with taking such action, and to other Parties within 10 business days after taking such action.

SECTION 18: Payments

- 18.1 Unless otherwise specified, all costs, balances, or payment amounts specified in dollars shall be deemed to be stated as of the year 2005, and Chelan PUD shall adjust such sums as of January 31 of each following year (starting in the first January after the effective date of the New License), or upon publication of, and in accordance with, the Consumer Price Index for all Urban Consumers, US City Averages, All Items, Not Seasonally Adjusted. Such Consumer Price Index is published by the U.S. Department of Labor, Bureau of Labor Statistics. If the publication of such Consumer Price Index is discontinued, the Parties shall select an appropriate alternative index to achieve the same economic effect.
- 18.2 Chelan PUD shall enter into a mutually acceptable agreement with any Party to which payments are due pursuant to the New License.
- 18.3 The mutually acceptable payment agreements entered into pursuant to subsection 18.2 shall, consistent with applicable federal and state law, provide for the method and timing of payments, documentation of the amount and cost of work completed, a certification that such work was performed in a manner consistent with this Agreement, provisions for addressing liability, and a process for handling disputes regarding documentation, payment, or related matters. Payments shall be made on a reimbursement basis. Within 180 days of entering into a payment agreement pursuant to subsection 18.2, the Agency or other entity requesting payment shall provide an initial planning report to Chelan PUD. The initial planning report shall include a detailed description of the work to be undertaken in the first year for which payment will be sought, and the estimated costs of such work. Subsequent planning reports shall be submitted to Chelan PUD by the Agency or other entity requesting payment by January 31 of each year during the term of the New License and any subsequent annual licenses, in which the Agency or entity

intends to seek payment. Such planning reports shall contain: (a) a detailed description of the work to be undertaken in the current year, and a detailed estimate of the costs of such work; (b) a general description of the work to be undertaken in the following year or next phase of the project, if any, and a preliminary estimate of the costs of such work. A draft of such planning reports shall be submitted by the Agency or other entity to Chelan PUD by September 1 of the preceding year. If there is a disagreement regarding a payment, or implementation of a measure for which payment is being sought, such disagreement shall be resolved using the dispute resolution process pursuant to Section 17.

- 18.4 For the term of the New License, and any subsequent annual licenses, Chelan PUD shall make available an annual statement indicating the status of all funding required by Chelan PUD under the New License, including the amount of funding provided and the amount of funding remaining available.
- 18.5 For the purpose of facilitating the solicitation of matching funds by an Agency or other entity, Chelan PUD shall provide a letter of intent upon request by such Agency or other entity stating that it will make available a certain amount of funds on a certain schedule, subject to the terms and conditions of the New License and consistent with the Comprehensive Plan.
- 18.6 The dollar amount of funding made available on an annual basis under this Agreement shall be adjusted pursuant to subsection 18.1 in the year it is made available, and any remaining balance, less any outstanding billings, shall be so adjusted each succeeding year of the New License term, including any subsequent annual licenses. Unless otherwise provided in the Comprehensive Plan, such amounts, as adjusted, shall remain available during the term of the New License, including any subsequent annual licenses. In the event that any carry-over funding remains available at the expiration of the New License, including any subsequent annual licenses, such funding shall no longer be available.

SECTION 19: General Provisions

- 19.1 **Entire Agreement.** This Agreement sets forth the entire agreement of the Parties with regard to the subject matters addressed in this Agreement related to the relicensing of the Project. This Agreement is made on the understanding that each term is in consideration and support of every other term, and that each term is a necessary part of the entire Agreement.
- 19.2 **No Third-Party Beneficiaries.** Without limiting the applicability of rights granted to the public pursuant to applicable law, this Agreement shall not create any right or interest in the public, or any member of the public, as a third-party beneficiary of this Agreement, and shall not authorize any non-Party to maintain a suit at law or equity pursuant to this Agreement. The duties, obligations, and responsibilities of the Parties with respect to third parties shall remain as imposed under applicable law.

- 19.3 **Modification of Agreement.** This Agreement may be modified by unanimous written consent of all Parties at any time during the term of the New License, including subsequent annual licenses. If such modification requires the approval of FERC, Chelan PUD shall submit such modification to FERC for approval, and no actions relating to such modification shall be undertaken until such approval is received.
- 19.4 **Successors, Transferees and Assigns.** This Agreement shall apply to and be binding on the Parties and their successors and assigns. Upon completion of a succession, transfer or assignment, the initial Party shall no longer be a Party to this Agreement. No change in ownership of the Project or transfer of the New License by Chelan PUD shall in any way modify or otherwise affect any other Party's interests, rights, responsibilities or obligations under this Agreement.

SECTION 20: Notice and Communication

- 20.1 **Notices, Meeting Notes, and Statements of Disputed Issues.** All written notices to be given pursuant to this Agreement shall be sent by electronic mail and first class mail or overnight express service, postage prepaid, to each Party at the addresses listed below or such subsequent address as a Party shall provide. Notices shall be deemed received three business days after the date of mailing, or on the date of receipt if overnight express or other receipt-notification service is used. All forum meeting notes and written statements of disputed issues required under Section 15 shall be posted to a designated Internet website and electronically mailed to each Party at the electronic mail address provided by the Party. Such notes and statements shall also be mailed by first class mail or overnight express service, postage prepaid, to any Party unable to receive electronic mail or requesting such service, and shall be deemed received on the date of electronic mailing (or, where applicable, three business days after first class mailing or on the date of receipt if overnight express or other receipt-notification service is used).
- 20.2 For purposes of implementing this Agreement, the Parties agree that the following individuals shall be designated to be the primary contact persons, and all written notices, forum meeting notes, and written statements of disputed issues shall be posted to the individuals listed below. Notification of changes of contact persons shall be made in writing and posted to the contact persons of all other Parties.

List of Contact Persons:

Chelan County PUD
 Director of Hydro Services
 Gregg Carrington
 P.O. Box 1321
 Wenatchee, Washington 98807
 Phone: (509) 661-4178
 Fax: (509) 661-8155

Email: gregg@chelanpud.org
 Washington State Department of Ecology
 Central Regional Office Director
 Derek Sandison
 15 West Yakima Ave -- Suite 200
 Yakima, WA 98902-3452
 Phone: (509) 457-7120

Fax: (509) 575-2809
Email: dsan461@ecy.wa.gov

Washington State Department of Fish and Wildlife
Regional Director, Dennis Beich
1550 Alder Street NW
Ephrata, Washington 98823-9699
Phone: (509) 754-4624
Fax: (509) 754-5257
Email: beichdwb@dfw.wa.gov

United States Fish and Wildlife
Supervisor, Mark Miller
215 Melody Lane
Wenatchee, Washington 98801
Phone: (509) 665-3508
Fax: (509) 665-3509
Email: mark_miller@fws.gov

City of Entiat
Mayor, Wendell Black
P.O. Box 228, 14070 Kinzel Street
Entiat, Washington 98822
Phone: (509) 784-1500
Fax: (509) 784-1112

Email: city@entiat.org

Alcoa Power Generating Inc.
NW Vice President for Government and Energy Affairs, Jack Speer
6200 Malaga Alcoa Highway
Malaga, WA 98828-9728
Phone: (509) 663-9331
Fax: (509) 663-9399
Email: jack.speer@alcoa.com

Bureau of Land Management
Acting Area Manager, Neil Hedges
915 Walla Walla Avenue
Wenatchee, WA 98801
Phone: (509) 665-2100
Fax: (509) 665-2116
Email: neil_hedges@or.blm.gov

National Parks Service
Pacific Northwest Region
Susan Rosebrough
909 First Avenue
Seattle, WA 98104
Phone: (206)220-4121
Email:susan_rosebrough@nps.gov

SECTION 21: Signatures

21.1 **Signatory Authority.** Each signatory to this Agreement certifies that he or she is authorized to execute this Agreement and to legally bind the Party he or she represents, and that such Party shall be fully bound by the terms hereof upon such signature without any further act, approval, or authorization by such Party.

21.2 **Signing in Counterparts.** This Agreement may be executed in any number of counterparts, and each executed counterpart shall have the same force and effect as an original instrument as if all the signatory Parties to all of the counterparts had signed the same instrument. Any signature page of this Agreement may be detached from any counterpart of this Agreement without impairing the legal effect of any signatures, and may be attached to another counterpart of this Agreement identical in form having attached to it one or more signature pages.

Dated this _____ day of _____, 2006.

PUBLIC UTILITY DISTRICT NO. 1 OF CHELAN COUNTY

By: _____
Wayne Wright, Interim General Manager

US FISH & WILDLIFE SERVICE

By: _____
Mark Miller, Project Leader

US BUREAU OF LAND MANAGEMENT

By: _____
Neil Hedges, Acting Field Manager

US NATIONAL PARK SERVICE

By: _____
Jonathan B. Jarvis, Regional Director
Pacific West Region

WASHINGTON DEPARTMENT OF FISH & WILDLIFE

By: _____
Jeff Koenings, Ph.D., Director

WASHINGTON DEPARTMENT OF ECOLOGY

By: _____
Derek Sandison, Central Regional Director

CONFEDERATED TRIBES OF THE COLVILLE RESERVATION

By: _____ Colville Business Council
Harvey Moses, Jr., Chairman Colville Business Council

CITY OF ENTIAT

By: _____
Wendell Black, Mayor

WASHINGTON PARKS AND RECREATION COMMISSION

By: _____
Jim Harris, Eastern Region Manager

ALCOA POWER GENERATING INC.

By: _____
Marc Pereira, Vice President Energy and Procurement

OTHER SIGNING PARTIES

Party: _____

By: _____
Name/Title

Party: _____

By: _____
Name/Title



**Federal Energy
Regulatory
Commission**

Office of Energy Projects

August 2006

FERC/FEIS—0184F

Final Environmental Impact Statement



Rocky Reach Hydroelectric Project Washington

(FERC Project No. 2145-060)

888 First Street N.E., Washington, DC 20426

FERC/FEIS-0184F

**FINAL ENVIRONMENTAL IMPACT STATEMENT
FOR HYDROPOWER RELICENSING**

**ROCKY REACH HYDROELECTRIC PROJECT
FERC Project No. 2145-060
Washington**

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
888 First Street, NE
Washington, DC 20426

August 2006

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FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, DC 20426

OFFICE OF ENERGY PROJECTS

To the Agency or Individual Addressed:

Reference: Final Environmental Impact Statement

Attached is the final environmental impact statement (final EIS) for the Rocky Reach Hydroelectric Project (No. 2145-060), located on the Columbia River in Chelan County, Washington.

Before the Commission makes a licensing decision, it will take into account all concerns relevant to the public interest. The final EIS will be part of the record from which the Commission will make its decision.

The Commission may issue its decision less than 30 days after publication of this final EIS. Any Commission order on the proposed action and alternatives considered in this final EIS will be subject to the Commission's rehearing process under 18 CFR 385.713. Request for rehearing must be filed within 30 days of the date of issuance of the Commission's order.

Attachment: Final Environmental Impact Statement

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COVER SHEET

- a. Title: Relicensing the Rocky Reach Hydroelectric Project in Washington, Federal Energy Regulatory Commission (FERC or Commission) Project No. 2145-060
- b. Subject: Final Environmental Impact Statement
- c. Lead Agency: Federal Energy Regulatory Commission
- d. Abstract: Public Utility District No. 1 of Chelan County (Chelan PUD) filed an application for a new license for the existing 865.76-megawatt Rocky Reach Hydroelectric Project (project) located on the Columbia River in Chelan County, Washington, approximately 7 miles upstream of the city of Wenatchee. The project occupies about 152 acres of federal lands managed by the U.S. Bureau of Land Management and the U.S. Forest Service. The U.S. Forest Service land is in Washington Department of Transportation and railroad rights-of-way.

The project is operated under the terms of the 1997 Mid-Columbia Hourly Coordination Agreement (Hourly Coordination Agreement), to which Chelan PUD is a signatory along with several other northwest utilities and federal agencies operating hydroelectric projects on the Columbia River. The Hourly Coordination Agreement facilitates maintaining the mid-Columbia reservoirs at or near their full levels. All power requests and non-power requirements are coordinated, and flows are released to maximize generation, keeping the reservoirs as full as possible while minimizing spill losses.

Six species of anadromous fish occur within the project area, including Upper Columbia River spring-run Chinook salmon, Upper Columbia River summer/fall-run Chinook salmon, Upper Columbia River steelhead, coho salmon, sockeye salmon, and Pacific lamprey. The first five of those species (referred to as the Plan Species) are covered by the 2004 Anadromous Fish Agreement and Habitat Conservation Plan for the Rocky Reach (HCP) project, a 50-year agreement with a goal of achieving no net impact on the Plan Species by using a combination of fish passage measures, hatchery programs, and a habitat improvement fund to improve fish passage survival rates and achieve a virtual 100 percent survival of fish passing the project.

Key issues associated with relicensing this project are: addressing total dissolved gas concentrations; implementing the HCP for the benefit of the Plan Species; improving conditions for other fish

species, including bull trout, white sturgeon, Pacific lamprey, and resident fish; protecting and enhancing wildlife habitat; protecting populations of the federally listed threatened Ute ladies'-tresses; enhancing local recreational opportunities; and protecting cultural resources.

The staff's recommendation is to relicense the project essentially as proposed, with additional measures recommended by the staff to protect and enhance environmental resources.

e. Contact:	Environmental Staff Kim Nguyen Federal Energy Regulatory Commission Office of Energy Projects 888 First Street, N.E. Washington, DC 20426 (202) 502-6105	Staff Counsel John Clements Federal Energy Regulatory Commission Office of the General Counsel 888 First Street, N.E. Washington, DC 20426 (202) 502-8070
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f. Transmittal: This final environmental impact statement prepared by the Commission's staff on the hydroelectric license application filed by Public Utility District No. 1 of Chelan County for the existing Rocky Reach Hydroelectric Project (No. 2145-060) is being made available to the public on or about August 4, 2006, as required by the National Environmental Policy Act of 1969¹

¹ National Environmental Policy Act of 1969, amended (Pub. L. 91-190, 42 U.S.C. 4321-4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258, §4(b), September 13, 1982).

FOREWORD

The Federal Energy Regulatory Commission (Commission), pursuant to the Federal Power Act (FPA)² and the U.S. Department of Energy Organization Act³ is authorized to issue licenses for up to 50 years for the construction and operation of non-federal hydroelectric developments subject to its jurisdiction, on the necessary conditions:

That the project adopted... shall be such as in the judgment of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water-power development, for the adequate protection and enhancement of fish and wildlife (including related spawning grounds and habitat), and for other beneficial public uses, including irrigation, flood control, water supply, and recreational and other purposes referred to in Section 4(e)...⁴

The Commission may require such other conditions not inconsistent with the FPA as may be found necessary to provide for the various public interests to be served by the project.⁵

² 16 U.S.C. §791(a)-825r, as amended by the Electric Consumers Protection Act of 1986, Public Law 99-495 (1986) and the Energy Policy Act of 1992, Public Law 102-486 (1992).

³ Public Law 95-91, 91 Stat. 556 (1977).

⁴ 16 U.S.C. §803(a).

⁵ 16 U.S.C. §803(g).

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ACRONYMS AND ABBREVIATIONS

ALP	alternative licensing process
APE	area of potential effects
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
B.P.	Before Present
BPA	Bonneville Power Administration
Bull Trout Plan	Rocky Reach Bull Trout Management Plan
cfs	cubic feet per second
Chelan PUD	Public Utility District No. 1 of Chelan County
Chelan Wildlife Area	Chelan Wildlife Management Areas
Colville Tribes	Confederated Tribes of the Colville Reservation
Commission	Federal Energy Regulatory Commission
Corps	U.S. Army Corps of Engineers
CRITFC	Columbia River Inter-Tribal Fish Commission
Cultural Plan	Rocky Reach Historic Properties and Cultural Resources Management Plan
CWA	Clean Water Act
DART	Corps' Data Access in Real Time
DFMS	downstream fixed monitoring site
DO	dissolved oxygen
Douglas PUD	Public Utility District No. 1 of Douglas County
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FCRPS	Federal Columbia River Power System
FERC	Federal Energy Regulatory Commission
Forest Service	U.S. Forest Service
FPA	Federal Power Act
FPE	fish passage efficiency
FR	Federal Register
FWS	U.S. Fish and Wildlife Service
GBT	gas bubble trauma
gpm	gallons per minute
Grant PUD	Public Utility District No. 2 of Grant County
Hanford Reach Agreement	Hanford Reach Fall Chinook Protection Program Agreement
HCP	Anadromous Fish Agreement and Habitat Conservation Plan for the Rocky Reach Project
Hourly Coordination Agreement	Mid-Columbia Hourly Coordination Agreement
IAC	Interagency Committee for Outdoor Recreation

ICD	Initial Consultation Document
Interior	U.S. Department of the Interior
ITP	incidental take permit
Joint Permit Program	Joint Aquatic Resource Permit Application Program
kcfs	thousand cubic feet per second
kV	kilovolt
kW	kilowatt
kW-yr	kilowatt per year
kWh	kilowatt-hour
mg/l	milligrams per liter
ml	milliliter
msl	mean sea level
MW	megawatt
MWh	megawatt-hour
National Register	National Register of Historic Places
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NPS	U.S. National Park Service
NSWG	Natural Sciences Working Group
NTU	nephelometric turbidity unit
NWPP	Northwest Power Pool Area
O&M	operation and maintenance
PA	Programmatic Agreement
Pacific Lamprey Plan	Rocky Reach Pacific Lamprey Management Plan
PDEA	Preliminary Draft Environmental Assessment
Permit Species	Upper Columbia River spring and summer/fall Chinook salmon, Okanogan River and Lake Wenatchee sockeye salmon, and Upper Columbia River steelhead
PIT tag	passive integrated transponder tag
Plan Species	Upper Columbia River spring and summer/fall Chinook salmon, Okanogan River and Lake Wenatchee sockeye salmon, Upper Columbia River steelhead, and Upper Columbia River coho salmon
PME	protection, mitigation, and enhancement
project	Rocky Reach Hydroelectric Project
REA	Ready for Environmental Analysis
Recreation Plan	Rocky Reach Recreation Resources Management Plan
Resident Fish Plan	Rocky Reach Resident Fish Management Plan

RM	river mile
Rocky Reach Project	Rocky Reach Hydroelectric Project
RR Cultural Forum	Rocky Reach Cultural Forum
RR Fish Forum	Rocky Reach Fish Forum
RR Recreation Forum	Rocky Reach Recreation Forum
RR Wildlife Forum	Rocky Reach Wildlife Forum
RTE	rare, threatened, and endangered
SCORP	State Comprehensive Outdoor Recreation Plan
SD1	Scoping Document 1
Settlement Agreement	Rocky Reach Comprehensive Settlement Agreement
Shoreline Erosion Plan	Rocky Reach Shoreline Erosion Management Plan
SHPO	State Historic Preservation Officer
SIS	Summary of Implementation Strategies
SNTEMP	Stream Network Temperature
SOBA	State Organization for Boating Access
SOC	species of concern
spp.	species
TCPs	Traditional Cultural Properties
TDG	total dissolved gas
TMDL	total maximum daily load
Umatilla Tribes	Confederated Tribes of the Umatilla Indian Reservation
USGS	U.S. Geological Survey
WA	wildlife area
WAC	Washington Administrative Code
Washington State Parks	Washington State Parks and Recreation Commission
Water Quality Plan	Rocky Reach Water Quality Management Plan
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WDOE	Washington Department of Ecology
WDOT	Washington Department of Transportation
White Sturgeon Plan	Rocky Reach White Sturgeon Management Plan
Wildlife Plan	Rocky Reach Wildlife Management Plan
WSHS	Western Shore Heritage Services, Inc.
Yakama Nation	Confederated Tribes and Bands of the Yakama Nation

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EXECUTIVE SUMMARY

This final environmental impact statement (final EIS) evaluates the potential effects on the environment associated with relicensing the 865.76-megawatt Rocky Reach Hydroelectric Project (project) No. 2145. The project is an existing, operating hydroelectric facility located on the Columbia River near the city of Wenatchee, Washington. The project occupies approximately 1,500 acres, of which about 152 acres are federal lands managed by the U.S. Bureau of Land Management and the U.S. Forest Service (Forest Service). All of the Forest Service land is in Washington Department of Transportation and railroad rights-of-way. The project is licensed to Public Utility District No. 1 of Chelan County (Chelan PUD). Chelan PUD filed an application on June 30, 2004, for a new license with the Federal Energy Regulatory Commission (Commission or FERC) for the continued operation and maintenance (O&M) of the existing project. No new capacity is proposed. The original project license expired on June 30, 2006 and the project is currently operating on an annual license per a Notice of Authorization issued on July 11, 2006.

On March 20, 2006, Chelan PUD filed a Comprehensive Settlement Agreement (Settlement Agreement) signed by the applicant and nine other parties⁶. On June 5, 2006, Chelan PUD filed an additional signature page to the Settlement Agreement, adding the Confederated Tribes of the Colville Reservation as one of the settling parties. On June 28, 2006, Chelan PUD filed an additional signature page to the Settlement Agreement, adding the Confederated Tribes and Bands of the Yakama Nation as one of the settling parties. The Settlement Agreement resolves issues related to relicensing the project.

In this final EIS, we, the Commission staff, assess the environmental and economic effects of: (1) continuing to operate the project with no changes or enhancements (no-action alternative); (2) operating the project as proposed by Chelan PUD in the Settlement Agreement (Chelan PUD's proposal); and (3) operating the project as proposed by Chelan PUD with additional or modified environmental measures (staff alternative).

NO-ACTION ALTERNATIVE

The no-action alternative is intended to describe the environment as it exists today, and to describe a baseline by which we judge the benefits and costs of any needed measures that would be applied under a new license. In June 2004, the Commission amended the project's existing license to include the Anadromous Fish Agreement and Habitat Conservation Plan for the Rocky Reach Project (HCP). In accordance with the

⁶ The nine parties are U.S. Fish and Wildlife Service, Washington Department of Ecology, National Park Service, U.S. Bureau of Land Management, Washington Department of Fish and Wildlife, Washington State Parks and Recreation Commission, City of Entiat, Entiat Coalition, and Alcoa Power Generating Inc.

amended license, Chelan PUD has begun to implement the HCP, but implementation is still in the early stages. Much of the cost of implementing the HCP is still to be expended and the expected benefits of the HCP have not begun to accrue; most of these costs and benefits would begin to accrue during the term of any new license that may be issued. Including future HCP measures as part of the no-action alternative would not reflect the environment as it exists today and would pre-judge the benefits and costs of including those measures in a new license. Therefore, to accurately differentiate between the no-action alternative (baseline), the proposed action (Chelan PUD's proposal, which includes implementation of the HCP), and any other alternatives, we define the no-action alternative as project operations as it existed on January 12, 2005, when the Commission issued its Ready for Environmental Analysis notice. Under the no-action alternative, the project would continue to operate, without implementation of future HCP-mandated measures. No additional enhancement measures, including those contained in the Settlement Agreement, would be implemented and power generation would remain the same.

Under the no-action alternative, total average annual generation would be 6,030,900 megawatt-hours (MWh). Based on our estimate of the current cost of replacing this amount of power with no consideration of inflation over the 30-year period of our analysis, the average annual power value of the project under the no-action alternative would be \$236.86 million (about \$39.27/MWh) and the average annual cost would be \$79.89 million (about \$13.25/MWh), resulting in an average annual net benefit of \$156.97 million (about \$26.02/MWh).

CHELAN PUD'S PROPOSAL

Chelan PUD's proposal would implement the protection and enhancement measures detailed in the Settlement Agreement. Measures included in Chelan PUD's proposal are: (1) establishing several forums to serve as a primary means of coordination between Chelan PUD and other parties regarding implementation of the management plans; (2) implementing a Shoreline Erosion Management Plan; (3) implementing a Water Quality Management Plan; (4) continuing to implement the HCP for the Rocky Reach Project to protect salmon and steelhead; (5) developing and implementing a White Sturgeon Management Plan; (6) continuing to implement the Bull Trout Management Plan; (7) implementing a Pacific Lamprey Management Plan; (8) implementing a Resident Fish Management Plan; (9) implementing a Wildlife Management Plan (Wildlife Plan); (10) implementing a Historic Properties and Cultural Resources Management Plan; and (11) implementing a Recreation Resources Management Plan. Specific measures included in each of the plans and programs are described in Section 3.0, *Environmental Analysis*.

Chelan PUD's proposal includes significant environmental measures, such as continued implementation of the HCP, restoration and maintenance of the fish bypass, hatchery improvements, and recreational facility improvements. The measures included

in this alternative would not change the project's installed or dependable capacity or its average annual generation. With the same average annual power value as the no-action alternative and with an average annual cost of \$97.33 million (about \$16.14/MWh), the average annual net benefit of Chelan PUD's proposal would be \$139.53 million (about \$23.14/MWh).

STAFF ALTERNATIVE

The staff alternative includes most, but not all, of the measures proposed by Chelan PUD as well as additional measures, including those recommended by state and federal agencies pursuant to sections 18, 4(e), and 10(j) of the Federal Power Act.

Measures proposed by Chelan PUD but not included in the staff alternative are:

(1) determining the carrying capacity of available habitat for white sturgeon and adjusting the supplemental program; (2) participating in the U.S. Fish and Wildlife Service's bull trout recovery plan development; (3) exchanging information and participating in regional monitoring efforts for bull trout; (4) literature review of upstream passage measures for Pacific lamprey; (5) identifying and addressing juvenile lamprey presence, abundance, and habitat use; (6) identifying and implementing measures to address unavoidable effects to achieve No Net Impact for Pacific lamprey; (7) resident fish rearing and stocking; (8) implementing resident fish/fishing enhancement measures; (9) recreational fishing evaluation for resident fish; (10) monitoring resident fish species composition and abundance; and (11) annual community meetings for recreation.

Additional or modified measures included in the staff alternative are: (1) filing a revised Wildlife Plan; (2) filing a report every 5 years on proposed Wildlife Plan activities; (3) revising the project boundary to include lands where O&M is required under the revised Wildlife Plan; (4) incorporating the riparian habitat associated with the Sun Cove property in the project boundary and protecting the wildlife habitat (as opposed to acquiring a conservation easement); and (5) filing a revised Recreation Plan.

Under the staff alternative, the project would have the same power benefit as Chelan PUD's proposal and the no-action alternative. With an average annual cost of \$97.19 million (about \$16.11/MWh), the average annual net benefit of the staff alternative would be \$139.68 million (about \$23.16/MWh).

The staff alternative does not include some of the recommendations filed by the Confederated Tribes of the Umatilla Indian Reservation and the U.S. Forest Service. They include: (1) formation of a Water Quality Committee; (2) establishing juvenile salmonid mortality and fish passage efficiency goal achievement; (3) adult upstream salmonid passage goal achievement; (4) funding for regional evaluation of salmon stock; (5) white sturgeon population supplementation program through hatchery construction; (6) monitoring and evaluation program for white sturgeon; (7) four-tier sturgeon studies; (8) improving passage for Pacific lamprey; (9) upstream lamprey passage activities; (10) downstream lamprey passage measures; (11) juvenile lamprey habitat assessments;

(12) Pacific lamprey regional research and information sharing; (13) meeting specified lamprey passage goals; (14) lamprey monitoring beyond the project boundary; (15) detailed fishery operations plan; (16) hatchery and habitat management plans; (17) recreation enhancement fund; and (18) a comprehensive Information and Education program.

CONCLUSION

We chose the staff alternative as the preferred alternative because: (1) the project would provide a significant and dependable source of electrical energy for the region (6.0 million MWh annually); (2) the project would avoid the need for an equivalent amount of fossil fuel-fired electric generation and capacity, thereby continuing to help conserve these nonrenewable energy resources and reduce atmospheric pollution; and (3) the protection, mitigation, and enhancement measures proposed by Chelan PUD, as modified and combined with additional measures recommended by the staff, would adequately protect and enhance environmental resources and mitigate impacts of the project.

The overall benefits of this alternative would be worth the cost of proposed environmental measures and would outweigh the consequences of not implementing the other alternatives or of license denial.

1.0 PURPOSE OF ACTION AND NEED FOR POWER

On June 30, 2004, Public Utility District No. 1 of Chelan County (Chelan PUD) filed an application for new license with the Federal Energy Regulatory Commission (Commission or FERC) for the continued operation and maintenance (O&M) of the existing 865.76 megawatt (MW)⁷ Rocky Reach Hydroelectric Project (Rocky Reach Project or project). On March 20, 2006, Chelan PUD filed with the Commission a revised proposal embodied in the Rocky Reach Comprehensive Settlement Agreement (Settlement Agreement) with several other parties. The project is located on the Columbia River in Chelan County, Washington, approximately 7 miles upstream of the city of Wenatchee (figures 1 and 2). The project occupies approximately 1,500 acres. Federal lands within the project boundary include 150.64 acres of U.S. Bureau of Land Management (BLM) land and 1.5 acres of U.S. Forest Service (Forest Service) land. All of the Forest Service land is in Washington Department of Transportation (WDOT) and railroad right-of-way status.

On July 19, 1999, pursuant to 18 CFR 4.34(i), Chelan PUD filed a request to use the alternative licensing process (ALP) for relicensing the project, which the Commission granted on October 25, 1999.

1.1 PURPOSE OF ACTION

The Commission must decide whether to issue a new license to Chelan PUD and what conditions to place on any license issued. Issuing a license would allow Chelan PUD to generate electricity for the duration of the new license. In deciding whether to authorize continued operation of the project in compliance with the Federal Power Act (FPA) and other applicable laws, the Commission must determine that the project will be best adapted to a comprehensive plan for improving or developing the waterway. In addition to the power and developmental purposes for which licenses are issued, the Commission must give equal consideration to the purposes of energy conservation, enhancement of fish and wildlife (including related spawning grounds and habitat), protection of recreational opportunities and preservation of other aspects of environmental quality.

⁷ The total authorized installed capacity of the project was reduced by the Commission from 1,237.4 MW to 865.76 MW in its November 19, 2004, Order Amending License and Revising Annual Charges under Article 43(i). The reduction was based on testing performed for Chelan PUD. The revised capacity includes the 800-kW turbine that was approved by the Commission on March 14, 2002 and will be installed in the fishway attraction water drop structure by April 2007.

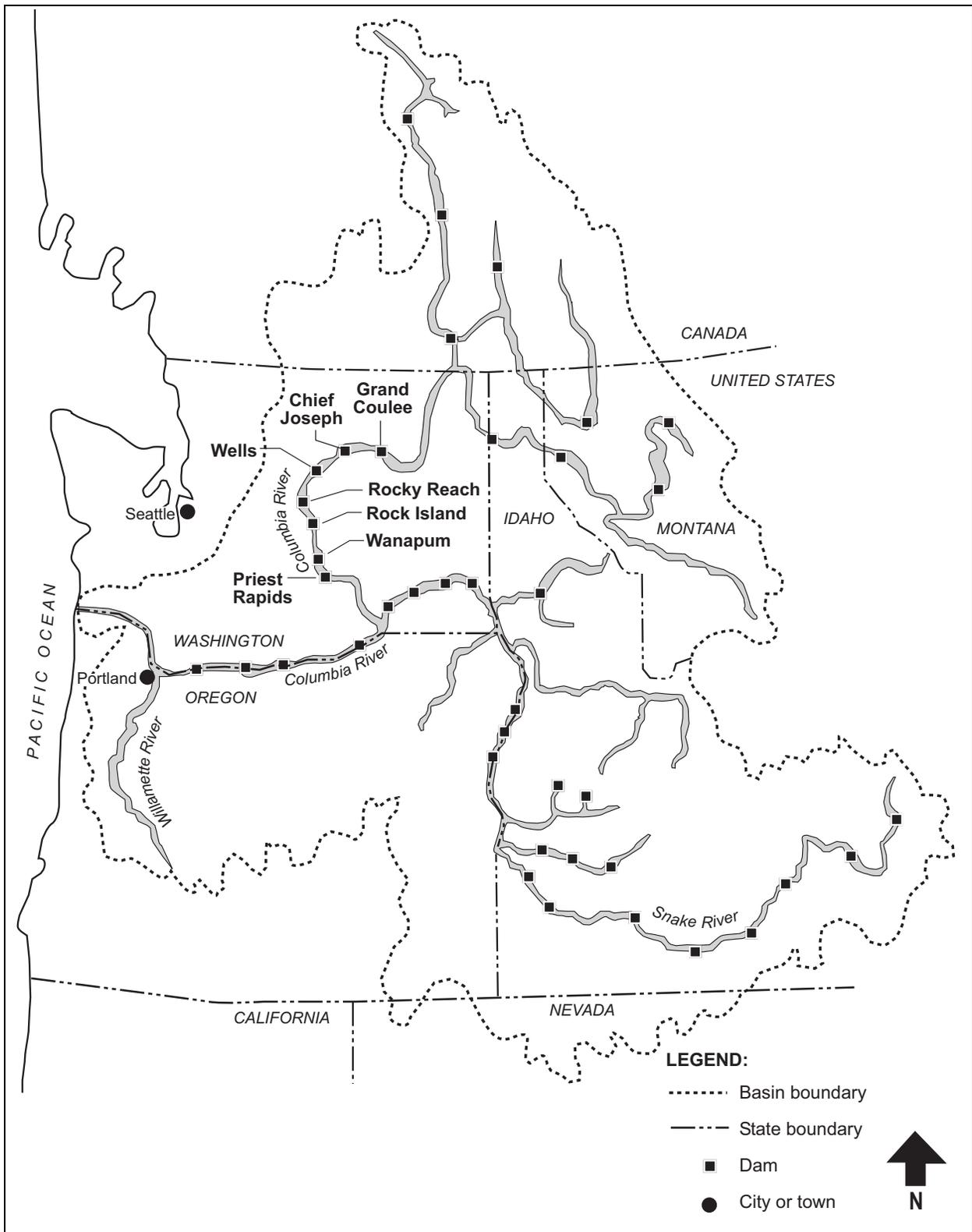


Figure 1. Location of the Rocky Reach Project in the Columbia River Basin. (Source: Staff)

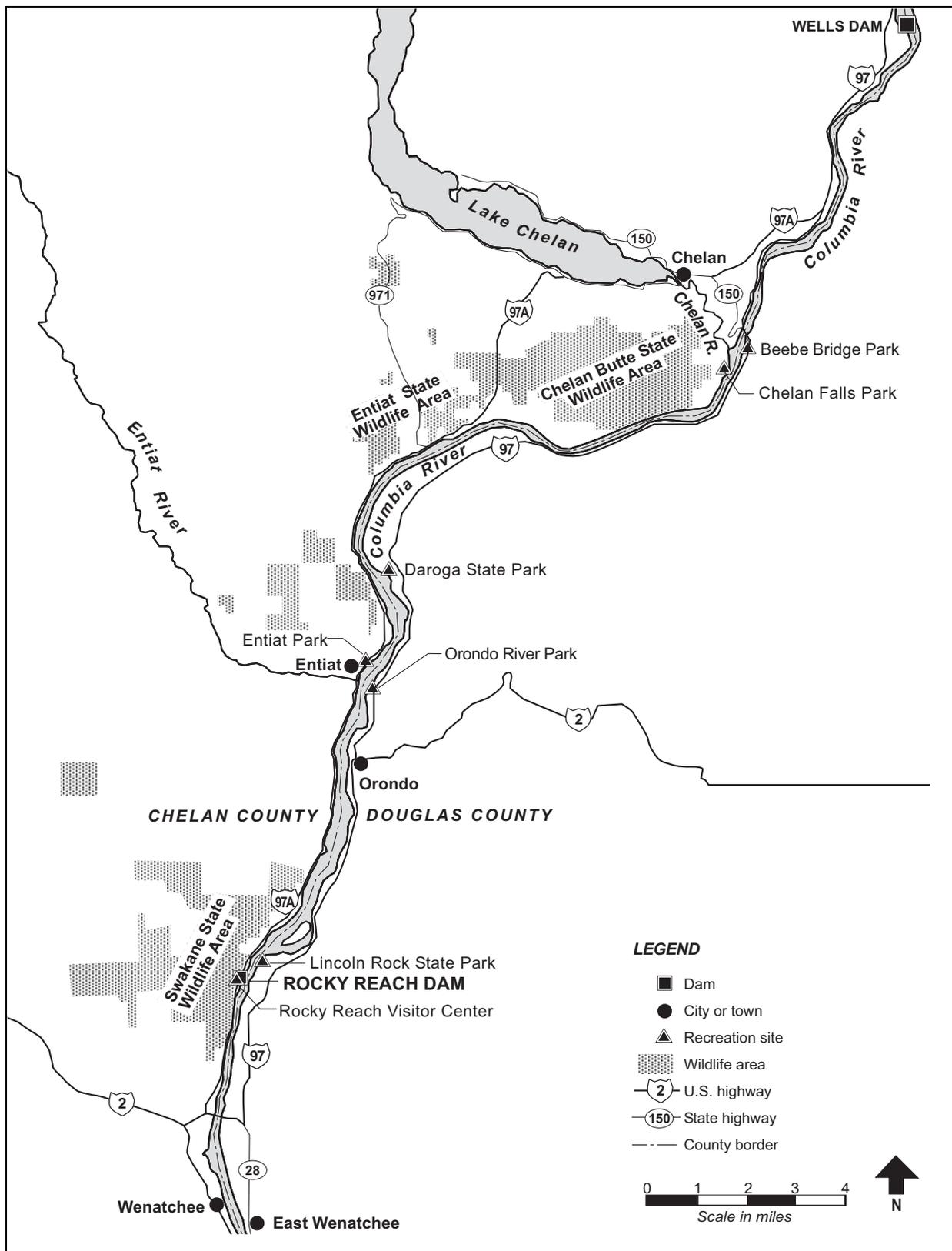


Figure 2. Area map of the Rocky Reach Project. (Source: Staff)

In this final environmental impact statement (final EIS), we, the Commission staff, assess the environmental and economic effects of: (1) continuing to operate the project with no changes or enhancements (no-action alternative); (2) operating the project as proposed by Chelan PUD (Chelan PUD's proposal); and (3) operating the project as proposed by Chelan PUD with additional or modified environmental measures (Chelan PUD's proposal with modifications, or staff alternative). The no-action alternative represents baseline environmental and economic conditions for comparison with other alternatives.

1.2 NEED FOR POWER

With an installed capacity of 865.76 MW, the Rocky Reach Project produces a net average of about 6,030,900 megawatt-hours (MWh) of electric energy per year⁸ that is available to serve the homes and businesses of Chelan County, Washington, and regional customers in the Pacific Northwest. Chelan PUD serves approximately 38,000 retail customer accounts within Chelan County, including residential, agricultural, commercial and industrial accounts, including Alcoa Inc. The load represented by these customer accounts amounts to more than 1.3 billion kilowatt-hours (kWh) annually. Chelan PUD also transmits about two-thirds of its power to five other utilities that serve more than 7 million customers in the Pacific Northwest.

The project is located in the Northwest Power Pool Area (NWPP) of the Western Systems Coordinating Council region of the North American Electric Reliability Council. The peak demand and annual energy requirements for the NWPP area are projected to grow at an average annual compound rate of 1.1 percent and 1.5 percent, respectively, over the 10-year planning period from 2004 through 2013 (WECC, 2004).

With planned generation additions of 10,091 MW, generating capacity reserve margins as a percent of firm peak winter demand in the NWPP area are projected to range from 35.2 to 46.0 percent over the 10-year planning period (WECC, 2004). The future adequacy of the generation supply in the NWPP area will depend on how many of the planned projects, consisting mostly of natural gas-fired, combined cycle combustion turbines, actually get built.

The power from the project would continue to be useful in meeting a part of the regional need for power. The project would displace some of the fossil-fueled electric

⁸ The average annual generation as stated in the license application was 5,806,000 MWh. However, due to generator rewinding and the planned installation of an 800-kW turbine in the fish passage attraction water drop structure, Chelan PUD provided a new generation estimate in its December 27, 2004, AIR response. Average annual generation is expected to be 6,030,896 MWh under both the no action alternative and Chelan PUD's proposed 50-year license alternative. We have rounded this figure to 6,030,900 MWh.

power generation the regional utilities now use, and thereby conserve nonrenewable resources and reduce the emission of noxious byproducts caused by fossil fuel combustion.

1.3 INTERVENTIONS AND AGENCY CONSULTATION

On January 12, 2005, the Commission issued a notice accepting Chelan PUD's application to relicense the project. This notice set a 60-day period during which interventions and comments, as well as terms, conditions, prescriptions, and recommendations, could be filed.

The following entities filed comments, terms and conditions, prescriptions, or recommendations. An (I) indicates the entity also filed a motion to intervene. None of the intervenors oppose the project.

<u>Entity</u>	<u>Filed Date</u>
U.S. Department of Agriculture (I)	February 22, 2005
U.S. Department of the Interior (I)	March 4, 2005; March 14, 2005; and June 1, 2005
U.S. Department of Commerce, National Marine Fisheries Service (I)	March 9, 2005
Washington Department of Fish and Wildlife (I)	March 9, 2005; March 10, 2005
Entiat School District No. 127 (I)	March 10, 2005
City of Entiat, Washington (I)	March 10, 2005
Washington Department of Fish and Wildlife	March 10, 2005
U.S. Forest Service	March 11, 2005
Alcoa, Inc. (I)	March 14, 2005
American Rivers (I)	March 14, 2005
Avista Corporation (I)	March 14, 2005
Columbia River Inter-Tribal Fish Commission (I)	March 14, 2005
Confederated Tribes of the Umatilla Indian Reservation (I)	March 14, 2005
U.S. Department of the Interior	March 14, 2005; June 1, 2005
Washington Department of Ecology (I)	March 14, 2005
Confederated Tribes and Bands of the Yakama Nation (I)	March 16, 2005
Portland General Electric Company	March 21, 2005

Chelan PUD filed responses to the comments, terms, conditions, prescriptions, and recommendations on April 27, 2005; May 11, 2005; and July 15, 2005.

1.4 SCOPING PROCESS

Pursuant to the National Environmental Policy Act (NEPA) of 1969, public scoping meetings were held on December 15 and 16, 1999, to provide agencies and interested parties an opportunity to review and provide input concerning the Initial Consultation Document (ICD), issued on July 7, 1999 and Scoping Document 1 (SD1, issued on November 15, 1999). Following those meetings, Chelan PUD issued a revised SD1 to all interested parties for further review and comment. Comments on both documents were due January 16, 2000, 30 days after the scoping meetings in December. Chelan PUD reviewed comments received as a result of the scoping process and issued Scoping Document 2 on June 7, 2000, which incorporated those comments.

Site visits were made by the Commission's Office of Energy Projects staff, agency representatives, and members of the public on Thursday, May 23, 2002, and on Wednesday September 15, 2004.

In addition to the comments received at the scoping meetings, the following entities provided written comments:

<u>Scoping Document No. 1:</u>	<u>Date of Comment</u>
Washington Department of Ecology	December 22, 1999
Washington Department of Fish and Wildlife	January 12 and 27, 2000
U.S. Forest Service	January 12 and 27, 2000
U.S. Fish and Wildlife Service	January 13, 2000
Public Utility District No. 2 of Grant County	January 14, 2000
Confederated Tribes of the Umatilla Indian Reservation	January 14, 2000
American Rivers	January 14, 2000
Columbia River Inter-Tribal Fish Commission	January 14, 2000
Confederated Tribes and Bands of the Yakama Indian Nation	January 14, 2000
Entiat Focus Group	January 17, 2000
U.S. Department of Commerce, National Marine Fisheries Service	January 24, 2000
City of Entiat, Washington	January 26, 2000

<u>Scoping Document No. 2:</u>	<u>Date of Comment</u>
Confederated Tribes and Bands of the Yakama Indian Nation	August 7, 2000
Washington State Department of Ecology	August 7, 2000
American Rivers	August 8, 2000
Columbia River Inter-Tribal Fish Commission	August 10, 2000

1.5 COMMENTS ON THE DRAFT EIS

The Commission staff sent the draft EIS to the U.S. Environmental Protection Agency (EPA) and made the draft EIS available to the public on September 9, 2005. The Commission staff requested that any written comments on the draft EIS be filed within 60 days. In addition, the Commission staff participated in a technical conference on October 19, 2005, and accepted oral comments from that conference. We modified the text of the final EIS as appropriate in response to oral and written comments. Appendix A lists the commenters, summarizes the comments, and presents our responses to those comments.

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2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO-ACTION ALTERNATIVE

The Commission typically defines the no-action alternative as continuing to operate the project under the terms and conditions of the existing license, with no additional environmental protection, mitigation, or enhancement measures being implemented that would change the existing environmental conditions in the project area. Thus, the no-action alternative is intended to describe the environment as it exists today, and by which we judge the benefits and costs of any needed measures that would be applied under a new license.

In this instant case, the Commission recently amended the existing license (June 2004) to include the Anadromous Fish Agreement and Habitat Conservation Plan for the Rocky Reach Project (HCP) (see appendix B) (107 FERC ¶61,281). In accordance with the amended license, Chelan PUD has begun to implement the HCP, but implementation is still in the early stages. Much of the cost of implementing the HCP is still to be expended and the expected benefits of the HCP have not begun to accrue; most of these costs and benefits would begin to accrue during the term of any new license that may be issued. Including future HCP measures as part of the no-action alternative would not reflect the environment as it exists today and would pre-judge the benefits and costs of including those measures in a new license.

Therefore, to accurately differentiate between the no-action alternative (baseline), the proposed action (Chelan PUD's proposal, which includes implementation of the HCP), and any other alternatives, we define the no-action alternative as project operations as they stood on January 12, 2005, when the Commission issued its Ready for Environmental Analysis (REA) notice. Under the no-action alternative, the project would continue to operate as it did at that time, without implementation of future HCP-mandated measures. No additional change to the current environmental setting in the project area would occur, and power generation would remain the same. No additional enhancement measures, including those contained in the Settlement Agreement would be implemented.

2.1.1 Existing Project Facilities

The project is located on the Columbia River at river mile (RM) 473.7 in Chelan County, Washington, approximately 7 miles upstream of the city of Wenatchee. The project reservoir extends 43 miles upstream to the Public Utility District No. 1 of Douglas County's (Douglas PUD) Wells Project (FERC No. 2149). The project is a run-of-river project, with run-of-river defined in this case as average daily inflow equaling the average daily outflow.

The initial application for the project was filed January 13, 1956. The license was issued by order dated July 11, 1957, and expires in 2006. Five amendments to the initial license had been approved at the time of Chelan PUD's submittal of its application for a new license.

The existing Rocky Reach Project consists of:

1. a reservoir, with a current normal maximum headwater elevation at the dam of 707 feet⁹ above mean sea level (msl) and an average flow of about 115,400 cubic feet per second (cfs);
2. a 130-foot-high and 2,847-foot-long concrete-gravity dam (including the powerhouse);
3. a spillway that is integral to the dam with twelve 50-foot-wide bays separated by 10-foot-wide piers, with flows being controlled by a 58-foot-high radial gate;
4. a 1,088-foot-long, 206-foot-wide, 218-foot high indoor powerhouse with 11 generating units (Units 1 through 7 with installed capacities of 68,392 kilowatt (kW) each and Units 8 through 11 with installed capacities of 96,554 kW) each and a service bay;
5. transformers, located on the powerhouse intake deck, which step up from 14.8 kilovolts (kV) to 230 kV, and five sets of 230-kV transmission lines that convey power from the powerhouse to the switchyard;
6. a forebay wall, which is integral to the dam and is formed by 10 blocks varying in heights and widths between the powerhouse and west abutment;
7. two 125-foot-high by 60-foot-wide non-overflow east abutment blocks that are integral to the dam;
8. a roughly 2,000-foot-long by 200-foot-deep (maximum depth of the cutoff) east bank seepage cutoff, which is buried and extends from the east end of the concrete portions of the dam;
9. a fishway with three entrances (between spillway bays 8 and 9, at the center of the dam, and at the powerhouse service bay) to provide for upstream adult fish migration;
10. three hydraulic turbine-driven pumps with a total capacity of 3,500 cfs to provide attraction water for the fishway passages;

⁹ All elevations in this document are referenced to the National Geodetic Vertical Datum of 1929. To convert to the newer U.S. Coast and Geodetic Survey datum commonly used on the Columbia River, subtract 1.78 feet.

11. a juvenile fish bypass system with a surface collection system and a bypass conduit to provide downstream passage to juvenile salmon and steelhead;
12. an 800-kW small turbine generator in the existing attraction water drop structure that provides supplemental flow to the adult fishway spillway entrance (licensed and planned for completion in April 2007);
13. fish rearing facilities on Turtle Rock Island and near the dam's left abutment, both upstream and downstream of the dam;
14. recreation facilities, including a visitor's center, powerhouse galleries, and seven parks; and
15. public safety measures, including a boat barrier, log boom, fencing, and signs to restrict access to parts of the project facilities.

The project has been operating for more than 50 years under the existing license and during this time, the Commission staff has conducted operational inspections focusing on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the license, and proper maintenance. In addition, the project has been inspected and evaluated every 5 years by an independent consultant and a consultant's safety report has been submitted for Commission review. As part of the relicensing process, the Commission staff evaluates the continued adequacy of the proposed project facilities under a new license. In any new license issued, special articles would be included, as appropriate. The Commission staff would continue to inspect the project during the new license term to assure continued adherence to Commission-approved plans and specifications, special license articles relating to construction (if any), O&M, and accepted engineering practices and procedures.

2.1.2 Current Project Operation

Chelan PUD operates the project reservoir with a normal maximum headwater elevation of 707 feet. The minimum headwater level is at elevation 703 feet, and the maximum headwater level, available for passage of flood flows, is at elevation 710 feet. Project operation, including decisions to start, stop, and adjust the output of the 11 generating units, is completely automated. The project's automated functions are backed up with around-the-clock, on-duty plant operators who monitor operations and can override computer control if needed.

The project has usable storage capacity of 36,400 acre-feet between headwater elevations 707 feet and 703 feet.

Chelan PUD is a signatory to the 1997 Mid-Columbia Hourly Coordination Agreement (Hourly Coordination Agreement), along with Douglas PUD, Public Utility District No. 2 of Grant County (Grant PUD), the Bonneville Power Administration

(BPA), the U.S. Army Corps of Engineers (Corps), the U.S. Bureau of Reclamation, and other Northwest utilities. The Hourly Coordination Agreement facilitates maintaining the mid-Columbia reservoirs¹⁰ at or near their full levels. All power requests and non-power requirements are collected and tracked by a computer and power management personnel at Grant PUD's headquarters in Ephrata, Washington. At the headquarters, flows are allocated to maximize generation, keeping the reservoirs as full as possible while minimizing spill losses.

Because of operation under the Hourly Coordination Agreement, plant capacity at the project does not change significantly with flow. Currently, the project operates in the top foot of reservoir storage 73 percent of the time and within the top 2 feet 98 percent of the time. As flows reach and exceed 150,000 cfs, tailwater effects reduce plant capacity due to higher tailwater levels and lower available gross head. At average flows, the reservoir's active storage is sufficient to run the plant for about 2 hours without additional inflow.

Chelan PUD is also a signatory to the 2004 Hanford Reach Fall Chinook Protection Program Agreement (Hanford Reach Agreement), along with Grant PUD, BPA, Washington Department of Fish and Wildlife (WDFW), the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS), Douglas PUD, and the Colville Confederated Tribes. The Hanford Reach Agreement sets flow fluctuation limits for the protection of fall Chinook salmon.

During a normal water year, the project operates at a plant factor of 55 percent. During high water years, the project operates at a higher plant factor and is more often subject to spill to pass flows in excess of plant turbine capacity. When operating at a higher plant factor, the project is able to operate at or near full load for longer periods without drafting the storage from the reservoir. Under lower water supply conditions, the number of hours that the plant can sustain operations at or near peak load diminishes.

2.1.3 Current Environmental Measures

2.1.3.1 Existing Fish Facilities and Programs

Upstream Passage

The Rocky Reach dam is equipped with a fishway with entrances located between spillway bays 8 and 9, the center of the dam, and at the powerhouse service bay. Fish

¹⁰ The Hourly Coordination Agreement applies to the Grand Coulee, Chief Joseph, Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids Hydroelectric Project reservoirs.

using these entrances follow passages to the center of the dam, and then along the downstream side of the powerhouse to a fish ladder along the forebay wall.

Hatchery Programs and Fish Production Facilities

The original FERC license for the project has provisions requiring Chelan PUD to construct, operate, and maintain facilities to conserve fish and wildlife resources. Ultimately, Chelan PUD entered into agreements with both the Washington Department of Fisheries and the Washington Department of Game, now merged and called WDFW, to develop facilities and programs for fish production (Chelan PUD, 1961, 1963a,b, 1965). The facilities constructed as a result of these and subsequent agreements include the Chelan Hatchery, Rocky Reach Hatchery, and Turtle Rock Hatchery.

Prior to implementation of the HCP, hatchery-based compensation program goals consisted of releases of summer/fall Chinook salmon (200,000 yearlings and up to 1,620,000 subyearlings), 200,000 steelhead, and 90,000 rainbow trout. Under the HCP, the 1.6 million subyearling Chinook salmon program has been converted to a program of 400,000 fish reared at 25 fish per pound and 660,000 fish released at 50 fish per pound. These production goals are subject to broodstock availability and other constraints related to changes in the genetic management for steelhead, which is listed under the Endangered Species Act (ESA). The production goals are intended to produce enough fish to meet the 7 percent hatchery compensation level necessary to achieve No Net Impact for all Plan Species.

Current Salmonid Fisheries Conservation Measures

Current anadromous salmon and steelhead fisheries habitat conservation measures within the project area evolved through a number of processes that date back to 1979, when FERC initiated an administrative proceeding known as the Mid-Columbia Proceeding. The purpose of the Mid-Columbia Proceeding was to develop a system-wide approach to protect the downstream migration of salmon and steelhead in the mid-Columbia River in the area stretching from the tailrace of Chief Joseph dam downstream to the Hanford Reach; this area includes the project.

Over the years, a FERC administrative law judge approved several interim stipulations related solely to the Rocky Reach portion of the Mid-Columbia Proceeding. The most recent revised interim stipulation, approved on May 23, 1996, is the Fourth Interim Stipulation. In the Fourth Interim Stipulation, Chelan PUD agreed to: (1) develop fish protection measures (which can include guidance and bypass systems) to facilitate downstream fish migration; (2) evaluate the effectiveness of the fish protection measures; (3) provide hatchery fish production; and (4) work with interested parties concerning long-term compensation options.

The Fourth Interim Stipulation expired on December 31, 1998. Despite its expiration, the Fourth Interim Stipulation continued to guide project operations while negotiating parties tried to reach agreement on a Fifth Interim Stipulation and a final conservation plan for anadromous species. These discussions were concurrent with negotiations on the HCP. For various reasons, the Fifth Interim Stipulation was not signed, and most parties agreed to defer to the HCP process.

The HCP is a 50-year agreement to protect five species of Columbia River steelhead and salmon: spring and summer/fall Chinook salmon (*Oncorhynchus tshawytscha*), sockeye salmon (*O. nerka*), coho salmon (*O. kisutch*), and steelhead (*O. mykiss*) (collectively, the Plan Species). Its goal is to result in no net impact on the Plan Species by using a combination of mitigation tools to improve fish passage survival rates and achieve a virtual 100 percent survival of fish passing the project. These mitigation tools include fish passage measures for juvenile and adult Plan Species, hatchery programs, and a fund for habitat improvements.

In August 2003, NMFS issued an incidental take permit (ITP) for four of the Plan Species: Upper Columbia River spring-run Chinook salmon, Upper Columbia River summer/fall Chinook salmon, Okanogan River and Lake Wenatchee sockeye salmon (*O. nerka*), and Upper Columbia River steelhead. The permit would apply to non-listed Plan Species if and when such species are listed (68 FR 53351). Coho salmon are not included in the ITP because the native stock of this species was extirpated early in the 1900s.

On November 24, 2003, Chelan PUD and the HCP signatories filed the HCP with FERC as an amendment to be incorporated in the original project license, and as a settlement of the Rocky Reach portion of the Mid-Columbia Proceeding. The HCP amendment was approved by FERC in June 2004 and is referred to in this EIS as part of Chelan PUD's proposal. The specific measures associated with the HCP are described in more detail in fisheries resource section 3.5.2, *Environmental Effects*.

On April 19, 2004, Grant PUD filed with the Commission the Hanford Reach Agreement under the proceedings for FERC Project No. 2114, Priest Rapids.¹¹ Parties to the Agreement include Grant PUD, NMFS, WDFW, Chelan PUD, Douglas PUD, the Colville Tribe, and BPA.¹² The Hanford Reach Agreement replaces the June 16, 1988, Vernita Bar Agreement to protect and enhance fall Chinook salmon on Vernita Bar during the spawning, pre-hatch, post-hatch, and emergence periods and provides for

¹¹ See Public Utility District No. 2 of Grant County, Washington (FERC No. 2114) Offer of Settlement with the attached Hanford Reach Fall Chinook Protection Program Agreement. Docket No. P-2114-000. Filed April 19, 2004.

¹² On February 10, 2006, Grant PUD filed a settlement agreement as part of the Priest Rapids Project relicensing proceeding and indicated that the FWS is now a signatory of the Hanford Reach Agreement.

minimum flows and regulation of flow fluctuations in the Hanford Reach to protect fall Chinook salmon fry during the rearing period. The Hanford Reach Agreement does not reduce the flow regulation requirements of the Vernita Bar Agreement, but establishes reservoir operating procedures that would be followed by Chelan PUD and Douglas PUD during the rearing period for the purpose of assisting Grant PUD in reducing flow fluctuations in the Hanford Reach and provides for the maintenance of an instantaneous minimum release at all times of at least 36 thousand cubic feet per second (kcfs) in the Hanford Reach.

2.1.3.2 Other Environmental Measures

Other environmental measures that are part of Chelan PUD's ongoing operations include the following:

1. Managing spill to minimize total dissolved gas (TDG) while meeting fish survival goals;
2. Monitoring water temperatures;
3. Implementing a Spill Prevention Control and Countermeasure Plan;
4. Executing a fish predator control program;
5. Maintaining a fish counting program;
6. Stocking rainbow trout;
7. Funding periodic wildlife studies such as those related to mule deer, bald eagles, and goose nesting;
8. Operating and maintaining recreation facilities, including a visitor center, powerhouse galleries, educational and interpretative displays, and seven parks;
9. Maintaining a shoreline development tracking system;
10. Maintaining a milfoil harvest program; and
11. Maintaining public safety measures, including a boat barrier, log boom; fencing and signs to restrict access to parts of the project facilities.

2.1.4 Current Project Boundary

The current project boundary is defined by contour lines on each side of the reservoir beginning at elevation 707 feet at the project dam upstream to the Wells Project tailrace. The elevation of the boundary lines increases with distance upstream of the project dam to take into account the anticipated water level at high flows. The project boundary encompasses about 1,500 acres of land, of which Chelan PUD owns about 600 acres.

2.2 CHELAN PUD'S PROPOSAL

2.2.1 Operational and Environmental Enhancement Measures

As described in the Settlement Agreement filed with the Commission on March 20, 2006 (Chelan PUD, 2006a), Chelan PUD proposes to implement the following operational and enhancement measures as part of a new license for the project, which Chelan PUD requests a 50-year license:

1. Establish a Rocky Reach (RR) Fish Forum, RR Wildlife Forum, RR Recreation Forum, RR Cultural Forum, and RR Policy Committee to serve as coordinators between Chelan PUD and other parties regarding implementation of the management plans included in the Settlement Agreement
2. Implement the Rocky Reach Shoreline Erosion Management Plan (Shoreline Erosion Plan) that includes:
 - a. an erosion control demonstration project
 - b. distribution of erosion control information
 - c. a shoreline erosion control inventory and monitoring program
3. Implement the Rocky Reach Water Quality Management Plan (Water Quality Plan) that includes:
 - a. measures to meet TDG numeric criteria and standards, including:
 - i. TDG monitoring
 - ii. spill management to continue meeting TDG numeric criteria while meeting the HCP survival objectives
 - iii. monitoring aquatic life for gas bubble trauma (GBT)
 - iv. determining TDG compliance
 - v. taking actions if TDG numeric criteria are not achieved
 - b. water temperature measures, including:
 - i. water temperature monitoring
 - ii. temperature modeling to confirm compliance
 - iii. participating in the development and implementation of the EPA water temperature total maximum daily load (TMDL)
 - iv. participating in tributary water temperature improvement planning

- c. continued project operation consistent with existing agreements (Hourly Coordination Agreement and Hanford Reach Agreement)
 - d. water quality sampling in macrophyte beds
 - e. developing and implementing an Aquatic Invasive Species Monitoring and Control Plan
 - f. continuing to implement and revise the Spill Prevention Control and Countermeasure Plan and Columbia-Snake River Spill Response Initiative
4. Continue to implement the HCP for Rocky Reach to protect salmon and steelhead, which would include:
- a. filing final annual and comprehensive progress reports and final results of all studies and testing pursuant to the HCP with the Commission
 - b. filing a license amendment application with the Commission prior to taking any action pursuant to the HCP that requires a change in the authorized project facilities or operations not specifically identified in the HCP
 - c. filing design drawings with the Commission prior to the implementation of any modification or addition to project works that is necessary to implement the HCP
5. Implement the Rocky Reach White Sturgeon Management Plan (White Sturgeon Plan) that includes:
- a. brood stock planning and collection
 - b. juvenile white sturgeon stocking, including:
 - i. initial stocking of yearling white sturgeon
 - ii. adjustments to stocking levels
 - iii. determination of a long-term approach to continuing the supplementation program
 - c. a monitoring program to assess the effectiveness of the supplementation program, including:
 - i. an index monitoring program
 - ii. an investigation of emigration rates and habitat use of the supplemented population
 - iii. supplementation program review
 - d. determining the carrying capacity of available habitat in the Rocky Reach reservoir and adjusting the supplementation program

- e. reporting to the RR Fish Forum and FERC annually summarizing the activities of this plan
6. Continue to implement the Rocky Reach Bull Trout Management Plan (Bull Trout Plan) that includes:
- a. operating upstream fishway and downstream fish bypass facilities including upstream fishway counts
 - b. evaluating adult bull trout upstream and downstream passage, including:
 - i. a bull trout monitoring program
 - ii. reporting and correlation analysis
 - c. monitoring of sub-adult bull trout
 - d. developing and implementing measures to modify the upstream fishway and downstream bypass or operations to reduce the identified impacts to bull trout passage, if any
 - e. participating in the development and implementation of the U.S. Fish and Wildlife Service (FWS) bull trout recovery plan, including:
 - i. meeting attendance
 - ii. tributary enhancement
 - iii. funding collection of tissue samples for genetic analysis
 - iv. participation in information exchanges and regional monitoring efforts
7. Implement the Rocky Reach Pacific Lamprey Management Plan (Pacific Lamprey Plan) that includes:
- a. addressing adult upstream and downstream fish passage, including:
 - i. fishway operations
 - ii. adult upstream passage counts
 - iii. upstream passage improvement literature review
 - iv. modifications to improve upstream passage
 - v. evaluation of upstream passage modifications
 - vi. adult downstream passage
 - vii. periodic monitoring

- b. juvenile downstream passage improvement measures, including:
 - i. operation of the downstream fish passage facilities
 - ii. juvenile impingement monitoring and reporting
 - iii. measurement of effects on juvenile downstream passage
 - c. measuring and addressing ongoing project effects on juvenile lamprey rearing habitat
 - d. identifying and implementing measures to address unavoidable adverse effects on Pacific lamprey in order to achieve No Net Impact
8. Implement the Rocky Reach Resident Fish Management Plan (Resident Fish Plan) that includes:
- a. fish rearing
 - b. resident fish enhancement measures
 - c. recreational fishing evaluation
 - b. resident fish monitoring
9. Implement the Rocky Reach Wildlife Management Plan (Wildlife Plan) that includes:
- a. restoring, maintaining, or improving WDFW lands within the Chelan Wildlife Management Area (Chelan Wildlife Area)
 - b. restoring 1,300 to 1,400 acres in the Chelan Wildlife Area that were previously under cultivation or in need of restoration
 - c. restoring, maintaining, or improving BLM lands within the Rocky Reach Wildlife Area
 - d. restoring, maintaining, or improving Forest Service lands within the Rocky Reach Wildlife Area
 - e. providing a conservation easement on Chelan PUD's Sun Cove property for the purpose of protecting riparian habitat
 - f. implementing an integrated noxious weed program
 - g. conducting annual wildlife surveys and preparing survey reports for species selected by the RR Wildlife Forum
 - h. implementing a noxious weed control program in areas where *S. diluvialis* occurs on public lands adjacent to the project reservoir
 - i. implementing a *S. diluvialis* monitoring program to evaluate the status of the populations in the project boundary

- j. pursuing conservation easements on a parcel of private land where *Spiranthes diluvialis* occurs
10. Implement the Rocky Reach Historic Properties and Cultural Resources Management Plan (Cultural Plan) that includes:
- a. twice-annual meetings of the RR Cultural Forum
 - b. adhering to consultation and permitting guidelines, including:
 - i. tribal consultation
 - ii. agency consultation
 - iii. consultation with private landowners
 - iv. annual reporting
 - c. cultural resource surveys within the area of potential effect (APE)
 - d. a protocol in the event that archaeological deposits or human remains are inadvertently encountered during any project-related activity
 - e. evaluating sites found within the APE
 - f. site treatment measures for Historic Properties currently and subsequently identified within the APE, including site monitoring
 - g. developing and implementing a Traditional Cultural Property (TCP) management plan
 - h. appropriate curation, including developing a collections report that contains information about the location and volume of cultural resources for which Chelan PUD is responsible and completing a collections inventory
 - i. an integrated cultural resources information management system
 - j. appointing a Cultural Resources Coordinator to oversee implementation of the Cultural Plan
 - k. developing and implementing an interpretive plan and education program
11. Implement the Rocky Reach Recreation Resources Management Plan (Recreation Plan) that includes:
- a. continued operation of Rocky Reach Park and Visitor Center, Beebe Bridge Park, Lincoln Rock State Park, Daroga State Park, Entiat Park, Chelan Falls/Powerhouse Park, and the continued O&M of the portion of Orondo Park that Chelan PUD owns
 - b. renovating and enhancing Lincoln Rock State Park and Daroga State Park

- c. trail link from Lincoln Rock State Park to a fish bypass viewing station;
- d. designing and constructing an irrigation system at Orondo Park;
- e. the Entiat Park Revitalization Plan, including Entiat Park upgrades, wastewater treatment plant upgrades, design and construction of an Entiatqua Trail link; implementation of a lease/purchase agreement with the City of Entiat, and convening of an annual community meeting
- f. an updated needs analysis/forecast to assess recreational use and needs within the project boundary
- g. a program to monitor and evaluate recreation resources
- h. complete construction of measures b, c, d, and e within 10 years of license issuance.

Additional descriptions of these proposals are provided in section 3.0 of this document and the HCP is provided in its entirety in appendix B.

2.2.2 Property Boundary Expansion

In 1999, Chelan PUD hired a professional land surveyor to survey the project boundary for the project. As part of this process, Chelan PUD had a computer-based river flow analysis performed to verify flood elevations throughout the reservoir. This new analysis, that included aerial mapping techniques, updated riverbed cross-sections. It also included computer modeling that shows 100-year-flood elevations between Beebe Bridge and Wells Hydroelectric Project as several feet greater, in some locations, than those previously identified using earlier hand calculation methods.

The new calculated flood elevations are approximately 6 inches to 4 feet above the previously surveyed elevations, and Chelan PUD amended the License Application Exhibit G project boundary maps to accurately reflect these increases. Lands affected by this increase are located in rural areas that have minimal development. Chelan PUD is currently working with property owners to amend the necessary flowage easements. Table H-2 of the Final License Application for the Rocky Reach Project (Chelan PUD, 2004a) lists parcels of land being secured by Chelan PUD to amend flowage easements.

2.3 Staff Alternative

2.3.1 Mandatory Conditions

Pursuant to the REA notice issued January 12, 2005, various resource agencies and other interested parties provided comments and recommendations (see section 1.3). Chelan PUD responded with reply comments in letters filed with the Commission on April 27, 2005; May 11, 2005; and July 15, 2005.

2.3.1.1 Water Quality Certification

Section 401(a)(1) of the Clean Water Act (CWA) requires an applicant for a federal license or permit for any activity that may result in any discharge into navigable waters to provide to the licensing or permitting agency a certification from the state in which the discharge originates that any such discharge will comply with certain sections of the CWA. On June 29, 2004, concurrently with the filing of its license application with the Commission, Chelan PUD requested a Section 401 water quality certificate from the Washington Department of Ecology (WDOE). On June 13, 2005, Chelan PUD withdrew its June 29, 2004, request and reapplied for a Section 401 water quality certification as settlement negotiations progressed. On February 8, 2006 following reaching a settlement with several parties, Chelan PUD withdrew its June 13, 2005 request and reapplied for Section 401 certification. In a March 17, 2006 order, WDOE issued a Section 401 certificate for the project.

2.3.1.2 Section 18 of the Federal Power Act—Authority to Require Fishways

Section 18 of the FPA, 16 USC § 811, states that the Commission shall require construction, maintenance, and operation by a licensee of such fishways as the Secretaries of the U.S. Department of Commerce and the U.S. Department of the Interior (Interior) may prescribe. By letter dated March 8, 2005, NMFS provided a preliminary fishway prescription requiring Chelan PUD to carry out its obligations, in their entirety, as set forth in the HCP.

By letter dated March 14, 2005, Interior prescribed that Chelan PUD shall implement the construction, operation, maintenance, and effectiveness monitoring set forth in the HCP. By letter dated June 1, 2005, Interior supplemented its prescription by prescribing upstream and downstream passage for bull trout and upstream passage for Pacific lamprey.

By letter dated January 17, 2006, Interior notified the Commission that Interior had received a proposed alternative fishway prescription by Chelan PUD under 43 CFR §45.4(c), and indicated an intent to file modified conditions and prescriptions at a later date. Due to the filing of the Settlement Agreement, Chelan PUD withdrew its alternative fishway prescription on March 27, 2006.

By letter dated May 24, 2006, Interior notified the Commission that the fishway measures contained in the Settlement Agreement constitute Interior's modified fishway prescriptions for relicensing the project, provided the Commission makes no material changes to the Settlement Agreement. If the Commission materially changes the Settlement Agreement in a manner that changes any of the proposed protection, mitigation and enhancement measures, Interior reserves the right to submit amended

fishway prescriptions that parallel the objectives outlined in the original Settlement Agreement.

2.3.1.3 Section 4(e) Conditions

Section 4(e) of the FPA gives the Secretaries of the Interior and Agriculture authority to impose conditions on licenses issued by the Commission for hydropower projects located on “reservations” under the respective Secretary’s supervision. See 16 U.S.C. §§ 796(2), 797(e).

By letter dated March 14, 2005, Interior on behalf of BLM submitted terms and conditions pursuant to section 4(e). By letter dated May 24, 2006, Interior withdrew its previously submitted section 4(e) conditions, stating that the measures contained in the Settlement Agreement address the substantive issues contained in their original section 4(e) conditions.

By letters dated March 8, 2005, and October 28, 2005, the Forest Service submitted two draft section 4(e) conditions: (1) the Commission’s standard Form L-1 and (2) a reservation of authority to issue revised terms and conditions in the event that Chelan PUD, the Forest Service, and other stakeholders enter into a Settlement Agreement resolving some or all of the issues raised in the proceeding in order to provide terms and conditions that are consistent with the terms of the agreement. The Forest Service plans to file final conditions within 90 days after issuance of the final EIS.

2.3.2 Parties to the Settlement Agreement

In addition to Chelan PUD, the parties to the Settlement Agreement include the FWS, BLM, National Park Service, WDFW, WDOE, Washington State Parks and Recreation Commission (Washington State Parks), City of Entiat, Entiat Coalition, Alcoa Power Generating Inc., the Confederated Tribes of the Colville Reservation (Colville Tribes), the Confederated Tribes and Bands of the Yakama nation (Yakama Nation). In this final EIS, we assume that Chelan PUD’s proposal, as set forth in the Settlement Agreement, represents the recommendations of the parties to the Settlement Agreement. We note that NMFS supports the Settlement Agreement but is not a signatory.

2.3.3 Staff Recommendation

After evaluating Chelan PUD’s proposal and recommendations from resource agencies, tribes, and other interested parties, we considered what environmental measures would be necessary or appropriate with continued operation of the project. We recommend including the following environmental measures proposed by Chelan PUD in any license issued for this project, but revising certain specific elements of the measures, as noted:

1. Establish four forums: RR Fish, Wildlife, Recreation, and Cultural Resource forums and a RR Policy Committee;
2. Implement the Shoreline Erosion Plan;
3. Implement the Water Quality Plan;
4. Continue to implement the HCP for Rocky Reach to protect salmon and steelhead;
5. Implement the White Sturgeon Plan (except as noted below);
6. Continue to implement the Bull Trout Plan (except as noted below);
7. Implement the Pacific Lamprey Plan (except as noted below);
8. Conduct a comprehensive evaluation of the effects of predatory fish species on HCP plan species;
9. Implement the Wildlife Plan with refinements (see below)
10. Implement the Cultural Plan;
11. Implement the Recreation Plan with refinements (see below); and

In addition to Chelan PUD's proposed measures, we recommend the following modifications and refinements:

1. Modify the goal of the White Sturgeon Plan from increasing sturgeon abundance to a level commensurate with available habitat to implementing measures that would reduce or eliminate the effects of the O&M of the Project on white sturgeon. Additionally, we are not recommending that Chelan PUD be required to implement an analysis of the carrying capacity of the available habitat.
2. Modify the Bull Trout Plan so that Chelan PUD will not be required to participate in development of FWS' bull trout recovery plan, specifically attending meetings and participating in regional information exchanges and monitoring efforts.
3. Modify the Pacific Lamprey Plan so that Chelan PUD will not be required to achieve the best passage rates found at other Columbia River projects, implement a no-net-loss standard for Pacific lamprey, fund regional research, or participate in regional information exchanges.
4. Implement one element of the Resident Fish Plan—conduct surveys to determine the effects of predatory resident fish on juvenile salmon and steelhead. Exclude from the license the other measures included in the plan, including fish rearing and stocking, fishing enhancement measures,

recreational fishing evaluation, and monitoring resident fish species and abundance.

5. Revise the Wildlife Plan in consultation with WDFW, BLM, the Forest Service, FWS, and other entities that wish to participate in the RR Wildlife Forum and file the Plan with the Commission for approval within 1 year of license issuance. The final Plan, which would be updated every 5 years, would: (a) specifically describe the habitat improvement projects that would be undertaken for the next 5 years, an implementation schedule, and a description of any monitoring or maintenance programs to ensure success of the measures; (b) include a detailed description of an integrated noxious weed control plan, including a description of the areas to be treated in the first five years of license issuance, and the methods of treatment; (c) include a detailed description of the wildlife surveys that would be implemented for the next 5 years, with subsequent 5-year reports including any proposed modifications to survey efforts; and (d) include the provisions of the “Ute-ladies’-tresses along Rocky Reach Reservoir Management Plan.” The final Plan should also contain a provision for including in the project boundary the Chelan Wildlife Area and BLM and Forest Service-owned lands where annual O&M of the implemented measures is required to ensure its effectiveness. The final plan should **not** include measures that are not directly habitat related, or measures that are generally the responsibility of the land managing agency.
6. Incorporate the riparian habitat associated with the Sun Cove property in the project boundary and protect the wildlife habitat for the term of the license (as opposed to acquiring a conservation easement).
7. Revise the Recreation Plan to include the following elements: (a) a description with detailed drawings of the type and location of all proposed recreational facilities and improvements, including proposed design, construction materials and methods; (b) an implementation schedule for all measures and filings with the Commission for approval; (c) a description of the interpretive trails and signs developed in concert with the Cultural Plan; (d) identification of the entity responsible for O&M of the recreation facilities; (e) a discussion of how the needs of the disabled were considered in the planning and design of the recreation facilities; (f) in concert with Article 9(g) (Recreation Resources Monitoring and Evaluation Program) of the Settlement Agreement, recreation use monitoring on an estimated 150 acres of BLM lands, located within the project boundary; and

(g) documentation of consultation with at least, but not limited to, WDFW, BLM, U.S. National Park Service (NPS), Washington State Parks, and the City of Entiat. File the plan for Commission approval within 1 year of license issuance. Components of the plan should be consistent with the proposed Recreation Plan implementation schedule in the Settlement Agreement.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

Other alternatives to the relicensing proposal were considered but eliminated from detailed study because they are not reasonable in this case. They are: (1) federal takeover and operation of the project; (2) issuance of a non-power license; and (3) project retirement.

2.4.1 Federal Takeover and Operation

Federal takeover and operation of the project is not considered to be a reasonable alternative. Chelan PUD is a municipal entity, and therefore, federal takeover of the project was barred by Congress in the Act of August 15, 1953 (67 Stat. 587). Moreover, no party has suggested that a federal takeover would be appropriate, and no federal agency has expressed an interest in operating the project.

2.4.2 Nonpower License

Issuing a nonpower license would not provide a long-term resolution of the issues presented. A nonpower license is a temporary license that the Commission would terminate whenever it determines that another government agency would assume regulatory authority and supervision over the lands and facilities covered by the nonpower license. In this case, no agency has suggested its willingness or ability to do so. No party has sought a nonpower license, and the applicant has no basis for concluding that the project should no longer be used to produce power. Thus, in these circumstances, a nonpower license is not a realistic alternative to relicensing.

2.4.3 Project Retirement

Project retirement could be accomplished with or without dam removal. Either alternative would involve denial of a license application and surrender or termination of an existing license with appropriate conditions. Dam removal has not been recommended by any party, and we have no basis for recommending it or studying it as an alternative.

The second project retirement alternative would involve retaining the dam and disabling or removing equipment that generates power. Project works would remain in place and could be used for historic or other purposes. This would require identifying another government agency with authority to assume regulatory control and supervision of the remaining facilities. No agency has advocated this alternative for the project, though one interested party, the Columbia River Inter-Tribal Fish Commission (CRITFC), has recommended studying it. Because the power supplied by the project is needed in the region, a source of replacement power would have to be identified. In these circumstances, removal of the electric generating equipment is not considered a reasonable alternative.

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3.0 ENVIRONMENTAL ANALYSIS

The project is located in north central Washington approximately 7 miles north of the city of Wenatchee on the Columbia River in Chelan County. The dam is 215 river miles south of the Canadian border and 474 river miles above the mouth of the Columbia at Astoria, Oregon. The project reservoir extends upriver 43 miles and has a surface area of approximately 8,235 acres.

The project's drainage area at the dam is about 87,800 square miles. The watershed lies east of the Cascade Mountains and west of the Rocky Mountains, in parts of Washington, Idaho, Montana, and British Columbia. The normal maximum headwater elevation is 707 feet, and the average tailwater is at elevation 617.6 feet.

The Columbia River System is primarily fed by snowmelt and upstream storage projects. The river at the project location is essentially a gorge interrupted by confluences with a number of tributary valleys. The two most significant tributaries within the project area are the Entiat and Chelan rivers, which enter the Columbia River at approximately RMs 483 and 503, respectively.

The project lies between two significantly different physiographic areas. It is located in a valley that is north-south trending, with the North Cascades Mountains to the west and the Columbia plateau to the east. The rugged peaks in the Cascades average about 5,000 feet and reach elevations of over 10,000 feet.

The climate in the vicinity of the project is semi-arid, which is typical of eastern Washington. The seasonal range of temperatures in the area is from a winter average of about 25°F (degrees Fahrenheit) to a summer average of about 75°F. Spring and fall temperatures average 50°F. Extreme temperatures can approach -30°F in winter and 110°F in summer. Precipitation is generally low, with an annual average of approximately 10 inches, the bulk of which falls between October and March. There are usually no more than 8 to 15 inches of snow on the ground.

Vegetative cover adjacent to the project reflects the low level of precipitation in the area and the definitive shoreline edge of the reservoir. Riparian vegetation occurs intermittently along the margins of the reservoir. Riparian grasses/forbs, riparian shrubs, and riparian deciduous trees are representative of vegetation within this typically narrow zone. Riparian vegetative types represent about 40 percent of the shoreline. Grassland, shrub steppe, and open conifer/shrub vegetation occur along the upland margins of the shoreline. Exposed rock of both fluvial and glacial origin is often mixed into the landscape. Narrow wetlands occur intermittently within the shoreline margins of the reservoir and are also found where depressions occur beside the highways that parallel much of both sides of the river.

3.1 Cumulative Effects

According to the Council on Environmental Quality regulations for implementing NEPA 40 CFR 1508.7, cumulative effects are defined as the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time, including hydropower and other land and water development activities.

Within the project, we have identified water quality, anadromous salmonids, Pacific lamprey, and white sturgeon as having the potential to be cumulatively affected by this project in combination with other hydroelectric project operations and other activities on the Columbia River.

3.1.1 Geographic Scope

The geographic scope of the cumulative effects analysis defines the physical limits or boundaries of the proposed action's effects on the identified cumulatively affected resources. Analysis of the cumulative effects at the project is limited to the Columbia River watershed, as bounded by the project from the tailrace of the upstream Wells Hydroelectric Project (FERC No. 2149) downstream to the beginning of the Rock Island Hydroelectric Project (FERC No. 943) reservoir.

3.1.2 Temporal Scope

The temporal scope of analysis includes a consideration of past, present, and future actions and their effects on cumulatively affected resources. Based on the likely term of a new license, we projected 30 to 50 years into the future, concentrating on the effects on the resources from reasonably foreseeable future actions. The historical discussion is limited, by necessity, to the amount of information available for each resource. We identify the current resource conditions based on the license application, comprehensive plans, and scoping comments received from various agencies and other stakeholders.

3.2 GEOLOGICAL AND SOIL RESOURCES

3.2.1 Affected Environment

Columbia Plateau lava flows and repeated failure of glacial ice dams during the continental glaciation of the Pleistocene epoch influenced the position of the Columbia River at the project site. Repeated uplifts have caused the river to be entrenched into its position at the edge of the lava flows. Glacial activity also has greatly enlarged the river

valley and shifted the river channel in some locations. The resulting glacial dam failures and floods were often catastrophic, resulting in a large flow of ice- and dirt-filled water that would rush down the Columbia River drainage scouring the canyon in some areas and depositing sediment in others. Steep, rocky upper slopes currently characterize both sides of this part of the river valley. In a few places, bedrock slopes extend to the reservoir level. In most areas, bedrock on the lower slopes is covered by talus or other soil deposits.

The valley is geologically young, and the Columbia River was still actively downcutting at the time of project development. The river in the project area is commonly incised into alluvial fans, terrace deposits, eolian¹³ deposits, and some deposits of lacustrine¹⁴ sediments, many of which are remnants of glacial processes in the area. Where the river passes through terraces, eolian deposits, or lacustrine deposits, the shoreline is characterized by steep banks typical of youthful river valleys. These banks are the remaining erosion faces from downcutting by the river and have relatively flat slopes above them. Alluvial fans more commonly exhibit moderate to gentle slopes that extend to, or nearly to, the water surface. Both terrace and alluvial deposits are composed of sandy gravel with varying percentages of cobbles. The eolian and lacustrine deposits are typically composed mostly of sand-sized and finer materials.

Based upon a flow of 220,000 cfs, a 1999 study conducted by Duke Engineering Services (DES) for Chelan PUD (DES, 2001a) found that silt was the most abundant substrate type in the river itself (25.6 percent), followed by large cobbles (17.7 percent) and sand (17.4 percent).

3.2.1.1 Existing Geologic Hazards

There are no seismic hazards related to the project, and no geologic hazards of significance have been identified. The project is periodically assessed for seismic and other geologic hazards through the required Part 12 inspections under the Commission's authority.

3.2.1.2 Sediment Supply, Transport, and Storage in Reservoir

The project is a run-of-river project with a generally narrow reservoir and a noticeable current flowing through the reservoir. Storage projects farther upriver, including the Wells Project immediately above the Rocky Reach Project, have reduced the sediment supply to the project reservoir.

¹³ Eolian deposits are sediments transported by the wind.

¹⁴ Lacustrine deposits are sediments associated with deposition in or directly adjacent to a lake.

The reservoir created by the Rocky Reach dam (known as Lake Entiat) is essentially a backwater effect. As such, it slows river velocities in the reservoir and raises the water level. Since the first generating units were placed in operation in November 1961, the project has regulated the water level in the reservoir to maintain water levels at the dam between 703 feet and 707 feet msl. The water level at the dam is generally between 706 and 707 feet msl, with a 20-year average of 706.53 feet. During flood flows in the river, the reservoir can be raised as high as 710 feet at the direction of the Corps to minimize the downstream flooding effects.

The water surface elevation is not constant throughout the reservoir, instead increasing measurably from the project dam to the upstream Wells Project dam and varying with the volume of flow. For example, with a headwater elevation at the Rocky Reach dam of 707 feet and a flow of 100,000 cfs, the reservoir water surface elevation at Wells dam is approximately 4 feet higher, or 711 feet msl.

Generally, depths increase in the reservoir from upstream to downstream. The shallowest, most riverine portion of the reservoir is found near the Wells Project tailrace, with depths increasing downstream to the Rocky Reach forebay.

As a result of project development, the typical range of flows and water levels experienced by the shoreline has changed. The annual range of flows has decreased as a result of water storage at upstream projects. These upstream projects store water when natural flows are high and release water during times of lower natural river flows, thus moderating the extremes of flow volume during the water year. Despite this tempering of seasonal variation, the daily range of changes in flow and water level may have increased as a result of regulation of the river. This effect results from the operation of projects upstream of the project and the project's need to pass incoming flows.

Water depths are relatively unchanged from that of the pre-project river in the upper part of the reservoir (i.e., immediately downstream of Wells dam). Immediately upstream of Rocky Reach dam, water depths exceed 100 feet, substantially more than prior to construction of the project. In short, the amount that the average shoreline water elevations have increased because of the project increases with distance downstream.

Lake Entiat also produces a backwater effect on tributary rivers, the extent of which varies with river flow and lake elevation (Chelan PUD, 2001a). At lake elevations at or below 707 feet msl (normal maximum lake level at the confluence of the Entiat and Columbia rivers) and for river flows up to and including the 25-year flood flow, the backwater effect is within the project boundary. Easements purchased for the project extend beyond the project boundary and encompass the entire backwatered area at the 25-year flood flow on the Entiat River. Chelan PUD has stated that the project's backwater effects are covered by these easements.

The backwater effect created by the reservoir at the mouth of the Entiat River results in the deposition of sediment near the river's mouth. In its December 27, 2004, letter, Chelan PUD indicates that prior to project development, it appears that essentially all of the Entiat River's sediment that reached the Columbia River was transported downstream in the river and on the river floodplain. Currently, the sediment deposit is roughly 1,000 feet long and extends from the mouth of the river (the location of which changes with the elevation of Lake Entiat) out into Lake Entiat (Chelan PUD, 2001a). Also in its December 27, 2004, letter, Chelan PUD reports that analysis of aerial photographs shows that mid-channel bars have formed on the Entiat River upstream of the Highway 97 bridge, and by 1998, these bars were heavily vegetated. The Entiat River still maintains a channel through this delta deposit, meeting the fluctuating reservoir water surface at Lake Entiat. Stream currents present in Lake Entiat may be capable of transporting some of the finer sediment from the toe of this delta, but much of the sediment forming the delta deposit remains.

Similarly, the backwater effect at the Chelan River mouth has deposited gravel carried down the Chelan River during flood flows. Gravel deposition in the area of the river mouth and the Chelan Project tailrace channel has created a successful salmonid spawning area (Chelan PUD, 2001a). As with the Entiat River, the Chelan River flow maintains a channel through the deposited gravel, providing access to the area by fish.

3.2.1.3 Shoreline Erosion

Erosion is occurring along the shoreline of Lake Entiat. Inventory fieldwork was done in the spring and summer of 2000. The approach to documenting and inventorying erosion sites included site location using hand-held Global Positioning System equipment. Sites were photographed and each site was described based on visual observations made at the site. Written observations include site characteristics such as material type and slope angle at various levels, apparent degree of erosion activity (or inactivity), height of slope, soil type, limitations on erosion at the site, freshness of exposed soils, and exposure of the site to waves. This inventory identified and mapped 48 erosion sites around the lake. Sites inventoried along the lakeshore have a combined length of approximately 7.3 miles, or about 8.5 percent of the shoreline.

Because shoreline erosion around Lake Entiat was not the subject of organized monitoring efforts prior to the work in 2000, no baseline data are available to estimate the average rate of recession at erosion sites. In the early 1980s, a reconnaissance-level review of erosion was done, with erosion sites marked on topographic maps. More precise data were not recorded, but in general the sites appear no more active or, in some cases, less active in 2000 than was noted in the 1980s. The only available photographs that might prove useful for comparison with current conditions are oblique aerial slides taken in 1991. The appearance of the shoreline has changed little since that time.

The majority of the existing erosion repair or protection work around the reservoir, as surveyed in 2000, takes the form of riprap placed in areas where the railroad or highway are adjacent to the reservoir. Some private property owners have done erosion control work, but most have not. Erosion control work on private property has taken a variety of forms, including riprap, individual large rocks, logs or other large woody debris, and vegetation. Few bulkhead walls were noted around the lake.

When the project was developed, Chelan PUD purchased flowage easements, or damage waivers, around the reservoir, except on sites federally owned at the time. The easements were intended to cover damage in perpetuity to land within the project boundary and to adjoining lands, by “seepage, erosion or similar causes...” as a result of raising the reservoir water level or water table. The easements are not contingent on land use or current ownership, and specifically cover any damage to “improvements, appurtenances and personal property.” The damage waivers are reflected in deeds with reservation of easement rights and flowage easements.

Most of the erosion along the project reservoir is occurring in alluvial fans or terrace deposits. The alluvial fans generally display relatively gentle slopes to, or nearly to, the water’s edge and are the most common setting for residential development. Terrace deposits, sometimes topped with eolian soils, are generally relatively level areas above the water level, with steep slopes down to the water. They also are commonly developed, with agricultural development more common than residential.

3.2.2 Environmental Effects

3.2.2.1 Shoreline Erosion

Shoreline erosion is occurring around the project reservoir and in some instances may be influenced by operation of the project. Important factors influencing shoreline erosion on Lake Entiat include waves caused by wind and boat wakes, stream currents, recreational and other land uses, and higher water levels on the shoreline as a result of project impoundment of the Columbia River. Surface water, including drainage from roads or irrigation, also appears to be a significant factor in some locations, as shown by gullies in banks of exposed soil.

Chelan PUD indicates that wave action is thought to be the most significant factor in erosion at most locations around Lake Entiat (Chelan PUD, 2004a). Waves on Lake Entiat commonly reach 3 to 4 feet in height, with larger waves occurring occasionally. Winds that produce the waves are predominantly up or down the valley. Reservoir levels expose parts of the shoreline that have not been inundated since the most-recent geologic disturbance, glaciation. These highly erodible soils increase the potential for shoreline erosion. Flow velocity is thought to play a larger part in shoreline erosion at some locations around Lake Entiat than is typical of most reservoirs. At these locations, there

is a discernable current at or near the shore. Recreational use and some other land uses also aggravate bank erosion. Foot traffic at parks and docks has killed some vegetation, compacted soil, and caused the displacement of sediment at some sites. Similarly, at some sites along the lake, construction activity has caused substantial disturbance that is unrelated to project operations.

An inventory of shoreline erosion (Chelan PUD, 2001b) noted 48 erosion sites around the reservoir, ranging in length from 30 feet to 5,350 feet, with an average length of 819 feet. These were photographed and described in the inventory report, referenced above. The total shoreline length of the erosion sites was 7.3 miles, which is about 8.5 percent of the roughly 86-mile-long shoreline. No substantial active erosion was noted downstream of the project dam. Most of the erosion along the project reservoir is occurring in alluvial fans or terrace deposits.

The available data do not support a quantitative estimate of the average rate of recession at the erosion sites; however, based on the presence of plants and other site features, the inventory suggests that recession is progressing relatively slowly at most sites. Of the erosion sites inventoried, two are on land managed by the BLM, while the remaining 46 sites are located on lands for which Chelan PUD holds erosion easements.¹⁵ Of the two BLM sites, one is within the project boundary for the Wells Hydroelectric Project. The second BLM site is a small area within the Rocky Reach Project boundary that was identified by the Cultural Resources Working Group as having cultural significance [Chelan PUD, 2001c]).

The Columbia River Valley is essentially an erosional feature and the landscape includes many features that are remnants of erosion that occurred or was in progress prior to project development. In many locations, particularly those where erosion is taking place in terrace or eolian deposits, steep erosion faces were created by the river's downcutting and lateral migration. These steep faces are the most prominent erosional features along the reservoir. Erosion of these faces continues with the higher water level of the reservoir. Factors influencing erosion at these sites vary in their ability to erode the shoreline: a decrease in flow velocities in the reservoir has likely resulted in decreased erosion from this source; however, areas of the river/reservoir formerly not subjected to wind- and boat-generated waves (i.e., steep erosion faces on terrace or eolian deposits that are now inundated by the higher reservoir water levels) likely have higher amounts of erosion. Despite these complicating factors, the study indicates that shoreline erosion appears to be progressing slowly at most sites. In the absence of significant changes in project operations or other relevant factors, the study suggests that erosion is expected to continue in a manner similar to what is currently taking place (Chelan PUD, 2001b).

¹⁵ As noted in section 3.2.1, Chelan PUD indicates that flowage easements, or damage waivers, were purchased around the reservoir, except on sites federally owned at the time of project development.

The erosion inventory (Chelan PUD, 2001b) indicates that erosion along the toe of alluvial fans at many of these locations is attributable to factors such as land use and irrigation. For example, where erosion is occurring along the edges of alluvial fans, native vegetation has been replaced by grass lawns that are being undercut very close to the water's edge. This is particularly noticeable since, in many cases, adjacent areas with native vegetation are not eroding, though they are similar in all other ways. Vegetation type and cover appear to be the key differences in these locations.

The upper surfaces of terrace deposits are often from several to many tens of feet above the water level. Downcutting and lateral migration of the river through the terraces have formed steep faces of soil standing at its angle of repose. Active erosion of many of these faces has continued under current conditions, with gravel and cobble accumulating at the toe of the slope/edge of the reservoir. In some instances, this harder material can act as revetment to some degree, protecting the toe of the slope. It is likely that similar erosion would have continued in the absence of project development, but at different elevations because of the change in the river/reservoir inundation level.

Eolian or lacustrine deposits found at some locations along the reservoir consist of sandy soil without significant gravel or cobble fractions. They are similar to the terrace deposits, but typically are not accumulating cobbles at their toes, so do not gain protection in that way. The fine sand and silt found in these deposits typically erode relatively easily.

In the Settlement Agreement, Chelan PUD proposes to perform erosion repair work at four sites selected by Chelan PUD to demonstrate appropriate erosion control techniques and educate the public about such techniques. In addition, Chelan PUD would make information about erosion control methods available to local governments and individuals with land along the reservoir shoreline, and monitor shoreline erosion during the new license term. Chelan PUD would conduct erosion control work at the BLM-managed cultural site; treatment of the site is included in the Cultural Plan (see section 3.7.2, *Cultural Resource, Environmental Effects*).

With regard to demonstrating erosion control techniques, Chelan PUD during the first 20 years of the license term would select four sites at which to perform erosion control work with the intent of demonstrating a variety of appropriate, permissible techniques to the public. Chelan PUD would select and perform erosion control work at the rate of one or more sites per 5-year period, after the effective date of the new license, although it could elect to conduct the work sooner. These sites would be repaired using current bio-engineering techniques and native plants resistant to erosion, and interpretive signs would be erected to explain the techniques. Chelan PUD would provide an opportunity for WDFW to provide input on the designs and sign content. An effort would be made to include, as one of the demonstration projects, a site at which riprap would be modified to improve its value as habitat. The intent of this effort and of the distribution of information to landowners is to enhance the public's understanding of

state-of-the-art erosion control techniques applicable to conditions found along the project reservoir and to encourage their use.

Chelan PUD proposes to distribute information to assist the public in efforts to control shoreline erosion. The information could include technical information on suggested repair methods and/or reference and contact information that would allow landowners to readily find suitable technical information. Distribution could take place through county offices responsible for building or shoreline development permits, and/or through the Chelan PUD staff responsible for arranging electrical service to sites along the reservoir. Information could also be distributed directly to owners of erosion sites continuing to have erosion problems. Chelan PUD would update the information no less than every 5 years of the first 20 years of the new license, or commensurate with the completion of one of the aforementioned demonstration projects.

Chelan PUD also proposes to complete and carry out a plan for monitoring the progress of shoreline erosion for changes in condition or trends and for monitoring the effectiveness of repairs in years 20 and 40 of any new license. Under this Shoreline Erosion Monitoring Plan, Chelan PUD would inventory erosion sites in the reservoir by boat, using techniques similar to the 2000 inventory of shoreline erosion (Chelan PUD, 2001b). In addition, to establish a baseline and examine erosion rates, Chelan PUD would select four to six representative erosion sites for more-frequent monitoring. These sites would not include any sites selected as erosion control demonstration sites. Chelan PUD proposes to monument or otherwise equip these sites to monitor the rate of erosion at 5-year intervals.

In addition to the planned shoreline erosion monitoring described above, Chelan PUD also proposes to inspect the reservoir shoreline for new erosion sites or substantial changes to existing sites after exceptionally high flows (e.g., 100-year level flood flows) through the reservoir or other events that could lead to unusual shoreline erosion, as determined by Chelan PUD. Shoreline monitoring under such special circumstances would be conducted similar to the year 20 and year 40 shoreline erosion inventories.

Our Analysis

There are 48 inventoried erosion sites greater than 30 feet long on the shores of Lake Entiat, with most of this erosion in alluvial fans or terrace deposits. Many of these features were eroding prior to the creation of the project. A substantial amount of effort has been devoted by various landowners to control erosion around the reservoir. This work has employed a variety of techniques, including riprap, rock walls, and anchored logs. These efforts have typically been successful where they have protected the toe of the slope (around the high water level) from waves. In those cases, the higher parts of the slope appear to have made progress toward stabilization. At other sites, where soil at the toe is not protected either artificially or by rock left behind by erosion, the shoreline has

not made as much progress toward stabilization. Plants along the toe have been of some benefit, but it is unclear whether plants alone are effective in stabilizing the toe.

Chelan PUD proposes to implement erosion control projects at five sites around the reservoir (four demonstration sites plus the one BLM-managed cultural site, as described in the Cultural Plan), educate the public regarding erosion control, and provide for long-term monitoring. All of these measures would bring increased stability to affected portions of the Lake Entiat shoreline, could help reduce the adverse effects of shoreline erosion, and could improve the state of knowledge regarding erosion control techniques for the land owners/managers surrounding the reservoir.

3.2.2.2 Sedimentation and Backwater Effects

The reservoir created by the Rocky Reach dam is essentially a backwater effect. As such, it slows the flow of the river through the reservoir and raises the water level. As noted by the participants in the ALP, these phenomena affect both the Columbia River itself and its tributary streams—notably the Entiat River.

In the reservoir, the slower flow is expected to contribute to greater sedimentation from the waters of the Columbia River because the slower current has a decreased capacity to transport sediment, allowing more sediment to be deposited. While this phenomenon is likely occurring, it does not appear to be producing substantial deposition because several large storage reservoirs upstream of the project remove sediment from the water that would otherwise pass downstream to the project.

The lower Entiat River contains a significant sediment accumulation at its confluence with the Columbia River. The accretion of sediment was likely encouraged by backwater effects from Lake Entiat, in conjunction with high sediment loads in the river resulting primarily from forest fire-induced erosion. Adjoining landowners have expressed concern about increased inundation of adjacent orchard land potentially resulting from the backwater effect.

A computer model of the lower Entiat River and its confluence with the Columbia River was developed to evaluate effects of the project reservoir water surface elevations and other factors on the Entiat River water surface profile (Chelan PUD, 2001a). The model was used to simulate the effects of various reservoir levels and Entiat River flows up to the level of a 25-year flood. The model results show that the backwater effect from the reservoir end within the project boundary and within the area covered by project flowage easements. Although the sediment accumulation is significant in terms of volume, its influence on backwater is limited. The hydraulic model was manipulated to analyze the effects the sediment may have on backwater profiles. As indicated in the backwater curve plots, removal (in the model) of the sediment accumulation downstream of the existing highway bridge (near RM 0.0) and upstream of the bridge for a distance of

approximately 1,600 feet resulted in negligible effects on the backwater profile of the river.

In its December 27, 2004, AIR response letter, Chelan PUD reports that aerial photographs of the mouth of the Entiat River prior to project development depict a small delta near the mouth. In the years subsequent to project development, this delta has reformed downstream of the Highway 97 bridge, and projects out into Lake Entiat. Sediment has also deposited upstream of the Highway 97 bridge, forming mid-channel bars. Also in its December 27, 2004, letter, Chelan PUD indicates that these bars have become heavily vegetated, forming valuable riparian habitat. Similarly, the backwater effect at the Chelan River mouth has resulted in the deposition of gravel carried down the Chelan River during flood flows. Deposition of the gravel in the area of the Chelan River mouth and tailrace channel has resulted in creation of a successful salmonid spawning area (Chelan PUD, 2001c). As with the Entiat River, the Chelan River flow maintains a channel that provides access to the area by fish and other aquatic resources.

After studying the backwater effect issues (Chelan PUD, 2001a), the Erosion Working Group concluded that no action was needed to address sedimentation or potential flooding. Chelan PUD's proposal does not include specific measures to address sedimentation.

Our Analysis

Water clarity in the project reservoir is well within the Washington State Class A water quality standards for clarity and turbidity. No problems or negative effects have been identified in connection with sedimentation at the mouth of the Entiat River. The project's potential influence on water levels during flood flows (up to the 25-year recurrence flow) in the Entiat River is contained within the limits of the project boundary and easements. At the mouth of the Chelan River, the backwater effect and sedimentation is, on the whole, beneficial because it has resulted in creation of salmonid spawning area. The backwater effect in the Columbia River caused by the project reservoir has a diminished influence on sediment transport because upstream reservoirs decrease the available sediment supply. For these reasons, we conclude that no action is needed to address backwater effects and sedimentation.

3.2.3 Unavoidable Adverse Impacts

Shoreline stabilization measures, placement of informative signage, and the construction and/or improvement of fisheries facilities, trails, campsites, boat ramps, and access areas, all elements of Chelan PUD's proposal, have the potential to result in minor, unavoidable, short-term, localized increases in the potential for erosion.

3.3 WATER RESOURCES

3.3.1 Affected Environment

3.3.1.1 Columbia River and Rocky Reach Project Hydrology

The project impounds 43 miles of the Columbia River from the project dam at RM 473.7 to Douglas PUD's Wells dam (FERC No. 2149) at RM 515.5. The drainage area of the Columbia River Basin upstream of the project dam is approximately 87,800 square miles. Annual average flow through the reservoir from 1960 to 2001 was 115,400 cfs (U.S. Geological Survey [USGS], 2002). However, since completion of Canadian flood control storage with construction of Mica dam (in 1973), the annual average flow has been 113,200 cfs (1973 to 2001). The maximum and minimum daily average flows for this same period were 358,000 cfs (June 12, 1997) and 25,100 cfs (November 11, 1973), respectively.

The Columbia River System is primarily fed by snowmelt. Numerous dams and reservoirs developed for hydropower and flood control alter the natural flow in the basin. Water is withdrawn from the Columbia River and its tributaries at various locations for agricultural, domestic, municipal and industrial supply. The annual flow regime is primarily controlled by flow releases from upstream storage projects regulated by the Federal Columbia River Power System (FCRPS). Upstream storage is managed under the terms of the NMFS 2000 Biological Opinion for Operation of the FCRPS (NMFS, 2000) and the FWS 2000 Biological Opinion on Effects to Listed Species from Operations of the FCRPS (FWS, 2000). The 2000 biological opinion sets conditions on the fill and drafting of upstream storage reservoirs to meet the multiple needs of flood control, passage conditions for anadromous fish, resident fish species, recreation, and power production. These storage projects operating conditions determine the daily flows that pass the project, with some additional flow contributed from tributaries (Okanogan, Methow, Chelan, and Entiat rivers) downstream of the storage projects. Management of the upstream storage releases accounts for these tributary contributions in the management of Columbia River flows.

The two major tributaries in the project area are the Chelan and Entiat rivers. The Entiat River enters the Columbia River at approximately RM 483, approximately 9 miles upstream of the Rocky Reach dam. Flow records from two Entiat River gaging stations provide information about inflows to the project. Long-term flow records are available for a gaging station located approximately 18 miles upstream of the Entiat River's confluence with the Columbia River (USGS gage no. 12452800, Entiat River near Ardenvoir, Washington), which has a drainage area that comprises about half of the entire basin. For water years 1957 to 1995, average monthly flow at this Entiat River gage station ranged from 112 cfs in September to 1,417 cfs in June. A maximum recorded flow of 6,430 cfs occurred on June 10, 1972. Since March 15, 1996, flow

measurements from the entire Entiat River Basin have been available from a gage near the confluence of the Entiat and Columbia rivers (USGS gage no. 12452990, Entiat River near Entiat, Washington). The minimum flow recorded at this gage, 58 cfs, was recorded on November 1 and 2, 2002, although lower flows may have occurred due to ice on December 12 and 13, 2000. For the period of March 1996 through September 2004, average monthly flows at the lower Entiat River gaging station ranged from 151 cfs in September to 1,711 cfs in June, while the measured flows at the upper Entiat River gage station ranged from 97 cfs in February to 1,477 cfs in June. Based on paired comparison of daily flows, flow at the upper gage accounted for an average of 85 to 92 percent of the total flow during the months of June through August, but only 55 to 65 percent of the total flow from December through April. In their comments on the draft EIS, the Forest Service and City of Entiat noted that the Entiat River is one of the few rivers in the world that commonly experiences anchor ice, which may cause infrequent flooding. In shallow turbulent sections of rivers that have minimal protection from riparian vegetation, ice crystals can form in the water column (frazil ice) and then these crystals can attach to the stream bottom (anchor ice) due to super cooling of the river bottom. This ice can create ice dams that restrict the flow of water and cause backwaters to flood upstream areas.

The Chelan River enters the Columbia River at approximately RM 503. The minimum, mean, and maximum recorded flows for the Chelan River are 0 cfs, 2,060 cfs, and 18,400 cfs, respectively. From 1903 to 2001, the mean annual flow recorded at USGS gage no. 12452500 (Chelan River at Chelan, Washington) ranged from 1,119 cfs to 3,158 cfs. The recorded flows include powerhouse releases as well as spill from the Chelan PUD's Lake Chelan Project (FERC Project No. 637) dam, which is located approximately 4 miles upstream on the Chelan River at the outlet of Lake Chelan. It is connected to the Lake Chelan Project powerhouse, which is a few hundred yards upstream of the Chelan River/Columbia River confluence.

The Rocky Reach project is primarily operated as a run-of-river project; however, there are some project-induced fluctuations in reservoir level and discharges to the tailrace. These can result, at least in part, from coordination of project operations with other hydroelectric projects in the mid-Columbia River. The operators of the five non-federal hydroelectric projects (Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids) cooperate with each other and with the operators of the federal projects immediately upstream (Grand Coulee and Chief Joseph) to efficiently manage the flow releases from Grand Coulee to meet the daily demands of power load peaking while maintaining reservoir levels as stable and full as possible. This cooperation is managed under the terms of the Hourly Coordination Agreement. Hourly coordination has also been used to manage flows and reservoir levels for protection of fisheries resources, in particular the spawning and incubation of Chinook salmon in the Hanford Reach of the

Columbia River, which is affected by flow releases from the Priest Rapids Project (Vernita Bar Agreement).¹⁶

The Hourly Coordination Agreement allows Chelan PUD to maintain the reservoir water surface elevation within 1 foot of the normal operating maximum of 707 feet approximately 73 percent of the time. Although the license allows the reservoir to be drawn down to an elevation of 703 feet, the forebay elevation is rarely below 705 feet. The water surface elevation, and therefore the volume of water impounded, varies upstream from the dam as a function of the headwater elevation and as a function of river flow.

At a flow of 20,000 cfs, the volume of the impoundment would be 346,900 acre-feet at elevation 703 feet and 383,800 acre-feet at a headwater elevation of 707 feet. At a flow of 220,000 cfs, the volumes would be 363,700 acre-feet and 398,200 acre-feet at the 703-foot and 707-foot elevations, respectively. The surface area of the impoundment varies similarly, with a typical value of approximately 8,235 acres at a headwater elevation of 707 feet and flow of 100,000 cfs. Under flood conditions, the headwater elevation may be drawn down to 703 feet and the reservoir used to store floodwaters to an elevation of 710 feet to reduce downstream flood flows, as directed by the Corps in accordance with the current Rocky Reach License Article 34. This operation occurs infrequently and has not been implemented in the past 20 years.

3.3.1.2 Water Use and Quantity

Project Water Rights

WDOE has jurisdiction over water use in the mid-Columbia River. Chelan PUD currently holds several water rights for various uses. It holds two surface water rights of 185,300 cfs and 24,700 cfs for power purposes and a reservoir permit for the project that allows 390,000 acre-feet of water to be impounded. WDOE's Water Right Application Tracking (WRAT) database (e-mail from B.A. Bealba, Technical Assistance Specialist, WDOE, Yakima, WA, to B. Mattax, Senior Aquatic Scientist, The Louis Berger Group, Bellevue, WA, November 30, 2005) indicates that Chelan PUD has four additional surface water rights for a total of 25.6 cfs for fish propagation and irrigation, and shares with Washington State University a 350-gallon-per-minute right (approximately 0.8 cfs per minute) for irrigation.¹⁷ WDOE's WRAT database indicates that Chelan PUD holds 12 groundwater withdrawal permits and has applied for two additional permits. The maximum total allowable withdrawal from these wells is 37,240 gallons per minute

¹⁶ See Public Utility District No. 2 of Grant County, Order Approving the Settlement Agreement, 45 FERC ¶61, 401, December 9, 1988.

¹⁷ This right was originally issued as a ground water right, but has been revised to authorize direct diversion from the Columbia River.

(gpm) (83.0 cfs) used for fish propagation, irrigation, domestic water, and heat exchange. Several of the wells are used on a seasonal basis, while others operate year-round.

Consumptive Uses of Project Waters

Irrigation—Orchards with apple, cherry, peach, apricot, and other fruit trees represent the primary agricultural activity in the Columbia River Valley and its tributary valleys throughout north central Washington. All orchards throughout the area rely on a source of irrigation water for their existence. Within the project area, irrigation withdrawals from the river constitute the largest segment of allocated water rights for consumptive water use. Annual irrigation water rights provide for the withdrawal of up to 313 cfs from the project reservoir. The allocated water rights represent the maximum withdrawals; hence it is reasonable to assume that actual withdrawals are frequently less than the established water rights. In their comments on the draft EIS, the Forest Service and City of Entiat note that a high percentage (up to 85 percent) of the water used for irrigation is not consumed but instead is lost in transmitting the water and that these losses return to the river.

The narrowness of the Columbia River Valley through the project area restricts space available for substantial additions to orchards or other irrigated agricultural activities. Current trends indicate an ongoing reduction in lands used for irrigated orchards as they are being replaced with residential development, resulting in a lowering of consumptive withdrawals from project waters. The majority of consumptive water use within the project area is non-project related; project-related consumptive use is primarily associated with irrigation of parks.

Domestic—Domestic water withdrawals of project surface waters are limited. Some withdrawals for use in irrigating yards and gardens may occur. Water withdrawals for drinking water are primarily from groundwater sources, although one municipal domestic water right has been issued. According to WDOE, domestic water rights for groundwater within the project area are 64 cfs (Chelan PUD, 1991). These domestic water rights are allocated to non-project related entities. No significant change in the use of project waters for domestic water supply is anticipated.

Commercial and Industrial—Commercial and industrial uses account for only 10.5 cfs, and stock watering use is at 3 cfs (Chelan PUD, 1991). The majority of this volume is allocated to non-project related entities.

Non-consumptive Uses of Project Waters

Fisheries and Natural Resources—Chelan PUD holds four water rights for fish propagation, which consist of one surface water right for 8 cfs and three groundwater rights for a total of 25,140 gpm, equivalent to 40,539 acre-feet/year (WDOE, 1999).

Power Production—As described above, Chelan PUD holds two surface water rights for project power production. These water rights are for 185,300 cfs and 24,700 cfs, entitling Chelan PUD to a total of 210,000 cfs for power production (WDOE, 1999). Chelan PUD also holds a reservoir permit that allows impoundment of up to 390,000 acre-feet of water in the project reservoir.

3.3.1.3 Water Quality

Applicable Water Quality Standards

Under current Washington water quality standards, the Columbia River at the project is classified as a Class A water body. Water quality of this class must meet or exceed the requirements for all uses. The characteristic beneficial uses for the project segment of the Columbia River include fish and wildlife (including salmonid species) habitat, water supply (domestic, irrigation, industrial), recreation, navigation, and commerce. Table 1 summarizes selected numeric criteria for Class A water quality.

Table 1. Summary of selected WDOE water quality criteria. (Source: WAC 173-201A)

Parameter	Class A
Temperature	Must not exceed 18.0°C ^a
pH	Within 6.5 to 8.5 units ^b
Dissolved oxygen	Must exceed 8.0 mg/l
Total dissolved gas	Not to exceed 110% ^{c,d}
Turbidity	Not to exceed 5 NTU over background, or 10% over background of 50 NTU or more
Fecal coliform	Not to exceed geometric mean of 100 colonies/100 ml, or more than 10% of all samples exceeding 200 colonies/100 ml

Notes: % – percent

°C – degrees Celsius

mg/l – milligrams per liter

ml – milliliter

NTU – nephelometric turbidity unit

WAC – Washington Administrative Code

^a Human activities shall not result in more than a 0.3°C increase when water temperatures naturally exceed this maximum criterion. Maximum incremental increase for non-point sources is 2.8°C.

^b Human-caused variation must be within 0.5 units.

^c This criterion does not apply when stream flow exceeds the 7-day, 10-year frequency flood (7Q10).

- ^d Special condition for this reach of the Columbia River establishes TDG levels above 110% for spill for fish passage (tailrace average of 12 highest hours \leq 120%, no single hour $>$ 125%).

Water quality in the Columbia River in and near the project area has met all water quality standards for Class A waters except for the numeric criteria for TDG and temperature on a seasonal basis. Table 2 lists documented historical exceedances of state water quality criteria in the Columbia River in and near the project area. This table represents exceedances from all sources in the project area but does not necessarily represent numeric criteria exceedances attributable to the project.

Table 2. Exceedances of numeric water quality criteria applicable to the Columbia River near the Rocky Reach Project area.

Parameters Exceeding Numerical Criteria	Monitoring Station Location and Study Timeframe	Total Exceedances during Study Timeframe (month of occurrence and number of days)	
$>$ 120% TDG (average of highest 12 hours in tailrace)	Rocky Reach DFMS located approximately 4 miles downstream of dam (1997–2002) ^a	April:	7 days
		May:	31 days
		June:	51 days
		July:	13 days
Dissolved oxygen $>$ 8 mg/l	WDOE ambient monitoring station at RM 450.9 (1971–1990) ^b	Month:	1 day ^c
Temperature $>$ 18.0°C ^d	WDOE ambient monitoring station at RM 450.9 (1971–1990) ^b	July:	10 days
		August:	16 days
		September:	12 days
		October:	3 days
	Rocky Reach DFMS (1997–2002) ^a	July:	13 days
		August:	119 days

Notes: % – percent

°C – degrees Celsius

DFMS – downstream fixed monitoring site

EPA – U.S. Environmental Protection Agency

mg/l – milligrams per liter

TDG – total dissolved gas

WDOE – Washington Department of Ecology

^a Source: Chelan PUD (2004a).

^b EPA STORET (storage and retrieval database) data for 205 grab samples from Columbia River at RM 450.9 (USGS gage no. 12462600, Columbia River below Rock Island dam; and Washington and WDOE station 1744A070, Columbia River below Rock Island dam).

- ^c In 1971, there was 1 event below criterion (7.9 mg/l).
- ^d The numeric water quality criteria for temperature for a Class A water body is either 18.0°C or no more than a 0.3°C increase over natural. Therefore, natural conditions may account for some of the temperatures above 18.0°C referenced above and may not, in fact, involve an exceedance of the applicable numeric temperature criteria.

The 1998 303(d) list recognizes three water quality concerns within the project area waters (WDOE, 2002). The Columbia River was listed for TDG, based on high values reported for the Wells Project tailrace and the Rocky Reach forebay and downstream of the Rocky Reach dam. A temperature listing for the Columbia River is based on high water temperatures in the inflow to the Wells hatchery at the upper end of the project's reservoir. The Columbia River also was listed for water column bioassay¹⁸ based on reduced reproduction rates of daphnid water fleas (*Ceriodaphnia dubia*) made near Wenatchee in July 1995. Contradicting results of additional bioassays that were conducted from 1999 to 2001 (Johnson and Era, 2001) resulted in this reach of the Columbia River not being included on the 2002/2004 303(d) list that was recently approved by the EPA (WDOE, 2005a).

WDOE and EPA Region 10 have been developing TMDL to address the water quality impairments for TDG and temperature in the project area and other segments of the Columbia River. On July 27, 2004, EPA approved WDOE's TMDL for TDG in the Columbia River reach that includes the project area (EPA et al., 2004). The TMDL for temperature has been delayed to further information exchange and consultation.

Regional Water Quality Data

Historical information on water quality that is applicable to the project reservoir and its major tributaries is available from several sources, including recent water quality studies within the project area, studies at Wells dam conducted by Douglas PUD, and recent data from a monitoring station near the Rock Island Project. These data suggest that water quality measurements within the project area are comparable to concurrent readings for the Wells and Rock Island projects. For this reason, when no historical data exist at Rocky Reach, we use historical data from the Wells and Rock Island Project areas to represent historical conditions within the Rocky Reach project area.

Data from WDOE's water quality monitoring station (WDOE station 44A70) located approximately 2.3 miles downstream of the Rock Island dam are considered to provide the most comprehensive, long-term, historical characterization of water quality relevant to the project. The period of record for monthly grab-sample water quality data from this WDOE station is 1977 to 1990. Table 3 provides average values for monthly water quality data from this source.

¹⁸ A test of the potency of compounds by their effects on organisms.

Table 3. Average values for water quality monthly grab samples at the WDOE monitoring station below Rock Island Hydroelectric Project dam, 1977–1990.

Month	Mean Flow ^a (cfs)	Mean Temp. (°C)	Dissolved Oxygen (mg/l)	Dissolved Oxygen Saturation (%)	pH (units)	Turbidity (NTU)	Specific Conductance (µmhos/cm)	Fecal Coliform (MFM-FCBR) per 100 m/l	Total Suspended Solids (mg/l)	Total ^b (mg/l)	Unionized Ammonia (mg/l)	Nitrite (mg/l)	Nitrate (mg/l)	Nitrite + Nitrate (mg/l)	Total Phosphates (mg/l)	Dissolved Ortho-P (mg/l)
January	135,425	3.6	12.9	98	7.9	2	156	12	3	0.02	0.0001	0.010	0.119	0.146	0.033	0.015
February	136,245	4.3	13.5	104	7.8	4	165	3	11	0.02	0.0001	0.010	0.176	0.130	0.035	0.018
March	121,100	8.4	13.9	113	8.1	3	166	6	33	0.03	0.0003	0.010	0.160	0.188	0.038	0.009
April	132,000	7.6	13.7	116	7.9	3	167	8	5	0.03	0.0001	0.010	0.178	0.135	0.035	0.017
May	156,758	10.5	13.1	118	8.0	4	156	44	13	0.05	0.0001	0.010	0.160	0.118	0.038	0.010
June	160,567	14.3	11.8	117	8.0	5	130	80	10	0.03	0.0002	0.010	0.105	0.057	0.042	0.013
July	141,327	17.6	11.2	119	8.0	3	135	124	12	0.04	0.0003	0.010	0.082	0.065	0.029	0.015
August	113,200	19.1	10.2	111	8.0	3	140	86	10	0.02	0.0010	0.010	0.089	0.082	0.025	0.017
September	106,745	19.2	10.1	110	8.2	2	141	61	5	0.03	--	0.010	0.117	0.228	0.036	0.017
October	100,979	16.6	10.4	108	8.1	2	147	17	4	0.03	0.0006	0.010	0.150	0.137	0.030	0.015
November	103,443	11.8	10.7	100	7.9	2	146	33	6	0.02	0.0003	0.010	0.207	0.135	0.035	0.013
December	122,269	6.8	11.4	94	7.7	2	161	22	6	0.02	0.0002	0.010	0.163	0.183	0.046	0.015
No. Months Sampled		147	147	147	147	142	147	145	142	140	13	82	78	64	136	139
Mean		11.6	11.9	109	8.0	2.9	151	40	10	0.03	0.0003	0.010	0.142	0.129	0.035	0.014
Maximum		36.0 ^c	16.3	146 ^c	9.2	11	202	700	300	0.26	0.0010	0.010	0.630	0.420	0.140	0.060
Minimum		0.8	7.9	76	6.7	1	96	0	1	0.00	0.0001	0.010	0.010	0.010	0.010	0.000
Standard Deviation		6.1	1.7	13	0.4	2	20	107	28	0.03	0.0003	0.000	0.098	0.083	0.020	0.009

Note: -- – no data

mg/l – milligrams per liter

NTU – nephelometric turbidity unit

^a Flow is computed as mean of daily values at which samples were collected.

^b NH₃+NH₄,

^c These data points may be inaccurate due to instrument error.

In coordination with the Corps, Chelan PUD has monitored water temperature at the Rocky Reach fishway since 1965 and TDG in the Rocky Reach forebay since 1982. Chelan PUD intensified its temperature and TDG monitoring in 1996. The monitoring data sets consist of daily temperature only (1965 to 1981), hourly temperature and TDG for the Rocky Reach forebay (April to August each year from 1982 to present), and hourly TDG and temperature at a downstream fixed monitoring site (DFMS) approximately 4 miles downstream of the Rocky Reach dam (April to August each year from 1997 to present). TDG monitoring with improved equipment and calibration procedures was initiated in 1995 for the forebay and 1997 for the DFMS (McDonald and Priest, 1997; Koehler and McDonald, 1997, 1998).

Douglas PUD has conducted similar studies at Wells dam, at the headwaters to the project reservoir. Transparency data are available for both the Rocky Reach dam forebay and the Wells dam forebay (1993 to present) as Secchi depth readings from the fishways. Additional information sources include studies done for site-specific projects, including the Daroga Park development (Johnstone and Mih, 1987) and the license amendment application to raise the Rocky Reach reservoir pool elevation (Chelan PUD, 1991). Regional data for the mid- and upper-Columbia Rivers also were reviewed to provide background descriptions of water quality.

Rocky Reach Project Vicinity, Water Quality Data

Nutrients

The nutrient balance within an aquatic ecosystem is an important determinant of the biological and aesthetic quality of an aquatic environment (Cooke et al., 1993). Nitrogen and phosphorous are the two primary nutrients of concern. Generally, the mid-Columbia River is a low nutrient system; the large volume of water flow and the regional geology, combined with a mostly rural watershed, are factors affecting nutrient levels.

The range of total nitrogen (NH_3^+ and NH_4^+) concentrations reported for monthly grab samples collected by WDOE at the Rock Island Project monitoring station from 1977 through 1990 was 0.00 to 0.26 milligrams per liter (mg/l); the average for these monthly concentrations was 0.03 mg/l (table 3). Total nitrogen is typically highest in the spring (due to runoff contribution from the watershed) and is low again by August due to primary production use. Nitrates (NO_3) are highest in the winter months and at seasonal lows in July and August. The average nitrate concentration for the monthly samples is 0.142 mg/l. Johnstone and Mih (1987) reported similar nitrate levels for samples collected in the vicinity of Daroga Park, which is located along the reservoir at RM 487.7 (figure 2) in summer 1986 (0.05 mg/l or less for the river and embayment). Nitrate levels in the Daroga lagoon were also low but displayed some localized spikes, possibly due to either inflow from elevated nitrate concentrations in groundwater caused by infiltration of fertilizers or by trout food in the trout pond. Total nitrogen and nitrate levels suggest the

project reservoir is oligo-mesotrophic, low to moderately low primary productivity (Chelan PUD, 2004a).

Phosphorous often limits algae and aquatic plant growth in rivers and lakes (Cooke et al., 1993). The primary sources of phosphorous for aquatic bodies are soil erosion associated with surface runoff, release of phosphorous from sediments and plants referred to as internal loading, and anthropogenic contributions. Phosphate concentrations in Daroga Lagoon reported by Johnstone and Mih (1987) as part of development of a swim beach ranged from 0.017 to 0.020 mg/l; these levels indicate phosphate is not a water quality concern within the lagoon. Reported phosphate levels in the Daroga embayment fluctuated more widely (0.015 mg/l to 0.046 mg/l). Reported total phosphorus concentrations for the project area waters indicate that the project reservoir is oligo-mesotrophic (Carlson, 1977).

Turbidity, Light, and Transparency

The Columbia River generally has low turbidity. The project area consists of igneous and metamorphic rock at the base of the Cascade Mountains to the west, basaltic material from the lava flows that created the Waterville Plateau to the east, and glacial outwash materials from the deep carving of the river valley itself. The tributaries that feed the mid-Columbia are primarily glacially carved, resulting in very low sediment loads.

Turbidity increases during periods of high inflow from the tributaries. Turbidity data collected daily by Chelan PUD and reported by the Corps' Data Access in Real Time (DART) information system (University of Washington, 2005) for the project forebay indicate an overall mean turbidity of 13.3 nephelometric turbidity units (NTU) from 1996 to 2004. Annual mean turbidity values for the forebay ranged between 4 and 8 NTU from 1996 to 1999 and between 14 and 18 NTU from 2000 to 2004. The cause for these higher values is not apparent, although it could be partially due to a more even sampling rate among spring, summer, and fall seasons in the latter years. Average monthly turbidity tends to be highest during the summer and fall. Chelan PUD (2004a) reported that turbidity in the project forebay is inversely correlated with discharge and positively correlated with water temperature. Temperature and discharge also correlate, which may explain the relationship between turbidity and discharge. It appears that turbidity may increase slightly in May with the onset of spring runoff and then show a slight increase again in July as primary productivity increases. Turbidity values reported for the project forebay are at comparable levels to the upstream Wells forebay and downstream Rock Island forebay.

Secchi disk transparency (visibility) in the reservoir is generally over 12 feet during late summer months, but can be lower during spring and early summer when snowmelt runoff in the tributaries is high. Chelan PUD monitors Secchi depths in the

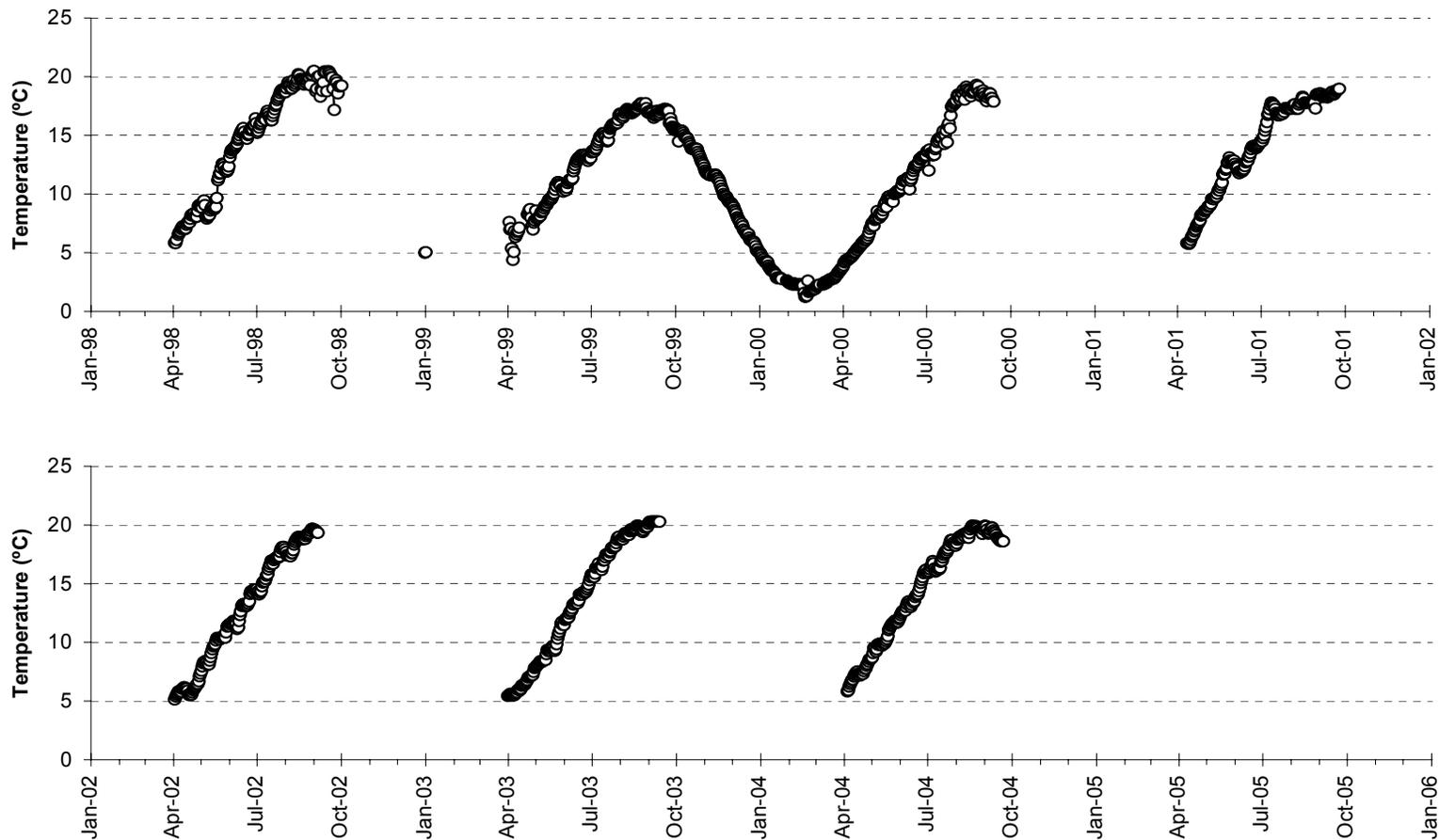
vicinity of the fishway during the fish counting season (April 16 to November 15). Secchi depths are rarely below 5 feet in May and June and typically exceed 17 feet from August through the fall. These Secchi depths suggest Rocky Reach reservoir is borderline oligotrophic (average 9.9 feet, range 5.4–28.3 feet for oligotrophic lakes; Carlson 1977).

Temperature

Chelan PUD collected water temperature data at the forebay and the DFMS located approximately 4 miles downstream of the project dam. Temperature monitoring in the project forebay was initiated in 1982. Between 1984 and 1997, 3 to 6 hourly values were reported daily to the Corps. After 1997, continuous recording devices were installed. The current fixed monitoring station in the forebay is on the west side of the dam, and temperature is generally monitored from April through September. Data for this and other Columbia River sites are made available as part of the DART information system on the internet (University of Washington, 2005). Mean daily temperatures reported for the 1998 to 2004 continuous recordings are presented in figure 3.

Thermal stratification is not evident in the Rocky Reach reservoir (Chelan PUD, 1991; Johnstone and Mih, 1987). The run-of-river operation of the project results in a rapid turnover rate in the reservoir, likely precluding stratification. The reservoir's hydraulic residence time at elevation 707 feet is 24.8 hours when the average discharge is 131,000 cfs (typical flows in May) and 65.2 hours when the average discharge is 84,800 cfs (typical flows in July) (Chelan PUD, 1991).

Water temperature in the project reservoir begins warming in March, reaches peak annual temperatures in late July through early September (monthly average daily temperature for August and September at the forebay is 18.6°C), then cools again during the fall and winter months to average temperatures in the 2°C to 4°C range (figure 3). Daily variability is typically less than 0.5°C but can range up to nearly 2°C during summer. Water temperatures appear to change very little as water flows through the Rocky Reach reservoir. Monthly comparisons of daily mean temperatures for the same days (1998 through 2004) suggest that there are minimal temperature changes. Monthly averages of temperature differences between the Rocky Reach forebay and DFMS compared to the Wells project tailrace are generally less than 0.3°C. Slightly larger (0.4°C) average differences occur in July between the Rocky Reach DFMS and Wells



^a These data were reviewed and corrected for anomalies (e.g., $>2^{\circ}\text{C}$ change in 24 hours, and temperatures that do not follow temporal trends and are substantially different than scroll case temperatures).

Figure 3. Daily mean water temperatures at the Rocky Reach forebay (RRH), 1998–2004.^a
(Source: University of Washington, 2005, as modified)

project tailrace. Chelan PUD (2004a) reported that the daily temperature change between the upper and lower end of the reservoir exhibited no pattern or statistically significant relationship to discharge or percent spill at the project.

WDOE's water temperature criterion for this reach of the Columbia River is that human-caused increases in water temperatures shall be limited to no more than 0.3°C above natural conditions when the natural conditions exceed 18°C. Allowable human-caused increases coinciding with cooler natural periods are a function of the background temperature and are as high as 2.8°C. Table 4 summarizes the frequency of daily mean temperatures exceeding the 18°C criterion at the Rocky Reach Project and other upstream and downstream hydroelectric projects. Although the sampling periods varied somewhat by location, this summary indicates that daily mean temperatures of discharges from the project (RRDW) exceed 18°C at about the same frequency as inflows to the project reservoir (WELW). The different sampling periods may have led to the project forebay (RRH) exceeding 18°C less frequently than both upstream and downstream stations in August and September. We discuss the results of project reach modeling studies in section 3.3.2.2, *Water Quality, Temperature*.

Table 4. Summary of daily mean temperatures greater than 18.0°C (in percent), 1998–2004. (Source: University of Washington, 2005, as modified)

Month	Wells Forebay (WEL)	Wells Tailrace (WELW)	Rocky Reach Forebay (RRH)	Rocky Reach DFMS (RRDW)	Rock Island Forebay (RIS)
July	10%	9%	12%	14%	13%
August	77%	77%	67%	76%	61%
September	90%	91%	74%	92%	65%
October ^a	67%	0%	3%	--	3%

Note: -- -- no data

^a Limited number of days with reported data. Zero days of data reported for RRDW, 3 days of data reported for WEL and WELW, and 32 days of data for RRH and RIS.

Dissolved Oxygen

Dissolved oxygen (DO) is an important indicator of aquatic eutrophication and a major determinant of coldwater fisheries viability. Salmonids generally require DO concentrations of 7 to 9 mg/l and are less tolerant of low DO concentrations than warmwater fishes, which can tolerate DO concentrations as low as 3 to 4 mg/l (EPRI, 1990). As discussed above, the project reservoir does not thermally stratify. DO levels in the reservoir are favorable for salmonids and provide a healthy aquatic environment throughout the year. Chelan PUD (2004a) states that the WDOE assigned the Rocky

Reach reservoir as category 1 for DO in its preliminary 2002/2004 303(d) listings, indicating that it typically meets the applicable DO standard.

Detailed historical DO monitoring data are not available for the project reservoir, but information from downstream locations is considered representative of conditions in the project. The annual average DO concentrations at the downstream WDOE monitor station downstream of Rock Island dam is 11.9 mg/l. Annual variation is influenced by water temperature (warmer water retains less oxygen). The range in DO concentrations recorded downstream of Rock Island dam is 7.9 to 16.3 mg/l (76 to 146 percent saturation). Monthly DO levels for this location are listed in table 3.

From 1977 to 1990, only one DO concentration of less than the 8.0-mg/l criterion was reported at the WDOE gage station below Rock Island. Johnstone and Mih (1987) report similar DO concentrations within the project reservoir, with the water fully saturated at all times. They also note diurnal fluctuation, with peak DO concentrations at 3:00 p.m. in summer months. Photosynthesis by aquatic plants may account for the high DO levels and diurnal fluctuation.

pH and Alkalinity

Alkalinity is a measurement of the buffering capacity of water to limit fluctuations in pH (Wetzel, 1975). Alkalinity in the river measured at Daroga Park (Johnstone and Mih, 1987) ranged from 55 to 66 mg/l as calcium carbonate (CaCO_3). This is considered to be relatively high alkalinity, indicating high carbonate concentrations, which promote biological growth.

The Columbia River pH level at WDOE's monitoring station below Rock Island dam averages 8.0 units, which is slightly basic. Although pH readings varied between 6.7 and 9.2 units for 147 monthly measurements taken between October 1977 and January 1990, no correlation appears to exist between pH and flow levels, temperature, or seasons of the year. Growth of phytoplankton and macrophytes can influence pH through the utilization of carbon dioxide for photosynthesis, and can lead to alkaline pH levels when excessive growth occurs. Johnstone and Mih (1987) reported a diurnal variation in pH of 7.1 to 8.6 units for the Columbia River at Daroga Park, and attributed this to the effects of photosynthesis. WDOE lists the Rocky Reach reservoir as category 1 for pH in its preliminary 2002/2004 303(d) listings, indicating that it typically meets the applicable pH standard (Chelan PUD, 2004a).

Specific Conductance

Specific conductance below Rock Island dam averaged 151 $\mu\text{mhos/cm}$ for the 1977 to 1990 monthly data, and remained relatively stable throughout the year (table 3) in this reach of the Columbia River.

Bacterial Contamination

Fecal coliform organisms are present in the intestinal tracts and feces of warm-blooded animals. Their presence and level of concentration are indicators of human or other warm-blooded animal pollution. The overall average of 40 fecal coliform organisms per 100 milliliter (ml) for the station below Rock Island dam is less than the geometric mean criterion of 100 organisms per 100 ml that is applicable to the project waters. Less than the 10-percent allowable limit of samples (6.2 percent) exceeded 200 organisms per 100 ml, which is within an acceptable range of the fecal coliform standard. WDOE listed the Rocky Reach reservoir as category 1 for coliform bacteria in its preliminary 2002/2004 303(d) listings, which indicates that the reservoir typically meets the applicable fecal coliform standard (Chelan PUD, 2004a).

Johnstone and Mih (1987) assessed bacteria in Daroga Park and reported generally low bacterial concentrations for enterococci, total *E. coli*, and fecal coliform. Localized high fecal coliform counts were found in July, followed by relatively low bacterial counts in August. The high counts were attributed to concentrated waterfowl usage within the area.

The Chelan-Douglas Health District has jurisdiction over individual onsite domestic sewage systems within the two-county area straddled by the project's reservoir. Since 1981, it has been the policy of the Chelan-Douglas Health District to issue individual onsite sewage disposal permits that require a 100-foot horizontal drain field setback from the river and a 3-foot vertical separation between the bottom of the drain field trench and seasonal high groundwater (Chelan PUD, 1991).

In its Preliminary Draft Environmental Assessment (PDEA) for relicensing this project, Chelan PUD (2004a) stated that it conducted a survey in 1981 of septic tanks and drain fields in the vicinity of the reservoir. These drain fields predate the 1981 health district policy changes, and some of these drain fields encroach upon the health district's current horizontal and vertical separation criteria. However, based on the very low bacteria concentrations noted above, it does not appear that these septic systems have caused any detectable contamination of the project reservoir.

Two municipal sewage treatment facilities are located near the project area. The treatment plant at Chelan Falls serves the lower Lake Chelan area; the other at Entiat serves that city. These sewage treatment plants operate under National Pollutant Discharge Elimination System (NPDES) permits that require treatment to protect water quality in the Columbia River. In addition, a small wastewater treatment facility serves the project dam and operates under NPDES Permit No. WA-005079-2.

Heavy Metals, Pesticides, and Contaminants

Much of the land adjacent to the project reservoir is for agricultural use, primarily orchards. Fertilizers, pesticides, and herbicides used in managing the orchards and other lands along the project reach, including Chelan PUD's parks, could have detrimental effects on the aquatic ecosystem if it were allowed to concentrate in the river at high levels. However, by requiring that applicators of chemicals be licensed, take continuing education courses, and maintain meticulous records about use of chemicals, the potential risk is limited. In its comments on the draft EIS, the City of Entiat noted that farmers attempt to reduce their use of chemicals by a number of means, including participating in an integrated pest management program. Chelan PUD indicates that analysis of soils from areas where the PUD removed orchards along the river to develop parks shows minimal levels of residual fertilizers and herbicides. Chelan PUD (2004a) reported that some residual lead-arsenic from pre-World War II orchard operations has been found at depth in heavy clay soils. The Forest Service and City of Entiat indicate that the elevated lead-arsenic levels may have originated from upstream mining operations in Canada. Concentrations of these contaminants are below regulated thresholds. Sandy soils have not shown any residual effects in these areas.

Chelan PUD uses and stores petroleum products (gasoline, oil, and grease) to maintain and operate the project facilities. Spillage of petroleum products, even in small amounts, may be toxic to aquatic life. WDOE reports that Chelan PUD has been responsible for two oil spills of greater than 10 gallons in the past 10 years (e-mail from G. Clear, ERTS/SEPA Coordinator, WDOE, Yakima, WA, to B. Mattax, Senior Aquatic Scientist, The Louis Berger Group, Bellevue, WA, dated November 30, 2005). On November 5, 1998, a valve left open by project operators resulted in a 700-gallon oil spill into the Columbia River at the Rocky Reach dam (WDOE, 1998). Observations at the Rock Island dam did not reveal a visible sheen, and no adverse effects to fish or wildlife in the Rock Island reservoir were observed during a reconnaissance survey of Rock Island reservoir conducted about 1 day after the spill (WDOE, 1998; letter from R. Salter, Director Lands and Facilities, Chelan PUD, Wenatchee, WA, to J. Lewis, Spill Responder, Central Regional Office, WDOE, Yakima, WA, November 20, 1998)¹⁹. During transfer of governor oil from unit 2 to unit 1 on October 28, 2002, 25 gallons of oil was spilled into the Columbia River (e-mail from R.E. Johnson, Records Analyst/Public Disclosure Coordinator, WDOE, Yakima, WA, to B. Mattax, Senior Aquatic Scientist, The Louis Berger Group, Bellevue, WA, December 14, 2005.). No distressed wildlife species were observed during this event. Chelan PUD has made operational improvements to prevent another spill from occurring.

¹⁹ Both of these references are included in the e-mail from R.E. Johnson, Records Analyst/Public Disclosure Coordinator, WDOE, Yakima, WA, to B. Mattax, Senior Aquatic Scientist, The Louis Berger Group, Bellevue, WA, December 14, 2005.

To minimize potential releases of petroleum products into the Columbia River, Chelan PUD implements a Spill Prevention Control and Countermeasure Plan. This plan, which was developed in June 2002 and revised in 2005, is designed to fulfill the requirements of 40 CFR 112, EPA Oil Pollution Prevention Regulations. This plan describes practices, procedures, structures, and equipment at the facility to prevent spills and to mitigate or preclude any adverse effect on the environment. Under existing regulations, the project's Spill Prevention Control and Countermeasure Plan is reviewed and revised at least every 3 years or within 60 days of a spill. The plan provides the locations, quantities, and contents of oil products stored at the project, a description of potential spill situations and control systems, and a detailed list of spill prevention measures associated with specific runoff and other drainage systems, storage locations, oil-containing equipment, maintenance activities, and personnel training.

Total Dissolved Gas

Spilling water at hydroelectric projects can entrain atmospheric gas in the tailwater, forcing this gas into solution and potentially leading to supersaturation of TDG (Weitkamp and Katz, 1980). High levels of TDG supersaturation can be detrimental to a wide array of aquatic animals and may cause a potentially lethal condition known as GBT in fish. GBT develops when dissolved gas in the bloodstream of animals comes out of solution and forms bubbles in the internal and external tissues.

Chelan PUD, in coordination with the Corps and other Columbia River hydroelectric project operators, has been spilling water to aid downstream fish passage at the project since 1976. Spill is a tool used for improving survival of anadromous salmonids during their downstream migration. Spill can also occur when high stream flows exceed the hydraulic capacity of the powerhouse (approximately 201,000 cfs) or, occasionally, when demand for energy is low and river flows are high. In the Columbia River Basin, a regional effort has been undertaken to monitor and control TDG supersaturation and its biological effects.

Although Washington's numeric water quality standard is 110 percent for TDG supersaturation in the Columbia River, an exception is made for times when spill is being used to increase downstream passage survival of juvenile salmon. This exception allows the project and other projects to spill water for fish passage as long as the TDG level in the tailrace does not exceed 120 percent (daily average of highest 12 consecutive hours), and no single hourly TDG measurement exceeds 125 percent. In addition, the spill must be controlled so that the TDG level in the forebay of the next dam downstream (i.e., Rock Island Project) does not exceed 115 percent.

In coordination with the Corps, Chelan PUD has monitored TDG levels in the project forebay since 1982. The monitoring data are composed of hourly TDG levels in the forebay (April to August of 1982 to present) and hourly TDG levels downstream of

the project dam (April to August of 1997 to present). Some tailrace data from a barge in the Rocky Reach tailrace are available for 1996. TDG monitoring with improved equipment and calibration procedures during the spring and summer seasons was initiated in 1995 for the forebay and 1997 for the site downstream of the project dam.

Chelan PUD has reported TDG levels for the forebay and downstream of the dam that are in compliance, with the exception to the WDOE standard described above. Study methods and results are reported in McDonald and Priest (1997), Koehler and McDonald (1997, 1998), and in annual compliance reports submitted to WDOE since 2000. TDG, temperature, and barometric pressure are recorded every 15 minutes, and the averages for the hour are stored in a database and transmitted to the Corps. The data are measured at a fixed station located in the forebay with the instrument probe deployed at a depth of approximately 15 feet. The downstream monitor is approximately 4 miles downstream from the project dam at the Odabashian Bridge.

TDG levels in the forebay and downstream of the dam vary throughout the spring and summer. This variation is attributable, in part, to changing spill volumes and upstream TDG levels associated with spills at upstream projects. The effect of the Rocky Reach dam on TDG levels is shown in table 5. Generally, the average TDG at the DFMS is 2 percent higher than the TDG level measured in the forebay. In 1996, the tailrace data, which were measured much closer to the spillway, show a greater increase in TDG (averaging 5 to 7 percent). The highest TDG levels upstream and downstream of the project's dam were recorded in 1997, due to high river flows and spill levels in that year, which had the highest stream flows since 1970.

Table 5. Total dissolved gas as percent saturation in the Rocky Reach forebay and downstream of the Rocky Reach dam, 1996–2003. (Source: Chelan PUD, 2004a)

Year	Spring ^a (average and range of hourly measurements)		Summer ^a (average and range of hourly measurements)	
	Forebay	DFMS	Forebay	DFMS
1996	114.7 (103.5–126.6)	121.2 (108.9–140.5)	109.5 (103.4–116.7)	115.1 (108.9–128.6)
1997	123.7 (98.5–133.5)	126.0 (108.1–138.3)	111.0 (99.8–120.8)	113.1 (106.8–128.3)
1998	108.8 (100.4–121.3)	111.3 (105.8–127.6)	108.1 (97.9–114.8)	110.9 (105.3–118.9)
1999	108.8 (97.3–116.4)	110.1 (101.7–27.3)	110.6 (103.6–122.4)	112.7 (108.0–24.5)

Year	Spring ^a (average and range of hourly measurements)		Summer ^a (average and range of hourly measurements)	
	Forebay	DFMS	Forebay	DFMS
2000	107.6 (100.1–20.5)	110.7 (102.9–32.2)	108.6 (101.6–12.7)	110.1 (105.3–14.6)
2001 ^b	107.9 (104.1–13.3)	108.3 (104.6–13.0)	108.8 (104.1–13.4)	109.1 (105.5–12.1)
2002	110.6 (104.2–28.0)	112.5 (105.2–27.6)	114.9 (108.5–35.7)	115.6 (108.7–32.2)
2003	107.6 (103.7–12.5)	108.9 (104.0–13.8)	110.8 (104.6–18.9)	112.1 (109.6–16.0)

Note: DFMS – downstream fixed monitoring station

^a The periods of time defined as spring and summer have varied from year to year. The spring period was approximately April 1 to June 30 for 1996 to 2001, April 14 to June 21 for 2002, and April 3 to May 31 for 2003. The summer period was approximately July 1 to August 31 for 1996 to 2001, June 22 to August 25 for 2002, and June 1 to August 31 for 2003.

^b There was no spill at the Rocky Reach dam in 2001. Thus, data for this year serve as a baseline for TDG levels with no spill-related TDG effect from the project.

Chelan PUD used regression analysis to evaluate the relationship between the change in TDG levels from the forebay to the DFMS and the spill rate (kcfs) as well as the percent of total flow spilled. Data were stratified by spring and summer. The correlation between TDG level and spill level has been highly variable, typically with correlation coefficients well below 0.5 for both total spill rate and percent of river flow spilled. This poor correlation is because spill at the project does not greatly increase TDG when the TDG level in the forebay is above 110 percent.

The Rocky Reach dam consists of a powerhouse parallel to the river flow, located on the west bank of the river and a spillway perpendicular to the flow located on the east bank of the river. Because of this configuration, TDG levels are expected to be higher in the east portion of the channel than in the west portion of the channel. Results of monitoring TDG at transects across the channel downstream of Rocky Reach dam indicates that there is a slight trend of TDG levels decreasing from the east channel to the west, as expected (Corps, 2003). The Chelan PUD (2004a) reported that this observation has been consistent during 8 years of transect monitoring.

Comparison of forebay to DFMS data showed an increase in TDG levels when there is little or no spill. The increase in TDG from forebay to DFMS when no spill occurred leads to the conclusion that factors other than spill may also influence TDG, or

there are potentially undetected vertical and/or horizontal gradients in TDG across the river channel that are not accounted for by monitoring at the fixed station.

The results of 8 years of TDG monitoring indicate that TDG levels at the forebay of the Rock Island dam largely depend on TDG levels reaching the Rocky Reach forebay. Although the effects of spills at the Rocky Reach dam on TDG are sometimes evident, results have not demonstrated a strong causal relationship between the project spill rate and TDG levels that exceed the applicable criterion for the forebay of Rock Island dam. In 1998, the spill pattern for fish passage at the project generally resulted in an increase in TDG levels from the forebay at the Rocky Reach dam to the forebay at the downriver Rock Island dam (Koehler and McDonald, 1998). Similar findings were reported for 1996 (McDonald and Priest, 1997). During the high flows in 1997, spill at the Rocky Reach dam was distributed across either 7 or 11 spillway bays, and the TDG data showed decreasing trends from the project to the Rock Island Project (Chelan PUD, 2004a). However, in recent years using different spill patterns, the TDG level arriving at Rock Island dam has been only slightly higher, and sometimes lower, than the TDG level in the forebay of the project (Chelan PUD, 2006b).

Groundwater

Groundwater in the study area is contained in shallow, unconfined aquifers composed of glacial drift deposits overlying basalt. In the vicinity of the project reservoir, the depth to high water table is more than 6 feet. The principal water-bearing units consist of sand and gravel in glacial outwash and glacial till. Well depths range from 50 to 250 feet. The water-yielding capability of the glacial drift aquifer is highly variable due to the spatial variability of the constituent materials.

Groundwater from the glacial drift aquifer is used as a source of domestic water supply in the region surrounding the project reservoir. Groundwater quality in the glacial drift aquifer is generally good, with some problems related to contamination from agricultural practices, including high levels of nitrates, phosphorus, and coliforms (FERC, 1996).

Minimal levels of residual fertilizers and herbicides were detected near the surface in soils within the project area. Residual lead-arsenic levels from pre-World War II orchard operations were found at depth in heavy clay soils; however, the measured levels were below the regulatory thresholds and have not been shown to affect groundwater quality in the project area.

The Columbia River Basalt Aquifer underlies the glacial drift aquifer and consists of alternating layers of dense but locally fractured basalt and interbeds of unconsolidated sand and gravel. Groundwater from the Columbia River Basalt Aquifer is used predominantly for irrigation. Well depths generally range from 50 to 750 feet, but may exceed 900 feet (USGS, 1985, as cited in FERC, 1996).

3.3.2 Environmental Effects

3.3.2.1 Water Use and Quantity

Water quality can be affected when water is consumed or when a non-consumptive use takes water out of the river channel over some distance, reducing flows in a bypassed reach. Water quality can also be affected when water is used for processes that contaminate the water with pollutants. The project does not take water away from the river channel for power generation; therefore, there is no bypassed reach. The amount of water used to irrigate parks and other project properties is minor, and the quantity used is regulated through flow measurements required by existing water rights. Water used at the project's fish hatcheries is non-consumptive, and the discharges from them are regulated through NPDES permits.

In the PDEA, Chelan PUD did not identify any adverse effects on water quality that result from the project's uses of water for irrigation, fish hatcheries, domestic consumption, or other uses associated with operation of the project, and Chelan PUD does not propose any new use of the project's water rights for power production or other uses.

In the Settlement Agreement, Chelan PUD proposes to continue operating the project under the Hourly Coordination Agreement to optimize the management of flows and power generation through the seven dams from Grand Coulee to Priest Rapids. Chelan PUD also proposes to continue to abide by the Vernita Bar Agreement and the recently executed renewal and expansion of these efforts through the Hanford Reach Agreement. The Hanford Reach Agreement allows use of active storage from the project reservoir to assist Grant PUD in meeting the discharge requirements for the Priest Rapids Project. The Hourly Coordination Agreement allows the project to meet a high proportion of the peaking load of power purchasers who have the rights to the output of both the Rocky Reach Project and Grant PUD's projects when the Priest Rapids and Wanapum projects are constrained by the Hanford Reach Agreement's anti-stranding provisions. In comments on the draft EIS, BPA stated that Grant PUD's purchasers lose some of their ability to request power for their needs at the Priest Rapids and Wanapum projects, although those who also have purchased generation rights to Rocky Reach may choose to exercise more of their rights at Rocky Reach to continue to meet their power requirements.

Consistent with Chelan PUD's proposal, CRITFC and other stakeholders have stated that the operations of the project should continue to support the protection of fall Chinook salmon in the Hanford Reach of the Columbia River, specifically via the Vernita Bar Agreement and operations to prevent stranding of juvenile Chinook salmon. The Priest Rapids Project does not have the ability to meet all project purposes and re-regulate the daily flow releases from the other projects. For this reason, the Hanford Reach

Agreement was developed to provide for the release of water from 1 foot of active storage at the Rocky Reach Project to supplement flows, when needed, after active storage at the Priest Rapids and Wanapum projects has been used. As part of their 10(a) recommendations, the Confederated Tribes of the Umatilla Indian Reservation (Umatilla Tribes) and the Yakama Nation recommend that the project be operated in accordance with the Hourly Coordination Agreement, which enables providing more stable flows for fall Chinook salmon in the Hanford Reach. In addition to recommending that Chelan PUD follow the Hourly Coordination Agreement, the Umatilla Tribes recommend that project operations not deviate from hourly coordination during the susceptible period for Hanford fall Chinook salmon spawning and juvenile rearing and migration.

Our Analysis

Information we present in section 3.3.1.2, *Water Use and Quantity*, indicates that the project's consumptive uses of water are minimal, and the total flow rate of surface water consumptive use water rights issued by WDOE for all users is just 326.5 cfs. These withdrawals have little effect on the flows of the Columbia River, particularly given that transmission losses from irrigation systems return to the river.

The project's use of water for irrigation, fish hatcheries, domestic consumption, and other uses associated with operation of the project is currently managed under the appropriate use-specific regulations (i.e., water rights, NPDES permits) that apply to each use. Under Chelan PUD's proposal, the water used for power production would continue to be managed through FERC license articles, the Hourly Coordination Agreement, the Vernita Bar Agreement, and the Hanford Reach Agreement, which is consistent with the recommendations of CRITFC, WDFW, the Umatilla Tribes, and the Yakama Nation. There is nothing on the record to indicate that other requirements or restrictions on the project's use of water are necessary or desirable.

3.3.2.2 Water Quality

To determine the current effects of project operations on water quality, the Natural Sciences Working Group (NSWG) helped develop nine studies, as follows:

1. Water Quality Monitoring Report—Rocky Reach Reservoir—Water Year 2000 (Parametrix and Rensel Associates, 2001)
2. Rocky Reach Reservoir Temperature Studies (Parametrix and TRPA, 2002)
3. Technical Report on the Development of a CE-QUAL-W2 Model for the Rocky Reach Hydroelectric Project (WEST Consultants, 2005)
4. Analysis of TDG Data, Rocky Reach Dam, 1997–2000 (Parametrix, 2000a)
5. TDG Supersaturation in the Natural River Environment (Parametrix, 2000b)

6. Total Dissolved Gas Exchange during Spillway Operations at Rocky Reach Dam, April 26–May 3, 2002 (Corps, 2003)
7. Gas Abatement Techniques at Rocky Reach Hydroelectric Project (MWH, 2003)
8. Operational and Structural Total Dissolved Gas Management (Schneider and Wilhelms, 2005)
9. Total Dissolved Gas Biological Effects, 2002 (Parametrix and RL&L, 2002)

The purposes of these studies were to confirm, expand, and update information contained in the historical record summarized in the ICD (Chelan PUD, 1999). Furthermore, these studies were specifically designed to determine if there were project effects on water quality that had not been previously identified and to better delineate the extent of project effects that were known to occur. These studies included an extensive, broad-brush study of overall water quality that was conducted in water year 2000. The purpose of this study was to provide a definitive basis for water quality certification by WDOE for the project. In addition, the study was to provide information about project-related effects on parameters that might not meet water quality standards (Parametrix and Rensel Associates, 2001).

Water Quality Parameters Meeting Standards

The parameters measured during the water year 2000 water quality study included DO, pH, turbidity, and fecal coliform, which correspond to parameters specified in the Washington State water quality standards (Parametrix and Rensel Associates, 2001). Other commonly monitored parameters were also studied, including total suspended solids, total dissolved solids, transparency (Secchi depth), specific conductance, total alkalinity, total hardness, various forms of phosphorous and nitrogen, chlorophyll-*a*, phytoplankton, zooplankton, and attached benthic algae. In addition, nitrogen to phosphorous ratios and trophic state indices were computed from the data collected. This study facilitated determination of both compliance with water quality standards and biological function of the project waters for those parameters (table 6). The other parameters important for water quality certification, temperature and TDG, were also measured and reported in the Water Quality Monitoring Report (Parametrix and Rensel Associates, 2001). In addition, much more extensive information for temperature and TDG was obtained under separate studies and monitoring programs. The information and studies pertaining to water temperature and TDG are discussed later in this section.

Table 6. Average values for pelagic water quality samples from Rocky Reach reservoir, water year 2000. (Source: Parametrix and Rensel Associates, 2001)

Month	Dissolved Oxygen (mg/l)	Dissolved Oxygen Saturation (%)	pH (units)	Turbidity (NTU)	Specific Conductance (μ mhos/cm)	Fecal Coliform (CFU per 100 ml)	Total Suspend Solids (mg/l)	Total N ^a (mg/l)	Nitrite (mg/l)	Nitrate (mg/l)	Total Phosphates (mg/l)	Dissolved Ortho-P (mg/l)
October	9.44	96.3	8.1	2.1	116	1	1.0	.0060	.0026	.0810	.0060	.0026
November	9.70	92.9	7.8	1.9	111	5	1.3	.0057	.0016	.0943	.0077	.0032
December	11.25	97.5	7.9	1.1	120	10	1.0	.0077	.0035	.1034	.0064	.0032
January	--	--	--	--	--	--	--	--	--	--	--	--
February	12.99	100.3	7.9	1.9	130	1	2.3	.0092	.0002	.1369	.0072	.0010
March	--	--	--	--	--	--	--	--	--	--	--	--
April	12.37	105.6	8.0	2.9	130	1	2.0	.0104	.0006	.2066	.0254	.0028
May	11.43	106.7	7.9	2.8	126	1	2.3	.0083	.0007	.0763	.0295	.0018
June	10.55	96.3	7.9	2.2	120	4	2.9	.0099	.0010	.0702	.0196	.0014
July	10.05	105.6	8.0	1.9	119	2	3.0	.0110	.0027	.0574	.0249	.0020
August	9.43	102.3	7.7	1.6	125	1	5.0	.0087	.0021	.0518	.0148	.0013
September	8.32	89.9	7.8	1.6	127	1	1.8	.0061	.0010	.0744	.0154	.0022
Mean	10.55	99.3	7.9	2.0	122	2.7	2.2	.0083	.0016	.0952	.0157	.0022
Maximum	12.99	106.7	8.1	2.9	130	10	5.0	.0110	.0035	.2066	.0295	.0032
Minimum	8.32	89.9	7.7	1.1	111	1.0	1.0	.0057	.0002	.0518	.0060	.0010

Notes: -- -- no measurements made
 CFU – colony forming units
 ml – milliliter
 mg/l – milligram per liter
 NTU – nephelometric turbidity unit
 μ mhos/cm – micromhos per centimeter

^a $\text{NH}_3 + \text{NH}_4$

In addition to sampling the physical and chemical parameters, biological sampling demonstrated that the project's waters are favorable for the maintenance of a healthy aquatic ecosystem. This is particularly important to the function of the reservoir as a rearing environment for juvenile salmonid fishes and for other native fish species. The nutrient levels, chlorophyll-*a* concentrations, and low turbidity levels indicate that the trophic status of Rocky Reach reservoir falls within the lower mesotrophic range (Parametrix and Rensel Associates, 2001). Analysis of zooplankton samples demonstrated large biovolumes of *Daphnia* from July through September, while free-drifting chironomids (midges that lack piercing mouthparts) and oligochaetes (aquatic annelids that lack a specialized head) were particularly prevalent in April and May (Parametrix and Rensel Associates, 2001). These organisms may be important food sources for migrating and rearing anadromous fish.

The Rocky Reach reservoir and tailrace were also studied for other biological and physical components of healthy aquatic ecosystems. The levels of attached benthic algae in the reservoir were high (Parametrix and Rensel Associates, 2001). A number of native fish species graze on benthic algae, including suckers and chiselmouth. A survey of benthic organisms (DES and RL&L, 2000), conducted as part of the fisheries resources studies, found healthy benthic communities in a variety of habitat types. In terms of density, midges, caddisflies, sow bugs, clams and mussels, and scuds accounted for most of the benthic macroinvertebrates collected. These organisms typically are important sources of food for fish (Wydoski and Whitney, 1979). Largely owing to the variability of habitats, each study site tended to be unique with regard to the number of taxonomic groups, total number of invertebrates, and the relative contribution of dominant taxa (percent composition) (DES and RL&L, 2000). These assessments of the aquatic community indicate that the Rocky Reach reservoir generally meets the objectives of the water quality standards by supporting a healthy, diverse aquatic community. In comments on the draft EIS, the Umatilla Tribes indicated that the aquatic community within the project area is less diverse and less productive than it would be in a free-flowing river.

Sampling stations selected for the water year 2000 water quality monitoring study were dispersed over a broad array of locations in the project area (figure 4). Results of this study confirmed that, with the possible exception of the numeric criteria for temperature and TDG, the Columbia River within the project area meets the applicable water quality standards (refer to tables 1 and 6).

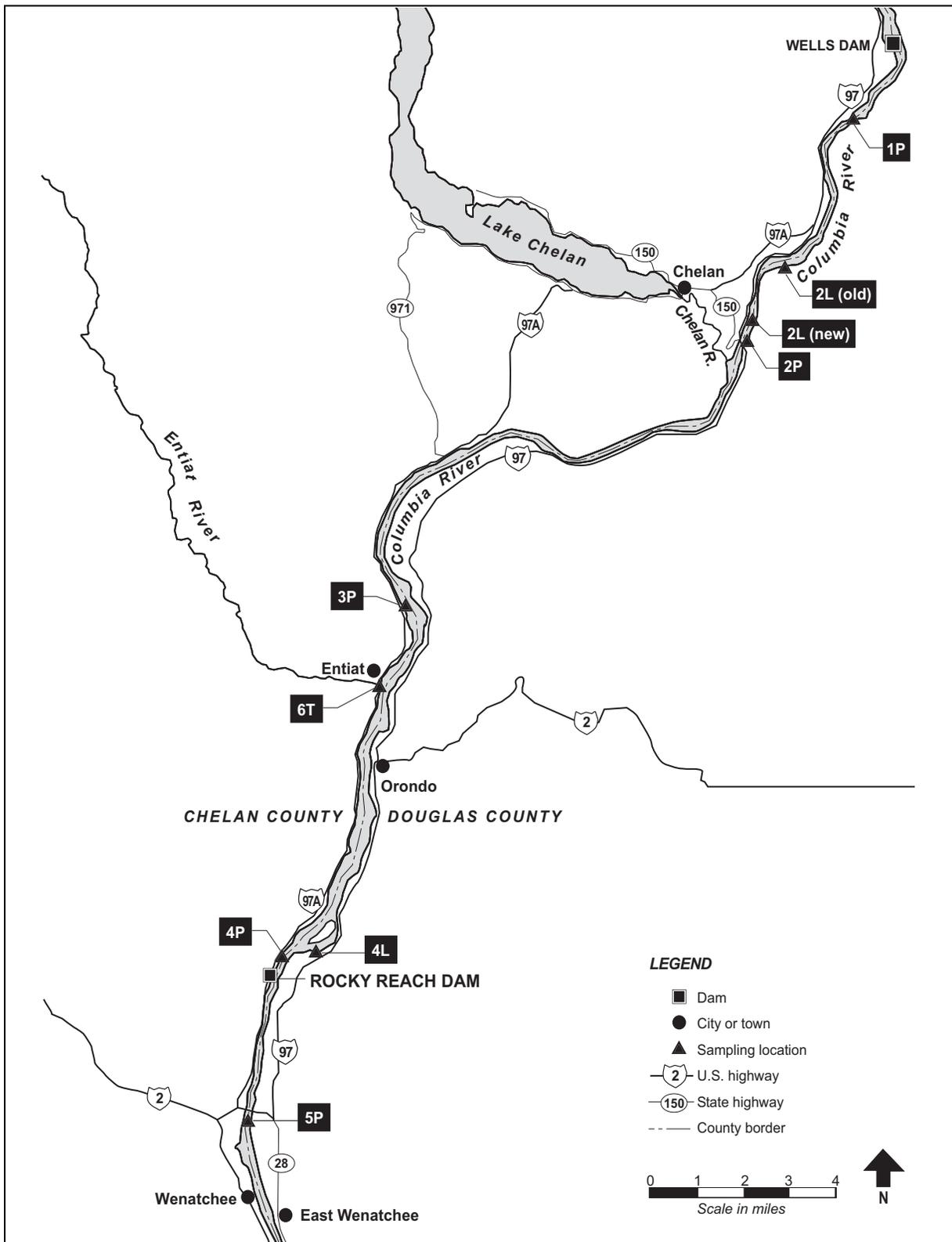


Figure 4. Rocky Reach Project water quality sampling locations. (Source: Parametrix and Rensel Associates, 2001, as modified by staff)

In the PDEA, Chelan PUD indicated that three water quality issues would likely require management through implementation of compliance plans: (1) water temperature, (2) TDG, and (3) oil and hazardous material spill prevention and countermeasures. Currently, these issues are individually governed by separate water quality actions. Chelan PUD has consolidated these separate actions and the results of the nine water quality studies into a single Water Quality Plan (Chelan PUD, 2006b) that provided WDOE with the basis for issuing the water quality certification.

The issues of temperature, TDG, and oil and hazardous materials spill prevention are each discussed separately below. Environmental measures for each of these issues are addressed by the Water Quality Plan that is part of the Settlement Agreement. This plan is described herein as it relates to each of these issues. As parties to the Settlement Agreement, WDOE and Interior concur with Chelan PUD's proposal.

In the PDEA, Chelan PUD indicated that it expected WDOE's water quality certification under Section 401 of the federal CWA to include a condition that requires periodic monitoring of parameters that currently meet water quality standards to ensure that the project does not impair water quality in the future. Chelan PUD has proposed to monitor the temperature, DO, and pH of shallow waters in Rocky Reach reservoir. WDOE included this as a condition of the Section 401 certificate.

In their comments on the PDEA, the Umatilla Tribes and American Rivers indicate that the project should be operated to comply with state water quality standards, which is consistent with Chelan PUD's proposal.

As part of their 10(a) recommendation 14 of March 14, 2005, the Umatilla Tribes recommend completing all modeling and implementing all project modifications needed to ensure compliance with Washington State water quality standards that are applicable throughout any new license period while achieving quantitative and qualitative performance standards and goals for salmon, Pacific lamprey, and white sturgeon. This approach is generally consistent with Chelan PUD's proposal, although the Umatilla Tribes also recommend that Chelan PUD establish a water quality committee to interact with the Fisheries Technical Committee to resolve water quality issues over the term of a new license. We discuss portions of these measures that specifically address water temperature, TDG, and oil and hazardous spills in the separate sections of this EIS addressing those issues.

Our Analysis

Chelan PUD has indicated (Chelan PUD, 2004a) that it expected the WDOE water quality certification for the project to contain an appropriate level of water quality monitoring requirements to ensure that the project does not impair water quality over the term of any new license. Based on consultations with WDOE, Chelan PUD developed a

schedule for implementation that would ensure that the project complies with applicable water quality standards within 10 years as required by WAC 173-201A-510(5).

Chelan PUD developed and iteratively revised a Water Quality Plan that summarizes the results of recent studies conducted to evaluate existing water quality in the project area and potential options for resolving water temperature and TDG issues and identifies measures to address water quality in the project area (Chelan PUD, 2006b). Chelan PUD developed a CE-QUAL-W2 temperature model for the project's reservoir.²⁰ Since issuance of the draft EIS, Chelan PUD has incorporated the results of the CE-QUAL-W2 modeling effort into the February 3, 2006, version of the Water Quality Plan that forms part of the Settlement Agreement, which has made the plan more comprehensive with respect to knowledge of water temperature (Chelan PUD, 2006b). Implementation of this Water Quality Plan should reduce any adverse project effects on water quality and beneficial uses. In the Settlement Agreement, Chelan PUD indicated that it may petition WDOE to initiate a process to modify the applicable water quality standards for TDG and/or temperature, if the existing numeric criteria are not satisfied.

In comments on the draft EIS, the Yakama Nation indicated that the macrophyte beds may potentially depress DO concentrations and thus result in adverse effects on fish residing in them. DES (2001a) estimated that aquatic macrophyte beds in the Rocky Reach reservoir covered an area of about 386 acres in 1999. Chelan PUD currently monitors and controls aquatic invasive species through separate programs. These programs include routine harvesting of Eurasian watermilfoil at public access points and recreational facilities. In the Settlement Agreement, Chelan PUD proposes to develop a 1-year sampling program, in consultation with WDOE, to determine if water quality criteria for temperature, DO, and pH are met in shallow water habitats in the reservoir. If measurements show that the water quality criteria are not satisfied, Chelan PUD would conduct further monitoring in coordination with the RR Fish Forum and WDOE to determine the adverse effects on aquatic habitat and what reasonable and feasible actions may protect aquatic organisms. Chelan PUD would determine any needs for additional monitoring and reasonable and feasible corrective actions through coordination with the RR Fish Forum and WDOE. Implementation of this proposed measure would address potential adverse effects of the macrophyte beds on DO levels and, consequently, on fish habitat.

Establishing and actively using a water quality committee according to the recommendations of the Umatilla Tribes would provide a forum for water quality discussions and coordination of water quality and fishery actions. However, we anticipate that it also would be redundant with WDOE's water quality certification and TMDL processes and result in an additional layer of oversight and burden on Chelan PUD and resource agencies. In comments on the draft EIS, Chelan PUD indicated that

²⁰ This modeling effort uses version 3.2 of CE-QUAL-W2, a two dimensional hydrodynamic and water quality model (Portland State University, 2005).

the RR Fish Forum would be available to assist WDOE and Chelan PUD, if needed. Therefore, we conclude that establishing a separate water quality committee would provide only minimal benefit in managing aquatic resources.

Temperature

The maximum numeric temperature criterion for the project segment of the Columbia River is currently 18°C under EPA-approved water quality standards. WDOE adopted revisions to the water quality standards that changed the water temperature criterion to 17.5°C (as the highest average of seven consecutive daily maximum temperatures) for the Columbia River reach that includes the project (WDOE, 2005b), although EPA recently disapproved portions of WDOE's revised standard that address water temperature.²¹ Under both the existing and revised criteria, allowable human-caused increases are a function of the background temperature with the maximum allowable increase over the natural water temperature being 2.8°C and the minimum allowable increase being 0.3°C above the natural water temperature, which is applicable when natural conditions cause water temperature to exceed 18°C (or 17.5°C). Ecology will propose a new set of standards to fix the deficiencies identified by EPA.

Historically, the Columbia River exceeded the 18°C criterion under natural conditions in the area that is now the project area. Data from Rock Island dam demonstrate frequent exceedances of 18°C prior to construction of any upstream hydroelectric project dams. Studies by Sylvester (1957), Davidson (1969), and EPA, as summarized by Parametrix and Rensell Associates (2001), have all shown that the Columbia River typically exceeded 18°C in August. However, the Columbia River's thermal regime changed following construction of Grand Coulee dam and other large storage reservoirs.

During development of the license application and PDEA for this project, the NSWG participated in the design and review of two studies that focused on water temperatures within the Rocky Reach reservoir: (1) a monitoring study in water year 2000 (Parametrix and Rensel Associates, 2001), and (2) a water year 2001 monitoring study along with a modeling study for water year 2000 and 2001 (Parametrix and TRPA, 2002). To better model water temperatures, the CE-QUAL-W2 model was selected and used to model water temperatures in the project reach.

In water year 2000, an extensive temperature monitoring effort was conducted to assess whether water temperature increased as water traveled through the reservoir and to assess whether there was thermal stratification within the reservoir (Parametrix and Rensel Associates, 2001; Chelan PUD, 2006b). Monitoring results indicate that little variation in water temperature in either vertical (surface-to-bottom) or lateral (shore-to-

²¹ Available at:
http://www.ecy.wa.gov/programs/wq/swqs/disapproval_docs/epa_disapprove_ltr.pdf

shore) directions generally occurred, although littoral stations appeared to be slightly warmer in summer than stations located in the thalweg of the reservoir. Vertical profiles of water temperatures were monitored at 10 to 11 stations along 8 transects in the morning and afternoon of September 1 and 2, 2001. Chelan PUD (2006b) reported that most transects had temperature differences ranging from 0.2 to 0.6°C in the morning and 0.8 to 2.1°C in the afternoon. Water temperatures at all Rocky Reach reservoir monitoring locations exceeded the 18°C Class A numerical criterion during late summer. Generally, differences in water temperatures in the Rocky Reach tailrace compared with the Wells dam tailrace did not exceed 0.3°C, although they did slightly exceed 0.3°C on a few days. This study was not able to distinguish if the water temperature increases through the project area were from natural warming processes or if the increases were, in part, attributable to the project's effects.

As part of developing the temperature TMDL for the Columbia River, EPA used RBM10, a dynamic one-dimensional water temperature model, to simulate water temperatures for a 30-year period. Results of this modeling indicate that generally the Columbia River temperatures increase during spring and summer at about the same rate as before construction of the hydroelectric project dams (Yearsley, 1999, as cited in Chelan PUD, 2006b). The model predicted that without reservoirs the river had much lower flows in late summer, and water temperature was much more variable in response to changes in climatic conditions. Peak water temperatures during hot weather were often higher than those that currently occur, but on average the river exceeded 18°C less of the time before the hydroelectric project dams were constructed (EPA, 2002). EPA has issued a review draft TMDL for temperature on the Columbia River. Supporting data presented by EPA at public workshops show that most of the temperature changes due to human effects are the result of large storage reservoirs. The smaller run-of-river projects, including this project, have much less effect on water temperatures.

To better define the extent of project influences on temperature increases, the NSWG reviewed the available modeling techniques and approved an intensive temperature study plan for 2001. The chosen study design included collecting temperature data adequate to support either a one-dimensional or a two-dimensional model. Because it appeared that the reservoir did not significantly thermally stratify either vertically or laterally, the NSWG approved a study plan to analyze the data collected in 2000 and 2001 using a one-dimensional model, the Stream Network Temperature (SNTEMP) model. The SNTEMP model was used to simulate Columbia River temperatures within the reservoir reach under variable conditions of flow and weather, both with and without the Rocky Reach dam and reservoir in place (Parametrix and TRPA, 2002).

Water temperatures monitored during the extremely low summer flows of 2001 indicate that the mainstem flow is generally well mixed. However, the warmest temperatures were monitored in shallow water near the shoreline and in near-surface

waters during the afternoon (Parametrix and TRPA, 2002). Longitudinal temperature differences also occurred during the summer of 2001. Data available prior to selection of the temperature model indicated little vertical or lateral stratification of the reservoir and hence supported the use of SNTEMP. However, using SNTEMP to simulate reservoir temperatures for 2001 encountered challenges that are related to the steady-state assumption of the model. The model is not capable of transferring mass or energy between time steps, so it may not accurately predict temperatures in situations where hydrological or climatic conditions are varying between time steps used (Theurer et al., 1984). Reliance on daily time steps limited the capability of the model to accurately simulate temperatures for the low flows in 2001 because the daily time step did not adequately represent the transfer of water through the reservoir.

Parametrix and TRPA Associates (2002) adapted the SNTEMP model to mitigate for the low flows in 2001 by treating the Rocky Reach reservoir as three separate stream segments. In the process of calibrating the SNTEMP model, the simulated temperatures under the measured climatic and hydrological conditions in 2001 were as expected for the upper reservoir (Beebe Bridge), but preceded the observed temperatures by 1 day at mid reservoir (Daroga Park) and by 2 days at the Rocky Reach dam. Chelan PUD applied the FloodWav model to the project reservoir in 2001 to determine water travel times. FloodWav, maintained by the National Weather Service, computes water travel times in a depth and width-averaged manner (i.e., one-dimensional, plus-time scale), predicted travel time from the Wells dam under the average 2001 study period flow of 60,000 cfs (extreme drought conditions). The resulting predicted water travel times from Wells dam were 0.44 day to Beebe Bridge, 1.56 days to Daroga Park, and 3.51 days to the Rocky Reach dam. This predicted delay in water movement within the reservoir generally matched the downstream temperature data delay recorded by the installed thermographs.

This water travel time information was then used to modify the study by segmenting the reservoir into three separate models. This effort partially compensated for the steady-state limitations of the SNTEMP model. However, even though the reservoir was segmented into three sub-reach SNTEMP models (and starting temperatures for each sub-reach used observed temperatures at their upstream boundaries), the delayed transport of warmed (or cooled) water from upstream still prevented accurate temperature simulation that would correspond to the observed temperatures on a daily basis. An additional factor may have been the increasing water volume closer to the dam (in relation to total flow) that retains heat energy with less potential for water surface/atmospheric interchange. Still, some conclusions can be drawn from the SNTEMP model study that support and expand on information developed with EPA's RBM10 model.

To assess the warming or cooling effect of the Rocky Reach reservoir on Columbia River temperatures, researchers constructed a pre-dam stream model by modifying the previously calibrated SNTEMP model. Water surface elevations, channel

widths, and topographic shade were the key structural input data changed for the model to allow for a simulation under “natural” conditions. The without-dam model was used to simulate stream temperatures within the three study reaches using 2001 and 2000 climatic and hydrologic data. At Beebe Bridge, in both 2001 and 2000, the dam exhibited minimal influence on water temperatures. Under 2001 (drought) conditions at Daroga Park, there is more evidence that the reservoir was having a warming effect early in the summer. This effect held until late September, when simulated without-dam temperatures were warmer than with-dam temperatures. This same relationship held true under 2000 conditions (normal flow year), but the crossover occurred earlier, in early August. At the Rocky Reach dam (lower reservoir sub-reach), the same relationships held true in both years, except the magnitude of the temperature differences was amplified.

In the broadest sense, SNTEMP model results suggest that Rocky Reach reservoir causes some warming in the river during July and early August and some cooling during later August, September, and October. This seasonal effect is most apparent downstream in the reservoir near the dam, and both the magnitude and timing of the effect are influenced by river flow. Accurate quantification of the effect, however, is limited within the SNTEMP model by the delay in the reservoir’s temperature response to changes in climate, particularly air temperature. The delay most likely results from the transport of warmed (or cooled) water from upstream to downstream over several days, plus the greater resistance of the large volume of impounded water to change temperature. Because the water travel time of the unimpounded river over a given distance would be less than for the reservoir, comparison of daily differences with and without the dam is not appropriate. A more reasonable estimate of change could be derived from the simulations by shifting the comparison in phase with the travel time for a given flow. Because making this type of shift would also have to account for daily changes in flow and because these changes were large in 2000 and 2001, a shift was not attempted.

The SNTEMP model results can be used to make general predictions about the relative effect of the project on water temperatures under different flows and climatic conditions. The maximum warming effect of the project would occur during a combination of low river flow, high air temperature, and greatest day length. Warming effects for all days in 2000 (a more normal water year) and on days without extremely low river flow, high air temperature, and long day lengths in 2001 were all less than for the 2001 extremes. Figures 5 and 6 show the simulated effect of the project on water temperatures under the historical climate and flow conditions (FCRPS-augmented, not natural) experienced in 2000 and 2001. Total flow in the Columbia River appears to be

the principal factor determining the effect of the Rocky Reach dam on water temperature. The important trends to note from these model results are:

- The project had very little daily effect on water temperatures in 2000.
- Temperatures in 2001 were more affected by the project in July before the river reached its peak temperatures.
- The project had no consistent effect on the peak temperatures in August and September of 2001.
- The project contributed to accelerated cooling of water in early October, when Chinook salmon begin mainstem spawning in the Rocky Reach reservoir and the Hanford Reach of the Columbia River.

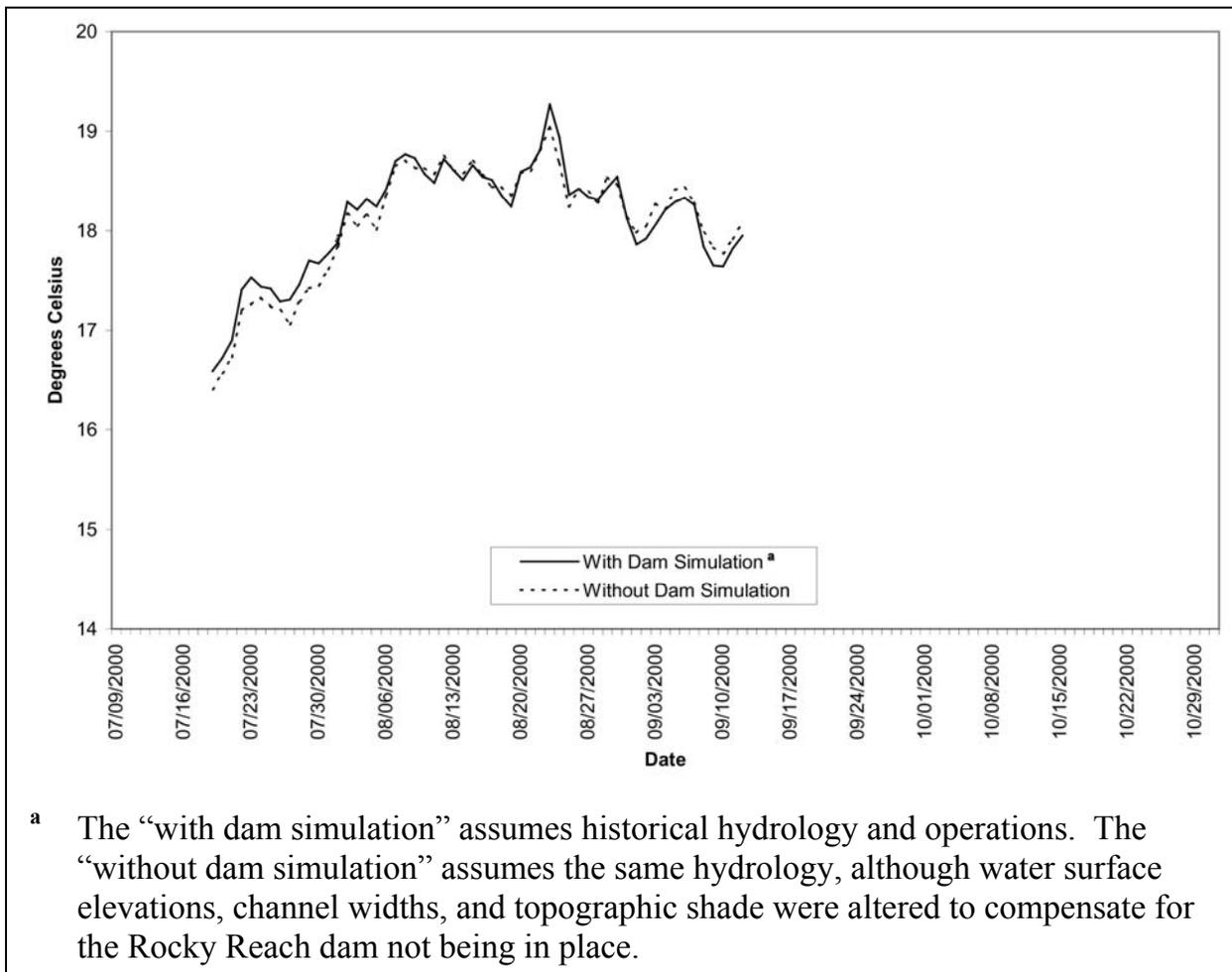


Figure 5. SNTMP modeled Columbia River daily average water temperatures for reach 3 of the Rocky Reach Project using 2000 data. (Source: Parametrix and TRPA, 2002, as modified by staff)

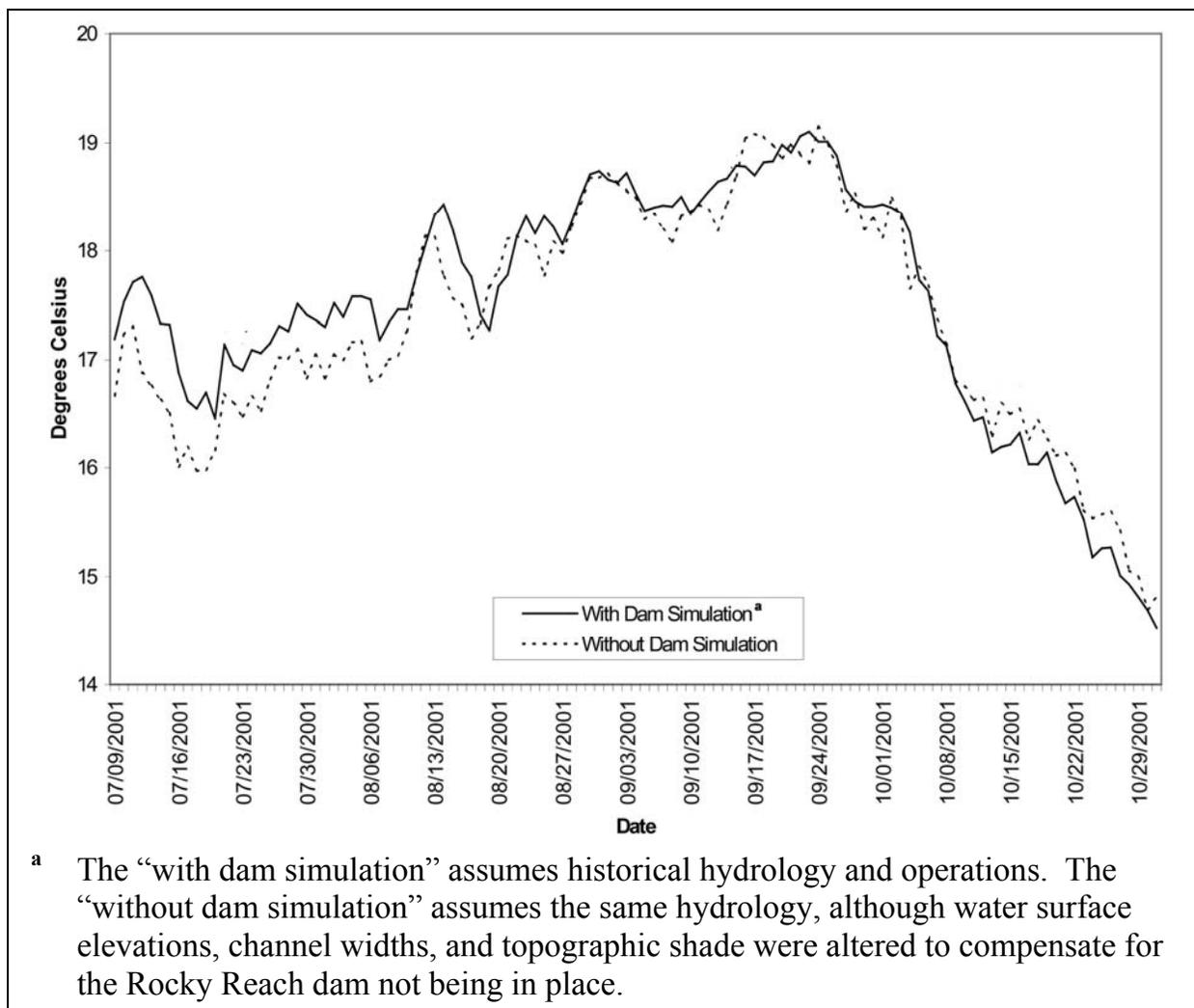


Figure 6. SNTemp modeled Columbia River daily average water temperatures for reach 3 of the Rocky Reach Project using 2001 data. (Source: Parametrix and TRPA, 2002, as modified by staff)

An important difference in the predicted effect of the project on temperature exists between the EPA RBM10 model and the predictions from the SNTemp model used by Parametrix and TRPA (2002). The RBM10 predictions, which use natural conditions as the basis for comparison (figure 7), show a continued heating or heat retention effect of the reservoir in the late summer and fall (days 230–325). In contrast, the SNTemp modeling effort, which compares temperatures under existing conditions to the same flow regime without the Rocky Reach dam, predicted that the reservoir has a cooling effect beginning in late August. Both models are one-dimensional and thus subject to the same limitations regarding vertical and lateral differences in daily maximum stream temperatures, although SNTemp’ steady-state assumption limits its ability to simulate longitudinal differences. However, the SNTemp model predictions by Parametrix and

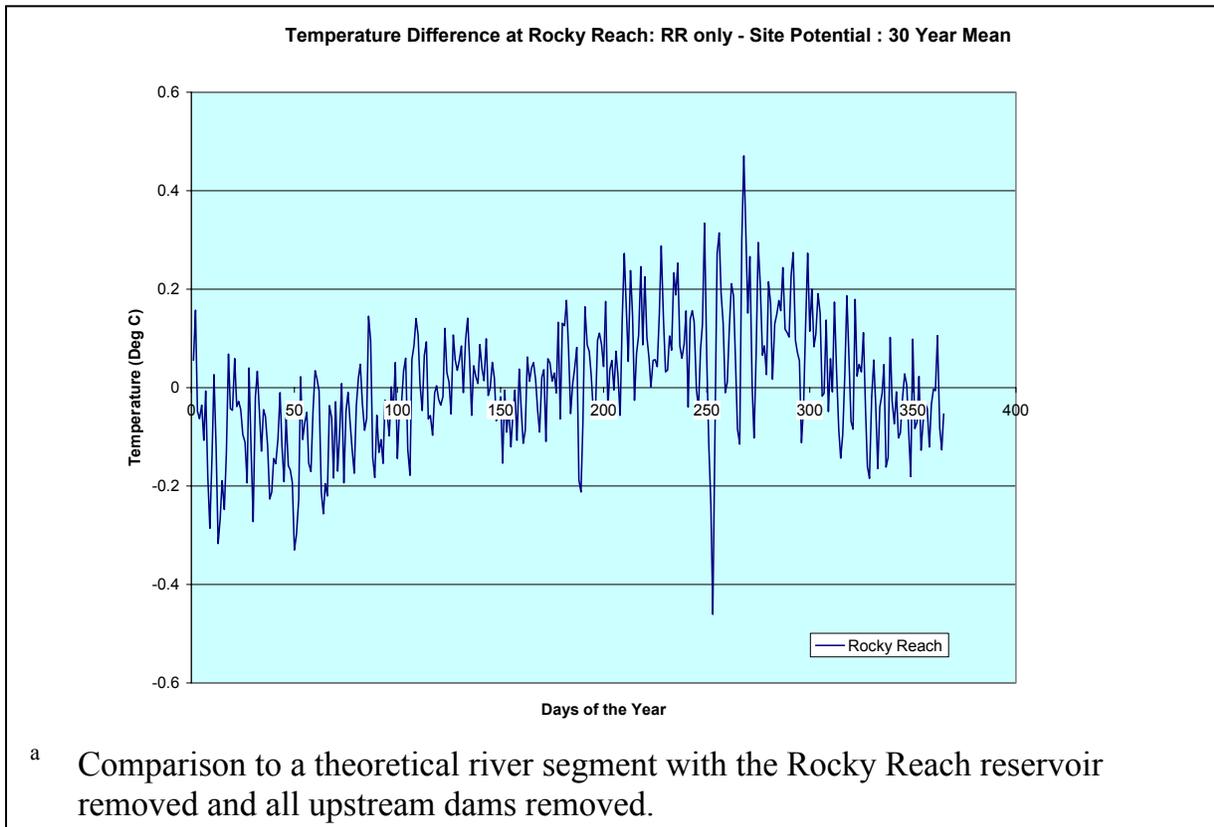


Figure 7. RBM10 modeled effect of Rocky Reach reservoir on Columbia River water temperature, 30-year mean.^a (Source: EPA, 2002)

TRPA (2002) used more detailed bathymetry, channel width, and shade information than was used by EPA for the RBM10 modeling. The EPA model predictions used a much broader 30-year data set of streamflow and climatic conditions, thus the RBM10 model predictions include a broader perspective of flow and climatic extremes.

To overcome some of the limitations caused by using a one-dimensional model and SNTMP's steady-state assumptions, Chelan PUD funded development and use of a CE-QUAL-W2 model. The CE-QUAL-W2 modeling effort was done by WEST Consultants in collaboration with WDOE; Chelan PUD; a peer review group of water temperature modeling experts; and the Water Quality Technical Group, a subcommittee of stakeholders in the relicensing settlement process. Following issuance of the draft EIS, Chelan PUD released the results of the CE-QUAL-W2 model (WEST Consultants, 2005). Initially, the model was developed and calibrated using data from 2000 and 2001, and then it was used to simulate "without project" temperatures by revising the bathymetry and changing the vertical eddy viscosity formulation to represent riverine conditions. Following this, WEST Consultants used CE-QUAL-W2 to model with and without project temperatures for 2002, 2003, and 2004.

Chelan PUD (2006b) states that WDOE used existing water temperature and flow regimes entering the project's boundary as the background condition for the section 401 certification analysis of compliance with the temperature standard. To evaluate compliance with the existing water temperature standard and WDOE's 2003 revision of the temperature standard, the Commission staff used WEST Consultants' (2005) analysis of compliance with these standards, which was based on flow-weighted and volume-weighted averages of model results for with and without project conditions. The flow-weighted averages are more representative of the main body of flow moving through the project, whereas the volume-weighted averages give greater importance to areas that are not in the main flow of the river, such as the shallow areas along the margin. WEST Consultants (2005) reported that flow-weighted averages of daily maximum temperatures did not exceed the existing water temperature standard at Beebe Bridge or Daroga Park in any cases during the 5-year period of 2000 to 2004. In the forebay, flow-weighted averages exceeded the allowable increase on 20 days in the 5-year period, although only 5 of these days had increases that exceeded the allowable limits by more than the accuracy of the temperature probe ($\pm 0.2^{\circ}\text{C}$).

Results of comparing the volume-weighted averages to the existing water temperature standard were similar to the flow-weighted averages. During the 5-year period, allowable increases were exceeded on zero days at Beebe Bridge, 2 days at Daroga Park, and on 22 days in the forebay. Of all these exceedances of the allowable increases, only 6 days were greater than the accuracy of the temperature probe above the allowable increase. Comparison of the 7-day averages of daily maximum temperatures to the 2003 revision of the water temperature standard indicated that the allowable increase would be exceeded only on one 7-day period at the forebay for flow-weighted averages and two 7-day periods for volume-weighted averages, and all of these increases were within the accuracy of the temperature probe. In its response to comments from agencies and other intervenors, Chelan PUD stated that a statistical analysis of CE-QUAL-W2 model results shows that there is no significant (p value = 0.1815) evidence Rocky Reach dam causes exceedances of temperature standards.

EPA's development of a temperature TMDL for the Columbia River from the United States/Canada border to RM 4 has been delayed to allow discussions and information exchange (EPA, 2005). The TMDL is expected to set load allocations for all dams downstream of the Canadian border on the Columbia River. Based on technical analysis made available by EPA, the project would likely receive a load allocation that is equivalent to the project's current effects on water temperature. The final load allocation will not be available until the TMDL is completed. The EPA TMDL will be accompanied by a Summary of Implementation Strategies (SIS), prepared by WDOE. The SIS will lead to a detailed implementation plan that must be completed within 1 year after the final TMDL is issued. The measures in the detailed implementation plan recommended for run-of-river dams with minor temperature effects are yet to be determined. However, the suite of potential actions is limited because these dams,

including Rocky Reach, have minimal control of Columbia River flow volumes. The SNTMP and CE-QUAL-W2 models predict that flow is the main factor influencing temperature response in the Rocky Reach reservoir (Parametrix and TRPA, 2002; WEST Consultants, 2005). The TMDL also will include an implementation strategy for water temperature management that is being developed by WDOE and the federal agencies that control the storage reservoirs that are responsible for most of the effects on water temperatures.

In the Settlement Agreement, Chelan PUD proposes to implement the Water Quality Plan that contains measures that address project-related effects on water temperature. The plan includes the following specific actions that are supported by the WDOE.

- Monitor hourly water temperatures from April through October in the project forebay and tailrace;
- Monitor water temperature in the juvenile bypass system and upstream fishway for at least one year;
- Conduct another 5-year temperature modeling analysis to confirm compliance with numeric temperature criteria;
- Participate in EPA Region 10's development of the temperature TMDL by supplying water temperature monitoring and modeling information;
- Participate in tributary restoration, water quality planning, and tributary TMDL implementation planning for the Wenatchee and Entiat rivers; and
- Develop a 1-year sampling program to evaluate compliance of DO, water temperature, and pH in shallow water habitats of the reservoir.

As previously noted, the Umatilla Tribes recommend that the water quality standards be met throughout any new license term while achieving quantitative and qualitative performance standards and goals for salmon, Pacific lamprey, and white sturgeon, which is consistent with Chelan PUD's proposed general approach to enhancing water quality. The tribes also recommend three additional measures, indicating that Chelan PUD should: (1) contribute funding to the regional effort to evaluate temperature control or modification operations at upstream storage projects when EPA finalizes the temperature TMDL for the Columbia River, (2) collect additional temperature data, and (3) conduct infra-red imaging of the reservoir to discover localized hot spots. In comments on the draft EIS, the Umatilla Tribes recommend that temperature effects within the narrow river margin area be part of a monitoring and mitigation plan.

Our Analysis

As discussed above, the effect of the project on water temperature is relatively minor, compared to the large storage projects that exist upstream from the project. The project affects temperature by impounding water in the reservoir upstream of its dam, which changes the thermodynamic response of the Columbia River to ambient climatic conditions.

Results of previous water temperature modeling efforts suggest that the project has some minor warming effects during portions of the summer depending on climatic and hydrological conditions. However, the one-dimensional nature of the RBM10 and SNTEMP models and the steady-state assumption of the SNTEMP model limit the accuracy of their predictions. To more accurately predict water temperatures in the Rocky Reach reservoir and determine if the project complies with the state water quality criteria, Chelan PUD funded development and use of a CE-QUAL-W2 model. The model was developed by WEST Consultants (2005) and peer reviewed by water temperature modeling experts. Once properly calibrated, this two-dimensional hydrodynamic and water quality model was used to provide more accurate predictions of water temperatures in the reservoir and a better basis for quantifying the effects of the project on temperature. This analysis indicates that the project generally satisfies the existing water temperature standard and WDOE's 2003 revision of the water temperature standard.

Chelan PUD has considered the potential to reduce the warming effect of the Rocky Reach reservoir by increasing river flow through storage release, operating the project with the forebay drawn down to an elevation of 704 feet, selective withdrawal for powerhouse and spill flows, cooling towers, chillers, increasing shade on the reservoir through establishment of riparian vegetation, and increasing shade on the pool and weir section of the upstream fishway. Chelan PUD (2006b) determined that none of these potential options would substantially reduce the warming effects of the reservoir, and some of them were not feasible due to their conflict with the Hourly Coordination Agreement or the loss of water through evaporation.

In their justification and support for their recommendations, the Tribes request that Chelan PUD contribute funding to the regional effort to evaluate temperature control or modification operations at upstream storage projects when EPA finalizes the temperature TMDL for the Columbia River. The CE-QUAL-W2 modeling effort that was funded by Chelan PUD increased the knowledge base of the effects of the project on the thermal regime of the Columbia River and indicated that the project generally complies with the applicable water temperature state standards.

Implementation of the February 3, 2006, Water Quality Plan would include hourly water temperature monitoring in the Rocky Reach forebay and tailrace from April through October, as well as monitoring temperature in shallow-water habitats of the

Rocky Reach reservoir during an unspecified period of the year (Chelan PUD, 2006b). Chelan PUD does not specify the method that it intends to use to monitor temperature in the shallow-water areas, but it does note that it would develop a plan, in consultation with WDOE, to monitor water temperature and other water quality parameters (DO and pH) to determine if water quality criteria are satisfied in shallow-water habitats of the Rocky Reach reservoir. In their justification and support for their recommendations, the Umatilla Tribes requests that Chelan PUD conduct infra-red imaging to discover localized hot spots in the project's reservoir. We note that it would be beneficial for Chelan PUD to consider the use of infra-red technology along with other technologies to develop an adequate evaluation of whether the project complies with applicable water quality criteria in shallow-water areas of the reservoir. In addition, we note that implementation of Chelan PUD's proposed temperature monitoring as described in the February 3, 2006, Water Quality Plan alone would provide temperature data for critical periods in late summer or early fall, and would provide data necessary to support more robust modeling of the project's effects on the thermal regime of the Columbia River.

Using CE-QUAL-W2 to model water temperatures for an additional 5-year period, as described by Chelan PUD (2006b) in the February 3, 2006, Water Quality Plan, would document whether the project complies with the applicable water temperature standard in the first 5 years of any new license period. By sharing the temperature monitoring data and model with EPA, as proposed, Chelan PUD would aid EPA in the development of a temperature TMDL that would be consistent with the recommendations of Umatilla Tribes. Chelan PUD also proposes to assist with maximizing the benefit of HCP tributary projects by participating in restoration, water quality planning, and TMDL implementation for the Wenatchee and Entiat rivers.

Chelan PUD has investigated the potential for warming in the adult and juvenile fishways. From May 29 to October 21 in 2001 and from August 19 to October 17 in 2004, Chelan PUD monitored hourly water temperatures of shallow and deep source water, make-up water, and at the end of the pool and weir section (Chelan PUD, 2006b). Average differences in paired temperatures were less than 0.1°C and the maximum difference was generally less than 0.5°C. Based on data collected in 2004, after installation of the surface collector that results in the adult fishway being supplied with vertically mixed water from the project's forebay, Chelan PUD (2006b) reports no significant (p value = 0.05) changes in temperature within the adult fishway and no evidence that the fishway concentrates warmer water from the surface of the forebay. Chelan PUD (2006b) indicates that the temperature of water in the juvenile fishway is not warmer than ambient temperatures in the Columbia River and the temperature does not increase during transit since the bypass pipe shields it from solar radiation and limits warming from warm air. To further evaluate temperatures in the adult and juvenile fishways, Chelan PUD proposes to monitor water temperatures in both fishways for one year, and review, in consultation with WDOE, the data collected in this and earlier studies to determine if further monitoring is needed. Because the existing data suggest

that temperature differences within the fishways do not form thermal barriers to fish migration, it appears that the combination of existing data and temperature data obtained for the fishways by implementing the Water Quality Plan included in the Settlement Agreement (Chelan PUD, 2006b) would provide adequate information to assess the thermal regime of the project's fish passage facilities.

Total Dissolved Gas

The project currently uses spill to improve juvenile fish passage survival during April through August. Chelan PUD manages these controlled spill levels with the goal of not exceeding WDOE's special fish passage condition allowance for TDG of 120 percent saturation (average of highest 12 hours per day) downstream of the tailrace and 115 percent saturation of water arriving at the forebay of Rock Island dam.²² Spill management to meet this water quality standard is accomplished through use of spillgate sequences and spill reductions when necessary. Rocky Reach Project spills are also managed to promote adult fish passage at the Rocky Reach dam.

Studies conducted under the NMFS biological opinions (1995 and 2000) for operations of the FCRPS have shown few adverse effects on salmonid fishes migrating through and residing in the Columbia River when TDG levels are managed to stay within the levels allowed by WDOE's special fish passage condition for TDG (NMFS, 2000, 2005). NMFS (2005) reported that the prevalence of externally visible subcutaneous emphysema, a sign of GBT, in juvenile salmonids was minor when TDG was 120 to 125 percent of saturation, but was generally 10 percent or greater when TDG was greater than 125 percent of saturation. The effects of GBT in juvenile salmonids appeared to be benign, signs were minimal to nonexistent, and there was no apparent GBT-related mortality when tailrace and forebay TDG levels were maintained at no more than 120 and 115 percent of saturation, respectively (Maule et al., 1997, as cited by NMFS, 2005; letter from R. Williams, Chair, Independent Scientific Advisory Board, Portland, OR, to W. Stelle, Regional Administrator, NMFS, Portland, OR, and J. Etchart, Chair, Northwest Power Planning Council, Portland, OR, January 5, 1999). This could be partially due to juvenile salmonids residing at depth where they gain the advantage of a 10 percent reduction in the surface TDG saturation per meter of depth below the surface. Results of using depth-sensitive radio tags to track juvenile salmonids between Ice Harbor and McNary dams indicate that they tended to use depths of 1.8 to 2.5 meters (Beeman et al., 1998, as cited in NMFS, 2005). The effects of elevated TDG on adult salmonids have been studied much less than the effects on juvenile salmonids, and, as a result, they are less understood. However, monitoring of adult salmonids at Bonneville and Lower Granite dams since 1994 and intermittently at Ice Harbor and Priest Rapids dams did not

²² Washington's numeric criteria for TDG are not applicable at flows greater than the 7-day, 10-year frequency flood, which is 252 kcfs for the Rocky Reach Project (EPA et al., 2004).

reveal signs of GBT in adult salmonids at TDG levels of 115 percent in the forebays and 120 percent in the tailraces (NMFS, 2005).

NSWG assisted in the design and review of six studies directed at better understanding the effects of the project on levels of TDG in the Columbia River and the effect on aquatic organisms downstream of the Rocky Reach dam during the annual spill season. The studies conducted for NSWG focused on two areas: (1) the effect of the project on levels of TDG in the river and how operations could minimize that effect (Parametrix, 2000a; Corps, 2003; MWH, 2003; Schneider and Wilhelms, 2005) and (2) the effects of TDG on the biological organisms inhabiting the tailrace and downstream areas (Parametrix, 2000b; Parametrix and RL&L, 2002).

TDG Monitoring Data Analysis

As discussed above in section 3.3.1, Chelan PUD has been monitoring TDG levels and evaluating different spill operations for their effect on TDG for many years. Addition of the fixed monitoring station downstream of the project's tailrace in 1997 provided more detailed information about the effects of different spill levels and spillgate configurations than were previously available. NSWG sought a more detailed analysis of how different operations affect TDG entrainment at the project than was available in the annual reports from the 4 years of monitoring data (1997 to 2000). The subsequent analysis of TDG and other pertinent data collected in 1997 to 2000 (Parametrix, 2000a) determined that spill at the project has a lower TDG entrainment effect than is observed at most other Columbia River projects. Parametrix (2000a) concluded:

Spill at Rocky Reach dam only produces minor increases [in] TDG levels. During the years of 1998–2000 TDG levels increased only slightly during the spill period (1–3 percent of saturation on average, range –5 percent to +15 percent). Average TDG levels during these years remained below 110 percent of saturation, although point measurements ranged from 100 percent to 120 percent of saturation. These conditions occurred with total river flows ranging from less than 100 kcfs to about 275 kcfs. Increases in TDG levels were only slightly greater at higher river flows.

In other words, even during very high river flows and spill volumes, the project did not increase TDG levels, on average, more than 3 percentage points above the TDG levels arriving at the Rocky Reach dam. In fact, at flow levels above 300 kcfs (which occurred only in 1997) the increase in TDG level between the forebay and downstream monitoring sites was less than at lower river flows (Parametrix, 2000a).

The analysis also determined that the TDG level at the DFMS, 4 miles downstream of the dam, is more influenced by the TDG level arriving at the Rocky Reach forebay than by the rate of spill at the project. During the high flow and high spill conditions in 1997, the spill at the Rocky Reach dam in many instances did not increase the TDG level above the saturation level of water arriving at the dam. The analysis did

indicate that different types of spill operations can affect the entrainment of air and resultant TDG level. Parametrix (2000a) reported that evaluations of different spill gate configurations used at Rocky Reach dam suggest that configurations using a greater number of gates tend to minimize the increases in TDG from the forebay to the tailrace. The analysis also determined that TDG levels dissipate somewhat when traveling through the Rock Island reservoir, with more reduction in TDG at lower flows than at higher flows (Parametrix, 2000a).

Near-field Effects Study

The near-field effects study was conducted to further explore the manner in which different spillway and powerhouse operations affect TDG entrainment (Corps, 2003). This was done by measuring TDG levels directly below the turbulent, aerated zone immediately downstream of the spillway's stilling basin and at other locations near the spillway and powerhouse. As stated in the study plan, the dissolved gas production characteristics of the existing projects must be thoroughly understood to evaluate structural and operational gas abatement alternatives. This study quantified gas transfer over a range of spillway and powerhouse operations that occurred during the 2002 spill season. The measurements were taken at various levels of spill discharge, spill pattern (gate openings), powerhouse discharge, and tailwater elevation conditions.

Based on results of the near-field study, the Corps (2003) concluded that spillway operations at the project increased TDG saturation in the Columbia River by 1.6 to 8.6 percent over levels arriving at the Rocky Reach forebay. Various spillgate configurations were tested, including the standard spill pattern (spill distributed over gates 2 through 8 with different flow rates per gate) and a uniform pattern (spill distributed evenly over gates 2 through 12). Study results indicate that the uniform spill pattern produces slightly less TDG than the standard pattern for total spills of about 50 kcfs. The entrainment of powerhouse flows into aerated spillway releases influenced TDG levels, but could be minimized by spilling at bays farther from the powerhouse (by using spill bays 2 through 12) and by maintaining a south powerhouse priority for unit operations. The current DFMS data were found to not be representative of maximum or average TDG, but the forebay monitoring site did represent TDG levels in the Columbia River arriving at the project. The Corps (2003) concluded that TDG exchange at the Rocky Reach dam is similar to TDG exchange at Lower Granite dam, which has been modified with TDG abatement structures, including spillway deflectors.

The Corps' Engineer Research Development Center (Schneider and Wilhelms, 2005) conducted an independent study to evaluate the potential to further reduce TDG during spills by implementing operational changes or making structural modifications. This evaluation consisted of a detailed technical assessment of the TDG exchange characteristics of Rocky Reach dam for current operations and nine different operational and structural TDG management alternatives, along with an evaluation of risk of injury to

juvenile salmon smolts passing through the spillways. The gas exchange processes observed during the Corps' 2002 near-field study and determined from the data collected during that study served as the basis for assessing the effects on TDG.

Schneider and Wilhelms (2005) concluded that one operational and two structural alternatives would potentially reduce TDG in the river downstream of Rocky Reach dam. The operational alternative consisted of changing the spill pattern from the standard method of using gates 2 through 8 to a uniform spill from gates 2 through 12. The two structural modifications identified as potential measures for reducing TDG include the following: (1) construction of an entrainment cutoff wall that would maintain a separation between powerhouse and spillway flows, and (2) a combination of constructing spillway flow deflectors and raising the tailrace.

Limited testing of operating the project with a uniform spill from gates 2 through 12 indicates a potential reduction in the average cross-sectional TDG levels of up to 2 percent of saturation. However, Chelan PUD (2006b) states that this operation would potentially affect upstream passage of adult salmon and steelhead seeking the entrance to the upstream fishways.

Under standard operations, powerhouse discharges are directed laterally across the channel and into the path of highly aerated spillway releases. Construction of an entrainment cutoff wall could substantially reduce entrainment of powerhouse discharges into the stilling basin and overall loading of TDG immediately downstream of the dam, although it would not alter peak TDG. Schneider and Wilhelms (2005) estimated that preventing any of the flow from the powerhouse from entering the spillway would reduce average TDG by as much as 1.6 percent of saturation at a total river flow of 250 kcfs. Reductions in average TDG for smaller total river flows of 200 kcfs and 150 kcfs were estimated as 1.3 and 1.0 percent of saturation. The cutoff wall would prevent any juvenile salmonids that pass through the powerhouse from becoming entrained in the stilling basin's turbulent high TDG environment.

The combination of spillway flow deflectors and raising the tailrace channel would reduce the initial plunge of entrained air in the stilling basin and promote stripping of TDG in the tailrace channel. Schneider and Wilhelms (2005) based their evaluation of this potential measure largely on conditions at Ice Harbor dam, which has spillway deflectors on all 10 spill bays and a shallow tailrace channel. This evaluation assumes that the tailrace would be raised to an elevation of 608 feet for a distance of 300 feet downstream of the gates 2 through 12, and that the operational policy of 25 percent of the total flow being spilled would remain in effect. Resulting estimates of reduction in peak TDG for total river flows of 150 to 250 kcfs ranged from 4.0 to 4.6 percent of saturation, while corresponding estimates in the reduction of average cross-section TDG ranged from 1.6 to 1.9 percent of saturation. Schneider and Wilhelms (2005) noted that the continuous baffles and the stilling basin end sill would interfere with the deflected surface jets and could alter the trajectory and TDG exchange properties and, therefore,

extensive hydraulic model studies would be required to develop a design that would provide safe stilling action of spill, accommodate guidance of adult and juvenile salmonids, and provide effective TDG management.

Biological Effects Studies

Two studies were conducted to evaluate the biological effects of TDG: (1) a general overview of biological effects relative to hydroelectric projects, and (2) a field study specific to the project. The general overview of the biological effects of TDG on anadromous and resident fish is reported in *TDG Supersaturation in the Natural River Environment* by Parametrix (2000b). This report discusses the physical and biological factors that contribute to the common observation that neither anadromous nor resident fish species exhibit many symptoms of GBT in Columbia River reservoirs when TDG levels remain at or below 125 percent. Although the sampling techniques used take primarily the shallowest portion of the migrant population, which overestimates the effects on the entire population, Parametrix (2000b) concludes that natural behavior patterns and depth distribution of both anadromous salmonids and resident fish prevents a high severity of GBT from developing when TDG levels range from 110 percent to 130 percent. These results are similar to those reported for resident fish in the lower Clark Fork River (Parametrix and Avista, 2002).

Field studies of the biological effects of TDG levels in the project tailrace area were completed in 2001 and 2002 (Parametrix and RL&L, 2002, 2003). These studies focused on determining the biological effect of elevated TDG levels on resident fish (i.e., non-salmonid fishes) and benthic macroinvertebrates. Salmonids were not studied because annual GBT monitoring has been reported for sampling at Rock Island dam since the 1980s, and the FCRPS 2000 biological opinion (NMFS, 2000) has an extensive discussion of the effect of TDG levels in its appendices. Also, due to ESA-listed species present in the Rocky Reach reservoir, the sampling permit required minimal handling of any salmonids incidentally captured. Information about resident fishes is less common, and no studies of these species have been conducted in the project area since 1974.

The first year of the biological effects study occurred during the 2001 drought when there was no spill. Consequently, there were no instances of highly elevated TDG in the Columbia River that year. The information gathered in 2001 served as a good test of the study method and provided a baseline frame of reference for comparison with 2002 data. In 2002, TDG levels ranged from slightly less than 110 to 134 percent. The highest TDG levels were not caused by spill at the Rocky Reach dam, but were generated during a high-flow period that coincided with turbine maintenance outages at the upstream Wells Project. The high spill levels that occurred at the Wells Project led to TDG levels exceeding 130 percent, which is the highest TDG recorded in the Rocky Reach forebay in more than a decade.

This event provided a range of TDG levels for the biological effects study. The incidence of GBT in resident fish and benthic macroinvertebrates was very low in both 2001 and 2002 (Parametrix and RL&L, 2003). In 2001, there were no signs of GBT in the 3,777 resident fish examined, and only two cases of GBT were observed in the 7,405 macroinvertebrates examined. During the spring monitoring period of 2002 (April 19 to June 26, with TDG ranging from 103 to 127 percent), none of the 2,134 resident fish that were examined during weekly sampling events exhibited any signs of GBT, despite being collected from shallow water where the development of GBT symptoms is most likely to occur. During the summer monitoring period of 2002 (July 9 to August 21, with TDG ranging from 107 to 134 percent), 160 (18 percent) of the 866 resident fish that were examined for GBT signs exhibited GBT symptoms, primarily hemorrhages in the fins.

These symptoms were first observed on the July 9 sampling session, which occurred at the end of the week with the highest TDG levels of the season. The TDG levels from July 1 to July 8 exceeded 125 percent of saturation about 25 percent of the time that week, including 53 consecutive hours between July 2 and July 4. In addition, TDG levels between July 2 and July 3 exceeded 130 percent of saturation about 15 percent of the time, including 23 consecutive hours. Despite these high TDG levels, the GBT symptoms (predominately subcutaneous hemorrhages, mostly in fins) were low level indications of chronic, rather than acute, GBT. Hemorrhages are believed to be the result of small bubbles that produce ruptured blood vessels. Only one fish (a 3-spine stickleback) was observed with a tissue bubble.

Samples of benthic macroinvertebrates in 2002 did not show adverse effects, despite the high TDG levels. Only 2 (0.02 percent) of the 9,885 organisms (representing 111 different taxonomic groups) examined exhibited GBT symptoms. Even organisms artificially exposed to constantly elevated TDG on artificial substrates suspended for 7 days at 1 meter of depth did not develop GBT (none of the 404 organisms examined had GBT symptoms).

Chelan PUD currently submits plans and schedules for compliance to WDOE. These plans are updated periodically at the direction of WDOE and include studies and operational measures. The current version of the *Gas Abatement Schedule for Compliance* (Chelan PUD, 2004b) has been reviewed and approved by WDOE. This document lists completion of measures and studies scheduled for 2003 and activities anticipated for completion in years 2004–2008. Actions completed in 2003 included construction of the permanent juvenile fish bypass system, a review and synthesis of operational and structural methods used in TDG abatement efforts at other hydroelectric projects, and an assessment of the applicability of those structural methods to the project (MWH, 2003). Gas abatement tools identified in this document include:

1. potential reductions in voluntary spill for fish passage survival based on fish survival studies and effectiveness of the juvenile fish bypass system;

2. studies to further investigate the feasibility of optimizing the use of spill through gates 2 through 12 during times when at least 50 kcfs is spilled;
3. once the long-term need for fish survival spill is determined, development of a priority ranking for potential abatement measures for further exploration, potential modeling, and testing of specific technologies, if any are identified to be practical and feasible at the project; and
4. investigation of the feasibility and potential benefits (TDG abatement) and detriments (fish survival) of modifying the depth of the stilling basin and structure of dentates/baffle blocks in the stilling basin.

In the PDEA (Chelan PUD, 2004a), Chelan PUD indicates that it also monitors TDG levels and biological response to TDG levels and uses this information to achieve compliance with water quality standards through real-time management of spill for fish passage in accordance with the *Rocky Reach Operational Plan for Total Dissolved Gas* (an internal document for plant operators). In addition to the current process for the special fish passage condition standard, WDOE and EPA jointly prepared a TMDL for TDG that sets load allocations for compliance with TDG water quality standards for the Columbia River dams from the Canadian border to the Hanford Reach (EPA et al., 2004). The project is one of the seven dams included in this TMDL. EPA has approved this TMDL, and WDOE and the Spokane Tribe prepared a summary implementation strategy that describes proposed measures that could be used to reduce TDG levels in the Columbia River.

In the Settlement Agreement, Chelan PUD proposes to implement the Water Quality Plan (Chelan PUD, 2006b) that includes annually submitting a gas abatement plan, accompanied by an up-to-date operations plan, a fisheries management plan, physical monitoring plan, and biological monitoring plan; and conducting the following measures, which are also supported by WDOE as a party to the Settlement Agreement:

- fish passage management with the objective of maintaining as much of the spill level scheduled without exceeding the tailrace TDG numeric criteria;
- minimizing voluntary fish passage spills;
- minimizing spill due to maintenance;
- minimizing spill past unloaded turbine units caused by imbalances between upstream flow releases and projected power demand;
- maximizing powerhouse discharge;
- testing alternative spillway operations using any of the gates 2 through 12;
- conducting hourly monitoring of TDG levels in the project forebay and tailrace at the juvenile fishway outfall;

- continued monitoring of the biological effects of TDG on salmonids, resident fish, and macroinvertebrates;
- preparing a TDG compliance report in year 5 of the new license, and
- continuing efforts to comply with the numeric TDG criteria.

The Umatilla Tribes include recommendations in their 10(a) proposals that are associated with the effects of the project on TDG and GBT in aquatic organisms. As part of their March 14, 2005, 10(a) recommendation 6, the Umatilla Tribes recommend development and annual review of a detailed operations plan to best meet performance goals and objectives for salmon. The Umatilla Tribes' recommendation does not specifically mention water quality. These recommendations are consistent with Chelan PUD's proposal to submit a gas abatement plan each year, accompanied by an up-to-date operations plan, a fisheries management plan, physical monitoring plan, and biological monitoring plan.

Our Analysis

Measures proposed by Chelan PUD would provide for development and, when feasible and beneficial, implementation of operational and structural modifications to ensure compliance with water quality standards for TDG. Under the proposed action, Chelan PUD would conduct hourly TDG monitoring in the project's forebay and tailrace from April through August for the term of any new license or until WDOE no longer requires it. Chelan PUD's evaluation of the TDG results from this monitoring effort, along with TDG data collected at the Rock Island forebay, would document the efficacy of reducing TDG levels through operational and structural measures and determine the project's compliance with applicable TDG standards. Chelan PUD's proposed monitoring for GBT symptoms in salmonids, resident fish, and macroinvertebrates, combined with GBT data collected at the Rock Island Project, is expected to adequately document the extent and severity of adverse effects on aquatic organisms.

This effort would be closely coordinated with the HCP requirements to ensure that fish passage survival objectives are met, while still allowing the TDG abatement studies to be conducted as soon as practical. Based on WDOE's proposed conceptual approach for water quality certification (Tebb, 2005; Chelan PUD, 2006b), the water quality certification contains all the necessary requirements for meeting water quality standards, including TDG, within a 10-year period. This would include an 8-year period for adaptively developing and implementing TDG abatement measures, followed by a 2-year period to pursue other means of satisfying Washington State water quality standards. Implementation of Chelan PUD's approach of providing up-to-date operations plans annually would facilitate this adaptive approach to managing TDG and fish passage.

Chelan PUD identified operational and structural modifications that would be reasonable and feasible and would implement these measures, if necessary, to comply with water quality standards in an adaptive fashion. Using the available information, Chelan PUD has developed estimates of the effects that each of these measures would have on TDG in the project's tailrace and forebay of Rock Island dam for worst-case conditions (table 7). These estimates are based on the maximum total river flow to which the numeric criteria apply (i.e., the 7-day, 10-year frequency flood of 252 kcfs) and assuming one of the turbines is not operational.

Schneider and Wilhelms (2005) concluded that monitoring TDG at a station located near the existing juvenile fishway outfall (FOP1, near the left channel bank about 1,600 feet below the spillway) would provide representative values for the maximum TDG just downstream of the highly aerated flow below the spillways. For this reason, along with the fact that the shore-based monitoring station would be readily accessible, we conclude that monitoring TDG and temperature at this station on an hourly interval would adequately reflect Chelan PUD's proposal, which is supported by WDOE's recommendation that the tailrace monitoring station be moved upstream to the juvenile fishway outfall.

By preparing an operations plan and consulting the RR Fish Forum regarding the plan, Chelan PUD would facilitate adapting project operations to current knowledge regarding fish passage and TDG issues at the dam and thereby improve survival of fish passing the dam and reduce the incidence of GBT in aquatic organisms. As long as the state of knowledge is expanding for the effects of spill on TDG and fish passage and health, it would be useful to revise this plan annually. Revising the operations plan on an annual basis after that point may provide little additional benefit. Thereafter, Chelan PUD could continue to follow the last in the series of annually revised plans, which would continue to represent the state of knowledge.

Oil and Hazardous Spill Prevention

The prevention and countermeasures for spills of oil and other hazardous materials is managed by Chelan PUD through implementation of a Spill Prevention Control and Countermeasure Plan, which is approved by EPA and WDOE in accordance with 40 CFR 112. The current Spill Prevention Control and Countermeasure Plan was prepared in June 2002 and revised in 2005. The Spill Prevention Control and Countermeasure Plan specifies the management practices that are used to prevent and contain spills, both internal and external reporting requirements for spills, and a schedule for periodic review, evaluation, and revision of the Spill Prevention Control and Countermeasure Plan as necessary to incorporate improved prevention and control technology.

Table 7. Estimates of compliance with Washington State total dissolved gas standard under worst-case conditions. (Source: Chelan PUD, 2006b)

Gas Reduction Scenarios	Estimated Date of Completion	September–March		April–August	April–August	April–August	April–August
		% of time TDG criterion is met at FOP1		Tailrace Criterion: % TDG at FOP1 ^a	% TDG at Rocky Reach LD Transect (mixed flow) ^a	Forebay criterion: % TDG at Rock Island Forebay	Instantaneous: % TDG at FOP1 ^b
		<i>Criterion: 110%</i>		<i>Criterion: 120%</i>	<i>Criterion: 120%</i>	<i>Criterion: 115%</i>	<i>Criterion: 125%</i>
Base conditions	Current operations	Years 1995–1999	Years 2000–2004	120.3% (Sm. down)	117.2% (Sm. down)	Averages > 115%	0%
		93.4% (Lg. down)	99.5% (Lg. down)	120.9% (Lg. down)	117.6% (Lg. down)		
		95.4% (Sm. down)	99.6% (Sm. down)				
		94.6% (weight. avg.)	99.6% (weight. avg.)				
Maximum powerhouse discharge	Effective date of new license	Years 1995–1999	Years 2000–2004	119.3% (Sm. down)	116.7% (Sm. down)	Averages < 115%	0%
		96.1% (Lg. down)	99.7% (Lg. down)	119.9% (Lg. down)	117.0% (Lg. down)		
		96.7% (Sm. down)	99.8% (Sm. down)				
		96.4% (weight. avg.)	99.8% (weight. avg.)				
Spill from gates 2 through 12	Testing <1 year of high water year	Same as base condition		Unknown, likely around 2% below base	Unknown, likely around 2% below base	Unknown, likely slightly lower than base case	0%
Entrainment cutoff wall	If TDG and GBT adverse biological effect, <10 years	Same as base condition		Same as base condition 120.3% (Sm. down) 120.9% (Lg. down)	116.4% (Sm. down) 116.6% (Lg. down)	Averages <115%	0%
SD&RTW	TDG and GBT adverse	Unknown, likely the same as base condition		116.3% (Sm. down)	115.5% (Sm. down)	< 115%	0%

	September–March	April–August	April–August	April–August	April–August
	% of time TDG criterion is met at FOP1	Tailrace Criterion: % TDG at FOP1^a	% TDG at Rocky Reach LD Transect (mixed flow)^a	Forebay criterion: % TDG at Rock Island Forebay	Instantaneous: % TDG at FOP1^b
biological effect<15 years		116.7% (Lg. down)	115.7% (Lg. down)		

Notes: Worst Case Assumptions:

1. 7Q10 flow of 252 kcfs.
2. The highest discharge for base condition within turbine efficiency curve is 204 kcfs. The capacity for the turbines is approximately 17.15 and 21 kcfs for the small (units 1–7) and large (8–11) turbines, respectively. Spill under 7Q10 flow (calculated by subtracting the missing turbine capacity from the base 204 kcfs and then subtracting that quantity from the 7Q10 flow of 252 kcfs) is 65.2 and 69 kcfs for having a small and large turbine down, respectively.
3. Maximum powerhouse discharge is 212 kcfs. The capacity for the turbines is approximately 17.8 and 21.85 kcfs for the small (units 1–7) and large (8–11) turbines, respectively. Spill under 7Q10 flow is 57.8 and 61.9 kcfs for having a small and large turbine down, respectively.
4. For the purpose of the calculations forebay TDG levels never exceeds 110% from September to March or 115% from April to August, which match the forebay criteria. FOP1 is monitoring location approximately 1600 feet downstream from the dam, which is consistent with the required TMDL measurement location.

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- ^a Values are estimated using regressions. The TDG at FOP1 is calculated at 0.1355 times the discharge plus 111.5. The TDG at the LD transect is calculated by multiplying the TDG in the forebay by the volume of water through the powerhouse and adding to the TDG calculated in the spill times the volume of water passed through the spillgates. The TDG at LD transect is calculated by multiplying the flow by 0.1509 and adding 111.61. The values provided have a known error of ±0.6% associated with them due to the error of the regressions used to generate them.
- ^b Using Schneider’s regression, 99.6 kcfs of spill are required. This would require 7Q10 flow and 2 turbines down which exceeds worst case assumptions and therefore can be assumed as 0%.

Provisions for the continuation and improvement of the existing Spill Prevention Control and Countermeasure Plan are provided within the Water Quality Plan (Chelan PUD, 2006b). As specified in the Water Quality Plan, Chelan PUD proposes to continue to implement and revise the Spill Prevention Control and Countermeasure Plan. The Columbia-Snake River Spill Response Initiative is currently being developed to provide additional protection from oil spills, and Chelan PUD proposes to implement the viable portions for which it is responsible. Chelan PUD indicates that it is not certain of the scope and intent of this initiative and that Chelan PUD will request further guidance from WDOE.

In its justification and support for its March 14, 2005, 10(a) recommendation 14, the Umatilla Tribes recommend that Chelan PUD conduct daily monitoring of all dam facilities to ensure that oil, grease, and other contaminants are not leaking and entering into the river.

Our Analysis

The existing Spill Prevention Control and Countermeasure Plan (Chelan PUD, 2003a) fulfills the requirements of 40 CFR 112, *EPA Oil Pollution Prevention Regulations*. Under the current plan, the plant operators conduct routine visual plant inspections at least twice daily and the maintenance staff conduct thorough weekly inspections of the facilities. To continue to comply with 40 CFR 112, Chelan PUD needs to periodically review and revise the plan for the project. Continued implementation of the current inspection schedule, along with other practices implemented as components of the Spill Prevention Control and Countermeasure Plan (e.g., training personnel in appropriate notification and cleanup procedures), would continue to ensure that project spills would be identified before they could enter project waters or cause much biological harm. Implementing daily project facility inspections as recommended by the tribes would make it a little more likely that any spills would be observed earlier, although this benefit is expected to be minimal because the current monitoring plan and measures appear to be sufficient to minimize the frequency and extent of spills at the facility. Implementing relevant measures identified in the Columbia-Snake River Spill Initiative, as is being proposed by Chelan PUD, may provide further protection from oil spills.

3.3.3 Cumulative Effects

Water temperature is slightly influenced by the project, with the project's effect being to increase the rate of heating or cooling depending on the difference between the water temperature and ambient climatic conditions. Upstream dams influence water temperatures entering the Rocky Reach reservoir. In general, the river is cooler in the spring and early summer and warmer in the late summer and fall than would occur in the absence of the other dams. This is primarily an effect of the Grand Coulee and other upstream storage reservoirs in the United States and Canada (EPA, 2002).

The cumulative effects on TDG levels largely depend on flows through spillways and powerhouses. Generally, routing water through powerhouses does not elevate TDG levels, whereas routing water through spillways and their stilling basins can entrain air and thereby elevate TDG, depending on many different factors. Spills at upstream dams can result in elevated TDG levels in water reaching the project. The effects of the project depend on the TDG levels in water reaching the project and the extent and configuration of spills at the project. The project may result in an overall increase in the level of TDG if it is spilling water and the TDG saturation of water arriving at the project is low (generally less than 115 percent). When incoming water has higher TDG levels, the project generally causes an overall reduction in TDG unless the total river flow exceeds approximately 250 kcfs. Whether increases in TDG at the Rocky Reach tailrace result in a cumulative effect downstream of the Rock Island dam depends on the spill actions at the downstream Rock Island Project and the amount of dissipation in the Rock Island reservoir.

3.3.4 Unavoidable Adverse Impacts

In spite of the measures proposed by Chelan PUD and recommendations of others, the project would still result in small adverse increases in water temperature and TDG under certain conditions.

3.4 FISHERIES RESOURCES

3.4.1 Affected Environment

3.4.1.1 General Description of the Fish Community and Habitats

Approximately 41 species of fish occur within the project area (from the tailwater of Wells dam to the Rocky Reach tailrace) (BioAnalysts, 2000a). Of the fish that have been identified in the project area, 15 are coldwater species, 18 are coolwater species, and 8 are warmwater species. In addition to the fish species that have been identified, it is probable that several species of sculpins (family Cottidae) also exist in the project area; however, sculpins have not been collected in the project area and are not included among the 41 species mentioned above.

Most of the 41 species are native to the project area, but 16 species have been introduced. Eleven of the 15 coldwater species and 14 of the 18 coolwater species that have been identified are native to the area (table 8). The Columbia River watershed upstream from the Rocky Reach dam supports naturally reproducing populations of Chinook and sockeye salmon and steelhead. Coho salmon were historically present, but the endemic stock was extirpated by the 1940s (Mullan, 1984).

Table 8. List of fishes that occur in the Rocky Reach Project reservoir.

Common Name	Species	Native (N) or Introduced (I)
Coldwater species		
White sturgeon	<i>Acipenser transmontanus</i>	N
Chinook salmon	<i>Oncorhynchus tshawytscha</i>	N
Coho salmon	<i>Oncorhynchus kisutch</i>	N
Sockeye/kokanee	<i>Oncorhynchus nerka</i>	N
Steelhead/rainbow	<i>Oncorhynchus mykiss</i>	N
Cutthroat trout	<i>Oncorhynchus clarki</i>	N
Brown trout	<i>Salmo trutta</i>	I
Atlantic salmon	<i>Salmo salar</i>	I
Bull trout	<i>Salvelinus confluentus</i>	N
Brook trout	<i>Salvelinus fontinalis</i>	I
Mountain whitefish	<i>Prosopium williamsoni</i>	N
Lake whitefish	<i>Coregonus clupeaformis</i>	I
Burbot	<i>Lota lota</i>	N
Longnose sucker	<i>Catostomus catostomus</i>	N
Coolwater species		
Longnose dace	<i>Rhinichthys cataractae</i>	N
Peamouth	<i>Mylocheilus caurinus</i>	N
Chiselmouth	<i>Acrocheilus alutaceus</i>	N
Northern pikeminnow	<i>Ptychocheilus oregonensis</i>	N
Redside shiner	<i>Richardsonius balteatus</i>	N
Sand roller	<i>Percopsis transmontana</i>	N
Bridgelip sucker	<i>Catostomus columbianus</i>	N
Mountain sucker	<i>Catostomus platyrhynchus</i>	N
Largescale sucker	<i>Catostomus macrocheilus</i>	N
Pacific lamprey	<i>Lampetra tridentata</i>	N
River lamprey	<i>Lampetra ayresi</i>	N
Western brook lamprey	<i>Lampetra richardsoni</i>	N
Threespine stickleback	<i>Gasterosteus aculeatus</i>	N
Pumpkinseed	<i>Lepomis gibbosus</i>	I
Walleye	<i>Stizostedion vitreum</i>	I
Yellow perch	<i>Perca flavescens</i>	I
Smallmouth bass	<i>Micropterus dolomieu</i>	I
Sculpin	<i>Cottus species (spp.)</i>	N
Warmwater species		
Channel catfish	<i>Ictalurus punctatus</i>	I
Black bullhead	<i>Ameiurus melas</i>	I
Brown bullhead	<i>Ameiurus nebulosus</i>	I

Common Name	Species	Native (N) or Introduced (I)
Tench	<i>Tinca tinca</i>	I
Common carp	<i>Cyprinus carpio</i>	I
Bluegill	<i>Lepomis macrochirus</i>	I
Black crappie	<i>Pomoxis nigromaculatus</i>	I
Largemouth bass	<i>Micropterus salmoides</i>	I

The four coldwater species that have been introduced to the project area include brown trout, brook trout, lake whitefish, and Atlantic salmon. The four introduced coolwater species include pumpkinseed, walleye, yellow perch, and smallmouth bass. All warmwater species that currently exist in the project area are non-native species (table 8).

In addition to fish that currently occur naturally in the project area, some species are stocked. These fish originate from hatchery facilities that produce Chinook salmon and steelhead. Steelhead hatcheries produce a stock derived from steelhead endemic to the Upper Columbia River. Chinook salmon hatchery production is generally derived from a mixture of endemic and introduced stocks. The exception is the Wells Hatchery program, which raises summer Chinook salmon solely derived from fish that are endemic to the Upper Columbia River.

3.4.1.2 Aquatic Habitat

Aquatic habitat mapping (DES, 2001a) indicated that the lower portion of the 43-mile-long reservoir from the Rocky Reach dam upstream to the Entiat River (Reach 1) consists of deep, slow-water habitat. The upper section (from Beebe Bridge upstream to Wells dam; Reach 3) has more constrictive characteristics, with higher water velocities and generally well-armored banks with bedrock, cobble and sandy soil shorelines. The middle section of the reservoir (Entiat River upstream to Beebe Bridge; Reach 2) is a transition zone between the predominantly slower-moving, deeper habitat in the lower section and the more riverine habitat in the upper section of the reservoir. The middle section includes the confluences of the Entiat River and the Lake Chelan Project tailrace with the project reservoir.

Generally, depths increase in the reservoir from upstream to downstream. The shallowest, most riverine portion of the project reservoir is found near the Wells dam tailrace, with depths increasing downstream to the Rocky Reach forebay. Substrate and cover were quantified in a 1999 study based upon a flow of 220,000 cfs (DES, 2001a). Silt was the most abundant substrate type found (25.6 percent), followed by large cobble (17.7 percent) and sand (17.4 percent). Combined, small cobble and gravels, which are important for salmonid spawning, make up 22 percent of the substrate. Boulders were

the most abundant cover type available in the reservoir, accounting for almost 90 percent of the available cover, followed by submerged aquatic vegetation and submerged terrestrial grasses.

Aquatic habitat mapping of the project area estimated the total acreage of aquatic macrophyte beds at 386 acres in 1999 (DES, 2001a). Acreages of aquatic plant communities are summarized in table 9. Non-native Eurasian watermilfoil is the most abundant aquatic plant species. Approximately one third of all the macrophyte bed acreage in the project area is vegetated by dense Eurasian watermilfoil-dominant growth. Close-leaved pondweed (*Potamogeton foliosus*) is the second most abundant species occurring throughout the project reservoir. This native species is often dominant within native plant beds as well as co-dominant within many Eurasian watermilfoil beds.

Table 9. Acreages by aquatic plant communities. (Source: DES, 2001a)

Description	Acres of Aquatic Plants ^a			
	Total Project Area	Reach 1 ^b	Reach 2 ^b	Reach 3 ^b
>90% EWM, dense	39.63	11.24	24.75	3.64
>90% EWM, sparse	14.61	6.12	6.95	1.54
Mixed 50–90% EWM, dense	99.75	35.42	53.22	11.11
Mixed 50–90% EWM, sparse	23.49	9.34	7.80	6.35
Mixed 30–50% EWM, dense	20.38	0.18	16.48	3.72
Mixed 30–50% EWM, sparse	3.16	1.09	1.61	0.46
Mixed native dominant, dense	75.44	35.22	39.82	0.40
Mixed native dominant, sparse	41.52	19.53	21.99	0.00
POCR dominant, dense	33.60	12.78	20.44	0.38
POCR dominant, sparse	34.35	22.39	10.46	1.50
Total	385.93	153.31	203.52	29.10

Notes: EWM – Eurasian watermilfoil, *Myriophyllum spicatum*
POCR – curly pondweed, *Potamogeton crispus*

^a Data are inclusive of small isolated sloughs within the project boundary that are separated by highways from the reservoir. Mouths of the Entiat and Chelan rivers are included within the project boundary. Daroga Park lagoon is not included.

^b Reach 1 (Rocky Reach dam to Entiat River); Reach 2 (Entiat River to Beebe Bridge); Reach 3 (Beebe Bridge to Wells dam)

3.4.1.3 Benthic Invertebrates

DES (2000) documented 72 different taxonomic groups of benthic macroinvertebrates among samples collected from the project area. The benthic macroinvertebrate community of the project area (from the tailwaters of Wells dam to the Rocky Reach dam) was dominated by midges (*Chironomidae*), caddisflies (*Trichoptera*), sow bugs (*Isopoda*), clams and mussels (*Bivalvia*), snails (*Gastropoda*), scuds (*Amphipoda*), water mites (*Acari*), and bristle worms (*Oligochaeta*). Combined, these taxa contribute 95 percent to the total number of animals in the samples collected.

Overall, midge larvae appear to be the most prevalent of taxa, accounting for between 21 and 92 percent of the animals at a given site. Midges are the most abundant major taxon among all the sampling sites, contributing greater than 50 percent to total numbers at nearly all sites.

DES and RL&L (2000) documented three species of bivalves and five species of gastropods within the project area. The bivalves that were identified include *Anodonta kennerlyi*, *Anodonta oregonensis*, and *Corbicula fluminea*. The gastropods that were identified include *Radix auricularia*, *Fossaria (B.) bulimoides cockerelli*, *Stagnicola (Hinkleyia) caperata*, *Stagnicola (S. traski)*, and *Physella (Physella) propinqua nuttalli*.

The survey found bivalves at every site except the Wells dam tailrace, and gastropods were found at seven of the 12 surveyed sites. No Washington priority or candidate species were encountered.

3.4.1.4 Anadromous Fish Species

There are six species of anadromous fish that occur within the project area. These include two evolutionarily significant units (ESU) of Chinook salmon (the Upper Columbia River spring-run Chinook salmon and the Upper Columbia River summer/fall-run Chinook salmon), steelhead, coho salmon, sockeye salmon, and Pacific lamprey.

Of the two Chinook salmon ESUs, the Upper Columbia River spring-run Chinook salmon are stream-type salmon that spend a year in the rivers before migrating downstream to estuaries, where they rapidly move out to sea. The Upper Columbia River summer/fall-run Chinook salmon are ocean-type salmon that migrate downstream immediately after they emerge from the gravel and spend several weeks in the estuaries before moving out to sea (Quinn, 2005). Both forms spawn in the fall. In the Columbia River, adult Chinook salmon passing Bonneville dam before June 1 are classified as spring-run, adult Chinook salmon passing Bonneville dam between June 1 and July 31 are classified as summer-run, and adult Chinook salmon passing Bonneville dam after July 31 are classified as fall-run (FPC, 2005a).

Upper Columbia River Spring-run Chinook Salmon

Spring Chinook salmon use the project area as a primary migration corridor during their upstream and downstream movements. Adult spring Chinook salmon pass the project dam on their way to spawning grounds in upstream tributaries, including the Entiat River, a tributary to the project reservoir (Peven, 1992). This typically occurs from late April to late June (Stuehrenberg et al., 1995), with the highest rate of passage (90 percent of all fish passed) occurring from May through the beginning of June (FPC, 1995).

Juvenile spring Chinook salmon (stream-type) that pass the project dam during their downstream migration to the ocean originate from natural spawning sites in upstream tributaries, as well as from hatchery releases. Both hatchery and naturally produced spring Chinook smolts pass the project dam in the spring, with on average, 90 percent of the spring migration (including steelhead) occurring from the last week of April through May (Chelan PUD, 2004a).

Limited observation suggests that the residence time of juvenile stream-type spring Chinook salmon in the Rocky Reach Project reservoir is no more than a few days to a week because these fish use the Columbia River only as a navigation route, not rearing habitat (Chelan PUD, 1991). Therefore, it is assumed that stream-type spring Chinook juveniles are not using the project reservoir for extended rearing, but are migrating actively while in the reservoir.

Observations of adult spring Chinook salmon passage at Rocky Reach dam are presented in figure 8.

Upper Columbia River Summer/Fall-run Chinook Salmon

Juvenile and adult Upper Columbia River summer and fall-run Chinook salmon also use the project area as a migration corridor. Ninety percent of adult summer and fall Chinook salmon pass the Rocky Reach dam from the end of June through the middle of November (FPC, 1995). Counts of summer-run and fall-run Chinook adult passage at Rocky Reach dam are shown in figures 9 and 10, respectively. Summer and fall Chinook salmon spawn in tributaries to the Rocky Reach reservoir, including the Entiat River and the Lake Chelan Project tailrace (Giorgi, 1992; Chapman et al., 1994a). However, unlike the spring-run Chinook salmon that do not typically spawn in the mainstem Columbia River, summer/fall-run Chinook salmon spawning has been documented in the reservoirs and tailraces of the Wells and Rocky Reach dams.

Summer/fall-run Chinook salmon juveniles migrate downstream during the summer as subyearlings. Juvenile migration timing at the Rocky Reach dam is similar to juvenile passage at the downstream Rock Island dam, where 90 percent of juvenile passage occurs during June and July. The size of naturally produced juvenile

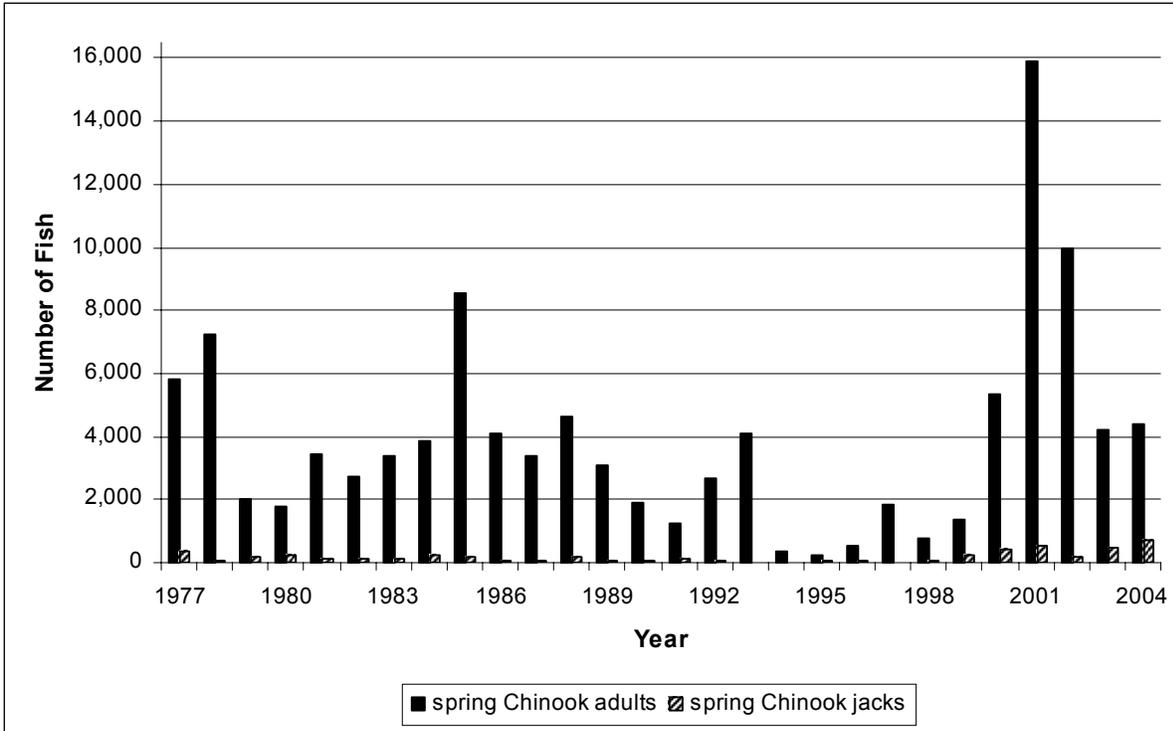


Figure 8. Spring Chinook salmon adult passage at Rocky Reach dam for years 1977–2004. (Source: FPC, 2005b)

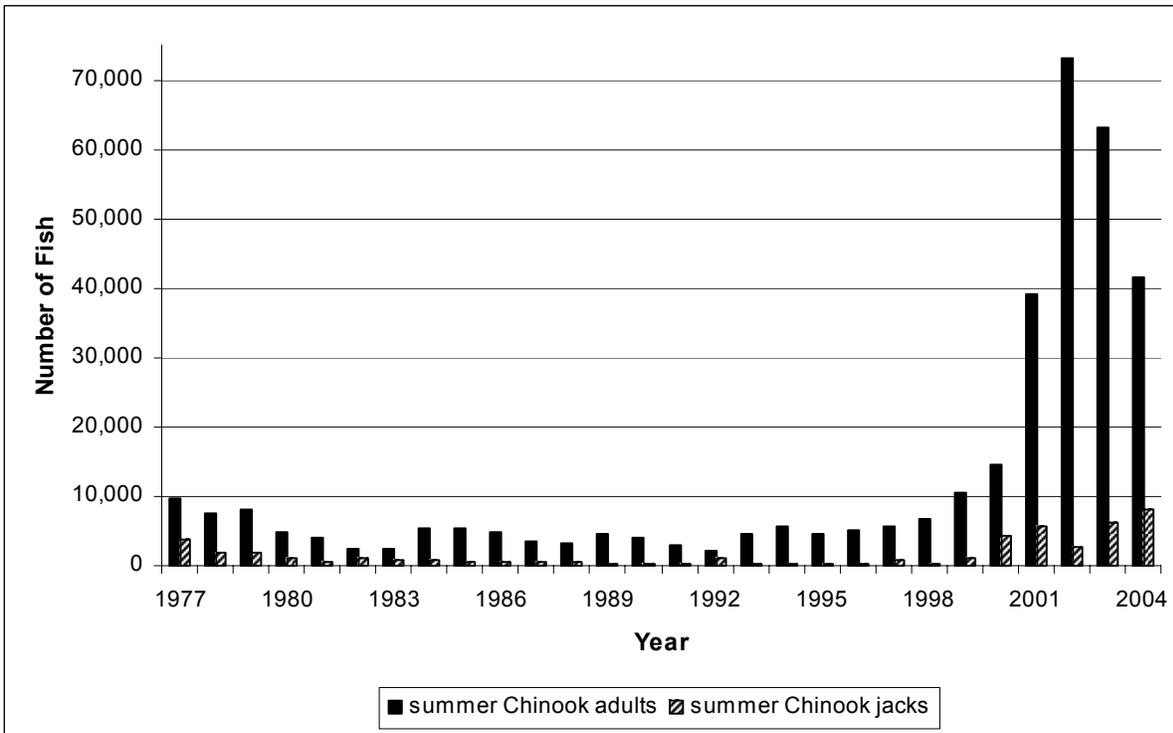


Figure 9. Summer-run Chinook salmon passage counts at Rocky Reach dam for years 1977–2004. (Source: FPC, 2005b)

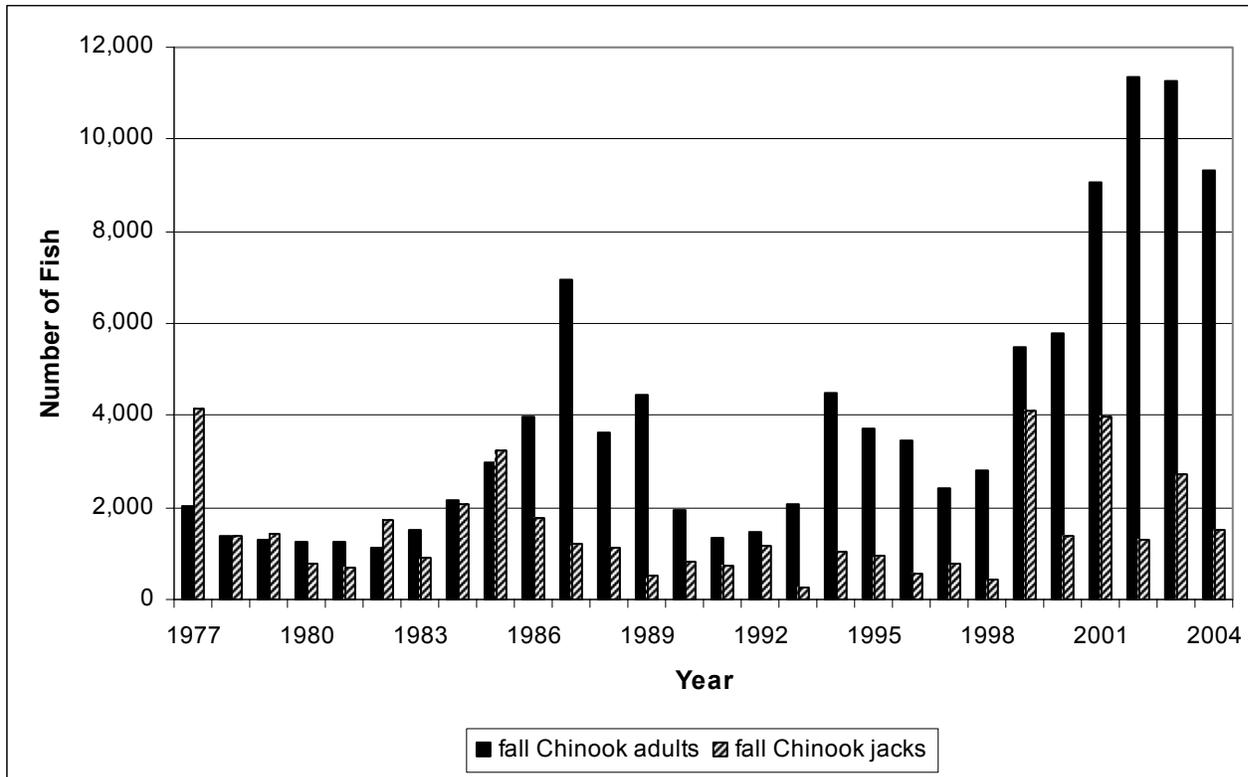


Figure 10. Fall-run Chinook salmon passage counts at Rocky Reach dam for years 1977–2004. (Source: FPC, 2005b)

summer/fall-run Chinook salmon at Rock Island dam ranges from 30 mm to 50 mm in late May/early June and increases to 80 mm to 120 mm by late July (Peven and Duree, 1990). Juvenile summer/fall-run Chinook salmon are likely to spend time rearing in the project reservoir.

Coho Salmon

Historically, coho salmon migrated through the project area to spawning areas in tributaries above the project, but became extinct in that area in the early 1900s (CBFWA, 2002). During the 1980s, Chelan PUD produced coho at its Turtle Rock hatchery, but adult returns were not strong enough to establish a population.

More recently, the Yakama Nation began a hatchery program using coho salmon from lower Columbia River broodstock and releasing them into the Wenatchee and Methow basins in an attempt to re-establish naturally reproducing coho salmon populations in mid-Columbia River basins. Their goal is to produce coho salmon in numbers at or near carrying capacity, which would provide opportunities for significant tribal and non-tribal harvest. Since 2000, adult passage at Rocky Reach dam has ranged from 550 to 1,628 fish (figure 11).

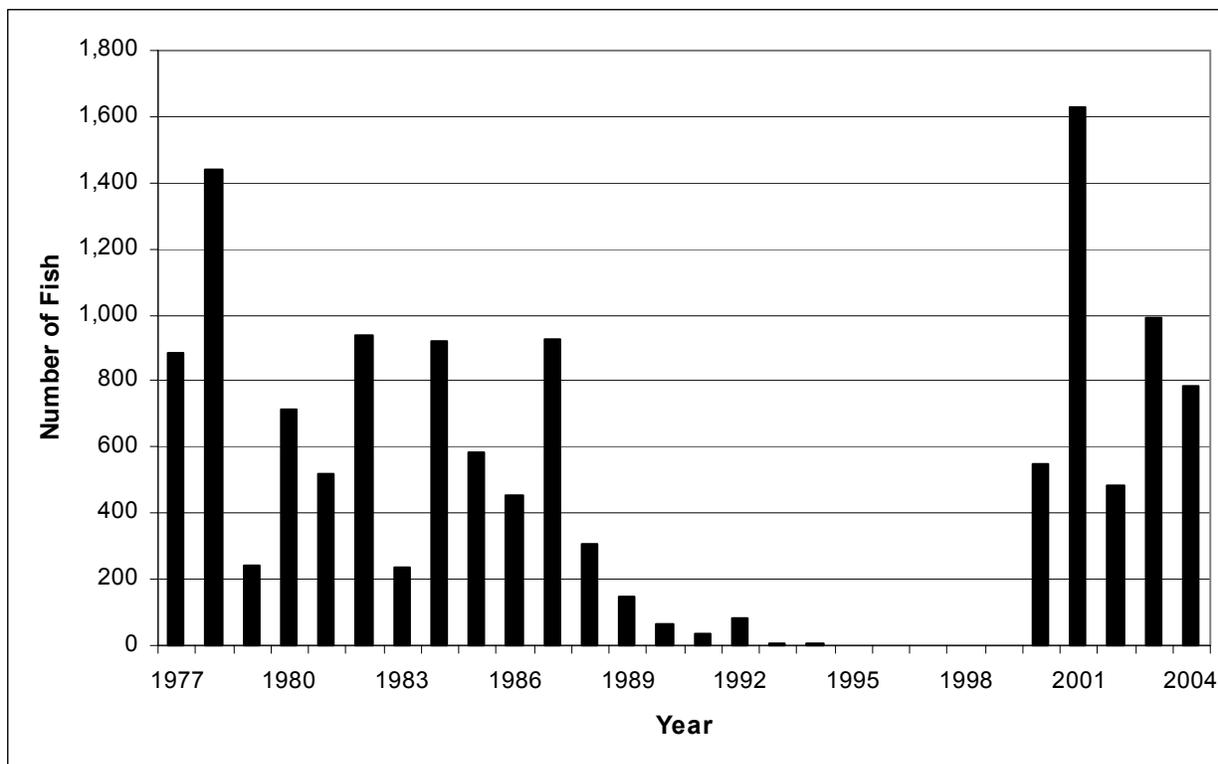


Figure 11. Coho salmon adult passage counts at Rocky Reach dam for years 1977–2004. (Source: FPC, 2005b)

Sockeye Salmon

Adult and juvenile sockeye salmon use the project area as a migration corridor. Adult sockeye pass the Rocky Reach dam on their way upstream to spawning grounds upstream of Lake Osoyoos on the Okanogan River. This passage typically occurs from late June through early August (FPC, 1995), with a vast majority of the adult sockeye passing the project dam in July.

Juvenile sockeye salmon that pass the project dam during their downstream migration originate from natural spawning areas upstream of Lake Osoyoos, as well as from hatchery releases. Sockeye salmon juveniles emigrating from Lake Osoyoos pass the Rocky Reach dam primarily during May (Peven et al., 1995).

Counts of adult sockeye passage at Rocky Reach dam are presented in figure 12.

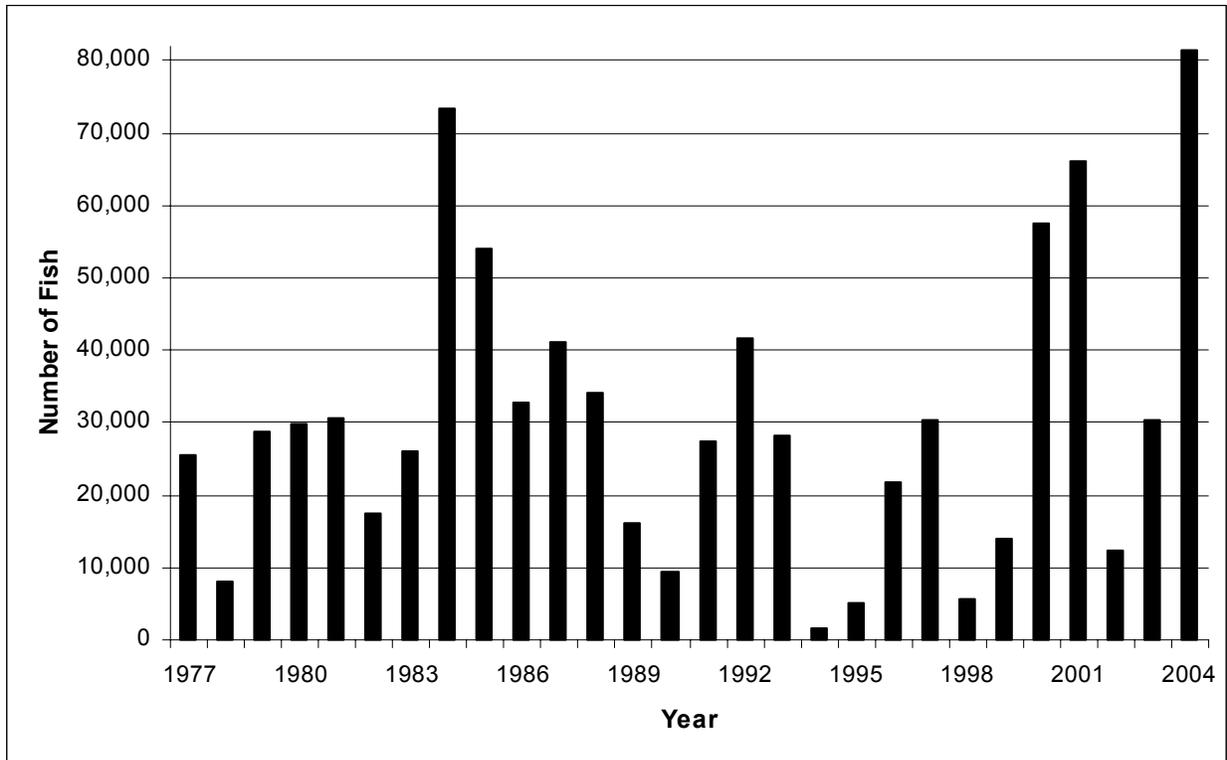


Figure 12. Sockeye salmon adult passage counts at Rocky Reach dam. (Source: FPC, 2005b)

Upper Columbia River Steelhead

NMFS listed the Upper Columbia River steelhead as endangered on August 18, 1997 (62 FR 43937). Juvenile and adult Upper Columbia River steelhead use the project area as a migration corridor. The majority of Upper Columbia River steelhead returning to the mid-Columbia River is of hatchery origin, but some natural production occurs in the Entiat River, a tributary to the project reservoir (Chapman et al., 1994b). Upper Columbia River steelhead adults pass the Rocky Reach dam from early July through early November (FPC, 1995). Observation of adult passage at Rocky Reach dam area presented in figure 13.

Juvenile Upper Columbia River steelhead typically rear in the fresh water tributaries for 2 to 3 years (ranging from 1 to 7 years) before migrating downstream as smolts. Hatchery smolts are released as yearlings. Both hatchery and naturally-produced steelhead pass the project dam in May (McGee, 1984; Peven et al., 1995). Juvenile steelhead, from hatchery and natural tributary origins, appear to migrate actively in the project reservoir, and residence time in the reservoir is, as for spring-run Chinook salmon, limited to a period of days (Chelan PUD, 1991).

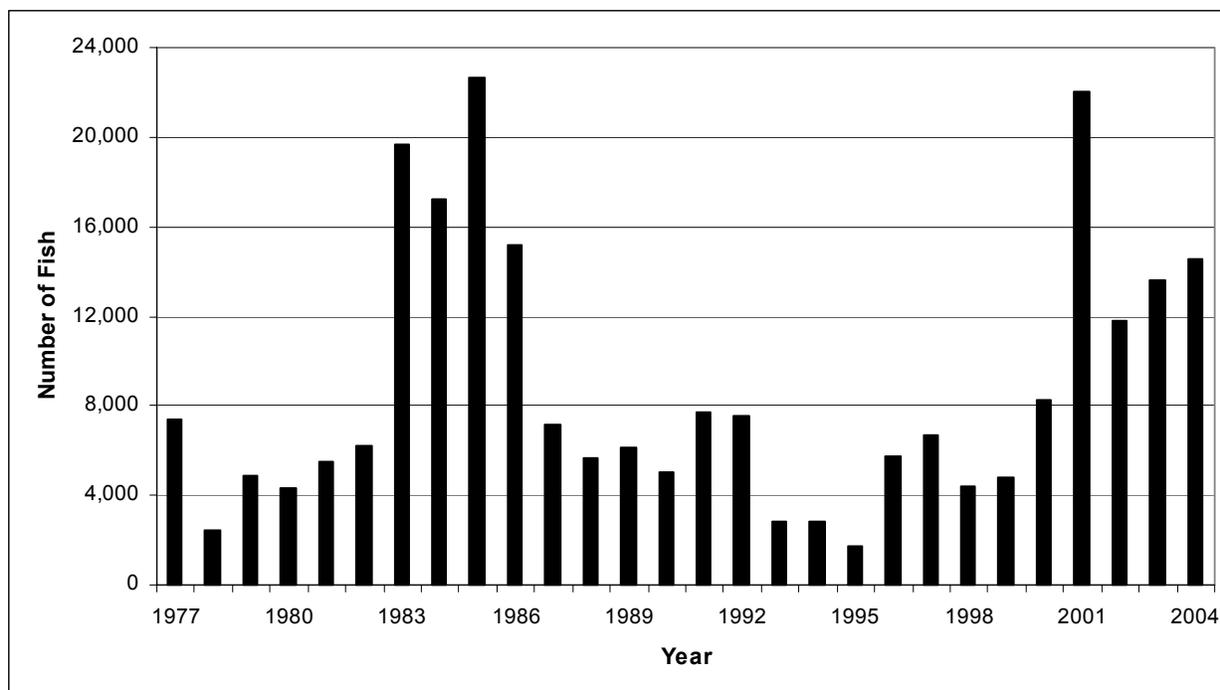


Figure 13. Steelhead adult passage counts at Rocky Reach dam for years 1977–2004. (Source: FPC, 2005b)

Bull Trout

Bull trout populations have been identified in the Wenatchee, Entiat, and Methow rivers, while they are thought to be extirpated from the Okanogan River. Although bull trout occur in the project area, they were probably never abundant in the mainstem mid-Columbia River (Mongillo, 1993).

The Columbia River bull trout populations were listed as threatened under ESA in June 1998 (63 FR 31647). Factors contributing to the decline of bull trout populations include overfishing, dams, forest management practices, livestock grazing, agriculture, water diversions, roads, and mining (Beschta et al., 1987; Brown, 1992). In addition, poaching and competition from non-native fish species are adversely affecting bull trout populations (Mongillo, 1993). Brook trout have replaced bull trout in South Fork Beaver Creek, a tributary of the Methow River.

Four general forms of bull trout are recognized (anadromous, adfluvial, fluvial, and resident), with each exhibiting a specific behavioral or life-history strategy (Brown, 1992; Wydoski and Whitney, 2003). Anadromous bull trout are typically found in coastal and Puget Sound river drainages, and are not found in the mid-Columbia River region (Nehlsen et al., 1991). The adfluvial form matures in lake environments and spawns in tributaries, where the young reside for one to three years. Fluvial bull trout have a similar life history, except that they move between the mainstem rivers and

smaller tributaries. Fluvial bull trout are the form most likely to be found in the project area. Resident bull trout typically spend their entire lives in smaller, high-elevation streams, apparently moving very little and seldom reaching a size larger than about 12 inches (Brown, 1994). Resident bull trout may have extensive seasonal movements or may change life-history strategies (from resident to adfluvial), depending on environmental conditions.

Observers frequently see bull trout in the adult and juvenile fish passage facilities of mid-Columbia River dams, but information is limited. Although bull trout have been enumerated by fish counters stationed in the viewing windows of fish ladders during adult salmon passage periods, counts prior to 1998 typically did not differentiate bull trout from other trout. Bull trout are observed passing the dams between April and November, with 75 to 90 percent passing during May and June. For the years 2000–2003, bull trout counts at Rocky Reach were 212, 204, 194, and 246, respectively (letter from M. Smith, Licensing and Compliance Manager, Public Utility District No. 1 of Chelan County, WA, to M.R. Salas, Federal Energy Regulatory Commission, Washington, DC, December 27, 2004).

Pacific Lamprey

Pacific lamprey (*Lampetra tridentate*) are a federal species of concern (SOCs) (FWS, 2004a) that occur, during their migration stages, in most tributaries to the Columbia River and in the mainstem Columbia River. They have cultural, utilitarian, and ecological significance in the basin because Native American Indian tribes have historically harvested them for subsistence, ceremonial, and medicinal purposes (BioAnalysts, 2000b). Because of their low population levels, lamprey are currently used primarily for ceremonial purposes by Columbia River tribes. As an anadromous species, Pacific lamprey also contribute marine-derived nutrients to the basin.

Little specific information is known about the life history or status of lamprey in the mid-Columbia River watersheds. Upstream migration through the project area occurs from July through November, with peak migrations observed during August. They are known to occur in the Wenatchee, Entiat and Methow rivers; however, there are no indications that they currently use the Okanogan system (BioAnalysts, 2000b). Mid-Columbia River populations of adult lamprey passing Rocky Reach dam ranged from about 1,000 to 17,000 from 1961 to 1969, then declined to less than 200 by 1976 (Mullan et al., 1986). The number of lamprey counted at Rock Island dam showed a similar decline, with counts stabilizing at about 400 per year from 1977 to 1982. However, as shown in figure 14, counts at Rocky Reach dam have increased in recent years, reaching 767 in 2000, 805 in 2001, 1,842 in 2002, 2,521 in 2003, and 1,043 in 2004 (FPC, 2005b).

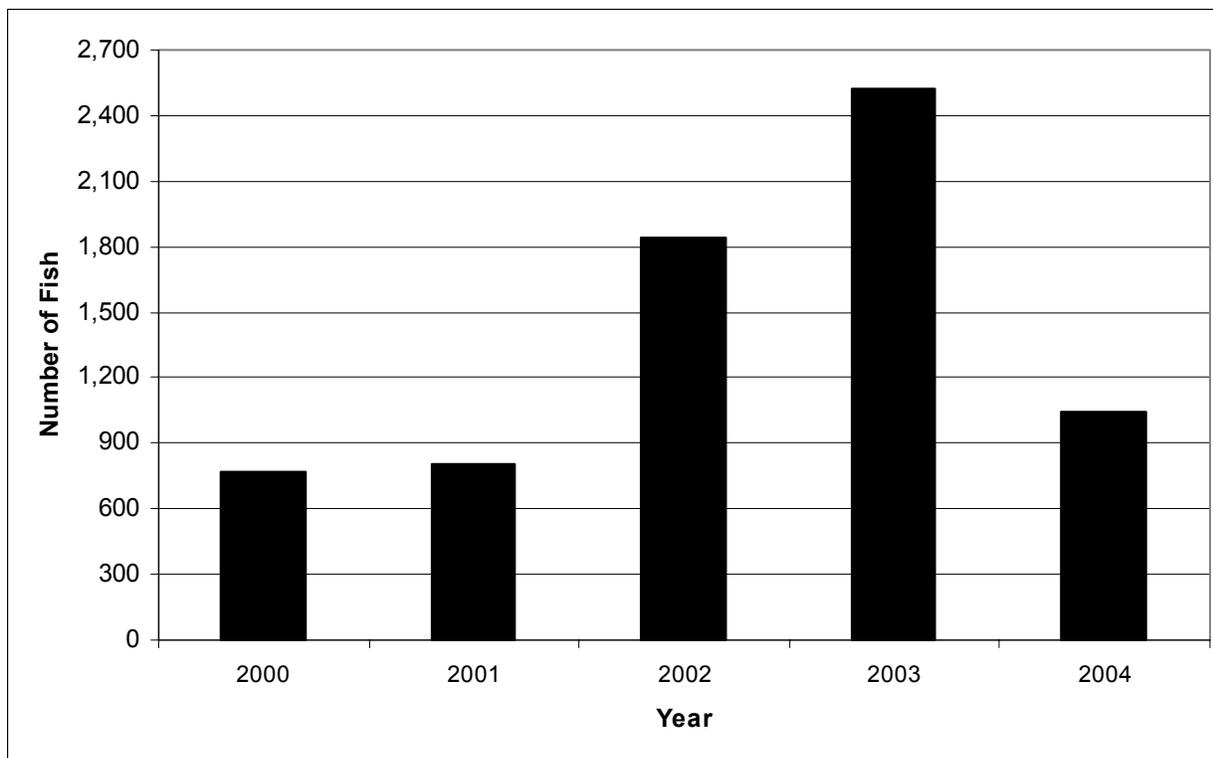


Figure 14. Lamprey adult passage counts at Rocky Reach dam for years 2000–2004. (Source: FPC, 2005b)

Benthic invertebrate studies conducted in 2002 resulted in the incidental capture of approximately 5.6 ammocoetes (juvenile lamprey) per square meter in sandy, depositional habitats within the project dam tailrace (Chelan PUD, 2004a).

3.4.1.5 Resident Fish Species

The project reservoir has sufficient spawning habitat, rearing habitat and food supply to support sizeable populations of native catostomids (suckers), cyprinids (northern pikeminnow, chubs, shiners) and stickleback (Mullan et al., 1986; Dell et al., 1975; DES, 2001b). Mountain whitefish are also present, although spawning success in the reservoir is probably limited because of warm temperatures in the fall and early winter (Mullan et al., 1986). Rainbow trout are common but not abundant. Historical hatchery plantings of catchable-sized trout in the Entiat River and hatchery steelhead smolts that do not migrate to the ocean probably contribute to this population. Bull trout, federally listed as a threatened species under ESA, are present in the project area in limited numbers. Adult and juvenile white sturgeon are also present in limited numbers (RL&L, 2002).

A fish presence and habitat use study of the project reservoir found the fish species assemblage of the reservoir was dominated by non-sport fish species, which contributed

more than 99 percent to the total number of fish recorded (DES, 2001b). The major non-sport fish species included, in order of decreasing abundance, threespine stickleback, northern pikeminnow, redbreasted shiner, sucker (various species, primarily largescale sucker), chiselmouth, and peamouth. The most abundant resident sport fish species recorded was the rainbow trout (anadromous Chinook salmon were the most abundant sport fish overall). Lesser numbers of mountain whitefish (native), and smallmouth bass (introduced) were captured. Mountain whitefish and smallmouth bass were relatively minor constituents of the sport fish population; only 10 mountain whitefish and 7 smallmouth bass were recorded, compared to 549 anadromous Chinook salmon and 62 resident rainbow trout.

Observers noted distinct spatial distribution patterns for the major fish species recorded in the reservoir with the patterns due primarily to the different physical characteristics of habitat in different sections of the reservoir. As noted in section 3.4.1.2, *Aquatic Habitat*, the lower section of the reservoir (Rocky Reach dam to the Entiat River) is lacustrine in character; it primarily supports species that prefer low-velocity habitats. The middle section of the reservoir, which includes the confluences with the Entiat and Chelan rivers, is a transition zone between the predominantly slower-moving, deeper habitat in the lower section and the riverine habitat in the upper section. The upper section of the reservoir (Beebe Bridge to Wells dam) has more constrictive characteristics, with higher water velocities.

Rainbow trout were recorded in all three sections of the Rocky Reach reservoir. However, the numbers of this species were highest in the upper section of the reservoir and declined with increasing distance downstream. Mountain whitefish and smallmouth bass were recorded only in the middle section of the reservoir.

Northern pikeminnow, redbreasted shiner, and chiselmouth were distributed throughout the reservoir, but all of these species were most abundant in the lower section of the reservoir. The recorded numbers of these species declined with increasing distance upstream. Peamouth was also most abundant in the lower portion of the reservoir and occurred in low numbers in both the middle and upper sections of the reservoir. The abundance of threespine stickleback was greatest in the middle section of the reservoir and very low in the upper section. Suckers were distributed throughout the reservoir but were most abundant in the upper section. There was no apparent difference in the abundance of suckers between the lower and middle sections of the reservoir.

White Sturgeon

White sturgeon have recreational, commercial, and/or tribal importance (WDFW, 2002). They are a long-lived, primitive fish species that forages primarily along the bottom of large river systems in the Pacific Northwest. White sturgeon is the largest freshwater fish in North America and occurs throughout the U.S. portion of the Columbia River and many of its larger tributaries. Historically, white sturgeon moved throughout

the Columbia River and likely undertook extensive seasonal migrations among habitats to take advantage of scattered and seasonally available food resources (Beamesderfer et al., 1995).

Construction of hydroelectric dams on the Columbia River from 1938 to 1968 has altered white sturgeon access to habitats it previously occupied, reduced seasonal variation in habitat by controlling annual floods, and reduced habitat diversity by creating a series of reservoirs (Beamesderfer et al., 1995). It is believed that the creation of reservoirs on the Columbia River has resulted in the fragmentation of the white sturgeon population into a number of small populations, which may or may not be isolated. The population dynamics and factors regulating white sturgeon production within these reservoirs are poorly understood. Overfishing and loss of critical habitats have further affected these populations to the point where harvest fisheries are allowed only on a few relatively abundant stocks that occur in the lower Columbia River.

To gather additional information on sturgeon populations in the project reservoir, Chelan PUD commissioned a 2-year sampling program that began in 2001 (RL&L, 2002). During the course of the study, 24 white sturgeon were captured and tagged (with passive integrated transponder [PIT] tags) in the area from the Wells dam tailrace to 4 miles downstream of the Rocky Reach dam. Calculations based on the results of this study estimate that the population of white sturgeon in the Rocky Reach reservoir is approximately 50 fish, with a 95-percent confidence interval of 23 to 698 fish (Golder, 2003a). The confidence in this estimate is low due to the small number of fish marked and recaptured ($n = 4$) in the project reservoir.

Northern Pikeminnow

Northern pikeminnow (formerly northern squawfish) are a species native to the Columbia River. Northern pikeminnow are the most abundant predator species in the Columbia River System, and they account for more than 75 percent of the total catch of predator fish in the mid-Columbia River (Loch et al., 1994). They tend to concentrate in tailrace areas downstream of mainstem dams during the juvenile salmonid migration period, holding in relatively slow-moving water areas (less than about 3 feet per second) near passage routes. They also occur in tributary streams where slow-moving water occurs.

Northern pikeminnow are considered a nuisance species because they tend to prey upon desirable native and sport fish species. Since 1994, efforts have been made to remove numbers of northern pikeminnow from the project area. In 2003, the predator abatement programs resulted in the removal of 7,391 northern pikeminnow at Rock Island dam and 13,321 at the Rocky Reach dam. More than 2,568 northern pikeminnow were removed during the 2003 annual fishing derby conducted between the Rock Island and the Chief Joseph dams.

3.4.1.6 Aquatic Invasive Plants

Non-native aquatic invasive plants in the project area and noxious weed SOCs in aquatic vegetation beds and emergent wetlands include curly pondweed (*Potamogeton crispus*), close-leaved pondweed (*Potamogeton foliosus*), purple loosestrife (*Lythrum salicaria*), yellow iris (*Iris pseudacorus*), and Eurasian watermilfoil (*Myriophyllum spicatum*). Eurasian watermilfoil is the most abundant aquatic plant species found in the project reservoir. Approximately one-third of all the macrophyte bed acreage in the project area is vegetated by dense Eurasian watermilfoil-dominant growth. Close-leaved pondweed is the second most abundant noxious aquatic species occurring throughout the project reservoir. This native species is often dominant within native plant beds as well as co-dominant within many Eurasian watermilfoil beds. Curly pondweed (*Potamogeton crispus*) was the third most abundant plant in the cumulative biomass samples and is likely the third most abundant plant. This species dominates approximately 19 percent of the total acreage of aquatic plant beds in the project reservoir.

Eurasian watermilfoil typically grows in areas with water depths between 4 and 12 feet. Its preferred habitat ranges from silty, sandy areas with low current to cobble areas with higher current. A typical vegetation pattern is for Eurasian watermilfoil to grow in dense beds within shallows, with a transition to curly pondweed dominance at a water depth of approximately 10 feet.

At Entiat Park, several EPA-approved aquatic herbicides have been applied in the swim beach and boat launch areas to control Eurasian watermilfoil. The designated areas were treated shortly after the weeds emerge from the sediments. This method proved to be approximately 50 to 60 percent effective in eliminating Eurasian watermilfoil in those areas (Chelan PUD, 1991). Aquatic herbicides are no longer used because there are currently no herbicides licensed for use in Washington's flowing waters.²³

Chelan PUD has been using a harvester to reduce aquatic plant growth at selected high-use swimming areas and public boat launches. The harvester removes the vegetation but not the root mass. Because Eurasian watermilfoil can proliferate from root fragments, this method of harvesting does not eradicate this species. Harvesting is a maintenance measure and must be performed with some regularity to control Eurasian watermilfoil growth.

²³ Rodeo™ is licensed by the U.S. Department of Agriculture for use near water, but not in flowing waters; therefore, it can be used in shoreline applications for species such as purple loosestrife but not for aquatic weeds such as Eurasian watermilfoil.

3.4.2 Environmental Effects

3.4.2.1 Actions Covered by the Rocky Reach Anadromous Fish Agreement and Habitat Conservation Plan

The HCP was the result of 10 years of deliberations between Chelan PUD, fisheries agencies, tribes, and NGOs in the region. Initial parties to the agreement include Chelan PUD, FWS, NMFS, WDFW, the Colville Tribes), and American Rivers. The HCP was incorporated into the existing license for the project on June 21, 2004. Orders implementing HCPs for the Rock Island Project and the Wells Project were issued by FERC at the same time. On July 14, 2005, the Yakama Nation filed signature pages with FERC indicating that it has become a party to the HCP agreement.

The HCP provisions apply to spring, summer, and fall Chinook salmon, sockeye salmon, coho salmon, and steelhead. As noted under the heading *Current Salmonid Fisheries Conservation Measures* in section 2.1.3.1, the goal of the HCP is to result in no net impact on the Plan Species through the implementation of a combination of mitigation tools to achieve fish passage survival rates and a virtual 100 percent survival of fish passing the project. These mitigation tools include fish passage measures for juvenile and adult Plan Species, hatchery programs, and a fund for habitat improvements.

The HCP agreement calls for establishment of an HCP Coordinating Committee composed of representatives of HCP signatory agencies. Non-signatory agencies and tribes were invited by letter to participate as non-voting members of the HCP Hatchery and Tributary committees.

The following sections discuss specific issues addressed by the HCP, including fish passage, hatchery programs for anadromous fish, and a tributary conservation program. Proposed measures to address non-Plan Species (white sturgeon, Pacific lamprey, and resident fish) are discussed under separate headings below. Proposed measures to protect bull trout are discussed in section 3.6, *Federally Listed Threatened and Endangered Species*.

Fish Passage

The project affects the upstream passage of adult fish and the downstream passage of juvenile and adult fish, particularly juvenile anadromous fish. Regardless of the fish passage facilities in place, some unavoidable impacts occur when fish pass the project (Mosey, 2004). Fish passage survival is an important issue for some species due to their listing under ESA or to existing low population levels.

To address anadromous fish passage under Chelan PUD's proposal, Chelan PUD would continue to implement measures described in the HCP. If the HCP terminates before the end of the license term, the provisions of the HCP call for Chelan PUD to

continue to implement the last-agreed-to measures until the Commission orders otherwise. However, FWS and NMFS have reserved authority under Section 18 of the FPA and could prescribe fishways for salmon and steelhead in the future.

As noted above, the HCP provides that no net impact on salmon and steelhead runs would be achieved on a specific schedule and maintained for the duration of the agreement. The no net impact goal has two passage components: (1) 91 percent combined juvenile and adult project survival achieved by project improvement measures implemented within the geographic area of the project; and (2) 9 percent compensation for unavoidable project mortality provided through hatchery and tributary programs, with 7 percent compensation provided through hatchery programs and 2 percent compensation provided through tributary programs.

Downstream Passage and Project Survival

Under Chelan PUD's proposal, it would continue implementation of elements of the HCP related to downstream passage, including modifying spill levels and operating the newly constructed juvenile fish bypass system.

The HCP is based on a survival standard of 91 percent combined juvenile and adult project survival. However, it is not currently technically feasible to measure achievement of the 91 percent goal, and measurement depends on developing new technologies that can assess natural mortality in the project area. The parties to the HCP agreed that adult passage mortality could not be distinguished from natural mortality due to other causes. They concluded that adult mortality is likely less than 2 percent and a juvenile project survival standard of 93 percent could be used to determine that the HCP survival objective has been achieved. If project survival cannot be measured, the HCP stipulates use of a juvenile dam passage survival standard of 95 percent. If juvenile dam passage survival cannot be measured, the HCP provides that Chelan PUD would calculate passage survival based on fish passage rates and survival rates through each route through the dam. The HCP relies on the juvenile fish bypass system as the primary method for increasing juvenile salmonid survival. As described in the HCP and the license application, Chelan PUD would continuously operate the juvenile bypass system from April 1 to August 31 each year to protect the juvenile fish migration.

The HCP also specifies spill as a means of increasing survival of juvenile salmonids as they pass through the project. The HCP specifies that Chelan PUD would provide spill to pass fish during a period that encompasses 95 percent of each species' downstream migration. Spill levels for 2004 through 2006 were set by the results of a 2003 juvenile fish passage efficiency (FPE) study. Under the terms of the HCP, the performance of the bypass system in 2003 in passing yearling Chinook salmon and steelhead was such that Chelan PUD is no longer required to provide spill for these species.

Spill levels would be 24 percent and 9 percent of the estimated daily average flow for sockeye and subyearling Chinook salmon, respectively. Survival studies are being conducted to assess whether Chelan PUD is meeting or exceeding its HCP survival standards, and accordingly, in 2007 and beyond, spill would supplement the bypass system as necessary to achieve the survival standards. Any modifications to the normal bypass operating period would be determined by the HCP Coordinating Committee.

Upstream Passage

Rocky Reach dam is equipped with a fishway with three entrances between spillway bays 8 and 9, at the center dam, and at the powerhouse service bay. Fish using these entrances follow passages to the center dam and then travel along the downstream side of the powerhouse to a fish ladder on the forebay wall. The proposed action continues use of the ladder to facilitate upstream passage for adult salmon and steelhead (as well as other fish species that use this pathway, including bull trout). The HCP establishes a survival standard for adult Plan Species that must be achieved when technology becomes available to measure adult survival. As of 2002, the HCP signatories agreed that adult fish survival cannot be conclusively measured for each Plan Species because the technology is not available to differentiate project-related mortality from natural adult losses and the parties to the HCP assumed adult mortality is less than 2 percent. Using this information, the parties agreed that Chelan PUD's achievement of the adult and juvenile survival standard of 91 percent would be determined based upon the measurement of the 93 percent juvenile project survival standard.

The HCP is to be implemented in three phases that provide for adjustments to ensure biological success. Beginning with the 2004 migration season, Chelan PUD implemented juvenile and adult operating plans and criteria to meet the survival standard and is monitoring and evaluating the results to determine compliance as part of Phase I of the HCP. Following completion of 3 years of juvenile survival studies, the HCP Coordinating Committee would determine whether the pertinent survival standard has been achieved for each Plan Species. If a standard has not been achieved for a particular Plan Species, Chelan PUD would proceed to Phase II, under which it has agreed to develop and implement additional measures to meet the pertinent survival standard. The HCP Coordinating Committee would decide on additional tools for Chelan PUD to implement to achieve the survival standard.

The HCP Coordinating Committee would select additional tools based on the likelihood of biological success, implementation time, and cost-effectiveness (if alternatives are comparable in their biological effectiveness). Chelan PUD would continue to implement Phase II until the standards are met or until the Coordinating Committee determines the standards are impossible to achieve. If the survival standard is achieved at the end of Phase I or anytime during Phase II, Chelan PUD has agreed to maintain the survival standard for the term of the HCP. Chelan PUD would proceed to

Phase III when the HCP Coordinating Committee has verified compliance with the combined adult and juvenile survival or juvenile survival standard of 93 percent; or has evaluated juvenile project survival between 91 and 93 percent; or has measured or calculated 95 percent juvenile dam passage survival. Initiating Phase III would indicate that the appropriate standard has either been achieved or is likely to have been achieved and provides additional or periodic monitoring to ensure that the survival of the Plan Species remains in compliance with the survival standards for the term of the HCP.

Under Chelan PUD's proposal, the HCP Plan Species would be continually monitored throughout the term of the license. The HCP sets a requirement for Chelan PUD to achieve the no net impact standard by 2013. If Chelan PUD fails to meet the no net impact standard in the required time frame or if the species are not rebuilding and the project is a significant factor in the failure to rebuild, the HCP agreement provides a mechanism for the fisheries parties to withdraw and pursue other legal remedies.

Furthermore, Chelan PUD would continue to meet the no net impact standard if stocks increase in the future, regardless of total numbers of Plan Species fish passing the project. In this manner, the HCP is designed to mitigate for potential project effects and would also provide for a response to regional impacts as future population levels change in accordance with the success or failure of regional actions relative to ESA or tribal recovery goals.

In letters to the Commission from NMFS, WDFW, WDOE, and the Yakama Nation (March 8, 2005, March 11, 2005, March 14, 2005 and March 14, 2005, respectively), the parties expressed their support for the continuation of HCP implementation. Interior expressed its support for HCP implementation in letters filed March 14, 2005 and June 1, 2005.

In their letter to the Commission dated March 14, 2004, the Umatilla Tribes' recommendation 2 states that Chelan PUD should be required to meet passage performance standards for salmon. Specifically these standards are: 1) direct and indirect mortality for juvenile salmonids through the project reservoir, dam, and tailrace should not exceed 8.5 percent by 2013; and 2) an 80 percent project juvenile FPE rate be achieved by 2013 and a 90 percent juvenile FPE rate be achieved by the year 2020. These goals are consistent with the Columbia River anadromous fish restoration plan, *Wy-Kan-Ush-Mi Wa-Kish-Wit* (Nez Perce et al., 1995). They also recommend that Chelan PUD assess indirect mortality and injury rates for juvenile salmon, and assess direct and indirect survival via smolt-to-adult evaluations.

The Umatilla Tribes' recommendation 3 states that Chelan PUD should meet adult salmon upstream survival rate of 97 to 98 percent by 2013, that adult fallback rates should be reduced, and that migrating steelhead kelts should achieve a "safe, timely, and effective passage standard." They base this standard on the 2000 FCRPS biological opinion.

The Umatilla Tribes' recommendation 4 states that Chelan PUD should contribute to the funding of regional evaluations of salmon stocks affected by the project. They state that it is uncertain how the Chelan PUD-proposed HCP provisions contribute to regional productivity/escapement goals for fish affected by the project, and that therefore the licensee's obligations to meeting those goals has yet to be defined.

The Umatilla Tribes' recommendation 5 states that Chelan PUD should index-test all powerhouse turbines for peak efficiency ranges and that once this range is determined, the turbines should be operated within these ranges to maximize fish passage protection.

The Umatilla Tribes' recommendation 7 state that Chelan PUD should adhere to the Hanford Reach and Hourly Coordination Agreements.

Our Analysis

In the final EIS for the Rocky Reach, Wells, and Rock Island HCPs, NMFS and FERC concluded that, based on their analysis for ESA-listed Upper Columbia River steelhead and Upper Columbia River spring-run Chinook salmon smolts, implementing the HCPs should provide survival levels that are greater than those actually measured in recent years at the project, and therefore implementing the HCPs would substantially increase survival rates of juvenile steelhead and spring-run Chinook salmon through the project (NMFS, 2002). NMFS and FERC also concluded that, for the unlisted Plan Species juveniles migrating through the entire HCP reach, survival should also improve compared to survival rates that were probably occurring prior to any HCP measures being implemented.

The ongoing monitoring and mitigation programs contained in the HCP would provide useful information to assess project influences on salmon stocks and other fish that pass through the dam, and through upstream and downstream passage facilities. The terms of the HCP agreement provide sufficient safeguards to ensure the passage and survival of Plan Species through the project. Furthermore, HCPs have also been incorporated into the existing licenses for the Wells and Rock Island projects, allowing for more regional collaboration than if different plans were approved for each project.

In its Master Order Granting Interventions; Approving Anadromous Fish Agreements, Settlement Agreement, and Applications to Amend Licenses; and Terminating Proceeding²⁴ and its Order Amending the Rocky Reach Project license²⁵, the Commission accepted the proposed HCP and its associated approach to attaining passage goals as described in the terms of the HCP, indicating that "the orders will serve the public interest by putting into place a long-term program to aid in the recovery of the endangered species and help to prevent other salmonids from becoming listed." The

²⁴ 107 FERC ¶ 61,280.

²⁵ 107 FERC ¶ 61,281.

Commission based its approval of the HCP on the environmental analysis presented in the final EIS (NMFS, 2002) for the HCP, with the Commission participating as a cooperating agency, and after consideration of all comments from other parties that pertained to the HCP. No new evidence or arguments have been presented that would cause us to change our previous conclusions regarding the HCP.

The Umatilla Tribes recommend adopting passage standards for juvenile and adult salmon through the entire project, with mortality defined as direct and indirect mortality. Additionally, the juvenile project survival percentage recommended by the Umatilla Tribes is lower than the juvenile project survival standard proposed by Chelan PUD, as contained in the HCP. The Umatilla Tribes do not provide any discussion of the derivation of their recommended standard or any explanation why their standard differs from the HCP standard. It is unclear how much additional benefit, if any, there would be from adopting the survival standard proposed by the Umatilla Tribe. Depending on the level of direct and indirect mortality that occurs within the project, the Umatilla standard could be more or less protective than the standard proposed by Chelan PUD and the agencies. Moreover, the HCP (and its associated survival standards) is an established plan that is working to recover small juvenile salmon such as summer Chinook salmon or fry.

In its reply comments to the Umatilla Tribes' recommendation to test and operate the powerhouse turbines to maximize fish passage protection, Chelan PUD stated that they have completed index-testing on units at Rocky Reach to identify peak efficiency ranges. Chelan PUD uses a computer program to maximize efficiency of all individual unit operation. Additionally, Chelan PUD operates units to provide maximum collection efficiency of the juvenile bypass system, thereby providing maximum fish passage protection to downstream migrating juvenile salmonids.

Hatchery Programs for Anadromous Salmonids

The HCP no net impact objective is a 91 percent combined adult and juvenile survival rate through the project area. The hatchery program, together with the tributary enhancement program, is intended to mitigate for the remaining 9 percent of unavoidable project mortality. The HCP agreement states that 7 percent of this compensation should be achieved through hatchery programs and 2 percent through tributary programs.

To meet its 7 percent compensation goal through hatchery programs, Chelan PUD proposes to provide funding for hatchery facilities operated and maintained by either Chelan PUD or a designated agent (such as WDFW). A Hatchery Committee, composed of voting representatives appointed by signatories to the HCP, would oversee the development, implementation, and monitoring of species-specific hatchery programs. The Hatchery Committee also would be responsible for determining periodic program adjustments in hatchery production levels and providing recommended implementation plans to Chelan PUD.

The HCP commits Chelan PUD to hatchery production goals through 2013. These production goals would be re-evaluated in 2013 and every 10 years thereafter. The hatchery program is designed to mitigate continuing effects on anadromous fish by the operation of the project.

Hatchery production goals are set for summer/fall Chinook salmon, spring Chinook salmon, steelhead and sockeye salmon. Coho salmon, which were extinct from the Upper Columbia River, are being reintroduced by the Yakama Nation (as noted in the Umatilla Tribes letter dated March 14, 2005) and would be covered by the HCP if “threshold population” levels are achieved. Because wild coho salmon are extinct in the portion of the Columbia River affected by the project, they are not protected under the ESA. Full no net impact protection as a Plan Species would be provided for coho salmon upon their successful reintroduction.

The HCP agreement stipulates that Chelan PUD spend \$4,000,000 on capital improvements to hatchery facilities; \$250,000 annually on HCP Hatchery Committee projects in the first 10 years of the license; and \$100,000 annually in years 11 to 50 of the license. In addition, they anticipate spending \$100,000 annually in the first 10 years of the license on hatchery management consultants.

As noted earlier, Interior, NMFS, WDFW, WDOE, and the Yakama Nation, in their March 2005 letters to the Commission, expressed their support for the continuation of HCP implementation.

In their March 14, 2005, letter to the Commission, the Umatilla Tribes recommend that Chelan PUD establish hatchery plans in coordination with and with the approval of a Fisheries Technical Committee, and that the plans contain state-of-the-art bioengineering and other applicable methods and standards. In their November 8, 2005 letter to the Commission, the Umatilla Tribes state that Chelan PUD needs to design and fund substantial project production facility improvements to increase the number of fish produced to mitigate for project losses and to provide for recovery of depleted populations above the project.

Our Analysis

Chelan PUD’s proposal would compel the PUD to meet the production goals specified in the HCP. Hatchery supplementation of Plan Species would contribute fish to populations in the reservoir and mitigate for potential project-related mortality. An increase in the number of juveniles released to migrate to the ocean would potentially result in an increase in adult fish returning to the project area. Increased populations of adult fish would support Indian treaty fisheries as well as sport and commercial fisheries. Chelan PUD and representatives of the other HCP signatory parties who would make up the HCP Hatchery Committee, including NMFS, would be responsible for evaluating how to provide the most efficient and effective program for future hatchery needs to

achieve the goals stated in the HCP. This may require renovation and/or upgrades of existing facilities.

In comments on the draft EIS, the Umatilla Tribes indicate that the Pacific Salmon Treaty calls for in-kind mitigation for losses of summer Chinook salmon from project passage effects. They state that since summer Chinook salmon naturally and historically outmigrated as subyearlings, yearling fish should not be used for hatchery mitigation. The benefits of the HCP hatchery program to summer Chinook salmon was evaluated in detail in NMFS (2002). Based on this analysis, we conclude that the proposed summer Chinook salmon hatchery program would mitigate for the 7 percent unavoidable losses targeted by the HCP. However, if yearling summer Chinook salmon releases are unsuccessful, the HCP process also allows for a modification of measures.

In the final EIS recommending implementation of the HCP, NMFS stated that the existing hatchery production levels, which were based on initial inundation and ongoing losses from project operations, are “believed to be greater than actual fish passage losses” at Chelan PUD projects (NMFS, 2002). As noted previously, the Commission was a cooperating agency in preparing the final EIS for the HCP, and in its Order Amending the License of the Rocky Reach Project, determined that implementing the HCP measures is in the public interest.

The Umatilla Tribes’ recommendation to implement state-of-the-art bioengineering and production methods at project facilities would potentially result in more efficient production, and could increase the number and survival of fish produced to mitigate project losses and enhance existing populations. However, no evidence has been filed with the Commission that shows that Chelan PUD is currently unable to meet its current production obligations. As stated above, in order to meet hatchery production goals required by the HCP, renovation and/or upgrade of existing facilities may be required as recommended by the HCP Hatchery Committee.

Tributary Conservation Program

The HCP would provide for enhancement of off-site tributary habitat used by salmon and steelhead within the mid-Columbia River Basin. Under the proposed action, Chelan PUD would annually contribute \$229,800 (in 1998 dollars) to a Plan Species Account to mitigate for 2 percent of unavoidable project mortality (2 percent of the no net impact goal). A Tributary Committee composed of HCP signatories would be charged with ensuring that an appropriate number of projects are implemented upstream of the project tailrace. Alternatively, the Tributary Committee could request certain lump sum payments in lieu of annual payments. In addition, Chelan PUD would fund a tributary assessment program (not to exceed \$200,000) for the purpose of monitoring and evaluating the performance of projects supported through the Tributary Conservation Plan.

As noted earlier, Interior (BLM, FWS, and NPS), NMFS, WDFW, WDOE, and the Yakama Nation, in their March 2005 letters and Interior in its June 1, 2005, letter to the Commission providing preliminary or final recommendations, terms and conditions, and prescriptions, expressed their general support for continued implementation of the HCP.

Our Analysis

Restoration and enhancement of tributary habitat are important components of the effort to increase access and use of habitat for impaired populations of coldwater fish species, including salmon, steelhead, resident trout, and bull trout. Viable habitat restoration projects specified in the HCP include habitat protection, flood plain rehabilitation, channel function improvement, instream flow improvement, passage provision, riparian restoration, and water quality improvement. Improving and enhancing existing habitat conditions for spawning and rearing fish would make more habitat available for spawning and rearing, thereby leading to increased production and survival of natural and hatchery-supplemented populations. According to section 7.7 of the HCP, acquisition of land or interests in land, such as conservation easements or water rights, or interests in water, such as dry year lease options, are a high priority. Additionally, project selection would be based on a unanimous vote by the Tributary Committee appointed by the signatories to the HCP. The Tributary Committee may also include expert non-voting advisors such as land and water conservancy groups.

No specific projects have been identified to date, so we are unable to make conclusions concerning site- or species-specific benefits of the proposed action. Chelan PUD states that re-establishment of shoreline riparian vegetation, flood plain continuity, and water conservation for maintenance of instream flows would be among the likely objectives of tributary habitat projects. These types of actions would improve and/or increase available spawning and rearing habitat for fish in the project area, resulting in potential increases in recruitment to existing populations. Given the collaborative structure of the HCP Tributary Committee, we are confident that the types of projects selected for funding would benefit cold-water fish species that might migrate through the project area. As noted previously, the Commission was a cooperating agency with NMFS in preparing the final EIS for the HCP, and in the Commission's Order Amending the License of the Rocky Reach Project, determined that implementing the HCP measures, including the proposed tributary conservation program, is in the public interest.

3.4.2.2 White Sturgeon Populations

As part of the Settlement Agreement, Chelan PUD proposes to implement the White Sturgeon Plan that contains measures to address project-related effects on white sturgeon. The objectives of the plan are as follows: (1) increase the population of white sturgeon in the reservoir to a level commensurate with available habitat and allowing for

appropriate and reasonable harvest through a supplementation program; (2) determine the effectiveness of the supplementation program; (3) determine the carrying capacity of available habitat in the reservoir; and (4) determine natural reproduction potential in the reservoir, and adjust the supplementation program accordingly.

To achieve the plan goals, Chelan PUD proposes the following measures, which are supported by FWS and WDFW as parties to the Settlement Agreement:

1. develop a brood stock collection plan, and, if feasible, begin brood stock collection in year two of the new license;
2. implement a white sturgeon supplementation program by initially releasing up to 6,500 yearling white sturgeon into the reservoir each year for 3 years, with subsequent annual release levels to be determined by the RR Fish Forum based on monitoring results;
3. in consultation with the RR Fish Forum, by year seven, determine a long-term source of fish to be used for continuing the supplementation program throughout the term of the new license;
4. conduct an initial 3-year index monitoring for juvenile and adult sturgeon in the reservoir to determine age-class structure, survival rates, abundance, density, condition factor, growth rates, and to identify distribution and habitat selection of juvenile sturgeon;
5. continue index-monitoring every 3 years to determine age-class structure, survival rates, abundance, density, condition factor, growth rates, and to identify distribution and habitat selection of juvenile sturgeon and to direct the supplementation program strategy;
6. conduct tracking surveys of juvenile white sturgeon to determine emigration rates from the reservoir;
7. compile information on other white sturgeon supplementation programs in the region; and
8. track adult white sturgeon to identify potential spawning locations, or place egg collection mats downstream of Wells dam to evaluate spawning activity and habitat use.

The Umatilla Tribes' 10(a) recommendation 13 calls for Chelan PUD to create, fund, and implement a White Sturgeon Plan to be developed in coordination with and with the approval of a fisheries technical committee. The Umatilla Tribes express the view that Chelan PUD is responsible for contributing to the rebuilding of a pre-project population, with an ultimate goal of a harvestable surplus. More specifically, they call for a plan to work toward the goal of rebuilding white sturgeon populations to levels of "optimal productivity," providing 500 adult white sturgeon for tribal fisheries.

The Tribes request that this plan be developed and implemented in coordination with a regional work group of state, tribal, and federal managers and Chelan PUD representatives to meet project-specific mitigation goals and the overall regional goal of sturgeon recovery (from the Columbia River mouth to Grand Coulee dam and on the Snake River to Hells Canyon dam).

Steps to implement the Tribes' goals are detailed below and organized in separate implementation increments: Tier 1—immediate (years 0-5), Tier 2—short term (years 5–15), Tier 3—re-building (years 15–25), and Tier 4—long-term (years 25+). The tier elements include supplementation measures; baseline stock assessments; annual monitoring and evaluation; hosting and funding annual meetings with state, tribal, and federal fisheries representatives; and other measures.

Tier 1—Immediate (years 0-5) objectives include the following:

1. Development of permanent sturgeon supplementation facilities as called for in the Rocky Reach terms and conditions from WDFW.
2. Baseline stock assessments, spawner surveys, young-of-year surveys, and broodstock tagging.
3. Initial releases of yearling sturgeon, likely from other sources, no less than 6,500 annually, with provisions for additional fish if deemed necessary, with a percentage of them appropriately tagged to study baseline information on entrainment rates, growth, and mortality. All released fish are to be scute marked and PIT-tagged prior to release.
4. Collection of broodstock for future spawning efforts. Broodstock collection efforts to emphasize mid-Columbia reservoirs as first priority. Other locations to be determined by agency and tribal fish managers.
5. Host and fund annual monitoring and evaluation meeting with state, tribal and federal fisheries managers to present information from past year and to confirm upcoming year operations schedule.

Tier 2—Short-term (years 5–15) objectives include the following:

1. Completion of Rocky Reach hatchery facilities
2. Use of Rocky Reach white sturgeon hatchery facilities.
3. Continue stock, young-of-year, and spawning surveys on a 3-year rotation. Information on growth and survival rates to determine annual release numbers to maintain integrity of reservoir ecosystem and sturgeon growth rates.
4. Continue periodic monitoring of entrainment potential, particularly as population increases and/or water conditions vary from the norm.

5. Collect and spawn broodstock annually.
6. Evaluate stock assessment data and growth information to evaluate potential for initial fishery opportunities.
7. Host and fund annual M&E meeting with state, tribal and federal fisheries managers to present information from the past year and to confirm the upcoming year's operations schedule.
8. Cooperatively work with other regional fish managers and PUD staff to coordinate and cooperate regarding sturgeon supplementation, monitoring and evaluation, and other appropriate tasks to as pertinent. For example, coordinate on broodstock collection and spawning activities.

Tier 3—Re-building (years 15–25) objectives include the following:

1. Collect and spawn broodstock annually.
2. Initiate annual spawning and young-of-year surveys to monitor the potential recruitment of now maturing fish from initial releases. Continue periodic monitoring of entrainment potential, particularly as population increases and/or water conditions vary from the norm.
3. Continue stock, young-of-year, and spawning surveys on a 3-year rotation. Information on growth and survival rates to determine annual release numbers to maintain integrity of reservoir ecosystem and sturgeon growth rates.
4. Continued use of hatchery facilities to produce annual broods for release.
5. Implement fisheries program with commensurate monitoring on Rocky Reach Reservoir.
6. Harvest information paired with periodic (3-year rotation) stock
7. Assessments used to maintain appropriate level of broodstock recruitment to insure some level of natural spawning.
8. Cooperatively work with other PUD staff to coordinate and cooperate regarding sturgeon supplementation, monitoring and evaluation, and other appropriate tasks as pertinent. For example, coordination on broodstock collection and spawning activities.
9. Host and fund annual monitoring and evaluation meeting with state, tribal and federal fisheries managers to present information from past year and to confirm upcoming year operations schedule.

Tier 4—Long-Term (years 25+) objectives include the following:

1. Collect and spawn broodstock annually.
2. Continue stock, young-of-year, and spawning surveys on a 3-year rotation. Information on growth and survival rates to determine annual release numbers to maintain integrity of reservoir ecosystem and sturgeon growth rates.
3. Continued use of Rocky Reach hatchery facilities to produce annual broods for release.
4. Implement fisheries program with commensurate monitoring on Rocky Reach Reservoir.
5. Harvest information paired with periodic (3-year rotation) stock assessments used to maintain appropriate level of broodstock recruitment to ensure some level of natural spawning.
6. Continue annual spawning and young-of-year surveys to monitor the potential recruitment of now maturing fish from initial releases. Continue periodic monitoring of entrainment potential, particularly as population increases and/or water conditions vary from norm.
7. Continue to host and fund annual monitoring and evaluation meeting with state, tribal and federal fisheries managers to present information from past year and to confirm upcoming year operations schedule.
8. Cooperatively work with other regional fish managers and PUD staff to coordinate and cooperate regarding sturgeon supplementation, M&E, and other appropriate tasks to as pertinent. For example, coordination on broodstock collection and spawning activities.
9. Host and fund annual monitoring and evaluation meeting with state, tribal and federal fisheries managers to present information from past year and to confirm upcoming year operations schedule.

Our Analysis

Development of hydroelectric power generation facilities within the Columbia River Basin has adversely affected white sturgeon. White sturgeon rarely use the fish ladder at the project for upstream or downstream passage, but they do move downstream by passing through the turbines or in spill. White sturgeon have been documented to use fish ladders at lower and middle Columbia River dams for both upstream and downstream passage, but for reasons that are not understood, the use of ladders by white sturgeon is highly variable among dams, even though the ladders are similarly designed (Lepla and Chandler, 2001; Golder, 2003a).

Project effects on white sturgeon spawning and rearing in the project area are currently unknown. Based on studies completed in the reservoir, it is evident that there is some recruitment, but the total number of individuals is low (Golder, 2003a). Results of surveys for white sturgeon conducted in 2001 and 2002 in the project area indicate the population size to range between 50 to 115 fish, with uncertainties in the data projecting a maximum population of no more than 300 fish (Chelan PUD, 2006c). Critical habitats for sturgeon in the project area have yet to be identified, and sturgeon are rarely seen in the fish ladder at the project.

Although recruitment and abundance are low, it is unknown what effect these parameters have on the population, or what population size this reach of the Columbia River is capable of sustaining. In its December 27, 2004, letter containing Chelan PUD's responses to FERC's AIR, Chelan PUD indicated that substantial rearing habitat for sturgeon exists in the project reservoir. However, habitats for white sturgeon spawning have not been identified. However, habitat for white sturgeon spawning in the project area has not been identified.

The current natural recruitment of sturgeon in the reservoir appears to be too low to maintain a healthy population of sturgeon in the project area. The White Sturgeon Plan's measures to increase numbers of juveniles through supplementation of 6,500 juveniles in the first 3 years after the license is issued would potentially lead to an increase in reservoir populations as these juveniles mature. The monitoring and evaluation programs described in the White Sturgeon Plan would provide information that would contribute to the success of the supplementation program and help to evaluate what supplementation levels may be necessary to achieve the plan goals. The tracking surveys proposed in the White Sturgeon Plan would provide information on emigration rates from the reservoir. Tracking adult sturgeon may provide information on habitat utilization and spawning areas in the reservoir.

The Umatilla Tribes' letter describes measures that should be included in the White Sturgeon Plan to address the data uncertainties in a comprehensive manner. Such a White Sturgeon Plan would benefit white sturgeon populations by potentially providing information that would aid in the development of actions that could be used to increase populations in the project area or minimize adverse project effects. Some of the Tribes' recommended measures listed above are specific measures designed to achieve the same objective as Chelan PUD's proposal and WDFW's recommendations.

Construction of a hatchery facility for white sturgeon would provide Chelan PUD with a dedicated source for white sturgeon broodstock, thereby potentially increasing the availability of broodstock for use in the supplementation program. The availability of broodstock is a critical component of the success of the population rebuilding efforts, because it would provide juveniles that would recruit to the population in the reservoir.

Implementation of the Umatilla Tribes' proposed measures would potentially increase existing populations of white sturgeon in the reservoir. The Tribes' Tier 1 measures are similar to the Settlement Agreement's White Sturgeon Plan in that they call for initial supplementation releases of up to 6,500 tagged fish, and describe specific monitoring actions that would provide information on the success of the supplementation program. By monitoring through PIT tagging and scute marking, subsequent growth, entrainment, and mortality studies could help identify factors that influence the survival of the introduced sturgeon. With this information, managers could more effectively tailor the supplementation program to increase the survival of the introduced sturgeon, thereby increasing the survival of hatchery populations in the reservoir over the long term.

Tier 2, 3, and 4 measures would continue to provide managers with information that could be used to better manage hatchery releases, thereby potentially increasing recruitment to the population of sturgeon in the reservoir. A sustainable increase in reservoir populations of white sturgeon could ultimately lead to the implementation of a harvest program on the reservoir stock.

The White Sturgeon Plan's stated objective, and the Umatilla Tribes' recommendation, seek to increase sturgeon abundance in the reservoir to a level commensurate with available habitat and that would allow for white sturgeon harvest. While this may be a reasonable fisheries management goal, it appears to be unrelated to the magnitude of project effects on the resource. With respect to relicensing the Rocky Reach Project, it would be more appropriate to establish goals for the White Sturgeon Plan that include identifying and quantifying the project's effects on the resource while simultaneously developing and implementing measures to mitigate for these effects. Many of the actions contained in the White Sturgeon Plan would be useful in identifying project effects or appropriate mitigation measures; however, the overall goal goes beyond addressing the effects of continued O&M of the Rocky Reach Project on white sturgeon.

3.4.2.3 Pacific Lamprey Populations

As part of the Settlement Agreement, Chelan PUD proposes to implement the Pacific Lamprey Plan with the goals of providing safe, timely, and effective passage for adult and juvenile Pacific lamprey, and implementing protection, mitigation, and enhancement (PME) measures that result in no net impacts to the population.

To achieve the Pacific Lamprey Plan goals, Chelan PUD proposes the following measures, which are also supported by parties to the Settlement Agreement:

1. Continue to provide upstream and downstream passage for Pacific lamprey through the project's upstream fishway and downstream bypass, in accordance with the operation criteria for anadromous salmonids and compatible bull trout migration guidelines;

2. Conduct annual upstream fishway passage counts of adult Pacific lamprey;
3. Complete a literature review for the effectiveness of lamprey passage measures implemented at other hydroelectric projects in the Columbia and Snake rivers;
4. Investigate and implement appropriate and reasonable upstream fishway modifications to provide safe, timely and effective volitional Pacific lamprey passage;
5. Implement a monitoring program, such as through the use of radio telemetry or other appropriate methods, to evaluate fishway modifications;
6. Develop a plan and implement appropriate and reasonable measures to address ongoing project effects on downstream adult passage that are identified through the monitoring program;
7. Once adult upstream passage success has been achieved, conduct radio telemetry monitoring every 10 years to confirm the success of any modifications;
8. Monitor juvenile Pacific lamprey impingement and implement appropriate and reasonable measures to address ongoing project-related effects, if any;
9. Measure the type and magnitude of any ongoing project impacts on the downstream passage of juvenile lamprey, using appropriate and reasonable methodologies
10. Determine juvenile Pacific lamprey presence/absence and relative abundance in the reservoir; and
11. Compile information on Pacific lamprey distribution, population status and trends, as well as juvenile downstream migration timing, to identify and implement appropriate measures to address unavoidable impacts to achieve no net impact.

The Umatilla Tribes' 10(a) recommendation 10 states that Chelan PUD should be required to make structural and operational modifications to the project to improve the downstream passage of lamprey. They recommend that Chelan PUD monitor passing lamprey and evaluate delayed mortality by monitoring lamprey, including locations outside the project boundary (i.e., in tributary streams where spawning and holding occurs). They also recommend that Chelan PUD develop operations and maintenance procedures to avoid lamprey effects from such practices as fishway dewatering.

The Umatilla Tribes' 10(a) recommendation 11 states that regional fisheries managers are currently working to develop downstream passage performance standards for juvenile Pacific lamprey. Once such standards are established, the Tribes indicate that Chelan PUD should be required to meet the standards at the project. For upstream passage of adult lamprey, the Tribes recommend that Chelan PUD meet a quantitative

passage goal of 80 percent passage in a 24-hour period by 2013 and a long-term passage goal of 97 percent to 98 percent by 2020. In addition, the Tribes recommend that Chelan assess indirect morality and injury rates for Pacific lamprey; however, they acknowledge that methods to evaluate juvenile lamprey passage and survival are still under regional development. The Umatilla Tribes state in their letter that they will continue to work with Chelan PUD to identify operational and structural modifications to improve fish passage and reduce lamprey mortality

The Umatilla Tribes' 10(a) recommendation 12 states that Chelan PUD should refine, fund, and implement actions in a Lamprey Passage Plan that would help move the project toward meeting qualitative and quantitative performance goals for juvenile and adult lamprey passage. The plan should ensure safe, timely and effective passage for juvenile and adult lamprey: assess and reduce project mortality from passage and habitat loss: and commit to attaining "sustainable, healthy and harvestable levels" of lampreys through cooperation and participation with regional lamprey recovery efforts. The Tribes state that the goal of the PME measures in the Plan should be no net effect of the project on Pacific lamprey. In working toward the no net effect goal, they indicate that Chelan PUD should (1) ensure safe timely and effective passage for juvenile and adult lamprey, (2) assess and reduce injury and/or mortality on Pacific lamprey populations from passage through the project and to mitigate appropriately for passage and habitat losses so there is no net effect on these populations from the configuration and operation of the project, and (3) commit to assist rebuilding these populations to sustainable, healthy and harvestable levels through cooperation and participation with regional lamprey recovery efforts. Specifically, the Tribes request that Chelan PUD:

- Determine discrete and cumulative impacts of the Rocky Reach Project on lamprey populations,
- Identify species/stocks for lamprey in Project area (this includes determination of anadromous/resident and parasitic/non-parasitic forms),
- Develop structures and project operations at Rocky Reach to facilitate juvenile and adult lamprey safe, timely and effective passage at rates similar to the best found in the basin,
- Ensure that structural and/or operational measures to promote safe and efficient salmon passage do not compromise lamprey passage,
- Investigate opportunities for supplementing lamprey populations through hatchery facilities and programs,
- Determine water quality effects of hydro projects on lamprey populations and implement actions to reduce these effects, and
- Evaluate tributary habitat conditions for potential off-site mitigation that will contribute to survival of spawning adults and rearing juvenile lamprey.

The Tribes recommend that Chelan PUD implement Tier 1 and 2 actions of the Lamprey Passage Plan as noted below and subsequently evaluate upstream passage effectiveness of lamprey at the project. If evaluations indicate that passage effectiveness does not meet the site-specific short term performance goal of 80 percent passage through the dam within a median time of 24 hours, the Tribes recommend that Chelan PUD implement Tier 3. In the Tribes' view, the ultimate objective of the plan should be safe, timely, effective, and volitional lamprey passage at all passage routes.

Chelan PUD would complete all Tier 1 tasks within 2 years of the effective date of the new license in consultation and with approval of the Fisheries Technical Committee. These tasks include modeling and design work, environmental measures, and monitoring and evaluations.

Chelan PUD would complete modeling and conceptual design work for passage structures at the dam to determine the most appropriate designs for improving upstream lamprey passage. These designs should be incorporated into the fish ladder and juvenile salmon bypass system and dam for adult lamprey that fallback over the dam.

Chelan PUD would complete all Tier 1 environmental measures to improve passage conditions for lamprey at the project after developing appropriate plans or designs in consultation with the Fisheries Technical Committee.

1. Based upon information from the existing adult radio-telemetry study and information from Corps' passage work at Bonneville dam, examine and incorporate successful techniques for improving lamprey passage such as, but not limited to, plating over grates, improving orifices for passage, rounding sharp edges, constructing rest areas in front of submerged orifices, reducing diffuser grating spacings, and providing collection devices for adults.
2. Conduct more detailed adult radio telemetry studies to determine where lamprey are moving through the fishway and where they are being lost. Information from the current adult telemetry study indicates that over 90 percent of the adults enter the ladder, but only 55 percent of those that enter the ladder successfully exit the ladder. Ladder entrance conditions such as whether the ladders are blocked with debris shall be evaluated. Chelan PUD shall conduct additional radio telemetry studies after structural modifications to the fishway have been implemented to assess post improvement passage.
3. Conduct a hydraulic study of the fish ladder with specific transects to examine fishway entrance conditions, and examine in detail velocities in different sections of the fishway. Results of the study would be used to implement modifications to the fishway to facilitate lamprey passage.
4. Experiment with project operations such as reducing fishway flows and velocities during nighttime hours when salmon do not pass ladders.

5. Fund and conduct an investigation of lamprey passage barriers with regional experts during the 2005–2006 adult ladder dewatering period.
6. Conduct post-adult telemetry evaluations to determine effects of structural and operational improvements as soon as the improvements are implemented.
7. Develop and implement specific written procedures for protecting and salvaging adult and juvenile lamprey at fish passage facilities during facility dewatering and other relevant times. These will be included in the annual detailed fishery operating plan
8. Contribute funding towards existing research and development for a juvenile lamprey radio-tag that can be used with balloon tag technology.
9. Develop PIT-tag or acoustic tag technology. Evaluate effects of downstream passage routes on juvenile lamprey survival.
10. Contribute funding toward the continuation of physiological and behavioral work.
11. Fund the artificial propagation of juvenile lamprey for use in future passage and survival studies at the project.

Chelan PUD would complete the following Tier 1 monitoring and evaluations at the dam with consultation and approval by the fisheries technical committee and coordinated with regional efforts.

1. Continue to use adult upstream passage count methodology, always working towards improving and standardizing it. Research the use of mark/recapture methods of adults in the tributaries as a tool to obtaining adult abundance and survival estimates.
2. Conduct spawning and/or redd counts.
3. Conduct juvenile and adult surveys in reservoir and tributaries.
4. Develop reliable methods for assessing juvenile relative abundance.
5. Explore the feasibility of conducting downstream juvenile counts.
6. Identify habitat parameters that augment and/or diminish lamprey productivity during juvenile and adult surveys.
7. Identify existing and potential rearing habitat within the reservoir and any other areas ever impacted by the project.
8. Identify existing and potential spawning habitat within the reservoir (if any) and any other areas ever impacted by the project.
9. Identify adult overwintering habitat.

10. If habitat appears to be limiting, Chelan PUD shall explore enhancement measures.
11. Actively participate and assist in funding a regionally supported assessment of juvenile lamprey passage technology.
12. Assess effectiveness of modifications that are made to improve passage.
13. Use active adaptive management processes and decision analyses until goals are achieved. The final Pacific Lamprey Plan should contain a decision tree of actions, dates when actions occur and specific check-ins (i.e., every 3 years to evaluate effectiveness of measures, and every 5 years to evaluate if goals are being met; if not then modify the measures and/or implement new measures to improve project passage, habitat and mitigation).
14. Investigate water quality issues, (e.g., toxin bioaccumulation, temperature effects, TDG) on lamprey. Collaboration with the Irrigation Districts on water quality issues seems reasonable.
15. Continue to use radio-telemetry as appropriate for abundance, passage and movement studies. Build and expand upon existing adult passage research. Conduct radio telemetry studies to determine passage rates and problem passage areas at each mainstem dam and reservoir. Track fish to tributary areas to augment other objectives identified above.
16. Develop engineering designs for fishway modifications to improve lamprey passage.
17. Evaluate the feasibility of a trap and haul program for adult lamprey as a short-term mitigation measure as volition passage is developed through the project.

Chelan PUD would complete all Tier 2 tasks within 5 years of the effective date of the new license. These tasks include environmental measures, and post-modification monitoring and evaluations.

Chelan PUD would complete the following Tier 2 environmental measures after developing appropriate plans or designs in consultation with the fishery technical committee and coordinate with regional efforts.

1. Chelan PUD would, with tools developed in Tier 1, evaluate route specific juvenile lamprey passage and survival through the dam and reservoir. Implement engineering measures to improve lamprey passage through the fishway.
2. Chelan PUD would continue to implement the adult salvage program to mitigate impaired passage. The program should be conducted annually until the Project meets the passage performance goal for the species or until the

fishery technical committee identifies one or more alternative measures that would be better investments of the resources dedicated meeting the passage goal.

3. Chelan PUD would fund tributary habitat measures such as securing habitat reserves or instream work in consultation and with approval of the fisheries technical committee.

Chelan PUD would complete the following Tier 2 monitoring and evaluations in consultation with the fishery technical committee and coordinated with regional efforts.

1. Chelan PUD would evaluate the effectiveness of the lamprey passage improvements, including the controlled flow structure(s). This evaluation should include a determination of passage effectiveness for the entire Project so that lamprey passage performance can be compared to the goal developed in Tier 2.
2. Chelan PUD would monitor and evaluate the effectiveness of the capture-and-haul program.
3. The Fishery Technical Committee would decide which suite of measures is appropriate to meet the passage goal.

If necessary to meet Project performance goals, Chelan PUD would implement Tier 3 within 8 years of the effective date of the new license. This tier includes several potential environmental measures.

If monitoring and evaluations conducted in Tier 2 indicate the upstream and downstream passage of lamprey does not meet the site-specific performance goals, Chelan PUD would implement one or more of the following Tier 3 environmental measures in consultation and with approval of the fisheries technical committee.

1. Install additional and or newly designed lamprey passage devices at the dam
2. Operational changes as determined by the fishery technical committee and next steps taken;
3. Continue comprehensive capture and haul program for lamprey adults.
4. Develop and implement a supplementation program.
5. Continue to fund tributary habitat restoration projects preference and use and restoration projects.

Chelan PUD would develop any necessary Tier 3 monitoring and evaluation plans in consultation with the fishery technical committee.

Our Analysis

The effects of project operations on Pacific lamprey populations are currently unknown. The study of Pacific lamprey in the Columbia River Basin is ongoing, and many critical uncertainties exist. Recent research in the lower (Moser et al., 2002a) and mid-Columbia River (Nass et al., 2003) indicates that fish passage facilities often delay or impede adult Pacific lamprey migration. The project can affect upstream migration of lamprey adults by hindering movement through project fishways and structures, and causing injury and mortality from upstream and downstream passage. Upstream migration can be delayed at the project due to the configuration of fishway structures and the swimming methods of adult lamprey. Lamprey critical swimming speeds are below average velocities at the entrances and channels of project fishways (Stevenson et al., 2005), and they may have difficulty negotiating past these areas of high velocity and adhering to passage structures. Impeded adult migration to spawning grounds can cause spawning delays or block access to upstream spawning areas. The importance of blocked passage to mid-Columbia River lamprey is unknown since it is possible that individuals that fail to pass upstream of dams may successfully spawn in downstream areas.

At the completion of their larval stage, Pacific lamprey transform into macrophthalmia, undergo a smoltification process, and start migrating downstream to the ocean where they begin their parasitic life form. The downstream movement of macrophthalmia may be affected by dams either from passage through turbines or via spill (Long, 1968). Macrophthalmia may also become impinged on the face of screen material or other structures that are intended to deflect young salmonids away from turbine intakes (Hammond, 1979). Once impinged, macrophthalmia may slide along these structures toward the gatewells.

Fish counting records at the project dam have documented adult Pacific lamprey passage since 1961 (BioAnalysts, 2000b). More recently, Pacific lamprey adult counts at the mid-Columbia River dams have increased, although they are still below most of the high counts recorded in the 1960s, when the range was 1,000 to 17,000.

Benthic invertebrate studies conducted in 2002 resulted in the incidental capture of approximately 5.6 ammocoetes (juvenile lamprey) per square meter in sandy, depositional habitats within the project dam tailrace (Golder, 2003b).

Specific reasons for the fluctuations in Pacific lamprey populations throughout their range in the United States are not fully understood, but have occurred in the same time period as similar declines of Pacific salmon populations. Causes of population decline may include (1) passage problems for adult and juvenile lamprey migrating through and past dams; (2) declining conditions of spawning and rearing habitat in freshwater; (3) a decline of the marine prey base; (4) industrial and agricultural pollution; (5) urbanization; (6) dewatering of streams; and (7) adult losses at sea (Close, 2002; Moser and Close, 2003). Although most of these factors could apply to mid-Columbia

River populations of Pacific lamprey, only those related to upstream and downstream passage and habitat conditions in the reservoir may be affected by operation of the project.

Chelan PUD conducted radio-telemetry studies at Rocky Reach during 2004 to assess impediments to upstream passage. Results showed a Net Ladder Passage Efficiency, (the proportion of fish detected in the tailrace of the dam that exit the upstream fishway, adjusted for downstream passage and re-ascent) to be 47 percent (Chelan PUD, 2005a). A comparison of mean migration rates through nine potential fishway entrances at the project showed the slowest migration rates occurred in the uppermost section of the fishway from the ladder flow regulation diffuser to the ladder exit (0.09 meter/minute compared to 1.03 to 21.09 meters/minute in other portions of the fishway). This section of the fishway contains the diffuser, public viewing windows, a Pickett Barrier, and the fish counting window and station, and Chelan PUD speculates that one or more of these structures may delay migration (Chelan PUD, 2005a).

Acquisition of adult upstream Pacific lamprey passage information (efficiency, timing, routes) past the project dam would be important to gain an understanding of project-related effects. Studies conducted at other Columbia River dams indicate that a high percentage (e.g., 30 percent to 40 percent at Bonneville dam [Moser, et al., 2002b]) of lamprey fail to move upstream past the fishways. Adult Pacific lamprey swim close to the bottom and need to attach to surfaces so they may not be able to effectively negotiate fish ladders originally designed to pass salmonids. Since fish ladders at Columbia River dams are similarly designed (Clay, 1995), it is possible that adult Pacific lamprey migration at the project dam is impeded by features similar to those observed at other facilities (i.e., fish count stations, fishway and spillway entrances, areas with diffusion grating, fishway weirs and orifices, and powerhouses and collection channels). Compilation of existing information on Pacific lamprey in the region for factors that impede upstream passage that are analogous to conditions at the project would enable potentially effective fishway modifications to be designed more efficiently.

Chelan PUD's proposal includes investigating and implementing measures to improve upstream passage in the project dam fishways, with the goal of achieving passage rates similar to the best passage rates found at other projects on the Columbia and Snake rivers. This information together with research compiled from fishway modifications implemented elsewhere on the Columbia River would help in the design and implementation of appropriate fishway modifications to improve the passage efficiency of lamprey through the project. However, requiring Chelan PUD to meet the best passage rates found at other projects on the Columbia and Snake rivers is not a well-defined goal, depends on many factors outside the influence of the project, and may not be reasonable or feasible.

Chelan PUD's proposal to identify and implement measures to address unavoidable impacts to achieve "no net impact" is similar to the Umatilla Tribes'

recommendation that project operations, and PME measures result in “no net effect” of the project on Pacific lamprey. However, quantifying effects from downstream passage through spill or the turbines is not technically feasible at this time, and consequently, assessing what constitutes ‘no net impact’ is not currently feasible. Additionally, there is no information in the record that demonstrates the project is affecting lamprey other than through effects on upstream passage.

Determining juvenile Pacific lamprey presence/absence and relative abundance in the reservoir would potentially provide information to fisheries managers on lamprey spawning in the reservoir, and on whether project operations are affecting spawning habitat or spawning success. Chelan PUD’s proposal to contribute to other local or regional lamprey programs to develop methods for research may help to determine what investigation techniques to employ at the project to determine project effects.

The Umatilla Tribes’ recommendations are similar to Chelan’s proposal in that they provide site-specific and applicable regional information that would provide a basis for development and implementation of future lamprey protection and enhancement measures. Development of O&M procedures that would avoid effects on lamprey of such practices as fishway dewatering would reduce project-caused mortality. Fishway dewatering for maintenance purposes typically occurs during the winter, when few fish would be expected to use the fishways. During recent years, Chelan PUD found fewer than 20 adult lampreys a year when it dewatered the fishways for winter maintenance (Chelan PUD, 2006d). This indicates that although routine O&M does not appear to represent a major source of lamprey loss, developing procedures that could minimize the losses that do occur would be beneficial.

The Umatilla Tribes’ proposed Pacific Lamprey Plan calls for Chelan PUD to investigate and implement reasonable and feasible fishway modifications within five years of the issuance of a new license, which is the same as Chelan PUD’s proposal. This would address current passage inefficiencies that have been identified, and the proposed continued monitoring would document the upstream passage effectiveness after any modifications are implemented. Improvements in upstream and downstream lamprey passage at the dam would minimize project impacts and potentially improve survival of lamprey during migrations. Participating in regional research and information exchanges regarding juvenile downstream migration as well as effective fishway modifications would enable Chelan PUD and other members of the RR Fish Forum to evaluate and implement effective improvements to project facilities. Continued monitoring throughout the life of the license, with periodic evaluation and implementation of fishway modifications, would further aid in improving passage performance for lamprey.

Implementation of the HCP could provide additional benefits to Pacific lamprey passing the project and inhabiting tributaries to the Columbia River in the vicinity of the project. Additional benefits to Pacific lamprey could be realized through (1) operation of the juvenile bypass system, which would provide a safe passage route for downstream

migrating macrophthalmia; (2) implementation of the Tributary Enhancement Fund, which would provide habitat improvements in local tributaries; and (3) implementation of the Northern pikeminnow predator control program, which would reduce mortality on downstream migrating macrophthalmia.

The Umatilla Tribes indicate that regional fisheries managers are developing passage standards for juvenile lamprey and that once these standards are developed, Chelan PUD should be required to meet these standards. Because no passage standards exist at this time, we are unable to determine whether such standards would be attainable or what benefit they would have.

For upstream adult lamprey passage, the Umatilla Tribes recommend that Chelan PUD be required to achieve 80 percent upstream passage with a median passage time of 24 hours by 2013. The Umatilla Tribes recommend that by 2030, Chelan PUD should be required to achieve 97-98 percent upstream passage. Regional fisheries managers are in the process of developing upstream passage standards for adult lamprey and there are no widely accepted upstream passage standards for Pacific lamprey at this time. The Tribes state that their recommended passage standards are reasonable and justified and they provided information suggesting 80 percent passage success has been achieved at other projects. Data collected by Chelan PUD at the Rocky Reach Project indicate that current passage rates are between 50 and 60 percent and Chelan PUD has proposed measures to increase those percentages. However, we have no information to indicate that 80 percent passage success is attainable at the Rocky Reach Project or that 98 percent upstream passage is attainable at Rocky Reach or any other project. Additionally, we have no information to indicate that adult lamprey failing to pass the Rocky Reach Project cannot successfully reproduce in areas downstream of the project. Lastly, it is not apparent that the recommended passage levels for the Rocky Reach project are necessary to maintain or recover the Columbia River lamprey population.

The Umatilla Tribes recommend that all Tier 1–3 actions be implemented in consultation with a fisheries technical committee. We view this recommendation to be comparable to the consultation with the RR Fish Forum specified in Chelan PUD's proposal and find that it would have a comparable effect on lamprey management. Cooperatively sharing information among agencies has the potential to result in more informed management decisions, thereby benefiting lamprey populations in the reservoir.

The Umatilla Tribes call for all Tier 1 tasks listed above to be implemented within 2 years of the effective date of the new license, and in consultation with and with the approval of a fisheries technical committee. This includes modeling and design work for passage structures at the dam to determine the most appropriate designs for improving upstream lamprey passage. Information resulting from this work, if used to implement improvements to fishway passage success for lamprey, would benefit lamprey populations by identifying and addressing impediments to passage caused by project facilities and operations. We note, however, that the responsibility for approving

measures called for under a Commission license lies with the Commission, and not other parties.

The Umatilla Tribes recommend 11 Tier 1 environmental measures that call for Chelan PUD to complete a variety of studies at the project, implement fishway modifications, fund physiological and behavioral studies, and fund artificial propagation of juvenile lamprey for use in passage studies. Completing passage studies at the project would aid managers in identifying project structural and operational changes that could be implemented to facilitate lamprey passage at the project. Funding radio-tag, PIT tag, or acoustic tag technology and physiological and behavioral studies for lamprey would aid in research, but it is unclear how funding such research would benefit lamprey populations affected by project operations and facilities.

Eighteen measures are listed in the Umatilla Tribes' Tier 1 monitoring and evaluations above, some of which are duplicates of Tier 1 environmental measures (12, 13, 17). Measures designed to improve upstream and downstream passage counts and success (1, 6, 13, 16, 18) would give managers more reliable information that could be used to address potential impacts to lamprey at the dam. Measures 2-5 and 15 would help to provide information on lamprey abundance and habitat use in the project area. This information could be used to guide potential habitat improvements that could be made to enhance lamprey populations in the reservoir. Measures 9-11 are investments in technology or habitat studies that would not specifically benefit lamprey within the project area and would not help identify or mitigate ongoing project effects. Measure 14 is a process for guiding decisions. Information from measure 18, evaluation of feasibility of trap and haul, would provide data on an alternative method to successfully pass lamprey through the project dam.

The Umatilla Tribes recommend that Chelan PUD complete all Tier 2 tasks within 5 years and Tier 3 measures within 8 years of the effective date of a new license. These tasks include both environmental measures and post-modification monitoring and evaluations that would build on Tier 1 measures. These measures would provide ongoing information that could be used to decrease project impacts and improve populations of lamprey in the project area. Implementing the Tribes' Tier 3 measures for installing additional or newly designed lamprey passage facilities at the project would mitigate project impacts to passage if other measures implemented in Tiers 1 and 2 were deemed insufficient during consultation with management agencies and the Tribes.

3.4.2.4 Fish Spawning and Rearing Habitat

Anadromous Fish

Compensation for losses of mainstem as well as tributary spawning habitat due to inundation by the project reservoir has been established in agreements dating to the construction of the Rocky Reach dam. As part of these agreements, Chelan PUD, tribes,

and fishery agencies agreed upon an artificial production program to mitigate all spawning and rearing effects on spring Chinook salmon and steelhead due to construction and operation of the project (FERC, 1995; Chelan PUD, 1961, 1963a). According to the agreements, the loss of spawning and rearing habitat has been fully mitigated by hatchery production. This program is continuing under the Commission-approved HCP for anadromous fish. The Hatchery Program and Tributary Conservation Program components of the HCP were described earlier in this document.

Resident Fish

Initial project construction raised concerns regarding the potential for loss of fishing opportunities (specifically whitefish) in the project area due to passage and habitat issues. Agreements between Chelan PUD and WDFW (formerly the Washington Department of Game) were established in 1963 to mitigate for project impacts on recreational fishing opportunities. The agreement includes a provision for stocking rainbow trout in local area lakes. The provisions of these agreements are still in effect, and Chelan PUD (2004a) indicates that they are considered successful.

Under the terms of the Settlement Agreement, Chelan PUD proposes to implement the Resident Fish Plan. As a party to the Settlement Agreement, WDFW and FWS concur with the proposal. The goal of the Resident Fish Plan is to protect and enhance resident fish and habitat in the project reservoir, and to enhance recreational fishing opportunities.

The Resident Fish Plan calls for Chelan PUD to continue producing 30,000 pounds of rainbow trout, or other species as agreed to by the RR Fish Forum, for stocking in local area water bodies in Chelan and Douglas counties. It also includes a measure for Chelan PUD to provide funds to evaluate creating an additional fishing opportunity by introducing a new species to the project reservoir. Another element of the plan is for Chelan PUD to implement resident fish enhancement measures in consultation with the RR Fish Forum. The first priority would be to use resident fish enhancement funds in the Lake Chelan Basin. However, through recommendations by the RR Fish Forum, funding could be used within the Rocky Reach Project boundary or in tributaries to the reservoir. Projects that would be considered for funding are:

1. Habitat enhancement on Twentyfive Mile Creek;
2. Culvert modification on Twentyfive Mile Creek to improve upstream fish passage;
3. Installation of remote-site egg incubators on Lake Chelan tributaries;
4. Blocking off the entrance to preclude fish access to the existing degraded Twentyfive Mile Creek spawning channel, and re-visiting Twentyfive Mile Creek spawning channel reconfiguration in the future;

5. Lake Chelan tributary habitat enhancements;
6. Fishing pier acquisition/construction/enhancement in Lake Chelan (located in the lower (Wapato) Basin with suitable public access); and
7. Other projects as recommended by the RR Fish Forum and the Lake Chelan Fish Forum, pending the results of a food web model study to be performed for Lake Chelan.

Chelan PUD also proposes to conduct a 1-year comprehensive evaluation of resident fish abundance and species composition in the project reservoir, focusing on predatory fish species. If the comprehensive evaluation shows that the predatory fish population adversely affects the achievement of HCP Plan Species survival standards in the reservoir, Chelan PUD would consult with the HCP Coordinating Committee to develop and implement predator control measures as necessary to achieve such standards. Following implementation of any such predator control measures in the reservoir, Chelan PUD would conduct an additional one-year follow-up comprehensive evaluation to determine the efficacy of predator control measures undertaken in the reservoir. If it is determined, based on the comprehensive evaluation, that a predatory fish problem does not exist in the reservoir for the HCP Plan Species, Chelan PUD would conduct three 1-year surveys to monitor any changes in abundance or species composition in the resident fish populations in the reservoir. The timing and methodologies for the monitoring surveys would be developed by Chelan PUD in consultation with the RR Fish Forum.

Our Analysis

The Chelan PUD proposal to commit to funding WDFW stocking programs is intended to allow WDFW to exercise a least-cost method of obtaining high quality fish, and would include raising or producing fish for planting in local area water bodies. The settlement parties support this proposal. This proposal is intended to enhance fishing opportunities in the local area.

Under this proposal, Chelan PUD would provide funds to WDFW to raise fish at WDFW facilities. In comments on the draft EIS, WDFW indicated that because of potential effects of hatchery fish on threatened and endangered fish species, the hatchery fish would not be stocked in the project area and would instead be stocked in various water bodies throughout Chelan and Douglas counties. Therefore, under this proposal, fish would be reared at non-project facilities and stocked outside of project area which would contribute to recreational fishing activities in Chelan and Douglas counties, but would not benefit project resources or provide recreation opportunities in the project area.

Chelan PUD's proposal provides a list of potential resident fish measures that could be funded, ranging from habitat enhancement activities to funding food-web model studies. Habitat improvements and culvert modifications at Twentyfive Mile Creek, and

Lake Chelan tributary enhancements, would potentially provide more suitable spawning habitat for resident fish in Lake Chelan. Installation of remote site incubators could improve the recruitment of salmonid fry over natural conditions. Increasing fishing pier availability for the public can improve the opportunity for recreational fishing for non-boaters.

The PDEA did not identify any effects on resident fish (Chelan PUD, 2004a) and no other impacts have been identified in the record. According to the Resident Fish Plan, the specific habitat improvement projects would be determined in consultation with the RR Fish Forum and would be intended to provide fishing opportunities for anglers in the Lake Chelan Project area, Rocky Reach Project area, or in tributaries to the Rocky Reach Project. The list of potential habitat improvement projects included in the Resident Fish Plan suggests that these measures would either directly enhance fish habitat and fish numbers or provide fishery managers with information useful in managing local recreational fisheries. However, because no specific location for implementing the resident fish habitat enhancement measures has been selected, we cannot determine the effect of this proposal on Rocky Reach Project resources.

As part of the Resident Fish Plan, Chelan PUD proposes to investigate the introduction of a new species for recreational fisheries in the project reservoir. This measure would provide information to fisheries managers and could lead to development of new fishing opportunities in the project area. However, introducing a new species to the project reservoir could adversely affect threatened and endangered fish species and it is not clear that such a measure is necessary or appropriate.

Conducting a comprehensive evaluation of the effects of predatory resident fish species on HCP Plan Species could be useful in identifying effective ways to increase reservoir survival of juvenile salmon and steelhead. However, if the comprehensive evaluation does not reveal any significant link between predatory fish and juvenile salmon and steelhead survival, Chelan would conduct three 1-year surveys to monitor changes in abundance or species composition of reservoir resident fish populations. It is not clear why the information from these latter surveys is needed or how it would be used. There is no information on the record to suggest that ongoing operations or programs affect resident fish, nor is there information about how data from these surveys would be used to benefit fish in the project area.

3.4.2.5 Predation

The project dam has altered the fluvial dynamics of the reservoir and has increased habitat for both native and non-native predatory fish species. There are approximately 41 species of fish in the project area; about half of them are piscivorous. Of the piscivores, northern pikeminnow, walleye, smallmouth bass, and white sturgeon may affect the survival of juvenile anadromous fish in the project area through predation. Walleye,

smallmouth bass, and white sturgeon are not abundant in the project area (Burley and Poe, 1994; BioAnalysts, 2000a) and, therefore, do not represent an important source of mortality for juvenile anadromous fish. WDFW stated in its comments on the draft EIS that the size of the walleye population in the Rocky Reach reservoir is significantly under-represented by fish presence surveys conducted to date. However, WDFW did not provide any evidence to support this statement or to indicate that walleye may be affecting populations of native fish or anadromous salmonids in the reservoir.

As a provision of the HCP, Chelan PUD would continue to conduct a predator control program to reduce predation-related mortality of juvenile salmon and steelhead. The program would contribute to the HCP's 93 percent survival goal for juvenile fish passing the project. Chelan PUD would conduct control efforts for both northern pikeminnow and piscivorous bird populations for the protection of juvenile Plan Species. Northern pikeminnow would be primarily controlled using hook and line angling at the dams and in project reservoirs. Longlines and trapping could also be used. Piscivorous bird populations, including Caspian terns, double-crested cormorants, and various gull species would be hazed, using such techniques as wire arrays in the tailrace, propane cannons, various pyrotechnics, and lethal control when necessary. This program is supported by parties to the HCP and participants of the Natural Resources Working Group.

Our Analysis

The nature of fish passage facilities tends to cause numbers of migrating fish to concentrate near the dam. This can facilitate foraging by predatory fish as well as avian predators. Northern pikeminnow, in particular, tend to concentrate in tailrace areas downstream of mainstem dams during the juvenile salmonid migration period. They hold in relatively slow-moving water areas (less than about 3 feet per second) near passage routes, where they prey upon the migrating salmonid smolts. In addition, avian predators pose a predation problem by disrupting and feeding on young fish in rearing and holding habitats.

Chelan PUD has implemented a predator abatement program for northern pikeminnow as a means of increasing the survival of juvenile anadromous fish that migrate through the project reservoir and pass the dam. Chelan PUD indicated that this program has proven to be successful in reducing the number of large (greater than 10 inches in length) northern pikeminnow that are known to consume outmigrating smolts. In 2003, 23,700 pikeminnow were removed from the Rocky Reach and Rock Island hydroelectric project reservoirs. Nearly 80 percent of the pikeminnow caught were less than 10 inches in length, indicating that the program is reducing the population of older, larger pikeminnows. The HCP provides for continuation of this program.

In 2002, Chelan PUD contracted with the University of Washington and WDFW to determine what effect avian predators were having on the outmigrating salmonid population. The product of this 3-year study will be an adaptive management program that would allow Chelan PUD to meet the HCP goals without having a negative effect on the local piscivorous bird populations (Chelan PUD, 2003b).

The predator control provisions of the HCP would reduce the numbers of predatory northern pikeminnow in the reservoir, resulting in a decrease in predation on juvenile anadromous fish, thereby increasing smolt survival and adult returns to the project area. Avian control programs would also increase smolt survival and ultimately help increase survival to adults.

3.4.2.6 Pool Fluctuations

Project-related fluctuations in both surface water elevation and water velocity in the Rocky Reach pool have the potential to affect migration, spawning, rearing, and stranding of fish within the reservoir, as well as riparian zone structure and reservoir habitat. Chelan PUD proposes to avoid such effects by continuing to operate the project under the Hourly Coordination Agreement, to which it is a signatory party, which establishes operating protocols that facilitate maintaining mid-Columbia reservoirs at or near full pool levels. This agreement is described in more detail in section 3.4.2.1, *Water Use and Quantity*. Chelan PUD also proposes to continue operating the project under the Hanford Reach Agreement.

The Umatilla Tribes recommend that Chelan PUD adhere to Hourly Coordination operational protocols developed for the Hanford Reach adult fall Chinook salmon spawning period and the Hanford Reach juvenile fall Chinook salmon susceptibility period (approximately March through early May) each year.

Our Analysis

Currently, the project operates in the top 1 foot of reservoir storage 73 percent of the time and within the top 2 feet 98 percent of the time. BioAnalysts (2000c) reported on an investigation into the potential effects of Rocky Reach pool fluctuations on fisheries resources. The investigation included an assessment of effects on ESA-listed anadromous fish populations, as well as the riparian habitat bordering the pool. BioAnalysts' study found no incidents of fish stranding since May 1988. The Rocky Reach forebay water level is very stable (within elevation 705 to 707 feet) and the forebay water level changes slowly because the forebay surface area is large compared to the hydraulic capacity of the powerhouse. These operational characteristics help avoid fish stranding.

No adverse effects on fish due to pool fluctuations have been identified as a result of project operations, and we conclude that no additional environmental measures are necessary beyond continued operation under the protocols established under the Hourly Coordination Agreement.

3.4.2.7 Other Fisheries Issues

Management/Oversight of Plans

Under the terms of the Settlement Agreement, Chelan PUD proposes that the Natural Resources Working Group would continue to function as the RR Fish Forum following the effective date of a new license and any subsequent annual licenses. The RR Fish Forum would be responsible for meeting to share information, coordinate efforts, and make recommendations regarding the implementation of the Bull Trout Plan, Pacific Lamprey Plan, Resident Fish Plan, and White Sturgeon Plan. The RR Fish Forum would be a recommending body only. The HCP Coordinating Committee would have management and oversight of measures relating to the HCP Plan Species. As a party to the Settlement Agreement, WDFW concurs with Chelan PUD's proposal.

The Umatilla Tribes recommend that Chelan PUD ensure that decisions are made through adaptive management, are consensus-based, and subject to appropriate dispute resolution procedures. The tribes call for Chelan PUD to establish one, truly comprehensive fisheries and aquatics committee (Fisheries Technical Committee) that would implement adaptive management measures for Pacific lamprey, sturgeon, Chinook salmon, steelhead, coho salmon, and sockeye salmon.

The Umatilla Tribes recommend that Chelan PUD develop a detailed fishery operations plan for the operation of the project to meet performance goals and objectives for salmon.

In addition, the Umatilla Tribes recommend that Chelan PUD establish hatchery and habitat management plans and expedite implementation of actions in these plans in coordination with and with the approval of the Fisheries Technical Committee. The Umatilla Tribes state that these plans should contain state-of-the-art bioengineering and other applicable methods and standards.

Our Analysis

The HCP Coordinating Committee has been established to oversee all aspects of the standards, methods, and implementation of the HCP by various means, including establishing methods to determine if survival standards are being achieved, determining if the signatories are carrying out their responsibilities, determining if no net impact is achieved, approving study plans and reviewing study results, making adjustments to the

passage survival plan, resolving disputes, and adjusting schedules and dates for performance.

The settlement parties have worked collaboratively to develop four management plans for HCP non-Plan Species. Chelan PUD's proposal would maintain the same process of technical review of various fisheries issues currently served by the Natural Resources Working Group, though the group would be renamed the RR Fish Forum.

Establishment of the RR Fish Forum, together with the HCP Coordinating Committee, would satisfy the Umatilla Tribes' recommendation.

Aquatic Invasive Species

Eurasian watermilfoil is present in project waters, and Chelan PUD currently harvests the aquatic weed at the project's recreational facility public access points. Under Chelan PUD's proposal, Chelan PUD would continue this effort. Zebra mussels do not currently occur in project waters. Chelan PUD has an ongoing program that includes plankton tow net sampling to monitor for the presence of zebra mussels on project structures. The PUD has also scheduled the use of mussel traps in project waters.

As reflected in the Settlement Agreement, Chelan PUD proposes to develop and begin implementation of an aquatic invasive species monitoring and control plan coordinated with WDOE's Freshwater Aquatic Weed Control Program to monitor for the presence of new aquatic invasive species at or near project facilities within one year of the effective date of a new license, in consultation with the RR Fish Forum. They propose that the plan and implementation include the following components: signage at boat launches and distribution of educational materials and boater questionnaires to voluntary participants at Rocky Reach reservoir boat launch sites during the peak boating season (May 1 to October 30 each year) to increase boater awareness of the issue; development of methods and a schedule of prevention, monitoring and control measures regarding the presence and movement of aquatic invasive species at or near project facilities; and an annual report of monitoring and educational activities conducted in the preceding year. WDFW, as a signatory to the Settlement Agreement, supports this proposal.

Our Analysis

Aquatic invasive species are often spread by recreational watercraft, and these species can pose a threat to native aquatic species. Eurasian watermilfoil is already present in project waters, although zebra mussels do not currently exist west of the Missouri River system. One way to reduce the spread of existing aquatic invasive weeds and to minimize the risk of zebra mussels expanding into the project area is to develop a prevention program aimed at educating boaters on how they can contribute to achieving those goals. The aquatic invasive species prevention program proposed by Chelan PUD

does not identify particular invasive SOCs, but could, if successful, provide a benefit to native aquatic species by: (1) promoting boater awareness and understanding of the general problem of aquatic invasive species, (2) providing for boat inspections to limit the spread of aquatic invasive species from one water system to another, (3) helping reduce the spread of aquatic invasive weeds, and (4) providing a means of rapid response for any new aquatic invasive species that could enter into the project waters and pose a threat to native species.

Chelan PUD's proposal to develop and implement an aquatic invasive species monitoring and control plan as described would facilitate the coordination of their actions with state activities and programs, potentially increasing their effectiveness, and would help Chelan PUD coordinate its actions with federal agencies that administer regional programs to monitor for invasive species.

3.4.3 Cumulative Effects

Of the measures proposed within this section, measures for anadromous fish including the Hanford Reach Agreement and HCP, the White Sturgeon Plan, and the Pacific Lamprey Plan are expected to contribute to cumulative effects on fisheries resources.

3.4.3.1 Anadromous Salmonids

Flow releases from the project have the potential to affect fish habitat found in waters downstream of the project. The Hanford Reach Agreement replaces the June 16, 1988, Vernita Bar Agreement to protect and enhance fall Chinook salmon on Vernita Bar during the spawning, pre-hatch, post-hatch, and emergence periods. The agreement provides for minimum flows and regulation of flow fluctuations in the Hanford Reach to reduce the cumulative effects of hydropower operations on fall Chinook salmon fry during the rearing period. The Hanford Reach Agreement establishes reservoir operating procedures that would be followed by Chelan PUD and Douglas PUD during the rearing period to assist Grant PUD in reducing flow fluctuations in the Hanford Reach to minimize effects on fall Chinook salmon, thereby reducing the cumulative effect on this species within the Columbia River Basin.

The Commission was a cooperating agency in the NMFS' final EIS for the HCP (NMFS, 2002) that analyzed environmental measures specified in the HCP, and cited that analysis in its Order Amending the License of the Rocky Reach Project. The HCP addresses a wide range of issues affecting salmon populations in the project area and the basin. Implementation of the HCP, in addition to federal, tribal, state and local salmonid recovery programs, is expected to increase wild fish populations in the Columbia River. Other environmental effects of the HCP and Columbia River Basin recovery programs are expected to include an increase in native riparian vegetation, an increase in wildlife

dependent on riparian habitat, a decrease in predators of salmonids (piscivorous fish and birds), habitat protection and enhancement, an increase in employment associated with habitat restoration and commercial and recreational fishing, more natural aesthetic settings in salmonid streams, an increase in passive recreational opportunities (such as hiking and boating), and increased protection of Native American cultural resources, including salmon. The HCP would reduce direct and indirect project-related effects on Plan Species, thereby reducing the cumulative effects on these species within the Columbia River Basin.

3.4.3.2 White Sturgeon

Development of hydroelectric power generation facilities within the Columbia River Basin has adversely affected white sturgeon. White sturgeon rarely uses the fish ladder at the project for upstream or downstream passage, but they do move downstream by passing through the turbines or in spill. The project dam would continue to present an upstream barrier to white sturgeon, as would other projects on the Columbia River.

Chelan PUD's proposal includes measures to mitigate this adverse effect. Implementation of the measures contained in the plan would increase the population of white sturgeon to a sustainable level, to be determined by the monitoring and evaluation, and includes the flexibility to adjust the program over the term of the new license as new information is gathered.

3.4.3.3 Pacific Lamprey

The number of adult Pacific lamprey returning to the Upper Columbia River appears to have declined over the past 40 years. These declines have been attributed to a variety of factors, including degraded habitats, past fisheries management practices, water pollution, dam passage problems, ocean conditions, and food availability. Adult lamprey uses the fish ladder at the project for upstream passage to spawning grounds. Juveniles migrate downstream to the ocean and pass through the juvenile bypass system, through the turbines, or in spill. Specific mortality rates for lamprey from Columbia River projects are not yet known. However, it is likely that some delays occur within the fish ladders and that some mortality occurs during downstream movements.

Chelan PUD proposes to investigate and implement feasible adult fishway modifications to mitigate this adverse effect on passage. Implementation of these measures would improve lamprey passage through the fish ladder.

3.4.4 Unavoidable Adverse Impacts

Continued operation of the Rocky Reach dam facilities will result in unavoidable losses to anadromous and resident fish species in the reservoir through turbine mortality,

upstream and downstream fish passage delays, and adverse effects on critical habitats. Measures contained in the HCP and the four proposed fish management plans are designed to minimize harm to fish species, to mitigate for fish losses, and to enhance the potential for species survival through the project.

3.5 TERRESTRIAL RESOURCES

3.5.1 Affected Environment

3.5.1.1 General Description of Terrestrial Resources

Located in the rain shadow of the Cascade Range, the mid-Columbia region is classified as arid to semi-arid and experiences dry summers with warm to hot temperatures and relatively cold winters. Continental-type climate conditions prevail, with some marine influences. Most of the Columbia River Basin receives less than 20 inches of precipitation annually, with much of this precipitation occurring in winter. Deep snow can accumulate on the mountainous areas, where water is held as natural storage until spring runoff.

Existing botanical resources consists mainly of shrub-steppe communities on upland habitats adjoining the project. Riparian and wetland plant communities have developed on the shoreline of the project reservoir, which inundated similar communities when the project was constructed in 1957. There are additional areas of riparian and wetland vegetation along tributary streams and rivers. In addition, there are some sparsely vegetated habitats with unique soil types including gravelly or sandy soils, shallow and/or stony sites, and sand dunes near the Columbia River (Franklin and Dyrness, 1973).

Disturbed/developed/modified cover types make up approximately 57 percent of the project area (DES, 2000). Orchards occupy the largest cover-type area (25.2 percent), followed by shrub-steppe (22.3 percent) and residential/industrial (15.6 percent) cover types. Collectively, riparian and shoreline wetland habitats constitute a small portion of all habitats in the area (9.2 percent). From 1991 to 1999, the residential/industrial cover type increased more than any other (approximately 230 acres), followed by the recreational cover type (increase of approximately 59 acres).

3.5.1.2 Botanical Resources

Upland Vegetation

Botanical investigations in the project area (Caplow, 1990)²⁶ identified undeveloped areas of shrub-steppe vegetation dominated by big sagebrush (*Artemisia tridentata*), rabbitbrush (*Chrysothamnus* species [spp.]), bitterbrush (*Purshia tridentata*), bluebunch wheatgrass (*Pseudoroegneria spicata*), arrowleaf balsamroot (*Balsamorhiza sagittata*), and numerous non-native weed species such as cheat grass (*Bromus tectorum*), bulbous bluegrass (*Poa bulbosa*), knapweeds (*Centaurea* spp.), Russian thistle (*Salsola kali*), and western tansy-mustard (*Descurainia pinnata*).

The shrub-steppe cover type is the predominant native terrestrial habitat in the study area (22.3 percent), but this cover type decreased more than any other cover type from 1991 to 1999 (approximately 204 acres) (DES, 2000). Most of this change was associated with new residential development and the expansion of existing orchards. Much of the remaining shrub-steppe cover type consists of small patches fragmented by orchards, residential developments, recreational facilities, and roads. Only north of Beebe Bridge is there a large unbroken expanse of shrub-steppe habitat. Wildlife species associated with shrub-steppe habitats in Washington are diverse and include several species that are considered obligate to this unique habitat (Dobler et al., 1996). Eleven of the 40 rare, threatened, and endangered (RTE) wildlife species potentially occurring within the vicinity of the project are closely associated with shrub-steppe habitats.

Wetland and Riparian Vegetation

Riparian and Shoreline Wetlands

Riparian and shoreline wetland habitats observed in the study area are small, isolated, and distinctly linear (DES, 2000). Expansion of the riparian vegetation in the project area is restricted by the arid conditions at higher elevations, rip-rapped embankments, and agricultural development. At lower elevations in undeveloped areas, shrub and forest riparian zones are dominated by species such as white alder (*Alnus rhombifolia*), water birch (*Betula occidentalis*), black cottonwood (*Populus balsamifera* spp. *trichocarpa*), willows (*Salix* spp.), and quaking aspen (*Populus tremuloides*). Common shrub species include wood rose (*Rosa woodsii*), redbud dogwood (*Cornus sericea*), and snowberry (*Symphoricarpos alba*). Common herbaceous species include stinging nettle (*Urtica dioica*) and reed canarygrass (*Phalaris arundinacea*).

²⁶ The project area covered by Caplow (1990) includes both lands within the project boundary and areas outside the project boundary that are likely to be affected by project operations.

Riparian and shoreline wetland habitats constitute a small portion of all habitats in the area (9.2 percent), but contribute disproportionately to the biodiversity of the region. Approximately 85 percent of Washington's wildlife species use riparian habitats at some time during their life cycle (Knutson and Naef, 1997). Some of the reasons why riparian and wetland habitats are so important to wildlife include: (1) the presence of water for drinking, bathing, or reproduction (amphibians); (2) high vegetative biomass; (3) high structural diversity; (4) the presence of edge habitats; (5) the presence of cool, shaded and humid microclimates; and (6) readily usable corridors for migration and travel (Thomas, 1979). Riparian habitats within arid or semi-arid environments are particularly distinctive and support species assemblages that could not occur otherwise.

The RTE Wildlife and Cover-type Mapping Study (DES, 2000) shows relatively small changes in riparian habitat over the past decade compared to mapping conducted by Ebasco Environmental in 1990 (EBASCO, 1991). Riparian cover types decreased by approximately 20 acres (5.6 percent) within the study area from 1991 to 1999, although the majority of this change was due to a reclassification of lawns within the Riparian Grassland type to Residential/Industrial. Riparian Deciduous Tree cover-types decreased by approximately 25 acres and Riparian Shrub cover-types increased by approximately 31 acres; therefore, the combined area of those cover types is generally unchanged. Differences in field interpretation could account for this difference. This finding suggests that riparian habitats within the study area are stable and have adapted to the water-level fluctuations associated with project operation. Irrigation runoff from adjacent orchards may influence some riparian habitats within the study area. This supplemental groundwater may promote development of riparian vegetation in areas that would otherwise be too dry. Furthermore, some existing riparian vegetation may be more lush because of this supplemental water source than it would be under natural conditions.

Submerged Wetlands

Chelan PUD's aquatic habitat mapping study (DES, 2001a) estimated the total acreage of aquatic macrophyte beds in the project reservoir to be about 386 acres in 1999. Submerged aquatic vegetation and submerged terrestrial grasses were the second most abundant aquatic cover type available in the project reservoir. Boulders formed the most abundant cover type.

Earlier wetland mapping efforts (Chelan PUD, 1991) also found wetland habitats to be widespread within the project area and consisting primarily of submerged aquatic vegetation beds and patches of emergent wetlands. These habitats are typically located in protected coves or in shallow areas where sediment has accumulated. They are also often found in isolated depressions associated with the railroad and the highways that parallel much of both sides of the river (Chelan PUD, 1991). Dominant native plant species of wetland habitat types within the project area include slender-leaved pondweed

(*Potamogeton filiformis*), common waterweed (*Elodea canadensis*), common cattail (*Typha latifolia*), and tule (*Scirpus validus*).

Noxious Weeds

A number of non-aquatic weeds classified as Class B designate and Class C non-aquatic noxious weeds for Chelan County²⁷ are also known to exist within the project area (Chapter 16-750 WAC). These include purple loosestrife (*Lythrum salicaria*), several species of diffuse knapweed (*Centaurea diffusa*), Russian knapweed (*Acroptilon repens*), perennial pepperweed (*Lepidium latifolium*), Dalmatian toadflax (*Linaria dalmatica*), yellow starthistle (*Centaurea solstitialis*), common mullein (*Verbascum thapsus*), camelthorn (*Alhagi maurorum*), Canada thistle (*Cirsium arvense*), common St. John's-wort (*Hypericum perforatum*), and hoarycress (whitetop) (*Cardaria draba*).

Chelan PUD continues to implement an annual purple loosestrife control program that was initiated in 1994. Purple loosestrife first began to appear in the Rock Island and Rocky Reach Project reservoirs in the early 1990s. Chelan PUD conducted a survey in 1993 to map purple loosestrife locations along both project reservoirs. The survey identified 110 locations with purple loosestrife. In the same year, Chelan PUD recognized purple loosestrife as a noxious weed and potential threat to wildlife habitat. As part of the control program, professional applicators are contracted to apply the herbicide Rodeo. There has been some decrease in the amount of purple loosestrife as a result of these annual efforts. However, purple loosestrife remains present along the reservoir shorelines.

Rare Plant Species

During a rare plant survey from 1999 to 2000 (Calypso Consulting, 2000), botanists located 14 populations of 6 rare plant species in the project area that are state-listed species: porcupine sedge, giant helleborine, adder's-tongue, little bluestem, blue-eyed grass, and Ute ladies'-tresses (table 10). One of these, the Ute ladies'-tresses, is also federally listed as a threatened species and is discussed in section 5.3.5, *Threatened and Endangered Species*.

²⁷ Class B designated noxious weeds are those that have become established in some parts of Washington but are of limited distribution or not present in other regions of the state. In regions where a Class B noxious weed is unrecorded or of limited distribution, prevention of seed production is required. In these areas, the weed is a "Class B designate," meaning it is designated for control by state law. Class C noxious weeds are those already widely established in Washington or of special interest to the state's agricultural industry. Placement on the state noxious weed list allows counties to enforce control if locally desired.

Table 10. Rare plant populations at the Rocky Reach Project area, 1999–2000.
(Source: Calypso Consulting, 2000)

Common Name	Scientific Name	Status	Number of Populations Observed during RTE Wildlife Study
Ute ladies'-tresses	<i>Spiranthes diluvialis</i>	State/federal threatened	3
Porcupine sedge	<i>Carex hystericina</i>	State sensitive	4
Giant helleborine	<i>Epipactis gigantea</i>	State sensitive	4
Adder's-tongue	<i>Ophioglossum pusillum</i>	State threatened	1
Little bluestem	<i>Schizachyrium scoparium</i>	State threatened	1
Blue eyed grass	<i>Sisyrinchium montanum</i>	State threatened	1

Each plant taxon of interest is described and summarized below. The rare plant survey included all lands within the project boundary and immediately adjacent lands likely to be affected by project operations; however, it did not differentiate whether populations were within or just outside of the project boundary. The study area for rare plant species extends from the tailrace of Rocky Reach dam (RM 473.5) upstream to the tailrace of Wells dam (RM 516.5). The project boundary varies in elevation along the reservoir and corresponds to the water elevation associated with the probable maximum flood.

Giant Helleborine and Porcupine Sedge

The 1999–2000 survey located four populations of giant helleborine within the project area. Two populations are associated with lakes, one is associated with a slough, and the remaining population includes all giant helleborine plants found directly along the Columbia River. The three lake- and slough-associated populations are limited in size. The river population includes, and greatly expands upon, the nine occurrences located during a previous rare plant survey conducted in 1990 for a proposed pool raise. That study area included all land subject to inundation or vegetation change as a result of the proposed pool raise. In 1990, these nine giant helleborine occurrences ranged in size from 9 to more than 250 stems, with an estimated total of 700 stems (Calypso Consulting, 1990). Currently, the river population consists of approximately 60 subpopulations and many thousands of stems.

The 1999–2000 survey also located four populations of porcupine sedge within the project area. All four populations of porcupine sedge were found growing among populations of giant helleborine. In 1990, no populations of porcupine sedge were located.

Adder's Tongue

Adder's-tongue is known to occur at 12 sites in scattered counties in Washington (Washington Natural Heritage Program, 2000). During the 1999–2000 survey, one adder's-tongue population with approximately 150 plants was found on Chelan PUD-owned land in a moist, herbaceous meadow adjacent to a small pond near the Columbia River. The pond is not directly connected hydrologically to the Columbia River via surface water (Calypso Consulting, 2000). However, there is probably a groundwater connection through the gravelly substrate between the pond and the river.

Little Bluestem

One population of little bluestem was found during the 1999–2000 survey (Calypso Consulting, 2000); it is the second population to be located in the state of Washington, where it is listed as threatened.

Blue-Eyed grass

One small population of approximately 50 blue-eyed grass plants was located in the project area, just above the high water level of the Columbia River (Calypso Consulting, 2000). This is the first known population of this taxon in the state of Washington. The plants were discovered growing in a mossy, vernal moist seep on the side of a hill in a silt loam substrate. This is the only known habitat of this sort on the Rocky Reach reservoir. This species is listed as threatened in the state of Washington.

3.5.1.3 Wildlife Resources

Mammals

Mule deer (*Odocoileus virginianus*), bighorn sheep (*Ovis canadensis*), cougar (*Felis concolor*), bobcat (*Lynx rufus*), and coyotes (*Canis latrans*) inhabit the mid-Columbia region. These species are present near the project reservoir, and have been recorded occasionally within the project boundary. WDFW manages big game winter areas adjacent to the west shore of the downstream half of the project reservoir; a deer fence, State Highway 97A, and a railroad separate the state management area lands from the project reservoir and habitats immediately adjacent to the shoreline.

In the mid-1960s, Chelan PUD provided funds to the Washington Department of Game (now WDFW) for the purchase of 20,397 acres of land along the Columbia River between Swakane Canyon and Chelan Butte. These lands, the Swakane, Entiat, and Chelan Butte WAs (figure 2), collectively known as the Chelan Wildlife Area, were purchased to mitigate the loss of the wildlife habitat that was inundated by the Rocky Reach and Lake Chelan Projects. The lands that were purchased provide important mule deer winter range within Chelan County. These lands are primarily composed of shrub-steppe habitat at the lower and intermediate elevations on exposed south-facing slopes. Some lands at the highest elevations are predominantly forested with alpine meadow and barren rocky areas (Myers, 2003). WDFW manages these lands.

Small mammals that use areas along the project shoreline include a variety of bat species; badgers (*Taxidea taxus*); striped skunks (*Mephitis mephitis*); a large variety of moles, voles, mice, and shrews; long-tailed weasels (*Mustela frenata*); mink (*M. vison*); raccoons (*Procyon lotar*); porcupines (*Erethizon dorsatum*); river otters (*Lutra canadensis*); beaver (*Castor canadensis*); and muskrats (*Ondatra zibethicus*). Shrub-steppe shorelines provide habitat for Great Basin pocket mice (*Perognathus parvus*), deer mice (*Peromyscus maniculatus*), and western harvest mice (*Reithrodontomys megalotis*), while talus slopes are used by yellow-bellied marmots (*Marmota flaviventris*), bushy-tailed woodrats (*Neotoma cinerea*), and Nuttall's cottontails (*Sylvilagus nuttalli*). Riparian cottonwood, ponderosa pine, and willow areas provide forage and cover for a variety of species.

Avian Species

There is a diverse array of avian habitat within the project area and surrounding vicinity. For example, belted kingfishers (*Ceryle alcyon*) use willows and cottonwoods as hunting perches. Large cottonwoods and ponderosa pine provide perch and nest sites for raptors and woodpeckers. Riparian and wetland vegetation provide nest, forage, and cover habitat for songbirds. Fruit orchards are used by a variety of birds, especially mourning doves (*Zenaida macroura*). Shorebirds include killdeer (*Charadrius vociferus*), spotted sandpipers (*Actitis macularia*), terns (*Sterna* spp.), herons, and gulls.

The project reservoir provides limited habitat for breeding waterfowl. Canada geese (*Branta canadensis*), mallards (*Anas platyrhynchos*), and common mergansers (*Mergus merganser*) are probably the most common breeding waterfowl, although backwater areas probably also support a few nesting pairs of pied-billed grebes (*Podilymbus podiceps*) and coots (*Fulica atra*). Winter use of the reservoir by waterfowl and other waterbirds is significant. Approximately 16,000 to 17,000 birds winter on the reservoir each year (Fielder, 1991), with 40 percent being coots.

Raptors that nest in the vicinity of the project reservoir include red-tailed hawks (*Buteo jamaicensis*), American kestrels (*Falco sparverius*), ravens (*Corvus corax*), great horned owls (*Bubo virginianus*), osprey (*Pandion haliaetus*), bald eagles (*Haliaeetus*

leucocephalus), and western screech-owls (*Otus kennicottii*). Cliffs and large cottonwoods and ponderosa pines provide raptor nesting sites. Artificial nesting platforms established by Chelan PUD also are used by some species, and nest boxes maintained by Chelan PUD and WDFW are used by kestrels.

Reptiles and Amphibians

Amphibians likely to be present in project area wetlands include Pacific tree frogs (*Hyla regilla*), tiger salamanders (*Ambystoma tigrinum*), long-toed salamanders (*Ambystoma macrodactylum*), Columbia spotted frogs (*Rana luteiventris*), western toads (*Bufo boreas*), great basin spadefoots (*Scaphiopus intermontanus*), and bullfrogs (*Rana catesbiana*). Shallow backwater areas and temporary pools provide habitat for these species.

Reptiles present in the project area include painted turtles (*Chrysemys picta*), western rattlesnakes (*Crotalus viridis*), gopher snakes (*Pituophis catenifer*), western fence lizards (*Sceloporus occidentalis*), western skinks (*Eumeces skiltonianus*), rubber boas (*Charina bottae*), and western terrestrial and common garter snakes (*Thamnophis* spp.). Some of these species are closely associated with wetlands (e.g., painted turtles) while others are more common along rocky and talus shorelines (e.g., rubber boas).

Rare Wildlife Species

Chelan PUD conducted a survey for RTE wildlife in the project area in 2000 (DES, 2000). The study area for the wildlife survey consisted of lands within the project boundary and areas likely to be affected by project operations. The study area extends from the tailrace of the project (RM 473.5) upstream to the tailrace of the Wells Project dam (RM 516.5). The width of the rare wildlife species study area varies by location but generally lies between the major roadways on either side of the Columbia River.

State and federally listed wildlife species that are known to, or potentially, occur within the study area are listed in table 10, along with an indication of whether they were observed during the RTE wildlife study. Potential occurrence for each species was determined from confirmed records and known distribution and habitat requirements. The Washington Gap Analysis Project and Chelan PUD records were the primary sources used to develop this list (DES, 2000).

Eleven state and/or federally listed species were documented during the RTE Wildlife Study (DES, 2000) in the project study area. These species, as well as monitor²⁸ and candidate species, are listed in table 11.

²⁸ State Monitor species are not considered state Species of Concern, but are monitored for status and distribution. They are managed by WDFW, as needed, to prevent them from becoming endangered, threatened, or sensitive.

Table 11. State and federally listed and monitored wildlife species known to occur or that may occur in the Rocky Reach Project area. (Source: DES, 2000)

Common Name	Scientific Name	Status	Known to occur in the project area
Bald eagle	<i>Haliaeetus leucocephalus</i>	State/Federal Threatened	Yes ^a
Pygmy rabbit	<i>Brachylagus idahoensis</i>	State/Federal Endangered	No
Common loon	<i>Gavia immer</i>	State Candidate	Yes ^a
Great blue heron	<i>Ardea herodias</i>	State Monitor	Yes ^a
Osprey	<i>Pandion haliaetus</i>	State Monitor	Yes ^a
Northern goshawk	<i>Accipiter gentilis</i>	State Candidate, Federal SOC	Yes
Swainson's hawk	<i>Buteo swainsoni</i>	State Monitor	Yes
Golden eagle	<i>Aquila chrysaetos</i>	State Candidate	Yes ^a
Peregrine falcon	<i>Falco peregrinus</i>	State Endangered, Federal SOC	Yes
Prairie falcon	<i>Falco mexicanus</i>	State Monitor	No
Burrowing owl	<i>Speotyto cunicularia</i>	State Candidate, Federal SOC	Yes
Sage grouse	<i>Centrocercus urophasianus</i>	State Threatened, Federal SOC	No
Sharp-tailed grouse	<i>Tympanuchus phasianellus</i>	State Threatened, Federal SOC	No
Lewis' woodpecker	<i>Melanerpes lewis</i>	State Candidate	Yes
White-headed woodpecker	<i>Picoides albolarvatus</i>	State Candidate	Yes
Pileated woodpecker	<i>Dryocopus pileatus</i>	State Candidate	No
Olive-sided flycatcher	<i>Contopus borealis</i>	Federal SOC	Yes
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	Federal Candidate	No
Willow flycatcher	<i>Empidonax traillii</i>	Federal SOC	Yes
Loggerhead shrike	<i>Lanius ludovicianus</i>	State Candidate, Federal SOC	Yes ^a
Sage thrasher	<i>Oreoscoptes montanus</i>	State Candidate	Yes
Sage sparrow	<i>Amphispiza belli</i>	State Candidate	No
Merriam's shrew	<i>Sorex merriami</i>	State Candidate	No

Common Name	Scientific Name	Status	Known to occur in the project area
Small-footed myotis	<i>Myotis ciliolabrum</i>	State Monitor, Federal SOC	Yes ^a
Little brown myotis	<i>Myotis lucifugus</i>	State Monitor, Federal SOC	Yes ^a
Yuma myotis	<i>Myotis yumanensis</i>	State Monitor, Federal SOC	Yes ^a
Big brown bat	<i>Eptesicus fuscus</i>	State Monitor	No
Pallid bat	<i>Antrozous pallidus</i>	State Monitor	No
Townsend's big-eared bat	<i>Corynorhinus townsendii</i>	State Candidate, Federal SOC	No
Western gray squirrel	<i>Sciurus griseus</i>	State Threatened, Federal SOC	Yes
Sagebrush vole	<i>Lemmyscus curtatus</i>	State Monitor	No
California bighorn sheep	<i>Ovis canadensis</i>	Federal SOC	Yes
Sagebrush lizard	<i>Sceloporus graciosus</i>	Federal SOC	Yes ^a
Night snake	<i>Hypsiglena torquata</i>	State Candidate	No
Western toad	<i>Bufo boreas</i>	State Candidate/ Federal SOC	Yes ^a

Note: SOC – species of concern

^a Observed during the RTE Wildlife Study (DES, 2000).

3.5.2 Environmental Effects

Chelan PUD proposes (Settlement Agreement Article 7) to fund implementation of the Wildlife Plan (Chelan PUD, 2006e) developed in consultation with the NSWG during pre-filing consultation and revised several times before reaching its final version in the Settlement Agreement. The objectives of the Wildlife Plan are to: (1) restore, maintain, or improve the Chelan Wildlife Area; (2) restore, maintain, improve, or increase habitat for key indicator wildlife species; and (3) implement the “Ute Ladies’-tresses (*Spiranthes diluvialis*) Along Rocky Reach Reservoir Management Plan.” To attain these objectives, Chelan PUD would: (1) fund measures that would restore, maintain, and improve habitats on WDFW’s Chelan Wildlife Area and on adjoining state and federal (Forest Service and BLM) lands, referred to as the Rocky Reach Wildlife Area; (2) provide a conservation easement to preserve riparian habitats associated with Chelan PUD’s Sun Cove property; (3) fund a noxious weed control program; (4) continue to conduct wildlife surveys; and (5) implement measures to protect Ute’s ladies-tresses,

including controlling noxious weeds at colony sites, monitoring colonies, and obtaining a conservation easement for one site.

Interior and WDFW recommend that the Commission adopt the terms of the Settlement Agreement. The Forest Service recommends, pursuant to FPA Section 10(a), that within 2 years of license issuance, Chelan PUD, in consultation with and subject to approval by the Forest Service and other state and federal agencies and Indian tribes, implement the September 23, 2005, version of the Wildlife Plan (Chelan PUD, 2005b). With respect to habitat restoration, the September 23, 2005, version calls for the same funding amounts and restoration measures as the February 3, 2006 version included in the Settlement Agreement.

3.5.2.1 Restoration of Habitats on the Chelan Wildlife Area and Adjoining Federal Lands

Chelan PUD explains in the offer of settlement that the signatory parties were unable to identify any lands within the project boundary that would be suitable for implementing environmental measures designed for protecting, mitigating, and enhancing wildlife. Therefore, the signatories decided to focus management actions to benefit key indicator wildlife species on the Chelan and Rocky Reach Wildlife Areas. Key indicator wildlife species include: mule deer and bighorn sheep; rare, threatened, endangered, and sensitive species; SOCs; or priority species.

Chelan PUD proposes to make funding, in varying amounts and timing, available to WDFW to restore, maintain, or improve lands in the Chelan Wildlife Area. Chelan PUD proposes to provide this funding as follows:

1. Within 180 days of the effective date of the new license, and by January 31 of each subsequent year of the new license, Chelan PUD would make available to WDFW \$74,000 to restore, maintain, or improve WDFW lands within the Chelan WMA.
2. Within 180 days of the effective date of the new license, Chelan PUD would make available to WDFW an amount not to exceed \$286,000 to restore 1,300 to 1,400 acres in the Chelan Wildlife Area previously under cultivation or in need of restoration to self-maintaining shrub-steppe habitat vegetated by bunchgrasses and shrubs such as snowy eriogonum, lupine, balsamroot, big sage, bitterbrush, serviceberry, and elderberry;
3. Within 180 days of the effective date of the new license, and by January 31 of subsequent years two through six of the new license, Chelan PUD would make available \$67,000 to WDFW for the habitat restoration of agricultural lands in the Chelan Wildlife Area; and

4. Between years 10 and 50²⁹ of the term of a new license, Chelan PUD would make available to WDFW an amount not to exceed \$457,000 to restore, maintain, or improve the Chelan Wildlife Area.

Chelan PUD also proposes to provide additional funding for habitat restoration on federal lands within the Rocky Reach Wildlife Area. Chelan PUD proposes to make available to BLM \$20,000 annually and up to \$20,000 annually on a 50/50 matching basis, and to provide to the Forest Service \$5,000 annually and up to \$5,000 annually on a 50/50 matching basis, for the term of the new license and any subsequent annual licenses, to restore, maintain, or improve BLM and Forest Service lands, respectively, within the Rocky Reach Wildlife Area. This funding could be used for native shrub-steppe habitat rehabilitation, noxious weed control, prescribed burning, native forb replanting, water development projects, and similar projects.

Under the applicant's proposal, wildlife management activities would occur on three areas of land: (1) Chelan PUD lands, (2) the Chelan Wildlife Area; and (3) Rocky Reach Wildlife Area lands. Lands within the Swakane, Entiat, and Chelan Butte Wildlife Areas are collectively referred to as the Chelan Wildlife Area and include state land managed by WDFW and the Washington Department of Natural Resources (WDNR). The Rocky Reach Wildlife Area is defined in the management plan as "public lands in Chelan County and Douglas County within approximately a 6-mile corridor of the Rocky Reach Reservoir including those of the Forest Service, BLM, and FWS lands adjacent to their hatchery."

Additionally, Chelan PUD proposes to form a RR Wildlife Forum to provide recommendations to the relevant management agencies about the direction of the Wildlife Plan and the best use of the funds to meet short- and long-term goals of the agencies.

Our Analysis

Habitats within the Chelan and Rocky Reach Wildlife Area s are upland shrub steppe habitats and associated riparian drainages, located well above the project boundary for the most part but also extending down to the project reservoir. Chelan PUD lands enclosed within the project boundary are predominately limited to the high-water line along the project reservoir and consist of a narrow band of riparian habitat.

The project operates in a manner that provides fairly stable water levels, resulting in a narrow, stable, and well-developed riparian corridor. There is no information in the record indicating that project O&M is adversely affecting upland habitats. However, there is some information suggesting that mule deer seeking and using low elevation

²⁹ Chelan PUD proposes a 50-year license term; however, the Commission would determine the term of any new license.

shrub steep habitat and riparian habitat adjacent to the project reservoir may be adversely affected by project-related recreation disturbance, particularly during severe winters.

The upland habitats that would be subject to the management plan consists of state lands purchased with funds provided by the Chelan PUD to mitigate the loss of land inundated by the original construction of the Rocky Reach and Lake Chelan Projects and federal lands that are managed in coordination with the Chelan Wildlife Area to maximize wildlife benefits. A major focus of the wildlife measures outlined in the management plan is restoring native shrub steppe habitat to improve mule deer winter survival, although other wildlife such as sage grouse would also benefit from a properly functioning shrub steppe ecosystem.

WDFW, in its October 28, 2005, comments on the draft EIS, states that in this region the success of wintering mule deer can hinge on minimizing energy expenditures. WDFW believes that the project reservoir represents an impediment to mule deer needing to access winter habitat across the river in Douglas County. According to WDFW, mule deer now have to expend more energy to cross the Columbia River to get to winter forage because project construction doubled the width of the river and reduced river current. In its May 24, 2006, letter, WDFW states that during severe winters mule deer are driven to milder microclimates in the valley bottom near flowing streams. WDFW says this exposes mule deer to human disturbance and vehicular collisions as they attempt to locate these habitats along the project shoreline. Finally, WDFW says that remaining riparian and low elevation shrub-steppe habitat immediately adjacent to the reservoir is of limited value because of noise and disturbance associated with motorized watercraft recreation and agriculture and urban development, which can be indirectly attributed to the presence of the project.

However, while it is not unreasonable to assume that mule deer historically crossed the Columbia River in the project area, that they are now impeded from crossing the project reservoir, or that the project resulted in increased energy expenditures of mule deer, there is no information in the record to support these assumptions. Mule deer studies conducted between 2000 and 2002 (Myers, 2003)³⁰ located mule deer outfitted with radio collars a total of 1,342 times in both winter and summer seasons. No deer were found in Douglas County or attempting to cross the river; although a few were located near the project reservoir on the Chelan County side. The lack of sightings in Douglas County may be attributed to low snow fall and higher than normal winter temperatures, as well as access limitations associated with residential and agricultural development, a state highway, and a railroad. During the summer months when water-based recreation levels are greatest, deer are located mostly in habitat above 3,904 feet in elevation (Myers, 2003). Thus, motorized watercraft likely disturb few individuals

³⁰ Chelan PUD funded the mule deer studies to provide baseline information on winter habitat use to determine the most effective way of enhancing mule deer habitat.

during the summer. During the critical winter periods, there is less water-based recreation, and it is likely limited to activities such as duck hunting and some snowmobiling. During critical winter periods, any such disturbance could significantly drain energy reserves of wintering mule deer and other wildlife.

Regardless, as WDFW acknowledges, the Chelan Wildlife Area and adjoining federal lands are now managed to provide mule deer habitat needs for thermal and hiding cover and that mule deer use of the riparian habitat along the reservoir within the project boundary is very limited. Lands within the project boundary represent a very small component of the habitat base for mule deer and other wildlife in the project area. Furthermore, WDFW states that it wishes to discourage big game from crossing the highway to get to the river.

The mule deer studies (Myers, 2003) determined that the primary cause of mule deer population decline in recent years is severe winters and loss of winter habitat and healthy forage due to fires in 1988 and 1994. Bitterbrush, the preferred mule deer winter forage species, was dramatically reduced by the fires. The majority of the shrub-steppe habitat that is important to wintering mule deer is located in the Chelan Wildlife Area, which is outside of the project boundary.

A number of cumulative factors are placing greater importance on remaining shrub-steppe habitats within the Chelan and Rocky Reach Wildlife Areas. Human activities such as residential development and agriculture have resulted in a highly fragmented landscape with relatively few large tracts of native vegetation (DES, 2000). WDFW reports that about 100 parcels of land out of nearly 400 parcels with frontage on the project reservoir have residences on them and conversion of habitats to residential/industrial uses has increased in total area by 231 acres (66 percent). Some of this development may be attributed to indirect cumulative effects associated with the project, including a rapidly increasing population growth in Chelan and Douglas counties, and the popularity of building along the reservoir because of the attraction of flat water for recreation. The remaining small areas of native habitat may be either too isolated or insufficient in size to support healthy wildlife populations. Other human activities that have negatively affected wildlife habitat in the area include land fill, trash dumping, off-road vehicle use, and uncontrolled camping, all of which is occurring outside the project boundary.

The lands within the Chelan Wildlife Area are not currently functioning at the level that was present at the time of their purchase, due to factors unrelated to continued project operations. Myers (2003) found that enhancing mule deer winter ranges in Chelan County would require the restoration of bitterbrush stands. Chelan PUD has apparently voluntarily provided some funding for wildlife habitat improvements, but WDFW has not had sufficient funding to restore and manage lands within the Chelan Wildlife Area to desired levels. Additional funding would permit habitat improvements that would preserve ecosystem functions and increase the level of habitat currently

available. Converting 1,400 acres of lands under cultivation to native shrub-steppe habitats would benefit mule deer populations and other wildlife dependant on shrub-steppe habitats by providing higher quality habitats. Coordinating restoration activities on adjoining federal land would maximize benefits to wildlife. Without continued maintenance (for example, prescribed burns and noxious weed control), established native vegetation would become senescent and habitat attributes would decline, as has the existing native shrub steppe habitats on the wildlife area and in the region.

In addition to shrub steppe habitat restoration, the Wildlife Plan identifies a number of other potential activities and projects that could be undertaken to benefit wildlife. These include establishing wildlife plantings in Swakane Canyon, planting trees and shrubs to develop riparian strips and shorelines, installing erosion control structures in selected canyons, installing water guzzlers and other wildlife watering basins, and improving and developing irrigations systems. All of these habitat measures would benefit a variety of wildlife, including mule deer. These improvements could help delay winter migration of mule deer to lower elevations, reducing their exposure to recreational disturbance.

Neither the settlement parties nor the Wildlife Plan explain the allocation of funds, provide a basis for the funding levels, describe in detail where the habitat improvement actions would take place, or provide a schedule for conducting management activities. Instead, the applicant and the settlement parties intend to coordinate annually to define appropriate actions and make recommendations regarding implementation of the plan. WDFW states that Chelan PUD would have oversight of all measures implemented under the plan and that any entity implementing any measures would be accountable to Chelan PUD to ensure the actions are consistent with any license issued. That accountability would be attained through an annual report to be filed with Chelan PUD by January 31 of each year detailing the work that has been completed in the previous year and the work planned for the subsequent year. Chelan PUD would provide reimbursement only for actions that were consistent with the license. Because of the lack of specificity in the plan and provisions for Commission approval, it would be difficult for the Commission to ensure compliance with the plan and ensure that the measures being implemented are benefiting project resources.

While the habitat improvement measures described above would directly benefit wildlife (from butterflies to mule deer) by helping to meet their life history requisites, several of the actions proposed in the Wildlife Plan go beyond restoration of native shrub steppe habitat to include actions that are typically the responsibility of the land managing agency, such as law enforcement, public education, public use management (road access control) to ensure compatibility with wildlife management objectives, and the introduction of native species.

3.5.2.2 Wildlife Surveys

In coordination with the RR Wildlife Forum, Chelan PUD proposes to continue to conduct habitat improvement projects and/or wildlife surveys similar to those conducted during the term of the original FERC license. The cost of these activities would not exceed \$10,500 or equivalent staff-days per year during the term of a new license and any subsequent annual licenses. The stated intent of this funding is to survey and monitor threatened, endangered, and sensitive species on a periodic schedule as directed by the RR Wildlife Forum. Surveys would be conducted annually and would address priority species. Survey techniques and schedule would be developed in coordination with the RR Wildlife Forum. Chelan PUD also proposes to provide annual wildlife survey reports to the RR Wildlife Forum. WDFW recommends that the Commission include this provision in the license without material modification.

Our Analysis

Chelan PUD has conducted bald eagle overwinter abundance surveys on the project reservoir since 1982 and Canada goose nesting surveys since 1983. Continuing these monitoring efforts would provide data useful to managing geese and monitoring the recovery of bald eagles. However, the Chelan PUD proposal would increase the amount of funding, open the effort to rare species, and allow funds to be used for habitat improvement projects. The wildlife surveys proposed by Chelan PUD would have the potential to provide site-specific information that could be used to benefit wildlife by identifying areas and/or species most in need of wildlife protection or management. The greater level of funding and broader range of surveyed species proposed by Chelan PUD could provide valuable rare species information that could be used to benefit a broader range of species than existing surveys. However, in its present ambiguous form, staff cannot fully evaluate the benefits, adequacy of the funding levels, or need for the additional habitat measures or alternative surveys included in the Settlement Agreement and Wildlife Plan.

3.5.2.3 Sun Cove Riparian Habitat Maintenance

In the Settlement Agreement, Chelan PUD proposes to enter into a contract with the Chelan-Douglas Land Trust, or other appropriate entity, to pursue and make available funding to acquire a conservation easement and to limit access to the reservoir on Chelan PUD-owned property near Sun Cove for protection of the shoreline riparian area. The easement would also allow the remaining portions of the properties to be managed or sold by Chelan PUD at its discretion. The easement would run the length of the riverward portion of the property (approximately 3,500 feet along the shoreline) and extend inland 50 feet from the ordinary high water line. The easement would also provide two 100-foot-long access corridors along the riverward portion of the Chelan PUD property at locations to be approved by WDFW, to provide community access to the river for the

benefit of future land owners, including boat launching and moorage facilities. Chelan PUD's October 28, 2005, and June 6, 2006, responses to the draft EIS state that the upland habitats have limited wildlife value and that the Sun Cove properties' primary habitat value is the riparian habitat. WDFW concurs with Chelan PUD's proposal.

Our Analysis

Sun Cove riparian and shrub-steppe habitats are located on the east bank of the project reservoir from RM 491.6 to 492.1 and from RM 492.4 to 492.9, respectively (DES, 2000). The Sun Cove property consists of about 164 acres of shrub-steppe and riparian habitats that are owned by Chelan PUD. These lands are outside, but adjacent to, the project boundary, with the exception of a narrow strip of land within the high-water mark that is within the project boundary.

The riparian habitat is relatively undisturbed because there is limited public access to the area. The shrub-steppe habitat has evidence of recent disturbance from ATV use along a trail within the site. Chelan PUD currently posts ATV restrictions on this trail. The nearby Sun Cove residential development is also encroaching on this area. Development, agriculture, and a highway fragment this habitat from other wildlife habitat, limiting its value to mule deer, grouse, and other wildlife species. Other than the indirect effects of dispersed recreation use of the sites, there are no project-related effects to the Sun Cove properties.

As noted earlier, high quality riparian habitat is limited in the project area. Given its proximity to the project reservoir, establishing and protecting a riparian buffer would protect valuable riparian habitat along the reservoir edge from encroaching development.

3.5.2.4 Noxious Weeds

Chelan PUD proposes to provide \$10,000 in funding annually, for the term of the new license and any subsequent annual licenses, for implementation of an integrated noxious weed control program in the Rocky Reach Wildlife Area. The program would be implemented by Chelan PUD personnel or other qualified personnel selected by the RR Wildlife Forum and would include noxious weed species defined by the Washington Natural Heritage Program, Washington State Weed Board, or other entity recommended by the RR Wildlife Forum. The program would not include aquatic weeds, which we address in section 3.4.2.7, *Other Fisheries Issues*. This program would be established through inter-agency cooperation and coordination with the intention of developing an area-wide noxious weed control strategy. In the PDEA, Chelan PUD indicated an intention to continue its current noxious weed program for purple loosestrife, which includes professional application of herbicides and bio-control methods. Although not mentioned in the Settlement Agreement, we assume that Chelan PUD still proposes to continue controlling purple loosestrife in this manner. In the Settlement Agreement,

Chelan PUD has proposed additional noxious weed control funding for protection of Ute ladies'-tresses or other rare species on public lands adjacent to the reservoir. Ute ladies'-tresses is a federally listed species and is discussed in section 3.6.2.5. As parties to the Settlement Agreement, Interior and WDFW support Chelan PUD's proposal.

Our Analysis

Weed invasion correlated with grazing, fire, fire suppression, water fluctuation, and development is extensive in the project area. The water fluctuation zone along the reservoir, where the water level fluctuates daily during the growing season, is dominated by weeds that thrive in this regime. Many of these weeds compete with native and rare plant species (Calypso Consulting, 2000). The more disturbance an area gets, the greater the probability that noxious weeds will become established and out-compete native species. Sources of disturbance include agricultural, residential, and commercial development; land clearing; grazing; and water-level manipulation. Daily reservoir water level fluctuations are controlled by Wells dam upstream and Rocky Reach dam downstream. Fluctuations in the upriver portion of the reservoir are mainly influenced by water releases from Wells dam, while the middle and lower portions of the reservoir are mainly influenced by water storage by the Rocky Reach dam.

The rare plant survey (Calypso Consulting, 2000) found that all six species of rare plants found in the project area (porcupine sedge, giant helleborine, adder's tongue, little bluestem, blue-eyed grass, and the federally listed threatened Ute ladies'-tresses) are in danger of being out-competed by various species of noxious weeds. All of these species are located in areas that are hydraulically connected to the project and therefore could be affected by project operations. Potential effects on the federally listed Ute ladies'-tresses are discussed in section 3.6.2.5.

Porcupine sedge and giant helleborine populations have expanded in the past 10 years. They occur within the lower and middle portions of the reservoir where the water level is more stable than upstream and there is a slow current. Because these conditions are favorable to these species, they would be expected to continue to expand under proposed project conditions. Possible project-related effects on these species include recreation activities, maintenance, and competition from noxious weeds. Both species are in danger of being out-competed by yellow flag and purple loosestrife. The largest subpopulation of giant helleborine in the project area is located near a very large stand of purple loosestrife that could threaten a portion of this subpopulation.

The noxious weed and rare species measures proposed by Chelan PUD would provide a mechanism to reduce, control, and monitor noxious weeds on Chelan PUD and adjoining public lands. The proposed integrated noxious weed control program would be developed through interagency coordination, which would support a wider reaching plan than the current program that targets only purple loosestrife. Because noxious weeds are

likely to pose the biggest threat to rare species in the project area, management and control of these weeds both within and near the project boundary would result in the protection and enhancement of current and potential rare plant habitat inside the project boundary.

However, neither the Settlement Agreement nor the Wildlife Plan clearly define the types of measures that would be implemented, where they would be implemented, or when they would be defined and implemented. The Settlement Agreement and Wildlife Plan also do not include any justification of the funding levels. Comments provided by WDFW (May 24, 2006) and Chelan PUD (June 6, 2006) indicate that the funds also would be used to control noxious weeds in the Chelan and Rocky Reach Wildlife Areas, particularly following management activities. Such actions would help ensure that native vegetation plantings successfully take hold and that management actions continue to provide wildlife benefits. As noted above, certain aspects of project operation (reservoir fluctuation and maintenance operations that result in soil disturbance) can contribute to the spread of noxious weeds. Efforts to minimize and control the spread of noxious weeds from project-related activities as part of an integrated noxious weed control program would benefit wildlife and be consistent with national and local control efforts.

Additional funding for noxious weed control is proposed with a focus on Ute ladies'-tresses protection. The additional noxious weed control would also benefit other rare species that coexist with the Ute ladies'-tresses, such as giant helleborine and adder's tongue.

3.5.2.5 Effects of Recreation on Wildlife Habitat

In the Settlement Agreement, Chelan PUD proposes a number of measures related to recreation development, such as renovations at Lincoln Rock and Daroga state parks, a paved one-mile trail linking Lincoln Rock State Park to a fish bypass viewing station, and the revitalization of Entiat Park, as outlined in the Recreation Resource Management Plan. These measures are discussed in greater detail in section 3.8.2 *Recreation Resources, Environmental Effects*. With respect to wildlife, Chelan PUD proposes in the Recreation Plan to conduct a Recreation Use Assessment during the term of the new license. A component of this study is to include "analysis of wildlife impacts resulting from recreation use of the reservoir." This analysis would be done in coordination with the RR Wildlife Forum. The RR Wildlife Forum would also coordinate with the RR Recreation Forum when habitat restoration, maintenance, and improvement projects are implemented in order to provide for compatible public use.

Our Analysis

Recreation development has the potential to displace or disrupt wildlife habitat. Chelan PUD proposes to consider both public use and wildlife effects through the course

of their recreation management planning and site development. As a result, any adverse effects on wildlife from recreational site development or use should be minimal.

3.5.3 Unavoidable Adverse Impacts

None.

3.6 FEDERALLY LISTED THREATENED AND ENDANGERED SPECIES AND ESSENTIAL FISH HABITAT

3.6.1 Affected Environment

Three federally listed threatened or endangered fish species are known to occur in the project area. These are the bull trout, Upper Columbia River steelhead, and Upper Columbia River spring-run Chinook salmon. According to the FWS, six federally listed threatened or endangered wildlife species (gray wolf, Canada lynx, northern spotted owl, grizzly bear, pygmy rabbit, and bald eagle) and three listed plant species (showy stickseed, Wenatchee Mountains checker-mallow, and Ute ladies'-tresses) may occur in the vicinity of the project area (letter from Mark G. Miller, Project Leader, Central Washington Field Office, FWS, to Gregg Carrington, Licensing Director, Chelan PUD, dated October 28, 2004).

3.6.1.1 Upper Columbia River Spring-run Chinook Salmon

NMFS listed the Upper Columbia River spring-run Chinook salmon ESU as endangered under the ESA on March 24, 1999 (64 FR 14307). Critical habitat for this species, effective January 2, 2006, was designated on September 2, 2005 (70 CFR 52630–52858). We address the species biology in section 3.4.1.4, *Anadromous Fish Species*.

3.6.1.2 Upper Columbia River Steelhead

NMFS listed the Upper Columbia River steelhead as endangered on August 18, 1997 (62 FR 43937). Critical habitat for this species, effective January 2, 2006, was designated on September 2, 2005 (70 CFR 52630–52858). Notice of final listing determination was issued on January 6, 2006 (71 FR 834). We address the species biology in section 3.4.1.4, *Anadromous Fish Species*.

3.6.1.3 Bull Trout

The Columbia River bull trout populations were listed as threatened under ESA in June 1998 (63 FR 31647). Critical habitat for this species was designated on September 26, 2005 (70 CFR 56212) and the mainstem Columbia River and tributaries in the project

area were excluded from the final designations. We address the species biology in section 3.4.1.4, *Anadromous Fish Species*.

3.6.1.4 Gray Wolf

The federally listed threatened gray wolf (*Canis lupis*) was historically well distributed throughout Washington before European settlers arrived. Since 1990, biologists have seen three separate groups of adults and pups in the North Cascades (NPS, 1998). Wolves may occasionally be present in the mountains of the Wenatchee-Okanogan National Forest that includes the drainages of the Wenatchee, Entiat, Methow, and Okanogan rivers. However, wolves are not currently present in the lower elevations near the project.

3.6.1.5 Canada Lynx

The federally listed threatened Canada lynx (*Lynx canadensis*) inhabit forests and wet bogs in the United States and Canada (WDFW, 2001). They are found in high-elevation forests of north central and northeast Washington, including Chelan, Okanogan, Ferry, Stevens, and Pend Oreille counties but may be extirpated from the southern Cascade mountains (WDFW, 2001). Transient lynx may occasionally be found west of the Cascade crest, probably during years of low prey availability east of the Cascades.

In the Cascade mountains, lynx live in the lodgepole pine and Engelmann spruce-subalpine fir forests of the high mountains. Older, mature, forests with downed trees and windfalls provide cover for denning sites, escape, and protection from severe weather. These habitats are not found in the lower elevation shrub-step-habitats associated with the project. The Canada lynx does not currently occur in the project area.

3.6.1.6 Northern Spotted Owl

The federally listed threatened northern spotted owl (*Strix occidentalis caurina*) is found in old-growth forests and occasionally in younger conifer forest in the Cascade, Sierra Nevada, and coastal mountains of British Columbia, Washington, Oregon, and northern California. The range of the spotted owl habitat on the Wenatchee and Okanogan National Forests has been described as being in old-growth and late successional conifer forest below the 5,000-foot elevation. Some of the 53 units totaling 2.2 million acres of critical habitat in Washington are included in the Wenatchee, Entiat, and Methow river drainages (personal communication, B. Gains, Forest Service Biologist, Wenatchee, WA, as cited Chelan PUD, 2004a). Owls nest in the Wenatchee and Okanogan National Forests (Smith et al., 1997) and a northern spotted owl activity center is documented on the northwest side of the Wenatchee River about 1 mile from the Chiwawa fish facility, a Rock Island Project satellite fish rearing facility. The project is not within known northern spotted owl habitat.

3.6.1.7 Grizzly Bear

The historic range of grizzly bears (*Ursus arctos horribilis*) once covered over a third of what is now the continental United States. It is federally listed as threatened in the lower 48 states, where it survives only in parts of the Rocky Mountains and northern Cascades. The North Cascades Grizzly Bear Recovery Area includes all of the North Cascades National Park, most of the Mount Baker-Snoqualmie National Forest, and all of the Wenatchee and Okanogan National Forest lands to the north of I-90. The recovery area extends roughly from I-90 to the Canadian border and east to the Columbia and Okanogan rivers on the east side of the Cascade Mountains. The North Cascades Grizzly Bear Recovery Area includes portions of Chelan and Okanogan counties but does not border the Columbia River or the project reservoir shoreline. The Wenatchee, Entiat, and Methow rivers and tributaries of the Okanogan River extend into the North Cascades Grizzly Bear Recovery Area. The grizzly bear does not occur currently in the project area.

3.6.1.8 Pygmy Rabbit

The federally listed endangered pygmy rabbit (*Brachylagus idahoensis*) is the smallest native rabbit in North America. Its distribution is scattered in the sagebrush-dominated shrub steppe areas of the Great Basin. This includes portions of Oregon, California, Nevada, Utah, Idaho, Montana, Wyoming, and Washington. Washington populations are discontinuous from the rest of the species' range and are genetically distinct from other populations. The known range of the Washington pygmy rabbit formerly occupied sagebrush habitat in five counties: Benton, Adams, Grant, Lincoln, and Douglas (WDFW, 1995). Pygmy rabbits are usually found in areas of dense sagebrush cover with relatively deep, loose soils. They dig their burrows underneath sagebrush bushes and depend almost exclusively on sagebrush for food during the winter. From spring through fall, they also eat native bunch grasses and forbs.

Pygmy rabbits are not found in the project area. The only known population in Washington and the last known location inhabited by pygmy rabbits in the state was in Douglas County at Sagebrush Flat on land owned by WDFW. Sagebrush Flat is in the south-central part of Douglas County, approximately 28 air miles from Rock Island dam. There are no documented historic occurrences of the pygmy rabbit within six miles of the Rocky Reach reservoir.

3.6.1.9 Bald Eagle

The federally listed threatened bald eagle (*Haliaeetus leucocephalus*) tends to select perch sites that offer an open-limbed structure, allowing good visibility and unobstructed flight (Stalmaster and Newman, 1979; Fielder and Starkey, 1986). In its December 27, 2004, letter, Chelan PUD indicates that the diurnal perches along Rocky

Reach reservoir preferred by bald eagles include cottonwood trees, ponderosa pine trees, and snags (44 percent, 25 percent, and 11 percent of 2,114 perch use observations, respectively). There is a potential night roost identified within one-half mile of Rocky Reach dam in Douglas fir trees growing on the north facing rock cliffs. This site has the habitat and topographic characteristics that may lend it to being a bald eagle communal night roost. However, no eagle presence has been documented to date at this site and Chelan PUD in its October 28, 2005, response to the draft EIS reports that the Washington Natural Heritage Program has removed the potential night roost from its list of potential roost sites. Also in its December 27, 2004, letter, Chelan PUD reports that one small communal night roost was suspected in a canyon north of Ribbon Cliff along the reservoir, but that became a nest site in approximately 1998. After the nesting pair started to nest at that site, eagles did not seem to use the site as a communal roost.

There are four known bald eagle nests in Chelan County. One nest site is north of Ribbon Cliff approximately one-quarter mile from the river in a canyon perpendicular to the river. A second nest is at the northwest end of Lake Wenatchee. A third, new, nest has been reported along the Icicle River approximately one-half mile upstream from its confluence with the Wenatchee River. The fourth bald eagle nest in Chelan County is located at the head of Lake Chelan. There are no known bald eagle nests in Douglas County near the project area.

Taylor (1989) reported that 1 to 7 bald eagles wintered along the Wenatchee River between 1982 and 1989. In its December 27, 2004, letter, Chelan PUD reports that several bald eagles use the lower portion of the Entiat River during winter. These eagles likely feed on resident fish in the rivers and deer carrion on surrounding hills. Salmon and steelhead are relatively unimportant in the diets of bald eagles wintering along Rocky Reach reservoir or the Wenatchee and Entiat rivers because most of the eagles do not arrive before November and by then, spawned out carcasses are no longer available to the eagles.

Most of the bald eagles that winter along Rocky Reach reservoir nest in Alaska and northwestern Canada (Stinson, 2001 as cited in Chelan PUD's December 27, 2004 AIR response). Waterfowl, especially American coots, provide most of the winter diet of bald eagles along the mid-Columbia River (Fielder, 1982). To a lesser extent, wintering bald eagles also feed on resident fish in the Rocky Reach reservoir and tributary streams during winter. During severe winters, eagles supplement their diet with winter-killed deer carrion along the hillsides overlooking Rocky Reach reservoir (Fielder, 2000).

3.6.1.10 Showy Stickseed

Showy stickseed (*Hackelia venusta*) is listed as endangered by FWS and the state of Washington. It is locally endemic in the Wenatchee Mountains in the eastern Cascades physiographic province of Chelan County, Washington. Showy stickseed is an

upland plant that occurs in dry, loose soils and crevices on granite or talus slopes that range from 25 to 75 degrees. It generally occurs at elevations of 1,500 to 2,500 feet. According to Chelan PUD's December 27, 2004, letter, there is only one known population of this plant, occurring on less than 2.4 acres of land on the lower slopes of Tumwater Canyon on federal land. Rare plant surveys along the Rocky Reach shorelines did not locate this plant (Calypso Consulting, 2000; Caplow, 1990).

3.6.1.11 Wenatchee Mountains Checker-Mallow

Wenatchee Mountains checker-mallow (*Sidalcea oregano* var. *calva*) is listed as endangered by FWS and the state of Washington. It occurs within tributary basins of the Wenatchee River at elevations ranging from 1,900 to 3,200 feet. This plant is most abundant in moist meadows that have surface water or saturated upper soil profiles extending into early summer. Suitable meadows vary in size from 0.5 acre to greater than 100 acres. In its December 27, 2004, letter, Chelan PUD indicates that this plant is also found in somewhat open coniferous stands dominated by Douglas fir and ponderosa pine and along edges of shrub and hardwood thickets. The historical range of this species covered an area of approximately 11 by 3 miles, extending south to southeast from Leavenworth in Chelan County, Washington, generally in the vicinity of the Camas Meadows and Camas Creek, east of Peshastin Creek (Washington Natural Heritage Program, 1998). Rare plant surveys along the Rocky Reach shorelines did not locate this plant (Calypso Consulting, 2000; Caplow, 1990).

3.6.1.12 Ute Ladies'-tresses

Ute ladies'-tresses, a federally listed threatened species, is an attractive, perennial, white-flowered member of the orchid family. It is known to occur in Utah, Colorado, Wyoming, Nebraska, Montana, and Idaho, as well as Washington. The preferred habitat of Ute ladies'-tresses is low-elevation wetland and riparian areas, including spring habitats, mesic to wet meadows, river meanders, and floodplains. Ute ladies'-tresses seem to require "permanent sub-irrigation," indicating a close affinity with floodplain areas where the water table is near the surface throughout the growing season and into the late summer or early autumn (FWS, 1995). Ute ladies'-tresses occur primarily in areas where the vegetation is relatively open and not overly dense or overgrown (FWS, 1995). Populations tend to decline if trees and shrubs invade the habitat where they reside (FWS, 1995).

Three Ute ladies'-tresses populations were found during surveys conducted in 1999–2000 (Calypso Consulting, 2000). The 1999–2000 surveys included all lands within the project boundary and immediately adjacent lands likely to be affected by project operations. All of the populations that were identified within the project area were located in wooded or wet-meadow wetlands. In 2005, BLM located a fourth

population on BLM land outside the project boundary in a narrow band above the high-water line and below drier, sandier soil.

The habitat requirements and life history features of this federally listed species make it vulnerable to the combined effects of land conversion, changes in hydrology, invasions of weedy species, loss of pollinators, and diminishing potential habitat. It is not known if the populations of Ute ladies'-tresses that have been identified within the project area are increasing, decreasing, or remaining constant.

3.6.2 Environmental Effects

Because of the lack of suitable habitat and their absence from the project area, relicensing the project will not affect gray wolf, Canada lynx, northern spotted owl, grizzly bear, pygmy rabbit, showy stickseed, or Wenatchee Mountains checker-mallow. These species are not discussed further.

3.6.2.1 Upper Columbia River Spring-run Chinook Salmon

For our analysis of effects on Upper Columbia River spring-run Chinook salmon, please see section 3.4.2.1, *Actions Covered by the Rocky Reach Anadromous Fish Agreement and Habitat Conservation Plan*.

In the final EIS for the HCP, NMFS and FERC concluded that, based on their analysis for ESA-listed Upper Columbia River spring-run Chinook salmon, implementing the HCPs should provide survival levels that are greater than those actually measured in recent years at the project, and therefore implementing the HCPs would substantially increase survival rates of Upper Columbia River spring-run Chinook salmon through the project (NMFS, 2002).

In its biological opinion for the HCP, issued August 12, 2003, NMFS found that under the HCP, there will continue to be adverse impacts to species considered under its biological opinion. These impacts include continuing mortality of juveniles passing the project and are related to both the existence of the project and project operations, which NMFS concluded cannot be separated. NMFS also noted that the levels of juvenile and adult mortality associated with the HCP represent an improvement over the project-caused mortality that occurred historically and contributed to the current species status. Although some short-term negative impacts may result from HCP tributary enhancement projects, these activities are also likely to benefit all Permit Species, to an as yet unknown extent, throughout the term of the ITP (NMFS, 2003) by protecting or enhancing tributary habitat in which these fish spawn and rear.

After reviewing the current status of Upper Columbia River spring-run Chinook salmon, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, NMFS' biological opinion concluded that implementation of the

HCP for Rocky Reach is not likely to jeopardize the continued existence of Upper Columbia River spring-run Chinook salmon (NMFS, 2003).

In its September 25, 2003, biological opinion, NMFS indicated that reinitiation of ESA consultation would be necessary if: (1) any action is modified in a way that causes an adverse effect on the species that is new or significantly different from those analyzed in connection with the HCP; (2) new information or project monitoring reveals adverse effects of the action in a way not previously considered or that involves additional take not analyzed in connection with the original HCP; or (3) a new species is listed or critical habitat is designated that may be affected by the action.

In a letter issued on September 7, 2005, we indicated that our analysis, presented in the draft EIS, did not identify any adverse effects of relicensing the project that would be new or significantly different from those already analyzed in connection with the HCP. We also stated that we are not aware of any new information or project monitoring that would reveal adverse effects not previously considered and that no new species had been listed subsequent to completion of consultation on the HCP.

In the September 7, 2005, letter, we indicated that effective January 2, 2006, new critical habitat for Upper Columbia River spring-run Chinook salmon was designated (70 CFR 52630–52858). Designated critical habitat for Upper Columbia River spring-run Chinook salmon that could be affected by relicensing the project includes the mainstem Columbia River in the project area and the mouths of the Entiat and Chelan Rivers. The primary constituent element of these designated critical habitats is to serve as a freshwater migration corridor. In the September 7, 2005, letter, we concluded that relicensing the project as proposed in the draft EIS (and now the final EIS) would not likely adversely affect any designated critical habitat for Upper Columbia River spring-run Chinook salmon.

Based on this determination, we indicated to NMFS that we did not believe there was any need to reinitiate formal consultation on Upper Columbia River spring-run Chinook salmon or their designated critical habitat and we requested a response within 30 days. On July 17, 2006, NMFS filed a letter with the Commission stating it did not agree with our determination and stating its intention to provide the Commission with its biological opinion no later than 135 days after the issuance of its letter.

3.6.2.2 Upper Columbia River Steelhead

For our analysis of effects on Upper Columbia River summer steelhead, please see section 3.4.2.1, *Actions Covered by the Rocky Reach Anadromous Fish Agreement and Habitat Conservation Plan*.

In the final EIS for the HCP, NMFS and FERC concluded that, based on their analysis for ESA-listed Upper Columbia River steelhead, implementing the HCPs should

provide survival levels that are greater than those actually measured in recent years at the project, and therefore implementing the HCPs would substantially increase survival rates of Upper Columbia River steelhead through the project (NMFS, 2002).

In its biological opinion for the HCP, issued August 12, 2003, NMFS found that under the HCP, there will continue to be adverse impacts to species considered under its biological opinion. These impacts include continuing mortality of juveniles passing the project and are related to both the existence of the project and project operations, which NMFS concluded cannot be separated. NMFS also noted that the levels of juvenile and adult mortality associated with the HCP represent an improvement over the project-caused mortality that occurred historically and contributed to the current species status. Although some short-term negative impacts may result from HCP tributary enhancement projects, these activities are also likely to benefit all Permit Species, to an as yet unknown extent, throughout the term of the ITP (NMFS, 2003) by protecting or enhancing tributary habitat in which these fish spawn and rear.

After reviewing the current status of Upper Columbia River summer steelhead, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, NMFS' biological opinion concluded that implementation of the HCP for Rocky Reach is not likely to jeopardize the continued existence of Upper Columbia River summer steelhead (NMFS, 2003).

In its September 25, 2003, biological opinion, NMFS indicated that reinitiation of ESA consultation would be necessary if: (1) any action is modified in a way that causes an adverse effect on the species that is new or significantly different from those analyzed in connection with the HCP; (2) new information or project monitoring reveals adverse effects of the action in a way not previously considered or that involves additional take not analyzed in connection with the original HCP; or (3) a new species is listed or critical habitat is designated that may be affected by the action.

In a letter issued on September 7, 2005, we indicated that our analysis, presented in the draft EIS, did not identify any adverse effects of relicensing the project that would be new or significantly different from those already analyzed in connection with the HCP. We also stated that we are not aware of any new information or project monitoring that would reveal adverse effects not previously considered and that no new species had been listed subsequent to completion of consultation on the HCP.

In the September 7, 2005, letter, we indicated that on September 2, 2005, new critical habitat for Upper Columbia River steelhead was designated (70 CFR 52630–52858). Designated critical habitat for Upper Columbia River steelhead that could be affected by relicensing the project includes the mainstem Columbia River in the project area and the mouth of the Entiat River. The primary constituent element of these designated critical habitats is to serve as a freshwater migration corridor. In the September 7, 2005, letter, we concluded that relicensing the project as proposed in the

draft EIS (and now the final EIS) would not likely adversely affect any designated critical habitat for Upper Columbia River steelhead.

Based on this determination, we indicated to NMFS that we did not believe there was any need to reinitiate formal consultation on Upper Columbia River steelhead or their designated critical habitat and we requested a response within 30 days. On July 17, 2006, NMFS filed a letter with the Commission stating it did not agree with our determination and stating its intention to provide the Commission with its biological opinion no later than 135 days after the issuance of its letter.

3.6.2.3 Bull Trout

The FWS 2000 biological opinion on the effects to listed species from operation of the FCRPS (FWS, 2000) concludes that run-of-river dams in the system directly affect bull trout populations. Upon reviewing the effects outlined in the FWS biological opinion, the NSWG identified the following issues of concern regarding bull trout populations in the project area:

- Project effects on upstream and downstream movement of bull trout; and
- Project effects on mainstem habitat.

Key findings of bull trout studies initiated by Chelan PUD in 2001 and other information gathered at the project are presented in the Bull Trout Plan (Chelan PUD, 2006f). Results of the study indicated the following project effects on bull trout, as presented in the Bull Trout Plan (Chelan PUD, 2006f).

Project Effects on Movement

The radio telemetry study identified no apparent adverse effects on movement or survival of tagged bull trout (BioAnalysts, 2002, 2004). Downstream passage routes available to bull trout include (1) passage over spillways during spill periods (generally between April 20 and August 15); (2) the juvenile fish bypass system, composed of one surface collector entrance (6-kcfs flow) and screened turbine units number 1 and 2 (generally operated April 1 to August 31); (3) one adult fish ladder; and (4) turbine units 3 through 11. Upstream passage is provided by a single fish ladder with three separate entrances in the tailrace, and a single exit in the forebay (see Chelan PUD, 2005f, appendix A, for fishway operations and maintenance).

Project Effects on Habitat

On May 12, 2004, the FWS filed with the Commission a biological opinion for bull trout as part of the license amendment application for the HCP (FWS, 2004b). The biological opinion states that Chelan PUD must monitor take of bull trout that is directly related to project operations. The biological opinion contains terms and conditions for

monitoring and minimizing incidental take of bull trout at the project, specifies minimization measures, and requires the PUD to develop a Bull Trout Management Plan to be filed with the Commission. On February 28, 2005, Chelan PUD filed a draft Bull Trout Management Plan under Article 411 of the existing license for the project, and FERC approved the Plan on April 19, 2005. The draft plan described measures Chelan PUD would implement under the current license as amended by the HCP, and also identified proposed environmental measures to be implemented under the new license. Measures in the draft plan included further discussion of proposed environmental measures as well as actions to monitor and minimize any incidental take consistent with Section 7 of the ESA.

In the Settlement Agreement, Chelan PUD proposes to implement a Bull Trout Plan that is slightly modified from the FERC-approved plan under Article 411 of the existing license, since some monitoring and interim measures of the FERC-approved plan have been completed or are currently in progress. As parties to the Settlement Agreement, WDFW and FWS concur with Chelan PUD's proposal. Elements of the proposed environmental measures in the Settlement Agreement are described below.

Chelan PUD would continue operating the upstream fishway and downstream bypass to pass adult and sub-adult bull trout, and would continue to conduct video monitoring in the upstream fishway to provide information on size, age, and condition of bull trout using the fishway.

Chelan PUD would identify any ongoing adverse project impacts on adult and subadult bull trout passage. Using radio telemetry, Chelan PUD would monitor adult upstream and downstream passage through the dam and reservoir, and implement appropriate measures to monitor any incidental take of bull trout. They would continue such monitoring for a one-year period in year 10 of the new license, and every 10 years thereafter to determine Chelan PUD's compliance with the project's incidental take allowances for adult and sub-adult bull trout. In year 10 of the new license, and every 10 years thereafter, upon recommendation of the RR Fish Forum, Chelan PUD would monitor sub-adult bull trout at the dam.

Chelan PUD proposes to investigate reservoir stranding of bull trout by investigating Rocky Reach inflow patterns, reservoir elevations, and backwater curves for three years to determine if bull trout are becoming stranded or entrapped during low flow events. If potential stranding areas were identified, then further sampling would occur to determine if incidental take is occurring, and if so, Chelan PUD would consult with the FWS and RR Fish Forum to develop a plan to minimize such take.

In consultation with FWS and the RR Fish Forum, Chelan PUD would implement appropriate and reasonable measures to modify the upstream fishway and downstream bypass if adverse impacts on bull trout were identified.

In the final Bull Trout Plan described in the Settlement Agreement, Chelan PUD proposes to participate in developing the FWS Bull Trout Recovery Plan, and would implement, as appropriate, measures identified in the plan. Chelan PUD also proposes to participate in information exchanges to explore methods to monitor upstream and downstream movement of bull trout. Chelan PUD also proposes to consider the feasibility of distributing large woody debris collected at the dam to project tributaries for projects funded by the Tributary Conservation Plan of the HCP Agreement. Finally, the Settlement Agreement's Bull Trout Plan also contains a provision that Chelan PUD fund the collection of bull trout tissue samples for genetic analysis.

In letters to the Commission from Interior, NMFS, WDFW, WDOE, Forest Service and the Yakama Nation (dated March 14, 2005, March 8, 2005, March 11, 2005, March 14, 2005 and March 14, 2005, respectively), the parties expressed their support for the continuation of HCP implementation. The Bull Trout Management Plan is a component of the HCP, as required by the FWS biological opinion.

Our Analysis

Monitoring measures contained in the final Bull Trout Plan would provide information on bull trout life history and migration, as well as the potential for incidental take from stranding through the project. Information that is gathered could be used to mitigate potential adverse project effects and would also aid in the recovery of bull trout populations in the region. The Bull Trout Plan outlines how Chelan PUD would implement measures to investigate and address project impacts to bull trout. The Settlement Agreement's Bull Trout Plan would effectively minimize and mitigate for project impacts to bull trout populations.

Chelan PUD's draft Bull Trout Plan was approved by the Commission on April 19, 2005. The draft Bull Trout Plan was intended to satisfy the requirements of the FWS' HCP biological opinion issued on May 12, 2004 and to be consistent with the FWS Bull Trout Recovery Plan. The Bull Trout Plan contains measures to be implemented under the current license (primarily monitoring), as well as measures proposed for the new license. Although there are some differences between the previously approved Bull Trout Plan and the version included with the Settlement Agreement, none of the changes would substantially change the potential effects on bull trout.

Implementation of the HCP measures discussed above would benefit bull trout by improving survival of adults and sub-adults by providing a safe passage route (the juvenile bypass system) through the project, providing tributary habitat enhancement, thereby increasing stream productivity, and by implementing the hatchery plan, which would increase the density of historically important prey items for bull trout.

Monitoring measures contained in the Bull Trout Plan would provide useful information on bull trout life history and migration through the project. Information

gathered can be used to mitigate potential effects and would also aid in the recovery of bull trout populations in the region. Additionally, the Bull Trout Plan outlines detailed descriptions of how the licensee would implement measures to address project impacts to bull trout. The Bull Trout Plan as described in Article 411 of the existing license for the project, and as the Commission approved the plan on April 19, 2005, effectively minimizes and mitigates for project impacts to bull trout populations.

The measures proposed in the Bull Trout Plan address the terms and conditions of the incidental take statement included in the FWS' HCP biological opinion issued on May 12, 2005. In the biological opinion, the FWS concluded that implementation of the HCP with the associated terms and conditions would not be likely to jeopardize the continued existence of the Columbia River distinct population segment of bull trout and would not be likely to destroy or adversely modify proposed critical habitat for bull trout.

In its May 12, 2004, biological opinion, the FWS indicated that reinitiation of ESA consultation would be necessary if: (1) the amount or extent of incidental take allowed by the biological opinion is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in the biological opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in the biological opinion; or (4) a new species is listed or critical habitat is designated that may be affected by the action.

In a letter issued on September 7, 2005, we indicated that we have no information to indicate that the amount or extent of incidental take specified in FWS's May 12, 2004, biological opinion has been exceeded. Additionally, we indicated that we are not aware of any new information that would identify effects on bull trout or critical habitat that were not previously considered in the opinion. Finally, we indicated that while no new species have been listed subsequent to completion of consultation on the HCP, new critical habitat was designated on October 6, 2004 (69 FR 59995). However, since the final rule designating critical habitat for bull trout excluded the mainstem Columbia River and all waters impounded behind dams (reservoirs and pools), we concluded that relicensing the project would not affect designated critical habitat for bull trout.

Based on these determinations, we indicated to FWS that we did not believe it was necessary to reinitiate formal consultation on bull trout and we requested a response within 30 days.

FWS filed a letter with the Commission on October 17, 2005, indicating it does not concur with the ESA determinations (no species were specified) contained in the Commission's September 7, 2005, letter, and indicating that FWS was initiating formal consultation. In a letter dated March 9, 2006, FWS indicated that a Settlement Agreement was forthcoming and the timeline for completing the biological opinion was moot. FWS recommended that the Commission reinitiate consultation based on the final

EIS. In a May 3, 2006, letter, we indicated that our recommended action (proposed action for ESA consultation) was unchanged and we requested that FWS complete the consultation initiated by the October 17, 2005, letter.

3.6.2.4 Bald Eagle

Chelan PUD proposes to continue to conduct wildlife surveys similar to those conducted during the original FERC license and/or habitat improvement projects at a cost not to exceed \$10,500 or equivalent staff-days per year during the term of the new license and any subsequent annual licenses. Currently, bald eagle overwinter abundance surveys are conducted by Chelan PUD on the reservoir. However, as proposed in the Settlement Agreement and the Wildlife Plan, the funds could be used to monitor or conduct habitat improvement projects to benefit other threatened, endangered or sensitive species. The specific measures would be determined in coordination with the RR Wildlife Forum. The Wildlife Plan, as proposed in the Settlement Agreement and supported by WDFW and FWS, also provides for coordination between the RR Wildlife Forum and the RR Recreation Forum during planning and implementation of recreational activities to consider public use while considering wildlife and terrestrial issues.

Our Analysis

The Wildlife Plan, as proposed by Chelan PUD in the Settlement Agreement, includes measures that could benefit bald eagles, such as riparian tree plantings and bald eagle and raptor perching habitat within the Rocky Reach Wildlife Area. None of the four bald eagle nests located in Chelan County are on project land and would not be affected by project operation. However, bald eagles do use the project area for perching and feeding, especially during the winter. Bald eagle use in the project area is influenced by several factors, including available perch sites, food availability, and various levels of human disturbance (Fielder and Starkey, 1986, 1987; Fielder, 1992). The preferred perch trees, cottonwood and ponderosa pine, are live trees located on or near the reservoir shoreline; however, they are not within the water or in the reservoir inundation zone. Thus, they would not be affected by project operations.

Waterfowl, especially American coots, are the predominant winter prey of bald eagles along the mid-Columbia River. The reservoir is used extensively by waterfowl in the winter, with approximately 16,000 to 17,000 birds wintering each year. Coots make up 40 percent of these birds. In the downstream part of the reservoir, where waterfowl are most abundant, the impoundment from Rocky Reach dam reduces river current and maintains a relatively stable water level. These conditions result in suitable waterfowl habitat, thereby maintaining an abundant prey base for wintering eagles. Fish enhancement measures described in section 3.4.2, *Environmental Effects on Fisheries Resources*, would also benefit bald eagles by enhancing their prey base.

Although project-related recreation could create human disturbance that negatively affects bald eagles, Chelan PUD's proposed RR Wildlife Forum coordination with the RR Recreation Forum would attempt to minimize public disturbance of wildlife habitats. Continuation of bald eagle surveys proposed by Chelan PUD would help ensure that any adverse effects to bald eagle populations in the winter would be identified promptly and would provide data useful to the continual recovery of the species. Chelan PUD proposes that additional funds be allocated for wildlife surveys, but also recommend expanding the surveys to other rare species. Therefore, we cannot determine how the level of effort devoted to bald eagle surveys under Chelan PUD's proposal compares to the existing survey effort or ensure that the surveys or habitat improvements for bald eagles would be provided each year.

Overall, Chelan PUD's proposal would have a beneficial effect on bald eagles and their habitat.

3.6.2.5 Ute Ladies'-tresses

One of the objectives of the Wildlife Plan proposed by Chelan PUD as part of the Settlement Agreement is to implement the "Ute Ladies'-tresses (*Spiranthes diluvialis*) Along Rocky Reach reservoir Management Plan". This plan contains several measures for the protection and enhancement of Ute ladies'-tresses and its habitat. Chelan PUD, in coordination with the RR Wildlife Forum, would make \$5,000 available annually, for the term of any new license issued and any subsequent annual licenses, for implementation of noxious weed control focusing specifically on areas where Ute ladies'-tresses occur on public lands adjacent to the project reservoir. Noxious weed control would be implemented by qualified personnel selected by the RR Wildlife Forum, for the term of the new license or any subsequent annual licenses. Chelan PUD would also make available \$3,000 annually for implementation of an annual Ute ladies'-tresses monitoring program to document population health within the project boundary. Chelan PUD also proposes to enter into a contract with the Chelan-Douglas Land Trust, or other appropriate entity, to pursue acquisition of a conservation easement on a parcel of private land to protect an identified Ute ladies'-tresses site, at a cost not to exceed \$160,000. As parties to the Settlement Agreement, FWS, BLM, and WDFW support Chelan PUD's proposal.

Our Analysis

It is not known whether this species is decreasing or increasing in population size within the project area. Prior to the discovery of the four populations discussed in section 3.6.1.12, there was only one other population known to exist in Washington. These populations are found in the upper reaches of the reservoir that are more riverine in nature, with less influence from impoundment from Rocky Reach dam. The riparian floodplain communities where these populations are located are, therefore, not affected

so much by water storage at Rocky Reach dam, but by water releases from the upriver Wells dam. Daily water level fluctuations as a result of these water releases create conditions that are favorable to the invasion of noxious weeds. Noxious weeds appear to pose the greatest threat to the Ute ladies'-tresses because they can take over the habitat. Ute ladies'-tresses cannot compete with aggressive species that form dense monocultures such as reed canarygrass or Canada thistle (FWS, 1995).

Timing and duration of inundation may also affect flowering and seed-set. The degree to which such factors are affecting the viability of Ute ladies'-tresses at the project is unknown. Monitoring the populations would help identify trends in colony establishment and growth and what factors may be influencing that growth.

The noxious weed control measures and Ute ladies'-tresses monitoring proposed by Chelan PUD and recommended by Interior would provide some level of protection for Ute ladies'-tresses populations on public land. By attempting to control the invasion of noxious weeds, the proposal would reduce the biggest threat to the populations. Annual monitoring would regularly document population health, allowing weed control efforts to be focused on the areas most in need. Because one of the populations is on private land, it would not be subject to the Chelan PUD management and protection measures. However, Chelan PUD proposes to pursue a conservation easement on that private property in order to extend the proposed protection measures to all four of the identified Ute ladies'-tresses populations. These protection measures would result in increased protection of Ute ladies'-tresses and its habitat and should benefit the species. We find that relicensing the project may affect, but would not be likely to adversely affect, the Ute ladies'-tresses.

3.6.3 Unavoidable Adverse Impacts

None.

3.7 CULTURAL RESOURCES

3.7.1 Affected Environment

3.7.1.1 Definition of Cultural Resources, Historic Properties, and Area of Potential Effects

Section 106 of the National Historic Preservation Act

Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended (Section 106), requires the Commission to evaluate potential effects on properties listed or eligible for listing in the National Register of Historic Places (National Register) prior to an undertaking. An undertaking means a project, activity, or

program funded in whole or in part under the direct or indirect jurisdiction of a federal agency, including, among other things, processes requiring a federal permit, license, or approval. In this case, the undertaking is the proposed issuance of a new license for the project. Potential effects associated with this undertaking include project-related effects associated with the day-to-day O&M of the project after issuance of a new license.

Historic properties are cultural resources listed or eligible for listing in the National Register. Historic properties represent things, structures, places, or archeological sites that can be either Native American or European-American in origin. In most cases, cultural resources less than 50 years old are not considered eligible for the National Register. Cultural resources also have to have enough internal contextual integrity to be considered historic properties. For example, dilapidated structures or heavily disturbed archeological sites may not have enough contextual integrity to be considered eligible.

Section 106 also requires that the Commission seek concurrence with the State Historic Preservation Officer (SHPO) on any finding involving effects or no effects on historic properties, and allow the Advisory Council on Historic Preservation an opportunity to comment on any finding of effects on historic properties. If Native American properties have been identified, Section 106 also requires that the Commission consult with interested Native American tribes that might attach religious or cultural significance to such properties.

Area of Potential Effects

Pursuant to Section 106, the Commission must take into account whether any historic property could be affected by a proposed new license within the project's APE. The APE is defined as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. In this case, the APE for the project includes lands within the FERC project boundary as it is delineated in the current FERC license, plus lands outside the project boundary where project operations may affect the character or use of historic properties and/or TCPs. The FERC project boundary for the project is defined by elevation contours that represent the surface area of the reservoir likely to be covered by water during a maximum flood year, ranging from 711 feet above msl at the dam to 734 feet above msl approximately 43 miles upriver at the end of the reservoir, downstream of the Wells Project dam.

3.7.1.2 Culture Historic Context

Rocky Reach Aboriginal Occupations

The project lies within the Columbia River Plateau Culture Area, in which native peoples evolved a distinctive way of life characterized by settlement along rivers,

exploitation of a wide range of food sources (game, fish, and plants), extensive cross-utilization of resources among various groups, extensive intermarriage among groups, and extension of trade links. Archaeologists working in this area over many decades have proposed a variety of cultural chronologies to describe and date the evolution of aboriginal cultures that go back to approximately 11,000 Before Present (B.P.). For approximately 3,000 years (11,000 to 7000 B.P.), the human population was relatively small and thinly scattered, with a mobile lifestyle that made use of both upland and riverine environments. Initially heavily dependent upon large game for subsistence, native peoples gradually began to incorporate fish, as well as roots and vegetables, into their diets. From about 7000 to 3900 B.P., there was an increase in the native population of the Rocky Reach area. The groups became less mobile, seasonally re-occupying selected locales, and exploiting anadromous fish to a greater extent. They also evolved more permanent habitation in the form of semi-subterranean pit houses used primarily during the winter. This general trend continued, with the period from around 3900 to 270 B.P. characterized by concentration of settlements to the north and south of the Rocky Reach area, construction of communal longhouses, less focus on hunting in favor of reliance on fish, roots, and vegetable resources. The appearance of the horse on the Columbia River Plateau around 1730 did not measurably alter subsistence or cultural patterns, but did make it possible for native peoples to range at greater distance.

Historic Period

At the time of the Lewis and Clark Expedition (1805), the native populations in the Rocky Reach area included the Salish-speaking Wenatchee, Entiat, Chelan, Methow, and Columbia Indians. They lived in locally autonomous villages, sometimes grouping to form bands under a central chieftainship. Each band had a permanent winter village situated along a principal water source, with principal subsistence focused on hunting, fishing, and the gathering of plant resources. Within a few decades, diseases brought by European-American explorers and fur traders had greatly diminished these native populations, a decline that was further accelerated by the large immigrations into Washington during the 1840s.

The Colville Indian Reservation was created by executive order in 1872; originally intended to be occupied by the Okanagan, Sanpoil, Nespelum, Colville, Lake, Pend d'Oriettes, Spokane, and Methow tribes. In 1879 and 1880, tracts of land, called the Columbia Reservation, were set aside for the Sinkayuse-Columbia, Chelan, Entiat, and Wenatchee Indian tribes. In 1883, tribal leaders for the Columbia, Chelan, Entiat, and Wenatchee tribes agreed to relocate to the Colville Reservation. However, a number of tribal members elected to remain in their ancestral homeland, and the government parceled out 37 allotments to Indian families. The tribes did not relinquish their rights through any of these events.

The Yakama Nation was "created" by combining members of the Yakama, Palouse, Wenatchee, Wenatshapam, and a number of other lower Columbia River groups,

including speakers of not only Salish but also Chinook and Sahaptin. In 1855, the Yakama Nation entered into a treaty with the U.S. government in which the tribes and bands ceded “the lands and country occupied and claimed by them” in exchange for a defined reservation as well as the right to fish, hunt, and gather plant resources in “usual and accustomed places.”

Although some mining occurred in the Rocky Reach area in the 1850s, white settlers did not appear in numbers until the 1880s, when passage of the General Allotment, or Dawes, Act of 1887 allotted specific lands to individual Native Americans, leaving the remainder of reservation lands open to legal claim by railroad interests, mining companies, and others. White agrarian settlement focused on diversified farming and livestock, gradually increasing production of a variety of fruits, including apples, peaches, pears, plums, figs, and grapes. Towns emerged as the focal points of economic activity, among them Entiat, Orondo, and Chelan Falls.

3.7.1.3 Cultural Resources Identified within the APE

Archaeological research in the project vicinity can be dated back to rock art investigations by Cain in 1945 at Orondo Rockshelter. Since that time, numerous archaeological investigations have been conducted in association with the project. The first survey of the project dam and reservoir was conducted by Washington State University in 1954 (Daugherty, 1956). Washington State University did further investigations in 1959 and 1981–82, including a survey of five proposed recreation sites along the reservoir (Gunkel, 1961; Schalk and Mierendorf, 1983).

In 1990, Eastern Washington University undertook a resurvey for Chelan PUD. This survey concentrated on the northern end of the reservoir, which had received less attention from previous investigators (Galm, 1990; Boreson, 1992).

In 2001, Western Shore Heritage Services, Inc., (WSHS) conducted another survey of the project area for Chelan PUD to check the locations of the 76 previously recorded sites. The archaeologists confirmed that 12 of the previously recorded sites were beneath the waters of the reservoir behind the Rocky Reach dam, 4 sites were found to have been destroyed by recent events unrelated to project operations, and 10 sites could not be relocated. Access for survey was denied by private landowners for about 2.2 miles of shoreline, where seven sites had been previously recorded. WSHS also checked eight areas that Eastern Washington University characterized as being archaeologically sensitive and found one isolated find and one new site. Testing was conducted at four previously recorded sites and the one newly recorded site (Hartmann and Schumacher, 2002, as cited in Chelan PUD, 2004a).

Of the 44 sites that were confirmed to exist in the 2001 survey, the Cultural Resources Working Group identified 10 as potentially eligible for the National Register.

Three are lithic scatters, six are prehistoric camps, and the remaining site is a prehistoric camp with a burial component.

TCPs are cultural resources identified by Indian or other traditional groups. TCPs can be archeological sites or other special activity areas that often lack artifacts or other obvious signs of human occupation. TCPs in general reflect places used traditionally for generations within a tribal community, and can be eligible for the National Register—if they have been continuously used for more than 50 years.

As part of the Washington State University cultural resources survey report produced in 1983 for Chelan PUD, Allan Smith prepared an ethnohistoric study of native peoples who formerly occupied or used the project area (Smith, 1983a,b). TCPs studies were also completed on behalf of the Yakama Nation (Griffin, 2002) and Colville Confederated Tribes as part of the relicensing processes for both the Lake Chelan and Rocky Reach Projects. These studies identified ethnohistoric village or camp sites and native place names in the vicinity of the project area, as well as sites associated with oral legends, vision quest activities, and human burials.

The initial project facilities were built between 1956 and 1961 and are under 50 years of age. They have not been evaluated for eligibility for inclusion in the National Register.

3.7.2 Environmental Effects

Effects on cultural resources within the APE can result from project-related activities such as reservoir operations, modifications to project facilities, or other project-related ground-disturbing activities. Effects can also result from other forces such as wind and water erosion, vandalism, and private and commercial development. The type and level of effects on cultural resources can vary widely, depending upon the setting, size, and visibility of the resource, as well as whether there is public knowledge about the location of the resource.

The conditions of most historic-period archaeological sites appear little changed from the time they were recorded. Conditions of prehistoric sites, however, are variable. Although the conditions of some of the sites appeared similar to conditions seen when they were originally recorded, erosion appears to have adversely affected several other sites. Some bank slumping has occurred in the northern end of the reservoir since the 1990 archaeological surveys in that area.

Chelan PUD and the Cultural Resources Working Group have drafted a Historic Properties and Cultural Resources Management Plan (Cultural Plan) that outlines measures for avoiding, reducing, or mitigating effects on National Register-eligible or potentially eligible cultural resources within the APE over the term of any new license issued. Chelan PUD proposes to finalize this plan and implement it in consultation with

the agencies and tribes. Key elements of Chelan PUD's Cultural Plan, as set forth in the Settlement Agreement (Chelan PUD, 2006g) and supported by BLM as a party to the Agreement, include:

- Formation of a RR Cultural Forum, composed of representatives from the Colville Tribes, Yakama Nation, Bureau of Indian Affairs (BIA), SHPO, BLM, Forest Service, and Chelan PUD to facilitate consultation with agencies and tribes and to ensure that all aspects of work on cultural resources are conducted in accordance with the Cultural Plan..
- Appointment of a Cultural Resources Coordinator, who would be the primary point of contact for all cultural resource tasks undertaken by Chelan PUD.
- Development and implementation of treatment plans in consultation with the RR Cultural Forum for currently identified, eligible archaeological sites within 1 year of license issuance, and development and implementation of treatment plans for other eligible resources as they may be identified over the term of the license.
- Implementation of an archaeological monitoring program to maintain current information about site conditions. The program would be designed to update site information on a regular basis using a rotation system that prioritizes sites on the basis of current assessments of project effects. Annual monitoring would be conducted at those sites subject to the most severe and sustained project effects, as well as any sites documented as containing burials. Chelan PUD's archaeological sites and resources monitoring plan (an appendix to the Cultural Plan in the Settlement Agreement) lists 16 sites warranting first priority for annual monitoring, including 7 archaeological sites that are located in BLM-mapped erosion sites. Eligible or potentially eligible sites that Chelan PUD's archaeological surveys determined were not being threatened by project operations would be monitored every five years. Sites that are currently evaluated as ineligible would be revisited every 15 years. The monitoring priorities would be reviewed annually by the RR Cultural Forum.
- Development of a stand-alone document for management of TCPs. Chelan PUD's treatment plans for identified TCPs within the APE that are affected by project operations would be based on recommendations from the interested tribes and the land management agency responsible for the property on which the TCPs are located.
- Preparation of a curation plan within 3 years of the effective date of the new license to preserve the project's archaeological materials and provide documentation according to the guidelines of 36 CFR 79.

- Development of an integrated cultural resource information management system incorporating data from Chelan PUD's Lake Chelan Project, the Rocky Reach Project, and the Rock Island Project.
- Development and implementation of an interpretive plan and educational program focusing on cultural resources.

Our Analysis

The NHPA (16 U.S.C. 470 et seq.) (as amended) requires federal agencies to manage cultural resources under their jurisdiction and authorizes the Secretary of the Interior to maintain a National Register. The law also provides for the creation of SHPOs to facilitate the implementation of federal cultural resource policy at the state level, and for the responsible federal agency (i.e., agency official) to consult with Native American tribes who attach religious or cultural importance to cultural resources under their jurisdiction. Section 106 of the NHPA requires federal agencies to take into account the effect of any proposed undertaking on properties listed in or eligible for listing in the National Register. If the agency official determines that the undertaking may have adverse effects on properties listed in or eligible for listing in the National Register, the agency official must afford an opportunity for the ACHP to comment on the undertaking. The relicensing of the project is considered an undertaking and the Commission acts as the agency official.

Finalization and implementation of Chelan PUD's Cultural Plan in consultation with the SHPO, Colville Confederated Tribes, Yakama Nation, BLM, BIA, and Forest Service, would ensure that adverse effects on historic properties arising from project operations or project-related activities over the term of the new license would be avoided or satisfactorily resolved. The Cultural Plan would include specific measures to resolve any potential adverse effects arising from license requirements.

Lands within the APE were ceded to the U.S. government in the mid-1850s under treaties with Indian groups. These lands within the APE fall within areas ceded by the Yakima Treaty of 1855.

Indian tribes hold certain rights and privileges reserved under treaty, statute, and executive order. Courts have recognized the origins of certain treaty rights as being "reserved" by tribes from land cessions made by tribes to the United States, rather than as rights "granted" to tribes by the United States. Indian reserved rights continue to be exercised by tribes and their members today under tribal regulation, and remain enforceable under the supremacy clause of the Constitution until extinguished by express Congressional action.

The concept of a federal trust responsibility comes from early Supreme Court decisions that sought to interpret Indian treaties and to determine the relationship among

Indian tribes, Indian property rights, and the federal government. These early cases determined that Indian tribes occupy a unique position as “domestic dependent nations”; that is, they are sovereign entities with authority to prohibit state intrusions but with a “ward-guardian” relationship with the federal government. The tribes trusted the federal government to fill its promises, and the government has thereby incurred a duty to protect the best interests of the tribes.

Implementation of the Cultural Plan would ensure that treaty and trust rights of the tribes for the protection of valued cultural resources are respected through the term of the new license, along with continued consultation occurring among the tribes, PUD, BLM, SHPO, BIA, and other interested parties, along with oversight from Commission staff.

Pursuant to the NHPA and to protect historic properties, we would craft and execute a Programmatic Agreement (PA) to implement the Cultural Plan as a condition of any new license for this project. The PA would be executed between FERC and the SHPO, with Chelan PUD, Yakama Nation, Colville Confederated Tribes, BLM, BIA, and Forest Service invited to sign the PA as concurring parties. With execution and implementation of the PA and the Cultural Plan, we would anticipate that any adverse effects on cultural resources from project operations would be appropriately resolved.

3.7.3 Unavoidable Adverse Impacts

None.

3.8 RECREATION RESOURCES

3.8.1 Affected Environment

3.8.1.1 Regional Recreational Opportunities

Recreational resources in the mid-Columbia River region are extensive and include public and private parks, wilderness areas, preserves, and multi-use lands. Recreational use is primarily associated with water-based activities within the region. Four tributary rivers to the Columbia River, including the Okanogan, Methow, Entiat and Wenatchee rivers, are popular for kayaking, rafting, other boating, fishing, and swimming. Visitors also use the tributaries for other outdoor activities that are enhanced by public access to rivers and lakes, such as sightseeing, camping, hiking, horseback riding, motorcycle riding, mountain bike riding, snowmobiling, cross-country skiing, bird watching, hunting, and other outdoor activities. Washington fishing regulations allow for some recreational fishing in the tributaries, except on the lower Entiat River.

In addition to the four tributaries, the reservoirs on the mainstem Columbia River formed by the Wells, Rocky Reach, and Rock Island projects, as well as numerous public

parks in the project area, provide popular sites for boating, camping, swimming, hiking, fishing, and field sports.

The Columbia River forms the county line between Chelan and Douglas counties, bisecting the project. Chelan County on the west side of the Columbia River includes large areas of public lands with forests, mountains, rivers, and lakes that provide extensive and dispersed recreational opportunities. Public lands include the Wenatchee National Forest, North Cascades National Park, and Lake Chelan National Recreation Area, as well as several designated wilderness areas and other lands managed by BLM, WDFW, and WDNR. These lands provide extensive trail-related recreational opportunities and provide public access for hiking, horseback riding, mountain biking, and off-road vehicles. Chelan County also has numerous lakes and rivers, including Lake Chelan and the Wenatchee and Entiat rivers, which are popular for kayaking and whitewater rafting, as well as for picnicking and sightseeing. Lake Wenatchee and Confluence State Park are popular locations for swimming and boating. The Peshastin Pinnacles State Park provides extensive recreational opportunities, including rock climbing and hiking to elevated view points above the Wenatchee River valley. Ohme Gardens, just outside Wenatchee, provides public access to nine acres of alpine gardens built on a rocky bluff overlooking the Wenatchee River valley and Columbia River.

In Douglas County, located on the east side of the Columbia River, most of the public recreational areas, including camping and day-use facilities, are adjacent to the Columbia River.

3.8.1.2 Recreation Facilities and Opportunities Associated with the Project

There are seven public recreational sites within the project boundary, shown in figure 2 and described in table 12. Chelan PUD built these parks, or portions of these parks, under its original license. Three parks are owned and operated by Chelan PUD, including the Rocky Reach Visitor Center and Park, Chelan Falls/Powerhouse Park, and Beebe Bridge Park. Chelan PUD built and owns two parks, the Lincoln Rock State Park and Daroga State Park, which are currently operated and maintained by Washington State Parks through an agreement with the State of Washington. Chelan PUD built Orondo Park and retains ownership of a small portion of the park. Douglas County Port, which owns most of Orondo Park, currently operates and maintains the site. Chelan PUD built and owns most of Entiat Park. The city of Entiat owns a small portion of the park, which it intends to exchange with the PUD as described in section 3.8.2.2 below. Chelan PUD and the city of Entiat share O&M costs for Entiat Park through a partnership agreement.

A variety of recreational services are available at the seven facilities, including RV and tent camp sites, restrooms with showers, RV sewage dump stations, boat launches and docks, picnic shelters with power, amphitheaters, landscaping and lawns, swimming beaches, athletic fields, and concession buildings.

Table 12. Existing recreational facilities within the Rocky Reach project boundary. (Source: Chelan PUD, 2004a)

Site	Acres	Camping	Picnic and Day-Use Facilities	Boating Facilities	Swimming Beach	Trails/Walkways	Interpretation Facilities	Barrier-free Facilities
Rocky Reach Hydroelectric Project Dam and Visitor Center	38	No	20 picnic tables, 2 shelters, formal gardens, visitor center, museum, playground equipment, 2 horseshoe pits, 3 restrooms, 241 parking spaces	No	No	0.45 mile	Yes	Yes
Lincoln Rock State Park	65	94 RV/tent spaces RV dump	166 picnic tables, 3 shelters, amphitheater, playground equipment, baseball field, volleyball courts, 2 tennis courts, 2 basketball courts, 3 horseshoe pits, 1 open court area, concession building, 6 restrooms/44 toilets/12 showers, 148 day-use parking spaces	3 launch lanes, 6 tie-up docks, 102 boat trailer parking spaces	175 linear feet	0.94 mile	No	Yes
Orondo River Park	5	14 RV/tent sites, grassy area with 10–15 tents	14 picnic tables, 1 shelter, 1 volleyball court, 1 horseshoe pit, 1 restroom/4 toilets/4 showers, 22 day-use parking spaces	1 launch lane, 3 tie-up docks, marina, overnight moorage, 14 boat trailer parking spaces	225 linear feet	No	No	Yes
Entiat Park	40	31 RV sites, 50 tent sites allowed (1991) in day-use area reduced to 25 tents allowed in 2001	108 picnic tables, 1 shelter, playground equipment, 2 horseshoe pits, restrooms/12 toilets/4 showers, 43 day-use parking spaces	1 launch lane, 2 tie-up docks, 17 boat trailer parking spaces	250 linear feet	No	Museum	Yes
Daroga State Park	140	28 RV/tent campsites + 17 boat/walk-in tent sites 2 group camping areas (total	75 picnic tables, 3 shelters, playground equipment, 1 baseball field, 1 soccer field, tennis courts, 2 basketball courts, 1 open court area, restrooms/38 toilets/12 showers, 114 day-use parking spaces	2 launch lanes, 3 tie-up docks, 76 boat trailer parking spaces	475 linear feet	2.5 miles	No	Yes

Site	Acres	Camping capacity 100 people) RV dump station	Picnic and Day-Use Facilities	Boating Facilities	Swimming Beach	Trails/ Walkways	Interpre- tation Facilities	Barrier- free Facilities
Chelan Falls and Powerhouse Parks	53	No	11 picnic tables + 16 in 2 shelters, playground equipment, 2 softball fields, 1 soccer field, 2 volleyball courts, 1 tennis court, 1 basketball court, 2 horseshoe pits, 2 open court areas, 3 restrooms/24 toilets/4 showers, 178 parking spaces	2 launch lanes, 2 tie up docks, 25 boat trailer parking spaces	375 linear feet	0.2 mile	No	Yes
Beebe Bridge Park	56	46 RV/tent sites	14 picnic tables + 14 in 1 shelter, playground equipment, 1 baseball field, 1 soccer field, 1 volleyball court, 2 tennis courts, 1 open court area, 3 restrooms/24 toilets/6 showers, 196 day-use parking spaces	2 launch lanes, 3 tie up docks, 16 boat trailer parking spaces	475 linear feet	0.6 mile	No	Yes

In addition to the seven project recreational sites, Douglas County PUD operates and maintains a boat launch at the tailrace of Wells dam. This boat launch provides access to the Rocky Reach reservoir, but is located within the Wells Project boundary and is not considered further in this environmental review.

3.8.1.3 Recreational Use of the Project

Chelan PUD prepared estimates of existing recreational use from field data collected in the peak summer season (May 30 to September 9, 1999) and the off-season (September 10 to October 31, 1999, and April 1 to May 26, 2000). Chelan PUD did not collect data during winter months because of the low usage of recreational facilities. Chelan PUD supplemented its field data with historical recreational visitor use statistics (1995–2000) that were collected by Washington State Parks, the Port of Douglas County, the city of Entiat, and other recreation facility managers in the area.

Table 13 summarizes estimated average daily use by recreational site and season and estimated visitor use by recreational activity. Lincoln Rock State Park receives the greatest average number of visitors, followed by the project dam day-use area, Daroga State Park, Beebe Bridge Park, and Entiat Park. Chelan Falls/Powerhouse parks and Orondo River Park generally received the lowest amount of use. Summer months received more than twice as many visitors per day at recreational sites in the study area than the fall months, and the fall months received more use than the spring months. For all seasons, average weekend use was about one and one-half times greater than weekday use. The project's seven recreational sites are used by an average of about 3,500 people per day during the peak season, an average of about 1,500 people per day during the fall, and an average of approximately 1,135 people per day in the spring.

Project facilities are of local and statewide significance, providing water access, camping and picnicking facilities, and athletic fields to residents from local towns and cities and visitors from the Puget Sound Basin metropolitan area. Coastal visitors are drawn to eastern Washington by the warm and dry weather patterns. Chelan PUD found that during peak season, more than 60 percent of visitors were from the Puget Sound Basin metropolitan area and 21 percent were from Chelan and Douglas counties. Approximately 40 percent of fall-season visitors were from the Puget Sound Basin metropolitan area and 25 percent of park visitors were from the two local counties. Approximately 40 percent of spring-season visitors were from the Puget Sound Basin metropolitan area, while 31 percent of spring visitors were from Chelan and Douglas counties.

Table 14 summarizes the estimated average number of people per day that participate in recreational activities at seven public recreational sites within the project boundary. During the peak season, camping, picnicking, boating, and walking were the most popular recreational uses.

Table 13. Estimated average daily use of Rocky Reach Project recreation sites.^a

Site	Peak Season (1999) May 30–September 9 Average # People/Day			Fall (1999) September 10–October 31 Average # People/Day			Spring (2000) April 1–May 26 Average # People/Day			Overall Totals
	Avg. Peak	Weekday	Weekend ^b	Avg. Peak	Weekday	Weekend ^b	Avg. Peak	Weekday	Weekend ^b	
Rocky Reach Dam Recreation Facilities and Visitor Center (day-use)										
Subtotal:	568	530	660	331	305	390	359	335	425	3,903
Lincoln Rock State Park										
Camping/overnight	337	285	455	215	185	285	124	100	170	
Boating	89	72	132	15	0	54	7	0	24	
Non-boating day-use	552	458	773	256	255	256	172	165	196	
Subtotal	978	815	1360	486	440	595	303	265	390	5,632
Orondo River Park										
Camping/overnight	63	50	90	8	5	15	14	10	20	
Boating	20	19	25	2	0	12	0	0	0	
Non-boating day-use	131	101	205	23	10	53	17	15	30	
Subtotal	214	170	320	33	15	80	31	25	50	938
Entiat Park										
Camping/overnight ^c	RV 59 Tent 56	RV 43 Tent 42	RV 92 Tent 88	All 40	All 25	All 80	All 2	All 0	All 5	
Boating	55	42	90	4	0	12	3	0	12	
Non-boating day-use	244	183	390	107	80	163	50	10	153	
Subtotal	414	310	660	151	105	255	55	10	170	2,130
Daroga State Park										
Camping/overnight (group)	69	55	97	12	0	38	0	0	0	
Camping/overnight (other)	120	97	175	58	40	95	34	25	49	
Boating	60	54	78	8	6	15	2	0	6	
Non-boating day-use	285	256	352	83	69	110	101	85	149	
Subtotal	534	462	702	161	115	258	137	110	204	2,683

Site	Peak Season (1999) May 30–September 9 Average # People/Day			Fall (1999) September 10–October 31 Average # People/Day			Spring (2000) April 1–May 26 Average # People/Day			Overall Totals
	Avg. Peak	Weekday	Weekend ^b	Avg. Peak	Weekday	Weekend ^b	Avg. Peak	Weekday	Weekend ^b	
Chelan Falls/Powerhouse Parks										
Boating	6	5	8	0	0	0	1	0	2	
Non-boating day-use	281	250	352	115	100	145	122	115	148	
Subtotal:	287	255	360	115	100	145	123	115	150	1,650
Beebe Bridge Park										
Camping/overnight	159	135	210	38	25	75	12	8	20	
Boating	68	60	90	5	0	21	1	0	2	
Non-boating day-use	275	220	405	181	180	179	114	110	128	
	502	415	705	224	205	275	127	118	150	2,721
TOTAL	3,497	2,957	4,767	1,501	1,285	1,998	1,135	978	1,539	19,657

^a Refer to Recreation Use Assessment Report (DES and Howe Consulting, Inc., 2001a).

^b Weekend refers to Friday and Saturday nights for camping/overnight and Saturday and Sunday for day-use.

^c Differentiation between RV and tent camping at Entiat Park during peak season is based on onsite surveys. No data are available to separate fall- and spring- season RV and tent camping

Table 14. Estimated average daily use by activity of Rocky Reach Project recreation sites.

Activity	Peak season (1999) May 30–September 9 Average # People/Day			Fall (1999) September 10–October 31 Average # People/Day			Spring (2000) April 1–May 26 Average # People/Day		
	All	Weekday	Weekend	All	Weekday	Weekend	All	Weekday	Weekend
	Days ^a			Days ^a			Days ^a		
Camping	863	707	1207	371	280	588	186	143	264
Boating	298	252	423	34	6	114	14	0	46
Visiting dam/visitor center	245	220	302	231	214	273	180	161	234
Shore Fishing	2	3	1	0	0	0	3	2	6
Visiting beach/sunbathing	117	90	176	0	0	0	23	10	50
Swimming/wading	99	67	174	0	0	0	10	4	20
Nature study/photography	3	4	0	0	0	0	14	24	0
Hang gliding	8	4	14	0	0	0	8	0	16
Walking	336	338	330	227	259	162	117	97	159
Skating	5	2	10	0	0	0	14	17	10
Jogging	50	58	34	0	0	0	0	0	0
Picnicking	598	450	945	183	131	260	261	160	498
Off-road vehicle riding	0	0	0	11	15	6	0	0	0
Bicycling on-road	8	8	7	5	2	8	29	17	40
Bicycling off-road	98	94	108	40	34	56	0	0	0
Sightseeing	185	180	200	30	8	76	13	6	20
Using playgrounds	210	225	175	13	0	44	50	82	30
Group activity	213	127	415	0	0	0	84	84	83
Total	3497	2957	4767	1501	1285	1998	1135	978	1539

^a Based on 1999/2000 data collection and field monitoring; refer to Recreation Use Assessment Report (DES and Howe Consulting, Inc., 2001a).

Fishing

Chelan PUD documented angling activity specific to the project reservoir in the 1999/2000 Recreational Use Assessment Study Report (DES and Howe Consulting, Inc., 2001a). During the period covered by the study, Chelan PUD found that most angling activity occurred during late summer, when the summer/fall Chinook salmon fishing was open on the Columbia River (opened August 10 and closed October 21). During other parts of the year, anglers primarily target walleye and smallmouth bass, although a large percentage of anglers also were seeking northern pikeminnow as part of a predator control effort. The study reported an average of five anglers per day along undeveloped shorelines during peak-season weekends, and no anglers during peak-season weekdays.

Chelan PUD allows public access to the tailrace for salmon fishing in the late fall and early winter when the fishery is open. After construction of the juvenile fish bypass system began in 2002, Chelan PUD complied with FERC dam safety requirements by prohibiting fishing and boat access within 400 feet of the downstream end of the outfall pipe. This safety and security measure eliminated access to the popular sport-fishing site downstream of the spillway and along the east bank downstream of the project dam. Those fishing for salmon must now move farther down the riverbank, which is open to salmon fishing in the fall and winter. An additional fishing access site has been made available in the project forebay, reached on foot through Lincoln Rock State Park on the Douglas County (east) side of the river.

Watercraft Use

Chelan PUD's monitoring in 1999 and 2000 indicates that peak weekend watercraft use on the reservoir is below the maximum capacity standards recommended by the State Organization for Boating Access (SOBA). The SOBA recommends a maximum boat density of 33 acres per boat on a typical 8,000-acre lake, and Chelan PUD observed an average of 101.5 acres per boat during the average peak-season weekend. Chelan PUD estimates that future peak-season watercraft use would grow to an average of approximately 57 boats on weekdays and 137 boats on weekend days. The projected average watercraft use on the project reservoir would equal approximately 21 and 50 percent use of the SOBA-recommended maximum capacity for weekdays and weekends, respectively. Boat counts made during the July 4 weekend, however, exceeded SOBA's recommended standards on the project reservoir in the reach between Daroga State Park and Beebe Bridge.

During the 1999 peak season, motorboats made up nearly 70 percent of the watercraft use, personal watercraft (jet-skis) made up 29 percent, non-motorboats made up 1 percent, and airplanes and windsurfers made up less than 1 percent of the watercraft use. During the 1999 fall season, all watercraft observed were motorboats. During the 2000 spring season, 80 percent were motorboats, 14 percent were jet-skis, and 6 percent were non-motorized craft.

Dispersed Use

Recreational uses of dispersed use areas include landing small boats, fishing, and swimming. Chelan PUD observed the greatest number of dispersed recreational users along undeveloped shorelines during peak-season weekends, with an average of 65 people per day. An average of 34 people per day was observed along undeveloped shorelines on peak-season weekdays, and little to no activity was observed along undeveloped shorelines during the off-season. Chelan PUD observed most dispersed shoreline use at a beach on Chelan PUD-owned Turtle Rock Island, Chelan PUD- and BLM-owned undeveloped shorelines between Daroga State Park and Beebe Bridge, and on private lands. Chelan PUD observed a few people on the Entiat River sandbar and undeveloped shoreline areas owned by Chelan PUD and managed by WDFW between Beebe Bridge and the Wells Project.

Estimated Use Compared to Estimated Physical Capacity at Existing Developed Sites

In its 1999–2000 monitoring, Chelan PUD found that visitor use at the primary recreational sites was generally well below capacity on peak-season weekdays and during fall and spring seasons. During average peak-season weekends, however, Lincoln Rock State Park campground was near 100 percent of its capacity, Beebe Bridge campground was over 90 percent of its capacity, and Daroga State Park was over 80 percent of its capacity. The capacity of the Entiat Park day-use area was exceeded during peak season weekends because of the number of tent campsites allowed in the day-use area. The estimated number of visitors participating in day-use activities exceeded the parking capacity at Orondo River Park during peak-season weekends. Peak-season visitor use was generally below estimated site capacities at other sites except on some holidays and exceptionally busy weekends.

3.8.1.4 Recreational Needs Assessment of the Project Area

The Interagency Committee for Outdoor Recreation (IAC) is responsible for assisting local, state, and federal agencies in planning, acquiring, and developing recreational resources. The IAC published the Washington State Comprehensive Outdoor Recreation Plan (SCORP) 2002–2007 in October 2002 (IAC, 2002). The SCORP contains information related to a participant survey, *An Assessment of Outdoor Recreational in Washington State*, to inform decision-makers about issues and opportunities associated with outdoor recreation.

Results from the assessment indicate that there is a need for additional lands and facilities to support almost all outdoor recreational categories, including additional provisions for walking, sightseeing, and bicycling. The assessment anticipates growth in nature photography, especially wildlife photography, and a decline in hunting and fishing.

In the assessment, IAC identifies a need to find acceptable means to pay for recreational facility maintenance and operation costs on public lands, including the need for improved on-the-ground management presence. There is also a need for improved data on public recreational behavior and preferences, as well as an inventory of available facilities, in order to ensure that public resources are more effectively used in meeting public needs.

The Douglas County Recreational and Open Space Plan (Douglas County Parks and Recreation, 2000) identifies objectives for the development of parks and recreational and open space systems within the county over a 20-year period. Included in the list of proposals is the development of almost 100 miles of multi-use trails south of the project area. The proposals also include an extension of the trail system north to Lincoln Rock State Park, where a trailhead would be developed.

The Master Plan for Entiat Park (DOH Associates, 1992) lists goals related to the park, including provisions for future expansion of a trail system that would include a new trailhead at the southern end of the park. These trails would provide access to other lands along the Entiat River to the west.

Chelan PUD's Rocky Reach Recreation Inventory (DES and Howe Consulting, Inc., 2001b) identified goals developed by the Washington State Parks for a trail extending from Lincoln Rock State Park to the Wenatchee Loop Trail system. The inventory also identified the potential for a trail connecting Chelan Falls Park and Powerhouse Park.

Chelan PUD found that visitors are generally satisfied with the recreational sites in the project area. During onsite interviews, visitors were asked to rate the site they were visiting on a scale of 1 to 10, with 10 being the most satisfied. All seven of the recreational sites were given very high ratings, with five of the parks given average ratings of 9 or above. Orondo River Park and Entiat Park were just below 9, with ratings of 8.7 and 8.5, respectively. The PDEA provides additional information about this topic (Chelan PUD, 2004a).

During onsite interviews, Chelan PUD asked visitors to choose from a list of items that could make the site better. Of items that were on the list, cleaner facilities and more docks received the most responses. Comments that were reported most frequently under "something else" included more, cleaner, better maintained, closer, and free bathrooms/showers; more and taller trees; more sewer hookups, and power, water, and facilities; more privacy, larger campsites, and more camp sites; more moorage, dock repairs, and both sides of some docks open; more, less, and repositioned sprinklers; more dumpsters, garbage cans, and recycling bins; better beaches and swimming areas and less seaweed; fewer geese and less smell; concession stands and a convenience store; fewer bees; admittance of dogs; and more telephones.

3.8.2 Environmental Effects

3.8.2.1 Recreation Plan

Early in the relicensing process, Chelan PUD convened the Social Sciences Working Group³¹ to develop, conduct, and review project-related recreational studies. The primary recreational issues identified by the Social Sciences Working Group included continued O&M of existing recreational facilities, the expansion/revitalization of some existing park facilities, the creation/extension of multi-use trails, the need for future evaluation of recreational use and needs, and a funding mechanism for implementing proposed PME measures.

To address the recreational issues identified by the Social Sciences Working Group, Chelan PUD proposes to implement the Recreation Plan, which was developed by Chelan PUD and the Social Sciences Working Group and was filed as part of the Settlement Agreement (Chelan PUD, 2006h). Specific elements of the plan, such as site improvements and recreational use monitoring, are addressed in section 3.8.2.2 through section 3.8.2.5 below. WDFW, BLM, Washington State Parks and other agencies, as parties to the Settlement Agreement, concur with Chelan's proposal.

The Forest Service recommends that Chelan PUD: (1) address development, funding and implementation of a comprehensive Information and Education (I&E) package to be used to complement efforts underway locally; (2) address appropriate types and levels of information available to the public about the recreation facilities and opportunities at or near the Project; and (3) implement the Recreation Resource Management Plan (RRMP) proposed in the June 30, 2004, *Preliminary Draft Environmental Assessment*, which includes a provision for a Recreation Enhancement Fund.

Our Analysis

Chelan PUD currently manages recreational facilities under a Recreation Resources Plan submitted by Chelan PUD to the Commission in 1976. Chelan PUD, in consultation with the Social Sciences Working Group, proposes to develop a new Recreation Plan pursuant to the Settlement Agreement. The recreation enhancement fund was designed to be a flexible method for stakeholders to address recreation resources within the river basin. A cumulative beneficial effects on recreation resources within the

³³ The Social Sciences Working Group consists of the Forest Service, NPS, WDOE, WDFW, IAC, Washington State Parks, BLM, Entiat Focus Group, Entiat School District, Boat Club of Wenatchee, Columbia Breaks Fire Interpretive Center, Entiat Valley Chamber of Commerce, Trout Unlimited, City of Entiat, landowners along the project boundary, and Chelan PUD.

river basin could occur, with the enhancement fund complementing the public access and recreation facilities included in Chelan PUD's proposal. Currently, recreational use of project lands occurs at the primary public recreational sites within the project boundary, and the proposed measures discussed in section 3.8.2.2 are designed to address current and reasonably foreseeable future project-related recreational demand at those sites. Further, the recreation-use data collected as part of the FERC Form 80 filing would identify future project-related recreational needs. Because the geographic scope of the recommended fund extends beyond the project boundary and there is no indication of displaced recreational effects from the project to these non-project lands, we do not find a nexus between project operations and the areas outside the existing project boundary that would be addressed by the Recreation Enhancement Fund.

Overall, the plan would guide management of recreational resources and provide a framework for the licensee's implementation of the site improvements and management measures included in the plan, as discussed in more detail in sections 3.8.2.2 through 3.8.2.5 below.

3.8.2.2 Recreational Facility Measures

As part of the Recreation Plan, Chelan PUD proposes the facility improvements summarized in table 15. These proposed enhancements would be located within the project boundary.

A resident of Entiat commented that more recreational facilities, particularly for children, are needed (letter from M. Peterson, Resident, Entiat, WA, to the Commission, filed March 11, 2005). She recommends that Chelan PUD develop and install a new sports field and track on school property, and add a sports field, swimming area, benches, and skateboard park at Entiat Park.

Our Analysis

Existing recreational facilities within the project boundary include seven park facilities that occupy nearly 400 acres of land along the reservoir and provide public access to project lands and waters. The infrastructure at many of the existing recreational facilities is degraded from deferred maintenance, and some of the facilities are not able to support the level of use during peak-use periods. Although most recreational visitors interviewed in 1999 and 2000 expressed a high level of satisfaction with the condition of the sites, they also noted their desire for improvements, including cleaner facilities, better maintained restrooms, dock repairs, and additional recycling and garbage containers. In addition, federal, state, and local recreational studies, including the Washington SCORP and the recreational studies conducted through the relicensing process, indicated a general need for trails, boating access, natural areas, and ball fields.

Table 15. Proposed recreational facility improvement measures. (Source: Chelan PUD, 2006h)

Project	Description	Implementation Schedule
Operate and maintain recreational sites within the project boundary.	Continue ongoing O&M and capital improvements and enhancements for Rocky Reach Park and Visitor Center, Entiat Park, Beebe Bridge Park, Chelan Falls/ Powerhouse Park, Daroga State Park, and Lincoln Rock State Park. Continue O&M of the portion of Orondo Park that Chelan PUD owns.	Ongoing operations and maintenance for existing facilities at the Rocky Reach reservoir would occur throughout the life of the new license.
Renovate and enhance Lincoln Rock and Daroga State Parks	Implement the renovation and enhancement of Lincoln Rock State Park and Daroga State Park to include feasibility, finalization of design, development of a schedule, and determination of costs based on conceptual plans outlined in the Settlement Agreement. Provide for major renovation of, and minor improvements to, existing facilities and enhancements at the parks, which could include, but are not limited to, group camping (an area of the park set aside for groups to camp together in tents, RVs) and convenience camping (small cabins with windows, a door, sleeping bunks, and electricity, but no water or sewer). Washington State Parks would be responsible for the cabins.	Phased, beginning within 1 year of the effective date of new license issuance.
Develop a trail link from Lincoln Rock State Park	In partnership with Washington State Parks on Chelan PUD lands, develop a 1-mile-long trail from Lincoln Rock State Park to a fish bypass viewing station located approximately 300 feet downstream of the Rocky Reach dam. The trail would be constructed on Chelan PUD-owned lands.	Within 180 days of new license issuance or after notification from Washington State Parks that it has completed its planning and permitting process, whichever comes later.
Add irrigation system at Orondo Park	Design and construct an upgraded irrigation system at Orondo Park.	Within 180 days of new license issuance.
Revitalize Entiat Park	Finalize and implement the Entiat Park Revitalization Plan.	Phased, with development beginning within 1 year of new license issuance.

Project	Description	Implementation Schedule
	Upgrade Entiat wastewater treatment plant.	The schedule is not specified in the Settlement Agreement.
	Lease or purchase shoreline land owned by Chelan PUD (9.23 acres) to the City of Entiat.	The schedule is not specified in the Settlement Agreement.
	Design and construct Entiatqua Trail (an interpretive/nature trail at the confluence of the Entiat and Columbia Rivers).	The schedule is not specified in the Settlement Agreement.

Chelan PUD's proposed measures at existing facilities, as discussed in the Recreation Plan, address many of these needs.³² The proposed enhancement measures at existing recreational facilities would improve the quality of recreational resources by: ensuring that the sites continue to provide public access; modernizing the site layout; adding new recreational facilities; and providing barrier-free facilities, where appropriate. These measures would help ensure that public access meets recreational demands for the term of the new license, improve the aesthetic quality and the physical condition of project-related recreational facilities, and reduce recreation-related adverse effects on environmental resources.

Chelan PUD states that Entiat Park upgrades would be based on community input. As identified in the Entiat Park Revitalization Plan (Chelan PUD, 2006h), proposed measures would include the following: (1) Entiat Park upgrades; (2) wastewater treatment plant upgrades; (3) design and construction of a trail linking Entiat Park to the Entiat River Outdoor Learning Center (Entiatqua) at the confluence of the Entiat and Columbia rivers; and (4) lease 9.32 acres of shoreline land owned by Chelan PUD to the City of Entiat with an option to purchase such land in 2012.

We find that these proposed measures at Entiat Park would: (1) address the recreational use capacity issues; (2) satisfy certain goals and objectives identified in the SCORP and in local plans, including the need for trails; and (3) contribute to a beneficial effect on the recreation resources at the park.

With respect to the comment concerning the need for additional recreational resources for children in Entiat, Chelan PUD's proposed measure to upgrade Entiat Park would provide new recreational opportunities and address recreational needs for children and other residents of Entiat.

3.8.2.3 Recreation Resources Monitoring and Evaluation Program

As part of the Settlement Agreement, Chelan PUD proposes to prepare a Recreation Resources Monitoring and Evaluation Program. Every 6 years, Chelan PUD, in consultation with the RR Recreation Forum, would review and evaluate information with respect to existing and potential recreational use within the project boundary, including on BLM lands. Chelan PUD would submit a report to FERC consistent with FERC Form 80 requirements and simultaneously present the information to Chelan PUD's communication department for use in its ongoing comprehensive I&E programs. Following submittal of the FERC Form 80, Chelan PUD and the RR Recreation Forum would review and evaluate the information from the FERC Form 80 along with the findings contained in the most recent Washington State SCORP document. Chelan PUD

³² We note the recommendation to contribute funds to the Entiat School District for ballfields is no longer part of the Chelan PUD proposal, pursuant to the Settlement Agreement.

and the RR Recreation Forum would also review the Recreation Plan for its adequacy in contributing to meeting the recreational needs within the project boundary and, if necessary, revise the plan to accommodate the updated recreation needs and priorities identified by these documents. The revised plan would be submitted to FERC for approval before implementation.

Our Analysis

A concern of the Social Sciences Working Group and other stakeholders expressed during workgroup meetings was how to address potential project-related recreational effects during the term of the license. The proposed monitoring and evaluation program is designed to be a flexible method for Chelan PUD and interested parties to address recreational resources within the project boundary. The proposal establishes a procedure for evaluating and updating the recreation plan. Consequently, the proposal would benefit recreational resources by addressing unforeseen recreational needs that may arise over the term of any new license issued.

The proposed and recommended recreation resources monitoring and evaluation program could provide an opportunity for interested parties to meet every 6 years and review recreational use data collected as part of the FERC Form 80 filing. Chelan PUD's proposal could allow the parties to consider the adequacy of public access and recreational facilities, address project-related recreation and other environmental resource issues; and provide the basis from which Chelan PUD could consider and prioritize new projects.

We acknowledge Chelan PUD's intent of creating the RR Recreation Forum to share information, coordinate efforts, and make recommendations and decisions on the Recreation Plan. Section 15 of the Settlement Agreement indicates that the signatory parties may elect to participate in the forum. Providing a means for the signatory parties to join the forum would help ensure that stakeholders have reasonable opportunities to comment on the recreation plan to meet changing recreational needs.

3.8.2.4 Recreation Use Assessment and Recreation Needs Forecast

Chelan PUD proposes to conduct a study of project recreational use and needs, as well as an analysis of recreational effects on wildlife. Chelan PUD would begin the study in year 20 of the new license and complete it in year 23. See Settlement Agreement, Chapter 9 at Section 4.6.

Our Analysis

The proposed recreational use study, to be completed in year 23 of the new license, would provide useful estimates of total recreational use, recreational use by

activity, the effects of recreational use on wildlife, and recreational resource mapping. This information would complement the recreational use information collected at 6-year intervals for the FERC Form 80 filing and would provide data for assessing site capacity and adjusting recreational resource management practices to meet future recreational needs. As described in section 15.4 of the Settlement Agreement, Chelan PUD would consult with the signatory parties to the agreement, which would help ensure that the study concentrates on the areas most affected by project-related recreational use.

3.8.2.5 Other Measures

As part of its October 28, 2005, section 10(a) recommendations, the Forest Service recommends that Chelan PUD address development, funding, and implementation of a comprehensive Information & Education package to be used to complement efforts underway locally. The Forest Service states that its interest is providing the public with wholistic recreation information about the entire area. In its April 27, 2005, response to agency and stakeholder recommendations, Chelan PUD points out that, although the implementation of a comprehensive information and education package is not included in its proposal, interpretive trails and signs in the project area are being considered for inclusion in the Recreation Plan. The Recreation Plan, filed with the Settlement Agreement, includes interpretive trails and signs in the project area.

Our Analysis

The Forest Service states that the recommended Information and Education package would integrate recreation interpretation and education needs of public recreation providers beyond National Forest System lands. However, the need for a program of this scope is unclear, since the Forest Service does not manage any formal public access sites at the Project. Currently, the existing public recreational sites at the project include educational signage, such as acceptable and prohibited uses. In addition, many of the existing sites, including the Rocky Reach dam site, include educational and interpretive signs and trails. As part of the proposed Recreation Plan, pursuant to the Settlement Agreement, Chelan PUD proposals for interpretation and education would complement the existing signs at the project. Furthermore, interpretation and education would be a component of the Cultural Plan.

3.8.3 Unavoidable Adverse Impacts

None.

3.9 LAND MANAGEMENT AND AESTHETIC RESOURCES

3.9.1 Affected Environment

3.9.1.1 Land Ownership and Use

The project is located in the Columbia River Basin, an important agricultural area and regional transportation hub providing rail service and a water route for barges carrying agricultural and other products to Pacific ports. The Wenatchee National Forest includes more than 2 million acres of public lands in Chelan, Kittitas, and Yakima counties west of the project. Approximately 40 percent of the forest is designated as wilderness, with the remaining 60 percent managed by Forest Service for multiple use, including timber harvest, livestock grazing, and road construction. Recreational opportunities include fishing, rafting, climbing, and skiing.

Other public lands west of the project include the Swakane, Entiat, and Chelan Butte WAs managed by WDFW. The Swakane and Entiat WAs cover approximately 19,200 acres of land and encompass valley bottoms and numerous steep drainages with both perennial and intermittent streams. Primary habitat types include sage steppe, ponderosa pine, and several riparian draws. The higher elevations and north slopes of these units have some heavy thickets of Douglas fir.

The Chelan Butte WA covers approximately 8,200 acres located just outside of Chelan on south-facing slopes of Chelan Butte. The WA is primarily dry grassland and provides habitat for upland birds including chukar, quail, grouse, and mourning doves. In 1963, Chelan PUD provided funds for purchasing 20,397 acres of lands in the Swakane, Entiat, and Chelan Butte areas as mitigation for the development of the project. WDFW manages these areas for hunting, as well as for deer and upland game bird habitat.

Ownership of lands outside and/or adjacent to the project boundary is held by WDNR, Washington Parks and Recreation Commission, the Forest Service, BLM, Chelan PUD, railroad companies, WDOT, City of Entiat, WDFW, and private landowners. Land use adjacent to the project reservoir is primarily agricultural and recreational, and development along the reservoir is low-intensity and rural in nature. Approximately half the development along the reservoir consists of orchards, pasture lands, and residential development associated with Entiat and Orondo. There are two wastewater outfalls that service the cities of Chelan and Entiat.

Seven parks that are part of Chelan PUD's existing Recreation Resources Plan are also located along the reservoir. These include almost 400 acres of land that provide public access to the river and adjacent lands for swimming, boating, personal water-craft use, fishing, camping, picnicking, water-skiing, and other recreational uses.

The remaining lands surrounding the reservoir are undeveloped. These lands can be characterized as dry lands, made up of shrub steppe and grasslands with areas of exposed rock. Much of the undeveloped shoreline lies in areas where the reservoir is very close to transportation rights-of-way, including a small, private railroad and State Route 97A on the west side of the project reservoir and State Route 97 on the east side. Narrow strips of riparian vegetation, including wetland areas, are present along those areas of the reservoir where the shoreline slopes are relatively gentle.

3.9.1.2 Project Lands

The project boundary encompasses approximately 1,500 acres. The majority of the project boundary runs along the 43-mile-long project reservoir. Federal lands within the project boundary include 150.64 acres of BLM land and 1.5 acres of Forest Service land. All of the Forest Service land is in WDOT and railroad right-of-way status. Chelan PUD has flowage rights easements for the remainder of the land within the project boundary.

The midline of the project reservoir forms the boundary between Douglas County to the east and Chelan County to the west. Land use activities within and adjacent to the project boundary on non-federal lands in each county are subject to the relevant county comprehensive plans (developed in accordance with the Washington State Growth Management Act of 1990) and the municipal zoning ordinances that guide specific land use activities under these plans. The Growth Management Act requires that specific planning elements be addressed by each jurisdiction and that implementing regulations (for example, zoning) be consistent and concurrent with the plan.

3.9.1.3 Shoreline Permitting System

Chelan PUD is responsible for reviewing permit applications for certain types of use and occupancy of project lands and waters, in cooperation with local and state agencies, to assure compatibility with FERC license terms and conditions and other appropriate regulations. Chelan PUD's role in the permitting process is to ensure consistency with project purposes, including safety, environmental concerns, and aesthetics. Chelan PUD also encourages consistency with local and county management plans and zoning. Chelan PUD administers a Shoreline Development Tracking System as a means of ensuring that structures built within project lands and waters have minimal environmental or visual effects.

Under the 1971 Washington State Shoreline Management Act, the Columbia River, including the entire shoreline within the project boundary, is designated as a shoreline of statewide significance. Both Douglas and Chelan counties have developed shoreline master programs consistent with the goals of the 1971 Washington State Shoreline Management Act to regulate land use of shorelines up to 200 feet inland from

the ordinary high water mark. The programs have eight goals: economic development, public access, circulation, recreation, shoreline use, conservation, historical/cultural, and restoration. Federal lands within the project boundary have very little shoreline development.

Chelan and Douglas counties and area municipalities participate in the Joint Aquatic Resource Permit Application Program (Joint Permit Program) to reduce the number of forms needed to comply with environmental laws that have a redundant purpose and authority. The project Lands Management Study (DES, 2001c) contains a summary of the Joint Permit Program and an example of the Joint Permit application form. One form can now be used to process any and all permits for:

1. Shoreline Substantial Development, Variance, or Conditional Use Permit issued by local government;
2. Temporary Modification of Water Quality Criteria issued by WDOE;
3. Hydraulic Project Approval issued by WDFW;
4. Section 401 Water Quality Certification issued by WDOE; and
5. Corps section 404 and section 10 Permits.

3.9.1.4 Project Setting and Aesthetic Features

The immediate project area includes about 60 river miles and is dominated by large tracts of natural-appearing landscapes, with agricultural lands and roads along the river and plateaus. The overall character of the landscape is rural, with some development associated with the Rocky Reach dam, Entiat, and Orondo. River terraces contained by high plateaus that are cut by canyons characterize the landscape around the reservoir.

Generally, long-range views from the project reservoir include natural and agricultural landscapes with visual variety created by variations in topography, geology, vegetation, and the relationship of the reservoir to the landscape. Distant views of the eastern slope and the high peaks of the Cascade Mountains are available from project-area roads and other points in the project area.

From Route 2 and Route 97A, the Columbia River and plateaus generally dominate the mid-range viewshed. Project developments, private residences, recreational sites, roads, and transmission lines provide visual contrast to the views of the river valley. In most cases, architectural design and site engineering for project facilities used local materials, so the facilities generally blend with the color and form of the river valley. With some exceptions discussed below, most project developments blend well with the surrounding area and the visual effects are marginal.

Project features, including the reservoir and dam, dominate the close-range views as seen by boaters from the reservoirs, by travelers on Route 2 and Route 97A, and by visitors at the public view points at the dam and on the southern end of the reservoir. Because the river terraces are relatively level and only sparse vegetation is present, there is little or no visual screening of the dam facility. However, where views of the project dam are available, the viewpoints are generally from a height that contains the visual elements of the development in the larger Columbia River Basin. Other components of the development are more prominent than the dam, including the fish passage facilities and fish rearing facilities, located upstream and downstream, respectively, of the project dam's left abutment; the switchyard; the five sets of 230-kV transmission lines that convey power from the powerhouse to the switchyard; and the high-voltage transmission lines, which are outside the project boundary.

The reservoir is the dominant visual element throughout most of the project area. It is well established, with areas of mature riparian habitats, sandbars, cobble and other elements that allow the reservoir to blend with adjacent natural, agricultural, and developed lands. Chelan PUD typically operates the reservoir at a fairly constant level throughout the primary recreational season, which reduces visual contrasts associated with reservoir drawdown, such as shoreline scouring and erosion.

3.9.2 Environmental Effects

3.9.2.1 Land Use Mitigation, Protection and Enhancement Measures

In its license application, Chelan PUD indicated an intent to continue administering the Shoreline Development Tracking System. Although the tracking system is not mentioned in the Settlement Agreement, we assume that Chelan PUD has not changed its stated intent to continue administering the system during the term of any new license.

Our Analysis

Chelan PUD does not propose to implement any specific measures that would affect land use or visual resources within the project area. However, new projects implemented by private or public entities could affect these resources during the term of the new license. The Chelan PUD-proposed measure to continue to administer the Shoreline Development Tracking System would continue to provide a mechanism for controlling shoreline development and ensuring that structures built within project lands and waters have minimal environmental or visual effects.

3.9.3 Unavoidable Adverse Impacts

None.

3.10 SOCIOECONOMIC RESOURCES

3.10.1 Affected Environment

3.10.1.1 Regional Population and Economy

In 2001, the population of Chelan County was approximately 67,100 people and the population of Douglas County was approximately 32,800 people. Overall, the region is sparsely populated, with most of the population concentrated along the Columbia and Wenatchee rivers. The city of Entiat is the largest community on the project reservoir with a population of about 975. The cities of Wenatchee and East Wenatchee, located 7 miles south of the project dam, are the largest in the region and have approximately 27,930 and 5,430 people respectively. Chelan County's population grew 11.8 percent and Douglas County's population grew by 10.8 percent from 1995 to 2001, a rate that is consistent with averages for rural Washington counties.

The economy of the north-central Washington region encompassing Chelan and Douglas counties is based in tourism, agriculture, government, and education. Chelan County provides 80 percent of the jobs in the two-county area and contains 65 percent of the total number of employers. Apples, pears, cherries, and other fruits are important crops in the Columbia River Basin. Other types of agriculture (vineyards, wheat, hay, and potatoes), retail trade, services, manufacturing, recreation, and tourism also support the regional economy.

Table 16 indicates that in Chelan County, the service industry (i.e., hotels, lodging, healthcare, professional services, recreation) is the largest sector in terms of employment and wages paid. Health care is the leading industry and accounts for almost half of the sector's employment and a significant portion of this sector's wages. Hotels and lodging are also important in the service sector, in part because recreational opportunities attract a large number of tourists and recreational visitors from coastal cities such as Seattle. The tourist industry supports a substantial portion of the retail sector in Chelan County.

Table 16. Employee and wages by industry, 1998. (Source: Chelan PUD, 2004a)

	Chelan County		Douglas County	
	Employment	Wages	Employment	Wages
Total by county:	36,021	\$860,009,112	8,910	\$187,016,602
Top three business sectors:				
Service industry	7,472	\$182,070,758	1,223	\$21,758,936
Agriculture	7,281	\$107,768,316	2,716	37,142,025
Government	6,151	\$203,175,772	1,877	60,953,160

The fruit industry (agriculture) is the second largest employment sector in Chelan County, and apples are the largest crop. The primary fruit-growing areas are located along the Columbia and Wenatchee River valleys, where water is available for irrigation.

Government is the third largest employment sector in Chelan County, with education accounting for half of the sector employment. State government employment includes employees of the local school districts, a community college, and the WDOT. Federal employment is primarily associated with the Wenatchee National Forest.

Alcoa Inc. owns and operates an aluminum smelter (Wenatchee Works) in Chelan County, Washington. Aluminum smelting is electricity-intensive and, at full operation, Wenatchee Work's electric demand is approximately 334 MW. In its March 14, 2005, filing with the Commission, Alcoa Inc. states that it has a long-term power supply contract with Chelan PUD to purchase power for consumption at Wenatchee Works.

In Douglas County, agriculture is the largest employment sector, with apples and other fruit as the primary crops. Most of the orchards in the county are located along the Columbia River. The county also has large areas on the Columbia plateau in dry land and irrigated wheat production.

Government is the largest non-agricultural sector in Douglas County, with 87 percent of employment in local government, most of which is devoted to education.

In Douglas County, as in Chelan County, most service-sector employment is in health care. Other service-sector and retail employment supports local businesses and residents and is less dependent on tourism than Chelan County.

Because of the predominance of agriculture in Chelan and Douglas counties, their unemployment rates tend to vary with the agricultural seasons. For example, Washington Employment Security Department (2002) data indicate that Chelan County's unemployment rate in January 2001 was 11.9 percent, rose slightly in February, and decreased to 6.0 percent in July during the peak cherry harvest and remained at 6.0 percent through October due to the apple harvest. Douglas County's unemployment rate showed a similar trend.

Washington Employment Security Department (2002) data also indicate that in 2001 9.5 percent of the population of Chelan County was unemployed, and 8.8 percent of the county population was determined to be below the poverty level. In Douglas County, 7.6 percent of the population was unemployed, and 11.2 percent was determined to be below the poverty level.

3.10.1.2 Project Relationship to Socioeconomic Resources

Chelan PUD and the Social Science Working Group developed a study plan to document current and recent historical economic conditions, as well as the relationship of the project to the economies of Chelan and Douglas counties. The Socioeconomic Study Report (McHugh and Associates, 2000) focuses on the influence of the project on specific industrial and agricultural sectors, as well as communities, within the two counties.

The study indicates that the agriculture sector, which receives water from the project reservoir for irrigation, contributed total (direct, indirect, and induced) output in 1999 amounting to \$166.3 million to the two counties. Total employment and earnings associated with agriculture amounted to 2,550 jobs and \$47.9 million in earnings, with average annual earnings of \$18,803.

Alcoa Inc., a metals manufacturing employer, generated total output of approximately \$254.9 million in 1999. The associated employment and earnings amounted to 1,365 jobs and \$53.5 million, respectively, with average earnings of \$39,198. Alcoa Inc.'s Wenatchee Works employs about 381 people. In its March 14, 2005, filing, Alcoa Inc. states that renewal of Chelan PUD's license for the Rocky Reach Project is critical to sustaining this employment. Alcoa Inc. states that, without continuing access to cost-based power from the project, the company would be forced to seek a power supply in the market place, and that the price would be too high for the company to sustain operations at Wenatchee Works.

Public utilities and electric services providers in the two-county region contributed a total of 307 jobs (including direct, indirect, and induced employment components) and \$11.4 million in earnings. These jobs and earnings are associated with power distributed to other industrial customers from direct allocations (approximately 15 percent of power generated is allocated to Chelan PUD and Douglas PUD) of electricity generated at the project.

The study estimated that the tourism and recreation industries, which depend in part on facilities at the project dam and along the project reservoir, generated total (direct, indirect and induced) output of \$42.9 million in 1999. The associated employment and earnings amounted to 1,108 jobs and \$15.3 million, respectively, with average earnings of \$13,802.

The economy of Orondo, a small rural center located on the east side of the project reservoir in the unincorporated portion of Douglas County, depends on agriculture, tourism, and recreation and was affected by reservoir inundation associated with project construction. Chelan PUD compensated Orondo landowners with a total payment of \$61,500 at the time of construction.

The downtown area of the city of Entiat, located on the west side of the project reservoir in Chelan County, was relocated to accommodate the initial development and inundation of the project. When the project began operations, Chelan PUD compensated landowners that were affected by dam construction and subsequent reservoir inundation. In addition, Chelan PUD provided infrastructure in upland areas of the town site. Chelan PUD paid a total of approximately \$3.1 million from 1956–1961 in compensation to property owners and provided planning assistance to the city of Entiat during this period. In addition, Chelan PUD made payments for legal assistance and infrastructure development totaling approximately \$426,000.

Relocation of the downtown core of Entiat changed the character and the economic welfare of the community during subsequent decades. The community experienced modest improvements in economic conditions, particularly in the real estate market, during the 1990s. A detailed analysis of the relationship of the project to the city of Entiat and Entiat School District No. 127 is provided in the appendix of the Socioeconomic Study Report (McHugh and Associates, 2000).

Environmental Justice

On February 11, 1994, President Bill Clinton signed Executive Order No. 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.” In the memorandum that accompanied Executive Order 12898, the memorandum stated that each federal agency shall analyze environmental effects, including human health, economic and social effects, of federal actions, including effects on minority communities and low-income communities, when such analysis is required by NEPA.

When considering environmental justice under NEPA, the Council on Environmental Quality (1997) provides guidelines to assist federal agencies so that environmental justice concerns are identified and addressed. For the Rocky Reach Project, we assess potential environmental effects of the proposed project on minority and low-income communities, including Indian tribes.

For Chelan and Douglas Counties, the Hispanic community comprises 19.3 percent (12,831) and 19.7 percent (6,433) of the counties’ population, respectively, compared to the state average of 7.5 percent and the national average of 12.5 percent. American Indian and Alaska Native comprise of 1.8 percent (1,187) and 1.9 percent (622) for Chelan and Douglas Counties, respectively (U.S. Bureau of the Census, 2000).

3.10.2 Environmental Effects

Chelan PUD made no proposals that pertain directly to socioeconomic resources within the project boundary.

In their comments on the PDEA, CRITFC recommends that Chelan PUD conduct an analysis on the effects of relicensing alternatives on tribal socioeconomics. CRITFC indicates that construction and operation of the project transferred wealth from tribal people to non-tribal peoples due to the loss of salmon resources.

Our Analysis

The project is operated to optimize use of the water resource to produce electric energy while taking into account the irrigation, recreation, fish and wildlife, flood control, and other beneficial uses of the resource. The project provides low-cost power to its customers, which provides a benefit to residents of Chelan and Douglas counties. The project has had a positive socioeconomic effect on the agricultural, basic metals (aluminum) manufacturing, tourism, and recreation industries and on the region. The city of Entiat and some lands in the area of Orondo were affected by the initial development of the project. However, during the period from 1958 through 1961 when the project began operations, Chelan PUD compensated affected property owners monetarily and provided funding for planning assistance.

Project operations under a new license would not change substantially from existing conditions, although there would be increased costs associated with fish mitigation, implementation of other environmental measures, and plant operations. Energy generation would continue at current levels. As such, the proposed project would not have adverse effects on the cost structure associated with dam operations or create adverse effects on socioeconomic resources in the region. In contrast, proposed measures, such as HCP implementation and implementation of management plans for anadromous and resident fish, could increase the quality of the existing fishery and enhance the recreational resource. These measures could attract new visitors to the area, and, in this way, contribute positively to the socioeconomic resources of Chelan and Douglas counties.

CRITFC's recommendation for further analysis of tribal economics does not appear to provide new information in our consideration of the environmental effects of proposed measures. Insofar as proposed environmental measures protect and enhance anadromous fish that reach project waters, Chelan PUD's proposal would have some positive effect on tribal socioeconomic conditions.

Based on available information including the Settlement Agreement, we find that the proposed project would have no adverse socioeconomic impact on minority and low-income communities within the project area.

3.10.3 Unavoidable Adverse Impacts

None.

3.11 EFFECTS OF NO-ACTION ALTERNATIVE

Under the No-Action Alternative as defined by the staff, the project would continue to operate as it is currently, with no further implementation of the HCP. There would be no significant change to the existing environmental setting or project operation. No new environmental measures, including those contained in the Settlement Agreement, would be implemented.

3.12 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Our recommended action alternative to relicense this existing project would not irreversibly or irretrievably commit any significant developmental or nondevelopmental resources in the basin. At any point in the future, project facilities could be modified or removed and any operational effects altered. There is no major new capacity or construction proposed or recommended that would commit lands or resources in an irreversible manner.

3.13 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

Our recommended operating alternative for the project is expected to provide an average of 6,043,800 kWh of energy each year to the region. This long-term energy productivity would extend for at least as long as the duration of the new license. Our recommendations are designed to minimize or avoid long-term decreases in biological productivity of the system, as well as enhance aquatic habitat and local and regional recreational opportunities.

If the project were operated solely to maximize hydroelectric generation, there could be a loss of long-term productivity of the river fisheries due to decreases in fish passage. Moreover, many efforts to enhance recreational opportunities at the project would be foregone.

With the proposed operating mode, as well as with proposed and recommended enhancement and protection measures, the project would continue to provide a low-cost, environmentally sound source of power. The project, with our recommended measures, would further many of the goals and objectives identified by agencies, tribes, and other interested parties.

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4.0 DEVELOPMENTAL ANALYSIS

In this section, we analyze the project's use of the water resources of the Columbia River to generate power, estimate the economic benefits of the project, and estimate the cost of various environmental measures and the effects of these measures on project operations. Chelan PUD does not propose any modifications to the project generation facilities, but it does propose several environmental and recreational enhancements that would affect project costs.

4.1 POWER AND ECONOMIC BENEFITS OF THE PROJECT

Consistent with the Commission's approach to economic analysis, we base the value of the project power benefits on current cost of replacement power using alternative resources. Our analysis is based on current costs, with no assumptions concerning future escalation or inflation of the various cost components included in the cost of project power or alternative power.³³ For the Rocky Reach Project, we assume the value of generation is similar to the cost of purchasing the equivalent generation from BPA at its new resource rate for firm power.³⁴ Using the average of the monthly high and low load hourly energy rates for BPA customers buying power for all 5 years of the 5-year rate period, we calculate an average energy value of 34.4 mills/kWh. We use BPA's new resource capacity demand rate schedule to value the project's 1,225,000 kW of dependable capacity at \$24 per kW per year (kW-yr). Using the average energy value of 34.4 mills/kWh and capacity demand of \$24/kW-yr, the result is a power value of 39.27 mills/kWh.

The current cost economic analysis is not entirely a first-year analysis in that certain costs, such as major capital investments, would not be expended in a single year. The maximum period we use to annualize such costs is 30 years. Also, some future expenses, such as taxes and depreciation, are known and measurable and are, therefore, incorporated in our cost analysis.

For our economic analysis of the alternatives, we used the assumptions, values, and parameters shown in table 17.

³³ Mead Corporation, Publishing Paper Division, 72 FERC ¶61,027 (July 13, 1995).

³⁴ Bonneville Power Administration, 2002 Wholesale Power Rate Schedules (Revised December 2001).

Table 17. Summary of key parameters for economic analysis of the Rocky Reach Project. (Source: Chelan PUD, 2004a, as modified by staff).

Assumption	Value	Source
Power value ^a	39.27 mills/kWh	Chelan PUD/staff
Overall cost of money	7 percent	Chelan PUD
Discount rate	7 percent	Staff
Insurance rate	0.25 percent of new net investment	Staff
Term of financing ^b	20 years	Staff
Period of analysis ^c	30 years	Staff
Escalation rate after 2006 ^d	0 percent	Staff
Net investment (2006\$) ^e	\$532,715,460	Chelan PUD/staff
O&M costs (2006\$) ^f	\$35,632,400	Chelan PUD/staff
No-action average annual generation (MWh) ^g	6,030,900	Chelan PUD/staff
No-action dependable capacity (kW)	1,225,000	Staff

^a Based on Chelan PUD (2004a) energy value of 34.4 mills/kWh and dependable capacity value of \$24/kW-yr.

^b Staff uses 20 years as the standard term of financing.

^c Chelan PUD submitted a 50-year analysis in its license application (Chelan PUD, 2004a). However, staff uses 30 years as the standard period of analysis. Costs that would be incurred by Chelan PUD beyond 2035, including major costs for acoustic studies in 2036 and 2046 and juvenile bypass system R&M in 2047, are not included in this analysis.

^d Chelan PUD assumed a 3.5 percent escalation rate in its license application (Chelan PUD, 2004a). Our analysis assumes no escalation.

^e Net plant investment from Chelan PUD (2004a, table 18), adjusted through straight line depreciation to 2006. Additional costs added by staff include installation of the Commission-approved micro-turbine (\$2,202,010) (Chelan PUD, letter dated December 27, 2004) and relicensing costs (\$16,200,000) and existing costs (\$119,672,600) (Chelan PUD, 2004a, table 20), all expressed in 2006\$.

^f O&M from Chelan PUD (2004a, tables 19 and 20), including existing annual O&M (\$28,373,000); local, state, and federal taxes (\$1,147,000), existing O&M

(\$2,932,659), and costs associated with the Bull Trout Management Plan that would be incurred prior to issuance of a new license (\$432,800). Additional costs added by staff include micro-turbine O&M (\$6,099) beginning in 2010. All costs were escalated to 2006\$.

- ^g Average annual generation (5,806,000 MWh) from Chelan PUD (2004a) plus increased efficiency gains due to turbine rehabilitation (231,700 MWh) and installation of approved micro-turbine (6,100 MWh), less effects of environmental measures incurred prior to relicensing (-12,900 MWh) (Chelan PUD, letter dated December 27, 2004).

4.2 COMPARISON OF ALTERNATIVES

Table 18 provides a summary of the annual cost, power benefits, and annual net benefits for the three alternatives: Chelan PUD's proposal, Chelan PUD's proposal with staff-recommended measures (staff alternative), and the no-action alternative.

Table 18. Summary of the annual cost, power benefits, and annual net benefits for three alternatives.

	No Action	Chelan PUD's Proposal	Staff Alternative
Installed capacity (MW) ^a	865.76	865.76	865.76
Annual generation (MWh) ^b	6,030,900	6,030,900	6,030,900
Annual power value (\$/MWh and mills/kWh)	\$236,862,960 39.27	\$236,862,960 39.27	\$236,862,960 39.27
Annual cost (\$/MWh and mills/kWh)	\$79,893,810 13.25	\$97,328,570 16.14	\$97,187,920 16.11
Annual net benefit (\$/MWh and mills/kWh)	\$156,969,150 26.02	\$139,534,390 23.14	\$139,675,040 23.16

^a Includes approved micro-turbine scheduled to be on line in 2010. Turbine is not associated with relicensing, and is therefore considered part of "No Action."

^b Includes increased efficiency due to rehabilitation of turbines and installation of approved micro-turbine.

4.2.1 No-Action Alternative

Under the no-action alternative, the project would continue to operate as it was operating when the Commission issued its REA notice on January 12, 2005. The planned turbine rehabilitation and micro-turbine installation approved by the Commission would occur, but Chelan PUD would not proceed further with HCP implementation and would not make other changes or enhancements to the environmental conditions of the project.

Following the noted turbine changes, installed capacity would be 865.76 MW and generation would equal 6,030,900 MWh of electricity annually. Based on our estimate of the current cost of replacing this amount of power with no consideration of inflation over the 30-year period of our analysis, the average annual power value of the project under the no-action alternative would be \$236.86 million (about \$39.27/MWh) and the average annual cost would be \$79.89 million (about \$13.25/MWh), resulting in an average annual net benefit of \$156.97 million (about \$26.02/MWh).

4.2.2 Chelan PUD's Proposal

Under Chelan PUD's proposal, the PUD would implement the environmental measures identified on table 19 as being recommended by Chelan PUD. Chelan PUD's proposal includes a number of substantial investments including continued implementation of the HCP, restoration and maintenance of the fish bypass, hatchery improvements, and recreational facility improvements. The measures included in this alternative would not change the project's installed or dependable capacity or its average annual generation. With the same average annual power value as the no-action alternative and with an average annual cost of \$97.333 million (about \$16.14/MWh), the average annual net benefit of Chelan PUD's proposal would be \$139.533 million (about \$23.14/MWh).

4.2.3 Chelan PUD's Proposal with Staff-Recommended Measures

Under Chelan PUD's proposal with staff-recommended modifications, the project would have the same power benefit as for Chelan PUD's proposal and the no-action alternative. With an average annual cost of \$97.19 million (about \$16.11/MWh), the average annual net benefit of the staff alternative would be \$139.68 million (about \$23.16/MWh). The staff alternative includes most, but not all, the measures proposed by Chelan PUD as well as several additional measures. We discuss the reasons for the staff modifications in section 5.1, *Comprehensive Development and Recommended Alternative*.

4.3 COST OF ENVIRONMENTAL MEASURES

Certain measures proposed by Chelan PUD and other parties would affect project economics because they can increase the production cost by requiring new capital expenditures or additional annual costs for O&M. None of the measures would affect the project's power production capability or average annual generation. Table 19 summarizes the costs of environmental measures considered in this final EIS.

Table 19. Costs of proposed and recommended environmental measures for the Rocky Reach Hydroelectric Project.
(Source: Chelan PUD, 2006a, modified by staff)

Environmental Measures		Recommending Entities ^a	Capital and One-time Costs (2006\$) ^b	Annual Costs Including O&M (2006\$) ^b	Total Annualized Cost
Rocky Reach Environmental Forums					
1	Establish RR Policy Committee and Fish, Wildlife, Recreation, and Cultural Forums	Settlement Parties, Staff	\$0	\$5,000	\$5,000
Shoreline Erosion Plan and Measures^c					
2	Erosion control demonstration projects	Settlement Parties, Staff	\$204,800	\$0	\$17,020
3	Distribution of erosion control information	Settlement Parties, Staff	\$0	\$510	\$510
4	Shoreline erosion control inventory and monitoring	Settlement Parties, Staff	\$0	\$3,690	\$3,690
Water Quality Plan and Measures					
5	TDG measures	Settlement Parties, Staff	\$10,240	\$62,550	\$63,400
6	Water temperature measures	Settlement Parties, Staff	\$0	\$37,860	\$37,860
7	Continued operation under the Hourly Coordination Agreement and the Hanford Reach Agreement ^d	Settlement Parties, CRITFC, Umatilla, Staff	\$0	\$0	\$0

	Environmental Measures	Recommending Entities^a	Capital and One-time Costs (2006\$)^b	Annual Costs Including O&M (2006\$)^b	Total Annualized Cost
8	Water quality sampling in macrophyte beds	Settlement Parties, Staff	\$0	\$9,000	\$9,000
10	Continued implementation of spill prevention and response plans ^d	Settlement Parties, Staff	\$0	\$0	\$0
11	Continued spill management to minimize TDG while meeting fish survival goals and continued monitoring of water temperatures in the project ^{d,e}	Umatilla Tribes, Staff	\$0	\$0	\$0
12	Management to meet Washington state water quality standards ^f	WDOE, Interior, Umatilla Tribes, American Rivers, Staff	\$0	\$0	\$0
13	Water Quality Committee ^g	Umatilla Tribes	\$0	\$5,120	\$5,120
Anadromous Fish Measures under the HCP					
14	Annual and comprehensive progress reports ^d	Settlement Parties, Staff	\$0	\$0	\$0
15	License amendment application as needed ^d	Settlement Parties, Staff	\$0	\$0	\$0
16	Design drawing filings as needed ^d	Settlement Parties, Staff	\$0	\$0	\$0
17	Energy loss (spill) ^d	Settlement Parties, Staff	\$0	\$0	\$0

	Environmental Measures	Recommending Entities^a	Capital and One-time Costs (2006\$)^b	Annual Costs Including O&M (2006\$)^b	Total Annualized Cost
18	Studies, including 2003 FPE, 2004 acoustic and PIT studies, and 2005 acoustic and PIT studies ^d	Settlement Parties, Staff	\$0	\$0	\$0
19	2006 acoustic study	Settlement Parties, Staff	\$1,761,280	\$0	\$146,340
20	2006 PIT study	Settlement Parties, Staff	\$1,718,580	\$0	\$142,790
21	2016 and 2026 acoustic studies ^h	Settlement Parties, Staff	\$3,522,560	\$0	\$292,680
22	Research and development under the HCP (years 1–10)	Settlement Parties, Staff	\$0	\$579,590	\$579,590
23	Pumping energy ^d	Settlement Parties, Staff	\$0	\$0	\$0
24	Continue the existing predator control program ^d	Settlement Parties, Staff	\$0	\$0	\$0
25	Increase the predator control program	Settlement Parties, Staff	\$0	\$102,400	\$102,400
26	Continue existing fish ladder O&M ^d	Settlement Parties, Staff	\$0	\$0	\$0

	Environmental Measures	Recommending Entities^a	Capital and One-time Costs (2006\$)^b	Annual Costs Including O&M (2006\$)^b	Total Annualized Cost
27	Continue existing fish counting ^d	Settlement Parties, Staff	\$0	\$0	\$0
28	Juvenile bypass system construction ^d	Settlement Parties, Staff	\$0	\$0	\$0
29	Bypass system flow ^d	Settlement Parties, Staff	\$0	\$0	\$0
30	Bypass construction R&M (year 2017) ⁱ	Settlement Parties, Staff	\$66,560,000	\$0	\$5,530,230
31	Bypass construction R&M (year 2032) ⁱ	Settlement Parties, Staff	\$66,560,000	\$0	\$5,530,230
32	Incremental bypass system O&M (years 1–5)	Settlement Parties, Staff	\$0	\$240,400	\$240,400
33	Incremental bypass system O&M (years 6–30)	Settlement Parties, Staff	\$0	\$490,940	\$490,940
34	Ongoing bypass system O&M (years 1–30)	Settlement Parties, Staff	0	\$501,240	\$501,240
35	Hatchery capital improvements	Settlement Parties, Staff	\$4,096,000	\$0	\$340,320

	Environmental Measures	Recommending Entities^a	Capital and One-time Costs (2006\$)^b	Annual Costs Including O&M (2006\$)^b	Total Annualized Cost
36	Continue existing hatchery O&M ^d	Settlement Parties, Staff	\$0	\$0	\$0
37	Hatchery O&M (incremental)	Settlement Parties, Staff	\$0	\$571,700	\$571,700
38	Hatchery management committees (years 1–10)	Settlement Parties, Staff	\$0	\$144,900	\$144,900
39	Hatchery management consultants (years 1–10)	Settlement Parties, Staff	\$0	\$57,960	\$57,960
40	Hatchery management committees (years 11–30)	Settlement Parties, Staff	\$0	\$87,420	\$87,420
41	Tributary Conservation Fund (habitat mitigation)	Settlement Parties, Staff	\$0	\$254,980	\$254,980
Alternatives or Additions to the HCP					
42	Established juvenile salmonid mortality and FPE goal achievement (2013 and 2020)	Umatilla Tribes	Unknown	Unknown	Unknown
43	Adult upstream salmonid passage goal achievement	Umatilla Tribes	Unknown	Unknown	Unknown

Environmental Measures		Recommending Entities^a	Capital and One-time Costs (2006\$)^b	Annual Costs Including O&M (2006\$)^b	Total Annualized Cost
44	Funding for regional evaluation of salmon stock	Umatilla Tribes	Unknown	Unknown	Unknown
White Sturgeon Plan and Measures					
45	Brood stock planning, collection, stocking, and monitoring ^j	Settlement Parties, Staff	\$0	\$61,440	\$61,440
46	White sturgeon population supplementation program through hatchery construction	Umatilla Tribes	\$786,430	\$102,400	\$167,740
47	Monitoring and evaluation program including construction of hatchery facility	Umatilla Tribes	\$0	\$43,030	\$43,030
48	Determining the carrying capacity of available habitat and adjusting the supplemental program ^g	Settlement Parties	\$0	\$26,160	\$26,160
49	Annual report to the RR Fish Forum and FERC ^g	Settlement Parties, Staff	\$0	\$10,240	\$10,240
50	Four-tier sturgeon studies	Umatilla Tribes	Unknown	Unknown	Unknown
Bull Trout Plan and Measures^k					
51	Operation of upstream and downstream fish passage, including fishway counts	Settlement Parties, Staff	\$0	\$5,120	\$5,120

	Environmental Measures	Recommending Entities^a	Capital and One-time Costs (2006\$)^b	Annual Costs Including O&M (2006\$)^b	Total Annualized Cost
52	Adult bull trout upstream and downstream passage evaluation	Settlement Parties, Staff	\$147,460	\$0	\$12,250
53	Sub-adult bull trout monitoring	Settlement Parties, Staff	\$0	\$5,120	\$5,120
54	Fishway and bypass modifications, if needed	Settlement Parties, Staff	Unknown	Unknown	Unknown
55	Participate in the FWS bull trout recovery plan development meeting	Settlement Parties	\$0	\$1,690	\$1,690
56	Bull trout radio-tagging and PIT tagging, 2005–2008 ^l	Settlement Parties, Forest Service, Staff	\$0	\$12,340	\$12,340
57	Sub-adult PIT tagging (2006–2009) ^l	Settlement Parties, Forest Service, Staff	\$0	\$2,240	\$2,240
58	Stranding and entrapment study (2005–2007) ^l	Settlement Parties, Forest Service, Staff	\$60,000	\$0	\$4,990
59	Impact minimization measures ^l	Settlement Parties, Staff	\$0	\$0	\$0
60	Radio telemetry study, correlation analysis, facility or operations modifications if required ^{m,n}	Settlement Parties, Forest Service, Staff	\$442,370	\$0	\$36,750

Environmental Measures		Recommending Entities^a	Capital and One-time Costs (2006\$)^b	Annual Costs Including O&M (2006\$)^b	Total Annualized Cost
61	Sub-adult bull trout PIT tagging (starting 2018 and every 10 years thereafter) ^m	Settlement Parties, Forest Service, Staff	\$0	\$260	\$260
62	Collection and funding of tissue samples for genetic analysis (starting 2018 and every 10 years thereafter) ^m	Settlement Parties, Forest Service, Staff	\$0	\$190	\$190
63	Information exchange and regional monitoring efforts ^m	Settlement Parties, Forest Service	Unknown	Unknown	Unknown
Pacific Lamprey Plan and Measures					
64	Continued operation of upstream fishway and downstream fish bypass facilities ^d	Settlement Parties, Staff	\$0	\$0	\$0
65	Upstream passage counts	Settlement Parties, Staff	\$0	\$10,240	\$10,240
66	Literature review of upstream passage measures	Settlement Parties	\$20,480	\$0	\$1,700
67	Measures and monitoring to address project-related effects on adult lamprey passage ^o	Settlement Parties, Staff	Unknown	Unknown	Unknown
68	Periodic passage monitoring (every 10 years)	Settlement Parties, Staff	\$0	\$14,190	\$14,190

	Environmental Measures	Recommending Entities^a	Capital and One-time Costs (2006\$)^b	Annual Costs Including O&M (2006\$)^b	Total Annualized Cost
69	Measurement of effects on juvenile downstream passage	Settlement Parties, Staff	\$716,800	\$0	\$59,560
70	Measures to identify and address juvenile lamprey presence, abundance, and habitat use ^{g,p}	Settlement Parties	\$51,200	\$0	\$4,250
71	Identify and implement measures to address unavoidable effects to achieve No Net Impact	Settlement Parties	Unknown	Unknown	Unknown
72	Investigation of fishway modifications for improving passage of Pacific lamprey, implementation of feasible measures and operational changes, and continued monitoring of fishway effectiveness ^{g,p}	Umatilla Tribes	\$102,400	\$0	\$8,510
73	Upstream lamprey passage activities (annual passage counts, fishway modifications, and radio telemetry program at unspecified intervals)	Umatilla Tribes	Unknown	Unknown	Unknown
74	Downstream lamprey passage measures	Umatilla Tribes	Unknown	Unknown	Unknown
75	Juvenile lamprey habitat assessments (measure abundance, evaluate impacts)	Umatilla Tribes	Unknown	Unknown	Unknown
76	Pacific lamprey regional research and information sharing ^g	Umatilla Tribes	\$0	\$81,920	\$81,920

Environmental Measures		Recommending Entities^a	Capital and One-time Costs (2006\$)^b	Annual Costs Including O&M (2006\$)^b	Total Annualized Cost
77	Meeting specified lamprey passage goals	Umatilla Tribes	Unknown	Unknown	Unknown
78	Lamprey monitoring beyond project boundaries	Umatilla Tribes	Unknown	Unknown	Unknown
Resident Fish Plan and Measures					
79	Fish rearing and stocking	Settlement Parties	\$0	\$100,000	\$100,000
80	Resident fish/fishing enhancement measures	Settlement Parties	\$0	\$3,820	\$3,820
81	Recreational fishing evaluation	Settlement Parties	\$61,440	\$0	\$5,100
82	Evaluation of predatory resident fish on HCP plan species	Settlement Parties, Staff	\$0	\$6,140	\$6,140
83	Monitor resident fish species composition and abundance	Settlement Parties	\$0	Included in No. 82	Included in No. 82
Other Fisheries and Wildlife Measures					
84	Detailed fishery operations plan	Umatilla Tribes	Unknown	Unknown	Unknown
85	Hatchery and habitat management plans	Umatilla Tribes	Unknown	Unknown	Unknown
86	Aquatic invasive species monitoring and control plan development and implementation ^g	Settlement Parties, Staff	\$7,680	\$0	\$640

Environmental Measures		Recommending Entities^a	Capital and One-time Costs (2006\$)^b	Annual Costs Including O&M (2006\$)^b	Total Annualized Cost
Wildlife Plan and Measures					
87	Provide funds to WDFW each year to restore, maintain, or improve WDFW lands within the Chelan Wildlife Area	Settlement Parties, Forest Service, Staff (except as noted in items 91 and 92)	\$0	\$75,780	\$75,780
88	Provide funds to WDFW for restoration of cultivated lands on Chelan WMA	Settlement Parties, Forest Service, Staff (except as noted in items 91 and 92)	\$0	\$59,230	\$59,230
89	Funding for BLM land management on lands in the Rocky Reach Wildlife Area ^q	Settlement Parties, Forest Service, Staff (except as noted in items 91 and 92)	\$0	\$40,960	\$40,960
90	Funding for Forest Service land management on lands in the Rocky Reach Wildlife Area ^q	Settlement Parties, Forest Service, Staff (except as noted in items 91 and 92)	\$0	\$10,240	\$10,240
91	File a revised Wildlife Plan ^r	Staff	\$0	\$0	\$0
92	File a report every 5 years on proposed Wildlife Plan activities ^r	Staff	\$0	\$0	\$0

	Environmental Measures	Recommending Entities^a	Capital and One-time Costs (2006\$)^b	Annual Costs Including O&M (2006\$)^b	Total Annualized Cost
93	Revise project boundary to include lands where operation and maintenance is required under the Wildlife Plan ^f	Staff	\$0	\$0	\$0
94	Establishment of a conservation easement on Chelan PUD Sun Cove property for protection of riparian shoreline	Settlement Parties, Forest Service, Staff	\$100	\$0	\$10
95	Implementation of integrated noxious weed management program on lands affected by reservoir fluctuation	Settlement Parties, Forest Service, Staff	\$0	\$10,240	\$10,240
96	Funding for threatened and endangered wildlife surveys and/or improvement projects for any species ^g	Settlement Parties, Forest Service, Staff	\$0	\$3,070	\$3,070
97	Implementation of noxious weed control for <i>Spiranthes diluvialis</i> protection in the Rocky Reach Wildlife Area	Settlement Parties, Forest Service, Staff	\$0	\$5,120	\$5,120
98	Implementation of a <i>Spiranthes diluvialis</i> monitoring program to evaluate the ongoing status of the populations	Settlement Parties, Forest Service, Staff	\$0	\$3,070	\$3,070
99	Funding for conservation easements on private lands where <i>Spiranthes diluvialis</i> occurs	Settlement Parties, Forest Service, Staff	\$0	\$3,280	\$3,280

Environmental Measures		Recommending Entities^a	Capital and One-time Costs (2006\$)^b	Annual Costs Including O&M (2006\$)^b	Total Annualized Cost
Cultural Plan and Measures					
100	RR Cultural Forum and twice-yearly meetings	Settlement Parties, Staff	\$0	\$2,050	\$2,050
101	Appointment of Cultural Resource Coordinator ^t	Settlement Parties, Staff	\$0	\$1,020	\$1,020
102	Development and implementation of treatment plans for eligible resources	Settlement Parties, Staff	\$0	\$3,070	\$3,070
103	Monitoring plan implementation	Settlement Parties, Staff	\$0	\$3,070	\$3,070
104	Development of separate TCP Plan	Settlement Parties, Staff	\$0	\$1,720	\$1,720
105	Curation Plan development	Settlement Parties, Staff	\$0	\$190	\$190
106	Integrated cultural resources information system development and implementation	Settlement Parties, Staff	\$0	\$1,720	\$1,720
107	Development and implementation of interpretive/educational plan/program	Settlement Parties, Staff	\$0	\$5,150	\$5,150
108	Site treatment measures ^u	Settlement Parties, Staff	\$204,800	\$0	\$17,020

Environmental Measures		Recommending Entities^a	Capital and One-time Costs (2006\$)^b	Annual Costs Including O&M (2006\$)^b	Total Annualized Cost
Recreation Plan and Measures					
109	Continued ownership, operation and maintenance of Rocky Reach reservoir park system ^d	Settlement Parties, Staff	\$0	\$0	\$0
110	Renovations and enhancements at Lincoln Rock State Park and Daroga State Park	Settlement Parties, Staff	\$6,144,000	\$0	\$510,480
111	Construction of a paved 1-mile trail from Lincoln Rock State Park to a fish bypass viewing station downstream of Rocky Reach dam	Settlement Parties, Staff	\$512,000	\$0	\$42,540
112	Design and implementation of an irrigation system at Orondo Park	Settlement Parties, Staff	\$25,600	\$0	\$2,130
113	Design and implementation of Entiat Park upgrades	Settlement Parties, Staff	\$6,144,000	\$0	\$510,480
114	Wastewater treatment plant upgrade to accommodate usage of Entiat Park facilities	Settlement Parties, Staff	\$1,331,200	\$0	\$110,600
115	Lease to the City of Entiat, with an option to purchase, 9.32 acres Entiat shoreline currently owned by Chelan PUD ^y	Settlement Parties, Staff	\$0	\$0	\$0

Environmental Measures	Recommending Entities^a	Capital and One-time Costs (2006\$)^b	Annual Costs Including O&M (2006\$)^b	Total Annualized Cost
116 Annual operation and maintenance of improvements made at Entiat Park	Settlement Parties, Staff	\$0	\$335,870	\$335,870
117 Design and construction of Entiatqua Trail	Settlement Parties, Staff	\$1,228,800	\$0	\$102,100
118 Annual community meeting	Settlement Parties	\$0	\$1,000	\$1,000
119 Recreation use study beginning in year 20	Settlement Parties, Staff	\$102,400	\$0	\$8,510
120 Recreation resources monitoring and evaluation program	Settlement Parties, Staff	\$0	\$27,960	\$27,960
121 Completion of construction by year 10	Settlement Parties, Staff	\$0	\$0	\$0
123 Recreation monitoring on BLM land ^g	Staff	\$0	\$3,070	\$3,070
124 Interpretive trails and signs at project recreational sites ^g	Settlement Parties, Staff	\$0	\$2,050	\$2,050
125 Recreation enhancement fund	Forest Service	\$1,000,000	\$211,739	\$294,830
126 Information and education program for project recreational sites	Forest Service	\$0	\$2,000	\$2,000
127 File a revised Recreation Plan ^f	Staff	\$0	\$0	\$0

Notes: CRITFC – Columbia River Inter-Tribal Fish Commission
 FERC – Federal Energy Regulatory Commission
 FPE – fish passage efficiency
 FWS – U.S. Fish and Wildlife Service
 HCP – Anadromous Fish Agreement and Habitat Conservation Plan for the Rocky Reach Project
 O&M – operation and maintenance
 PIT tag – passive integrated transponder tag
 R&M – restoration and maintenance
 REA – ready for environmental analysis
 RR – Rocky Reach
 TCP – traditional cultural property
 TDG – total dissolved gas
 WDFW – Washington Department of Fish and Wildlife

- ^a Settlement Parties = proposed by Settlement Parties in Settlement Agreement; Staff = recommended in staff alternative; Forest Service = recommended by the party in its letter(s) to the Commission in response to the Commission’s REA notice.
- ^b Costs based on Chelan PUD estimates in the Settlement Agreement, except as noted.
- ^c Costs and measures to implement shoreline erosion at BLM cultural sites are contained in Measure No. 108.
- ^d Cost included in no-action alternative; no incremental cost associated with Chelan PUD’s proposal.
- ^e Included as component of TDG measures in Water Quality Plan.
- ^f Staff assumes that the cost of achieving state water quality standards is reflected in the measures recommended for inclusion in the water quality plan.
- ^g Staff cost estimate.
- ^h Does not include acoustic studies in 2036 and 2046, which occur beyond the 30-year economic analysis period.
- ⁱ Does not include bypass R&M in 2047, which occurs beyond the 30-year economic analysis period.

- j Staff does not recommend hatchery construction at this time, but recommends that other elements of the proposed supplementation program be implemented on license issuance, and that the hatchery be constructed if monitoring and evaluation of initial measures indicates that it is needed to achieve White Sturgeon Plan goals.
- k Measures included in FERC-approved Bull Trout Plan.
- l Staff assumes that costs to be incurred in 2005 and 2006 to implement the FERC-approved Bull Trout Plan are part of the no-action alternative; costs to be incurred in 2007 and beyond are treated as incremental costs associated with Chelan PUD's proposal.
- m Post-licensing costs associated with implementation of the FERC-approved Bull Trout Plan are assumed to be incremental costs of Chelan PUD's proposal.
- n Does not include the cost of facility modifications or operational changes if they are identified.
- o Most of this measure is reasonable and would benefit lamprey; however, we do not recommend including a requirement to meet passage rates similar to best rates at other projects in the Columbia and Snake rivers in any license issued for the project.
- p Does not include the cost of implementing feasible measures or operational changes if they are identified.
- q Costs include matching funds.
- r Cost for staff's recommended measures are assumed to be included in cost of respective plan.
- s Chelan PUD currently funds wildlife surveys at \$7,500 per year. The proposal would fund studies at \$10,500 per year, equaling an incremental cost of \$3,000 annually.
- t Assumes duties undertaken by existing staff rather than new hire.
- u Cost for stabilizing site 45CH254 (on BLM land) is included in this measure.
- v Chelan PUD estimated a zero cost for this trade-lease/purchase agreement. Staff assumes the lands to be traded are of equal value.

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5.0 STAFF'S CONCLUSIONS

5.1 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a) of the FPA, 16 U.S.C. 797(e) and 803(a)(1) require the Commission to give equal consideration to developmental and non-developmental uses of the waterway on which a project is located. When we review a hydropower project, we consider the water quality, fish and wildlife, recreational, and other non-developmental values of the waterway equally with the project's electric energy and other developmental values.

This section presents our rationale in balancing the developmental and non-developmental values and our recommendations for the plan best adapted to comprehensive development of the waterway. Our balancing analysis considers the comparative environmental effects of the alternatives (section 3.0, *Environmental Consequences*), their economic viability (section 4.0, *Developmental Analysis*), and their consistency with relevant agency recommendations, comprehensive plans, and laws and policies (sections 5.2, 5.3, and 5.4, respectively).

Based on our independent review and analysis of the project, the measures proposed by Chelan PUD, and the additional measures recommended by agencies and other stakeholders, we recommend relicensing the project as proposed with our additional staff-recommended environmental measures (staff alternative) as discussed below.

We are recommending the staff alternative because: (1) issuance of a new license would allow Chelan PUD to continue to operate the project as a dependable source of electric energy for its customers; (2) the 865.76-MW project would avoid the need for an equivalent amount of fossil-fuel fired electric generation and capacity elsewhere, continuing to help conserve these non-renewable energy resources while reducing atmospheric pollution; and (3) the recommended environmental protection and enhancement measures would improve water quality, protect or enhance fish and terrestrial resources, improve public use of recreational facilities and resources, and maintain and protect historic and archaeological resources within the area affected by project operation. The overall benefits of this alternative would be worth the cost of proposed environmental measures.

We recommend including the following environmental measures proposed by Chelan PUD in any license issued for this project, but revising certain specific elements of the measures, as noted:

1. Establish four forums: RR Fish, Wildlife, Recreation, and Cultural Resource forums and a RR Policy Committee;

2. Implement the Shoreline Erosion Plan;
3. Implement the Water Quality Plan;
4. Continue to implement the HCP for Rocky Reach to protect salmon and steelhead;
5. Implement the White Sturgeon Plan (except as noted below);
6. Continue to implement the Bull Trout Plan (except as noted below);
7. Implement the Pacific Lamprey Plan (except as noted below);
8. Conduct a comprehensive evaluation of the effects of predatory fish species on HCP plan species;
9. Implement the Wildlife Plan with refinements (see below)
10. Implement the Cultural Plan; and
11. Implement the Recreation Plan with refinements (see below).

In addition to Chelan PUD's proposed measures, we recommend the following modifications and refinements:³⁵

1. Modify the goal of the White Sturgeon Plan from increasing sturgeon abundance to a level commensurate with available habitat to implementing measures that would reduce or eliminate the effects of the O&M of the Project on white sturgeon. Additionally, we are not recommending that Chelan PUD be required to conduct an analysis of the carrying capacity of the available habitat.
2. Modify the Bull Trout Plan so that Chelan PUD will not be required to participate in development of FWS's bull trout recovery plan, specifically attending meetings and participating in regional information exchanges and monitoring efforts.
3. Modify the Pacific Lamprey Plan so that Chelan PUD will not be required to: achieve the best passage rates found at other Columbia River projects, implement a no-net-loss standard for Pacific lamprey, fund regional research, or participate in regional information exchanges.

³⁵ The Commission has often stated that it is the licensee's responsibility to complete measures required by the license, that dollar figures are not absolute limitations (that is, the Commission reserves the authority to require licensees to fulfill the requirements of the license notwithstanding any limitations on expenditures either proposed by the applicant or recommended by others), and that cost caps are not absolute limitations (See Virginia Electric Power Co., 110 FERC ¶ 61,241 [2005] and Portland General Electric Co., 111 FERC ¶ 61,450 [2005]).

4. Implement one element of the Resident Fish Plan—Conduct surveys to determine the effects of predatory resident fish on juvenile salmon and steelhead. Exclude from the license the other measures included in the plan, including fish rearing and stocking, fishing enhancement measures, recreational fishing evaluation, and monitoring of resident fish species and abundance.
5. Revise the Wildlife Plan in consultation with WDFW, BLM, the Forest Service, FWS, and other entities that wish to participate in the RR Wildlife Forum and file the Plan with the Commission for approval within 1 year of license issuance. The final Plan, which would be updated every 5 years, would: (a) specifically describe the habitat improvement projects that would be undertaken for the next 5 years, an implementation schedule, and any monitoring or maintenance programs to ensure success of the measures; (b) include a detailed description of an integrated noxious weed control plan, including a description of the areas to be treated in the first five years of license issuance, and the methods of treatment; (c) include a detailed description of the wildlife surveys that would be implemented for the next 5 years, with subsequent 5-year reports including any proposed modifications to survey efforts; and (d) include the provisions of the “Ute-ladies’-tresses along Rocky Reach Reservoir Management Plan.” The final Plan would also contain a provision for making project features and including in the project boundary the Chelan Wildlife Area and BLM and Forest Service-owned lands where annual O&M of the implemented measures is required to ensure effectiveness. The final plan would **not** include measures that are not directly habitat related and are generally the responsibility of the land managing agency.
6. Incorporate the riparian habitat associated with the Sun Cove property in the project boundary and protect the wildlife habitat (as opposed to acquiring a conservation easement).
7. Revise the Recreation Plan to include the following elements: (a) a description with detailed drawings of the type and location of all proposed recreational facilities and improvements, including proposed design, construction materials and methods; (b) an implementation schedule for all measures and filings with the Commission for approval; (c) a description of the interpretive trails and signs developed in concert with the Cultural Plan; (d) identification of the entity responsible for O&M of the recreation facilities; (e) a discussion of how the needs of the disabled were considered in the planning and design of the recreation facilities; (f) in concert with Article 9(g) (Recreation Resources Monitoring and Evaluation Program) of the Settlement Agreement, monitor recreation use on an estimated 150 acres of BLM lands, located adjacent to the Rocky Reach Project reservoir and within the project boundary; and (g) documentation of consultation with at

least, but not limited to, WDFW, BLM, NPS, Washington State Parks, and the City of Entiat on the design and implementation of the proposed recreation facilities. File the plan for Commission approval within one year of license issuance. Ensure components of the plan are consistent with the proposed Recreation Plan implementation schedule in the Settlement Agreement.

Most of the measures proposed by Chelan PUD and the staff would reduce the net power benefits of the project. We discuss the most substantive of these measures in the following text. We also discuss measures not included in our recommended alternative.

5.1.1 Shoreline Erosion Plan

In the Settlement Agreement, Chelan PUD proposes four measures to address erosion: (1) performing erosion repair work at four sites selected by Chelan PUD to demonstrate appropriate erosion control techniques and educate the public about such techniques; (2) making information on erosion control methods available to local governments and individuals with land along the reservoir shoreline; (3) monitoring shoreline erosion during the new license term; and (4) planning and carrying out appropriate erosion repairs at a BLM site within the project boundary. The first three measures are included in Chelan PUD's proposed Shoreline Erosion Plan and could be implemented at an annualized cost of \$21,220. The measures would stabilize four sites that are currently eroding, provide the public tangible examples of appropriate stabilization techniques and information regarding stewardship measures that can be used to prevent shoreline erosion, and provide a basis to identify erosion sites and sites in need of remedial work. We conclude that these benefits would be worth the associated costs. The fourth measure of Chelan PUD's proposal, the cost of which is included in Chelan PUD's proposed Cultural Plan (see section 5.1.10), would stabilize and protect a cultural site from project induced erosion. This measure, along with other cultural site treatment measures, has an estimated cost of \$204,800 (equaling an annualized cost of \$17,020), and we conclude that this site protection would be worth the associated cost.

5.1.2 Water Quality Plan

With the exception of the numeric criteria for temperature and TDG, the Columbia River within the project area generally meets the applicable water quality standards (refer to tables 1, 2, 6, and 7). CE-QUAL-W2 modeling results suggest that project-caused increases in the water temperatures seldom exceed the allowable limits set in the existing water temperature standard. Three water quality issues would likely require management through implementation of compliance plans: (1) TDG, (2) oil and hazardous material spill prevention and countermeasures, and (3) water temperature. Chelan PUD proposes to address water quality issues by implementing the Water Quality Plan that includes operating the project under the Hourly Coordination Agreement and Hanford Reach

Agreement; implementing several measures addressing TDG and its potential effects on fish; monitoring water temperatures in the project's forebay, tailrace, and juvenile and adult fishways; monitoring temperature, DO and pH in shallow waters of the project's reservoir; and implementing and revising the project's Spill Prevention Control and Countermeasure Plan along with upgrading oil monitoring and separating equipment as needed. In the Water Quality Plan included in the Settlement Agreement, Chelan PUD (2006b) addresses water quality issues and cites the results of nine water quality studies that provided WDOE with the basis for issuing a water quality certification for the project. We recommend implementing this Water Quality Plan, which would incur an annualized cost of \$110,260 and would facilitate Chelan PUD's meeting state water quality standards and thereby improve water quality in the project area. That goal is supported by WDOE and the recommendations of the Umatilla Tribes and American Rivers, and would benefit designated uses, including fish (including salmonid species) and wildlife habitat, water supply (domestic, irrigation, industrial), recreation, and navigation. Implementing Chelan PUD's proposal to monitor water temperature in the project's forebay and tailrace from April through October along with modeling for an additional 5-year period would support more robust modeling to better evaluate project effects on discharges.

Chelan PUD's proposal to annually submit a gas abatement plan accompanied by an up-to-date operations plan, a fisheries management plan, physical monitoring plan, and biological monitoring plan would likely improve the efficacy of fish passage based on results of TDG monitoring, and would provide a mechanism for meeting performance goals with respect to native fish. Annually updating the plan would address the potential need to revise the operations plan as recommended by the Umatilla Tribes. We recommend that Chelan PUD implement measures for meeting water quality standards, including TDG, within a 10-year period. Chelan PUD should coordinate activities associated with meeting TDG standards with meeting fish passage criteria to ensure that meeting the TDG standards does not result in an overall negative effect on the fish community. This would include an 8-year period for adaptively developing and implementing TDG abatement measures, followed by a 2-year period to pursue other means of satisfying Washington State water quality standards. We do not recommend adopting the recommendation of the Umatilla Tribes that Chelan PUD establish a special water quality committee. We estimate that the cost of this measure would be \$5,120 annually, and we conclude that such a measure would not be worth the cost and would be unnecessary since the proposed function of the committee would be adequately addressed by the RR Fish Forum.

5.1.3 HCP Implementation for Anadromous Fish

Implementation of the HCP is a key element of Chelan PUD's proposal. The HCP is a 50-year agreement to protect five species of Columbia River steelhead and salmon: spring and summer/fall Chinook salmon, sockeye salmon, coho salmon, and steelhead,

which are collectively referred to as the Plan Species. The HCP aims to result in no net impact on the Plan Species by implementing a combination of mitigation tools to achieve fish passage survival rates and a virtual 100 percent survival of fish passing the project. Components of no net impact include 91 percent combined juvenile and adult project survival achieved by project improvement measures implemented within the geographic area of the project, 7 percent achieved through hatchery programs, and 2 percent achieved through the tributary program, which includes a fund for habitat improvements. Under the terms of the HCP, if the HCP terminates before the end of the license term, Chelan PUD would continue to implement the last agreed-to measures until the Commission orders otherwise.

The HCP relies on the juvenile fish bypass system as the primary method for increasing juvenile salmonid survival. As prescribed in the HCP, Chelan PUD would continuously operate the juvenile bypass system from April 1 to August 31 each year to protect the juvenile fish migration. The HCP also specifies spill as a means of increasing survival of juvenile salmonids as they pass through the project. The HCP specifies that Chelan PUD would provide spill to pass fish during a time period that encompasses 95 percent of each species' downstream migration. The HCP calls for continued use of the existing fishway to facilitate upstream passage for adult salmon and steelhead (as well as other fish species that use this pathway, including bull trout). The HCP establishes a survival standard for adult Plan Species that must be achieved when technology becomes available to measure adult survival, with a three-phase program that would provide for adjustments to ensure biological success.

Full implementation of the HCP as a means of protecting anadromous fish, which would be achieved at an annualized cost of \$15,014,120, has wide-spread support among the stakeholders and is included in Interior's and NMFS' section 18 fishway prescriptions, WDFW's section 10(j) recommendations, and the recommendations of WDOE. The Umatilla Tribes recommend alternative goals, including reduced juvenile salmonid mortality goals for 2013 and 2020, adult salmon upstream survival goals of 97 to 98 percent by 2013, and additional funding for regional evaluations of salmon stocks.

In both its Master Order (107 FERC ¶ 61,280) and its Order Amending the Rocky Reach Project license (107 FERC ¶ 61,281), the Commission accepted the proposed HCP and its associated measures, indicating that "the orders will serve the public interest by putting into place a long-term program to aid in the recovery of the endangered species and help to prevent other salmonids from becoming listed." The Commission based its approval of the HCP on the environmental analysis presented in the NMFS final EIS (NMFS, 2002) for the HCP, with the Commission participating as a cooperating agency, and after consideration of all comments from other parties that pertained to the HCP. The Umatilla Tribes recommend passage standards for juvenile and adult salmon through the entire project, with mortality defined as direct and delayed mortality. However, as we discuss in section 3.4.2.1, *Actions Covered by the Rocky Reach Anadromous Fish*

Agreement and Habitat Conservation Plan, there is currently no proven method for accurately differentiating project-caused mortality and natural mortality. Additionally, the Umatilla Tribes' recommendation does not propose any measures to address losses resulting from failure to pass through the project as does the Commission-approved HCP. Because the costs of the Umatilla Tribes' more stringent standards are unknown, and methods to achieve those standards are not certain, it is not apparent what public benefit would be realized by implementing the Tribes' standards compared to the HCP. Therefore, we do not recommend adopting the Umatilla Tribes' proposed standards.

5.1.4 White Sturgeon Plan

Chelan PUD proposes to implement the White Sturgeon Plan designed to promote white sturgeon population growth in the project reservoir to a level that is supportable by the available habitat. The White Sturgeon Plan includes a supplementation program, a monitoring program, long-term indexing, investigation of emigration rates of the supplemented population, supplementation program review, determination of carrying capacity of available habitat based on monitoring results, and an evaluation of spawning potential. The White Sturgeon Plan would include consideration of a new hatchery as one of several potential elements of a supplementation program, but does not specify a schedule for hatchery construction. Development and implementation of a White Sturgeon Plan was endorsed by recommendations of the Umatilla Tribes as well as by the parties to the Settlement Agreement, including FWS and WDFW. The Umatilla Tribes made additional recommendations, calling on Chelan PUD to implement a 4-tier sturgeon study and construct a hatchery facility within 5 to 15 years of new license issuance to supplement the sturgeon population.

As we note in our analysis in section 3.4.2.2, *White Sturgeon Populations*, development and implementation of the White Sturgeon Plan, as described in the Settlement Agreement, would provide a supplementation program for white sturgeon that would mitigate for project effects and enhance the white sturgeon population in the reservoir. As proposed by Chelan PUD, the total annualized cost of finalizing and implementing the plan would be \$71,680. We conclude that this plan would be worth the cost and we recommend that Chelan PUD implement the measures within the White Sturgeon Plan. However, we do not recommend that Chelan PUD be required to meet the goals of the plan. The goals of the plan would require Chelan PUD to increase the white sturgeon population to levels commensurate with available habitat and levels that would allow for appropriate and reasonable harvest. Because we are unable to determine if these goals are attainable and what level of enhancement, including costs, would be necessary to achieve these goals, we do not recommend including these goals as a requirement of any license issued for the project.

The Umatilla Tribes recommend construction of a white sturgeon hatchery facility within 5 to 15 years after license issuance. At this time, the results of the initial

investigations into the success of the supplementation program and other study results are unknown. The White Sturgeon Plan contemplates construction of a white sturgeon hatchery, but states that the RR Fish Forum would use adaptive management to determine how to best provide broodstock for the supplementation program and would decide if construction of a white sturgeon hatchery is necessary. This approach would provide flexibility for selecting a source of white sturgeon. Because construction of a hatchery may be unnecessary and not worth the cost if other lower cost sources of viable white sturgeon are available, we do not recommend, at this time, requiring Chelan PUD to construct a white sturgeon hatchery facility within 5 to 15 years of license issuance.

5.1.5 Bull Trout Plan

On February 28, 2005, Chelan PUD filed its Bull Trout Management Plan under Article 411 of the existing license for the project, and the Commission approved the plan on April 19, 2005 (111 FERC ¶ 62,071). The plan as approved by the Commission included the following elements: (1) a monitoring program to identify potential project-related impacts to upstream and downstream passage of adult and subadult bull trout, (2) evaluation of potential stranding or entrapment that may occur, (3) participation in regional bull trout monitoring and research efforts, (4) implementation of impact minimization measures, and (5) implementation of conservation measures, as spelled out in the Bull Trout Management Plan. In its April 19, 2005, order approving the plan, the Commission indicated that implementation of the Bull Trout Management Plan was in the public interest and our analysis in this document further supports the conclusion that implementing the Bull Trout Management Plan as part of relicensing the Rocky Reach Project would be in the public interest. Refinements to the FERC-approved plan that are incorporated into the Settlement Agreement would have similar effects on bull trout in the project. Therefore, we recommend that implementation of the Settlement Agreement's Bull Trout Plan (with an annualized cost of \$79,260) be included in any license issued for the project area.

While some coordination and consultation of bull trout measures would be inherent in efforts to mitigate for project effects on bull trout, attendance at FWS's bull trout recovery plan meetings, and participation in regional bull trout monitoring and research efforts are not project-related. Therefore we do not recommend including this measure in any license issued for the Rocky Reach Project.

5.1.6 Pacific Lamprey Plan

Chelan PUD proposes to implement a Pacific Lamprey Plan with provisions to measure ongoing impacts on upstream passage of adult lamprey, and downstream passage of adult and juvenile Pacific lamprey and eliminate those impacts where appropriate and reasonable. The plan measures would address current passage inefficiencies that have been identified, and the proposed continued monitoring would

document the upstream passage effectiveness after modifications are implemented. Implementation of this plan would assist in the recovery and maintenance of the Pacific lamprey, which are a culturally significant native species in the Columbia River. We estimate the total annualized cost for implementing the plan to be \$83,990 and we find that the benefits of the plan would be worth the cost.

As part of the plan, Chelan PUD proposes to implement measures to meet a passage standard for lamprey that is similar to the best passage rates at other projects on the Columbia and Snake rivers. Such standards are unrelated to the magnitude of project effects and may vary in time, and thus are difficult to enforce. Further, the passage rates that can be achieved at other projects may be unreasonable or infeasible when applied to the Rocky Reach Project. Lastly, the cost to achieve these standards is unquantifiable, but could be very high. Therefore, we conclude that these standards may not be worth the cost and we do not recommend including them in any license issued for the project.

Implementing the HCP, which we recommend, may provide additional benefits to Pacific lamprey passing the project and inhabiting tributaries to the Columbia River in the vicinity of the project. Such actions would include operation of the juvenile bypass system, which would provide a safe passage route for downstream migrating juvenile lamprey, and implementation of the Northern pikeminnow predator control program, which would reduce the predation mortality of downstream migrating juvenile lamprey.

The Umatilla Tribes indicate that regional fisheries managers are developing passage standards for juvenile lamprey and that once these standards are developed, Chelan PUD should be required to meet these standards. Because no passage standards exist at this time, we are unable to determine whether such standards would be attainable or worth the cost and we do not recommend that Chelan PUD be required to meet undefined juvenile lamprey passage standards.

For upstream adult lamprey passage, the Umatilla Tribes recommend that Chelan PUD be required to achieve 80 percent upstream passage with a median passage time of 24 hours by 2013 and 97 to 98 percent upstream passage by 2030. Regional upstream passage standards for adult lamprey are currently under development. The Umatilla Tribes provide information suggesting that 80 percent passage has been achieved at other projects; however, we have no information to indicate that 80 percent passage success is attainable at the Rocky Reach Project or that 98 percent upstream passage is attainable at Rocky Reach or any other project. Additionally, it is not apparent that failure of adult lamprey to pass the Rocky Reach Project results in unsuccessful reproduction or that the recommended passage standards are necessary to recover or maintain the Columbia River lamprey population. Based on this information, we do not recommend including this requirement in any license issued for the project.

Chelan PUD's proposal includes providing juvenile lamprey to investigate project effects on downstream migrating lamprey. Obtaining juvenile lamprey from outside the

project area for such studies would avoid injury to local stocks resulting from such investigations. Chelan PUD also proposes to contribute to local or regional investigation programs to develop methods to assess effects on juvenile lamprey. While coordination and consultation would be inherent in efforts to mitigate for project effects on lamprey, contributing to local or regional investigation programs are not project-related. Therefore, we do not recommend inclusion of such provisions as a requirement in any license issued for the Rocky Reach Project.

Chelan PUD proposes, and the Umatilla Tribes recommend, that Chelan PUD identify and implement measures to address unavoidable impacts to achieve no net impact to lamprey from project operations. Addressing unavoidable project impacts would further reduce project effects on lamprey and benefit the population; however, the FPA does not impose a no-net-loss requirement³⁶, and we do not recommend including this as a requirement of any license issued for the project.

We do not recommend the habitat assessments as proposed by Chelan PUD or as recommended by the Umatilla Tribes because they would not specifically benefit lamprey populations within the project area or identify or mitigate for ongoing project effects.

5.1.7 Resident Fish Plan

The Resident Fish Plan proposed by Chelan PUD as part of the Settlement Agreement is intended to protect and enhance resident fish and habitat and enhance recreational fishing opportunities in the project area. The plan includes measures to continue an existing resident fish stocking program, implement resident fish habitat enhancement projects, evaluate the introduction of new species to the project waters, and conduct a comprehensive evaluation of the effects of predatory resident fish species on HCP plan species.

Under the Resident Fish Plan, Chelan PUD would continue to fund the existing fish stocking program to enhance off-site recreational fishing opportunities in Chelan and Douglas counties. As parties to the Settlement Agreement, WDFW, BLM and FWS support Chelan PUD's proposal.

In comments on the draft EIS, WDFW indicates that the hatchery fish would not be raised at project facilities or stocked in project waters; therefore, the resident fish stocking proposal included in the Settlement Agreement would have no benefit to resident fish or recreational resources in the project area. In comments on the draft EIS, WDFW indicates that stocking resident fish species in the project area could adversely affect threatened and endangered fish species. Under the staff-recommended alternative,

³⁶ See, e.g., *Ohio Power*, 71 FERC ¶ 61,092 (1995) and *Indiana Michigan Power Co.*, 82 FERC ¶ 61,274 (1998).

Chelan PUD would expend substantial effort and expense to benefit threatened and endangered fish species in the project area. Based on the potential conflict with efforts to recover threatened and endangered fish species in the project area, we conclude that stocking resident hatchery fish in the project area would be imprudent. Because the resident fish stocking proposal would have no benefit to resident fish or recreational resources in the project area and any efforts to enhance resident fish in the project area could conflict with salmon and steelhead recovery efforts, we do not recommend including this measure as part of any license issued for the project.

As part of the Resident Fish Plan, Chelan PUD listed several resident fish habitat enhancement projects that would be considered for implementation within the Lake Chelan Project area. Chelan PUD also indicated that other, unspecified projects may be considered for implementation within the Rocky Reach Project area or on tributaries to the project reservoir. While implementation of these measures may have general benefits for resident fish and enhance recreational fishing opportunities, the uncertainty regarding the location for implementation of these projects prevents us from determining the effect of these measures on Rocky Reach Project resources and we do not recommend including them in any license issued for the Rocky Reach Project.

The Resident Fish Plan's measure to investigate introduction of a new species for recreational fisheries in the reservoir would provide information for resource managers that may lead to the development of new recreational fishing opportunities in the project area. However, as indicated above, there could be adverse effects between federally listed species and any introduced non-listed species and we do not have enough information in the record to indicate that such a measure is necessary or appropriate. Therefore, we are not recommending that this measure be included in any new license for the project.

One aspect of the Resident Fish Plan that we recommend would be conducting a comprehensive evaluation of the effects of predatory fish species on HCP Plan Species, which could be useful in identifying effective ways to increase reservoir survival of juvenile salmon and steelhead. We estimate the annualized cost of this measure to be \$6,140, and conclude that the benefit to fish resources would be worth the cost. However, if the comprehensive evaluation does not reveal any significant link between predatory fish and juvenile salmon and steelhead survival, Chelan PUD proposes to conduct three 1-year surveys to monitor changes in abundance or species composition of reservoir resident fish populations. It is not clear why this information is needed or how it would be used. There is no information in the record to suggest that ongoing operations or programs affect resident fish, nor is there information on how data from these surveys would be used to benefit fish in the project area. Therefore, while we recommend including a study of the effects of predatory resident fish on HCP Plan Species, we cannot find any basis for conducting the three 1-year surveys of resident fish.

5.1.8 Other Fish and Wildlife Measures

As part of the relicensing process, technical groups were formed for each comprehensive plan (e.g., resident fish, white sturgeon, bull trout, Pacific lamprey, and wildlife) due to the complexity of issues surrounding each species and so that agency experts could focus on meetings pertaining to their specific area of expertise and not be required to attend all NRWG meetings. Chelan PUD proposes that the various technical groups continue to function as part of a RR Fish Forum. We view the Tribes' recommendations to form a comprehensive fisheries and aquatics committee to be equivalent. We recommend the RR Fish Forum share information, coordinate efforts, and make decisions regarding implementation of the provisions of the Resident Fish Plan, the White Sturgeon Plan, the Pacific Lamprey Plan, and the Bull Trout Plan. If the RR Fish Forum recommends measures that would be inconsistent with the conditions of any new license, Chelan PUD, as the licensee, could request FERC approval of modified management plans or an amendment of the license.

The Umatilla Tribes recommend that Chelan PUD develop and annually update a detailed fishery operations plan to meet performance goals and objectives for all native species and water quality interests. In their response to comments (April 17, 2005), Chelan PUD stated that as part of the HCP they annually produce a Fish Passage Plan that is developed and reviewed in conjunction with state and federal fishery agencies and Tribes, and must be approved by NMFS. In the draft EIS, we concluded that the Tribes' detailed fishery operations plan was not needed because it would duplicate current programs and would not provide any net benefit to fish resources. In comments on the draft EIS, the Umatilla Tribes state that the annual Fish Passage Plan is not offered to the Tribes for comment because the Tribes have not signed the HCP. To address this issue, any order issued for the Rocky Reach Project would consider the need for Chelan PUD to consult with the Umatilla Tribes on the Fish Passage Plan.

Chelan PUD proposes to develop and begin implementation of an aquatic invasive species monitoring and control plan to monitor for the presence of new invasive species at or near project facilities, which we estimate would cost \$7,680 to prepare. Chelan PUD already manages the Eurasian watermilfoil through routine harvest at public access points at its recreational facilities. In addition, though zebra mussels have not been identified in the project area, Chelan PUD is already monitoring their current dispersion and investigating potential methods for mitigating its impacts, should the species be detected in the project area. An aquatic invasive species prevention program would benefit native aquatic species by formalizing Chelan PUD's existing aquatic invasive species programs. Therefore, we recommend that Chelan PUD develop an aquatic invasive species plan that describes Chelan PUD's efforts and plans to monitor and control aquatic invasive species.

5.1.9 Wildlife Plan

Chelan PUD proposes and the Forest Service, BLM, and WDFW recommend that Chelan PUD implement the Wildlife Plan filed with the Settlement Agreement. The Wildlife Plan broadly describes measures that would be implemented to restore and enhance wildlife habitat on state and federal lands within the Chelan and Rocky Reach Wildlife Areas, to protect riparian habitat along the reservoir on Chelan PUD's Sun Cove property, to control noxious weeds within the Rocky Reach Wildlife Area, to continue conducting wildlife surveys, and to protect the federally listed Ute ladies'-tresses. We review each of these measures below.

Under the terms of the Settlement Agreement, Chelan PUD would be responsible primarily for funding actions to be undertaken by WDFW, the Forest Service, and BLM on lands within the Chelan and Rocky Reach Wildlife Areas—lands located outside the current project boundary and consisting mostly of upland habitats that are not affected by project operations (see section 3.5.2).

The Settlement Agreement and Wildlife Plan lack sufficient detail for the Commission staff to determine specifically what actions would be undertaken, where they would occur, when they would occur, and although less important, a basis for the defined funding allocations and timing. The settlement parties suggest that such details would be determined in coordination with the RR Wildlife Forum on an annual basis. An annual progress report would be prepared documenting actions taken and funded during the year, accomplishments, monitoring and evaluation results of such actions, and recommendations for future actions. The plan does not, however, provide for filing such plans with the Commission for review and approval to ensure that the actions are benefiting resources affected by the project.

Consequently, we recommend that Chelan PUD file, within 1 year of license issuance, a final Wildlife Plan for Commission approval. The final Wildlife Plan should be developed in consultation with WDFW, BLM, the Forest Service, FWS, and other entities that wish to participate in the RR Wildlife Forum. Our additional recommended revisions to the Wildlife Plan and the basis for those revisions are described below.

5.1.9.1 Habitat Restoration and Enhancement

Under the proposed terms of the Settlement Agreement, Chelan PUD would make available to WDFW a total of \$849,000 over the term of the license to restore 1,300 to 1,400 acres of agricultural lands within the Chelan Wildlife Area to native shrub-steppe habitat. In addition, Chelan PUD would also make available \$74,000 annually to WDFW to restore, improve, and maintain (presumably, other native shrub-steppe habitat) other lands within the Chelan Wildlife Area. As discussed in section 3.5.2, the Wildlife Plan identifies potential activities that could benefit terrestrial resources in the wildlife areas: plant shrubs and trees to develop riparian strips and wetland areas; install water guzzlers

and other wildlife watering basins; provide artificial nesting structures; and provide brush piles to offer escape cover as an interim measure until planted riparian habitat becomes established.

Chelan PUD would also provide the Forest Service and BLM up to \$10,000 and \$40,000 annually to coordinate restoration actions on adjoining Forest Service and BLM lands, respectively. As identified in the Wildlife Plan, funding could be used for native shrub-steppe habitat rehabilitation, noxious weed control, and water development projects (i.e., wildlife watering basins).

A principal objective of the habitat restoration measures is to improve winter survival of mule deer. Lands within the Chelan and Rocky Reach Wildlife Areas now serve as the principal wintering habitat for mule deer. However, under extremely severe winter conditions (heavy snowfall and frigid temperatures), mule deer may be forced to seek and use the riparian habitats along the project shoreline and across the Columbia River.

No information in the record indicates how often this occurs, but WDFW during the 2005 technical conference indicated that it has happened, exposing mule deer to human disturbance and vehicular collisions as they cross a state highway and railroad to get to habitats along the project shoreline. In addition, the mule deer would be subject to disturbance associated with winter recreation activities on the project reservoir, such as duck hunting and some snowmobiling.

Improving the amount and quality of shrub-steppe communities within the Chelan and Rocky Reach Wildlife Areas may help delay migrations to and demands on riparian habitat adjacent to the project and across the Columbia River in Douglas County. There are no opportunities within the current project boundary to make habitat improvements that would be as beneficial to wintering mule deer, but those improvements could be undertaken within the wildlife management areas. For further discussion, see section 3.5.2.1.

The Wildlife Plan filed with the Settlement Agreement goes beyond habitat improvements to include actions typically borne by the land managing agency, including providing law enforcement to protect wildlife areas, managing non-project related public use, and managing non-project related recreation to ensure compatibility of such recreation within wildlife areas. We do not recommend that these measures be included in the final plan.

To ensure that future habitat improvement projects maintain a nexus to the project, we recommend that Chelan PUD file a report every 5 years for Commission approval that specifically describes habitat improvement projects that would be undertaken over the next 5 years. The Plan would specifically describe the planned measures and would include an implementation schedule, a description of any needed monitoring and

maintenance programs to ensure the success of the measures and the monitoring results of the previous 5 years.

Implementing the above habitat restoration measures is estimated to have a total annualized cost of \$186,210. The benefits to mule deer and other shrub steppe dependant wildlife from implementing these measures would outweigh their costs. Where such habitat improvement measures involve annual O&M, the lands subject to such measures should be brought into the project boundary.

5.1.9.2 Sun Cove Riparian Habitat Protection

Chelan PUD proposes and WDFW recommends that Chelan PUD enter into a contract with the Chelan-Douglas Land Trust or another organization for a conservation easement in perpetuity, at no cost to the acquiring entity, on the Sun Cove property owned by Chelan PUD in Douglas County, Washington, for the purpose of protecting riparian habitat. The conservation easement would protect a 50-foot-wide, 3,500-foot-long stretch of riparian habitat, while providing for two 100-foot-long access corridors to provide future recreation access to the reservoir. The riparian habitats are undisturbed and provide habitat for a variety of wildlife. The adjoining upland habitats have limited wildlife value because they are small, fragmented, and abut existing development. The riparian habitats would be subject to future development. Protecting the riparian habitats would help control the impacts of future development, while still providing access to the project reservoir. It is typical and appropriate in this case to include such a buffer zone within the project boundary. Because Chelan PUD owns the property and protection of the lands would not require active management, there would be only a nominal cost to the project. There is no need to enter into a conservation easement to protect these lands. We recommend that the above-mentioned lands be included in the project boundary and that Chelan PUD protect these habitats from future development through the Wildlife Plan.

5.1.9.3 Wildlife Surveys

Chelan PUD proposes in the Settlement Agreement to continue to conduct annual wildlife surveys for species selected by the RR Wildlife Forum. Chelan PUD would conduct the surveys and report the survey results to the RR Wildlife Forum on a schedule determined by the Forum. The Wildlife Plan filed with the Settlement Agreement goes further to also include habitat improvement projects and to limit the cost of the survey and habitat improvement projects to \$10,500³⁷ or equivalent staff-days per year for the

³⁷ Because Chelan PUD's proposed expenditure of \$10,500 annually for these surveys is \$3,070 more than its expenditure under the current license, the entry for this measure on table 19 is \$3,070 because that would be the incremental cost associated with this measure under a new license.

term of the license. The intent of the funding as described in the management plan is to survey and monitor threatened, endangered, and sensitive species using techniques and on a schedule developed in coordination with the RR Wildlife Forum.

As noted above, the Commission cannot agree to cost caps. In addition, allocating additional funds for habitat improvements would be redundant with the recommended habitat improvement measures for the Chelan and Rocky Reach Wildlife Areas discussed above and thus is not warranted.

Chelan PUD currently conducts Canada goose nesting surveys and over-wintering bald eagle surveys. Continuing the goose and bald eagle surveys would provide valuable information for continued management of these species on project lands and waters. Broadening the survey efforts to include other threatened and endangered species may help promote the recovery of listed species or prevent future listings. However, as described in the Settlement Agreement and Wildlife Plan, the Commission cannot evaluate the cost or need of such efforts or ensure compliance with this currently undefined measure. Therefore, we recommend that Chelan PUD include in its final Wildlife Plan a detailed description of the survey efforts that would be conducted during the first 5 years of the license. Subsequent 5-year wildlife management reports, as described above, would allow for any modifications to approved survey efforts.

5.1.9.4 Integrated Noxious Weed Control Program

Chelan PUD proposes to implement an Integrated Noxious Weed Control Plan (see section 3.5.2.4) in accordance with the measures described in the Wildlife Plan. The Wildlife Plan, however, requires Chelan PUD to make available \$10,000 per year for the term of the license to implement an integrated noxious weed control program in the Rocky Reach Wildlife Management Area. The plan does not describe the methods of control, areas to be treated, or an implementation schedule. Chelan PUD's participation in an area-wide noxious weed control strategy would facilitate restoration of shrub-steppe communities, protect wildlife habitat, protect and enhance sensitive plant communities, and ensure that project operations do not contribute to the spread of noxious weeds. Thus we recommend that the final Wildlife Plan include a detailed description of an integrated noxious weed control plan, developed in consultation with BLM, the Forest Service, and WDFW, and including a description of the areas to be treated in the first 5 years of license issuance, and the methods of treatment. Because the details of the plan have not been fully developed, we cannot accurately estimate the cost of the program. However, \$10,000 per year (excluding development costs) seems to be a reasonable estimate and the benefits in terms of noxious weed control would be worth the cost.

5.1.9.5 Ute Ladies'-tresses Protection

Chelan PUD proposes and settlement parties support a three-pronged approach to protecting Ute ladies'-tresses populations along the project reservoir. Chelan PUD would: (1) implement an integrated noxious weed control program; (2) monitor populations of Ute ladies'-tresses; and, (3) acquire, from willing sellers, a conservation easement for a population on private lands.

Four populations of Ute Ladies'-tresses are located on lands hydraulically connected to the project reservoir and harbor populations of other rare plant species. Three are under Chelan PUD or state or federal control. The fourth is located on private lands. Potential threats to the population on private lands have not been identified.

Implementing an Integrated Noxious Weed Control Program would help control the major threat to existing populations of Ute ladies'-tresses. As we said in section 3.6.2.5, daily water level fluctuations as a result of the water releases create conditions that are favorable to the invasion of noxious weeds. Noxious weeds appear to pose the greatest threat to the Ute ladies'-tresses because they can take over the habitat. Ute ladies'-tresses cannot compete with aggressive species that form dense monocultures. Monitoring these populations would help track changes in population numbers and distribution. Such information may help determine the habitat requirements of these plants and the influences of water fluctuations on those requirements. Implementing the monitoring program is estimated to cost \$3,070 annually and would be worth the cost.

A conservation easement on the private lands supporting the aforementioned fourth population would help protect from development those populations that are located on lands otherwise outside of Chelan PUD control, but on lands hydraulically connected to the project reservoir. At an estimated cost of acquiring the conservation easement of \$160,000, we recommend that Chelan PUD pursue the acquisition to protect this federally listed species from willing sellers. These lands should be brought into the project boundary.

5.1.9.6 Coordination with Recreation Improvements

Chelan PUD's proposed recreational improvements would have little effect on wildlife habitat because the improvements would occur at existing recreational sites, in areas that have received heavy dispersed recreational use, and in primarily urban lands in the City of Entiat. Nonetheless, we included in the Staff Alternative Chelan PUD's proposal to consider potential adverse recreational effects on wildlife habitat during recreation management planning and site development so that we can ensure that recreational development considers potential effects on wildlife. The cost of this measure would be included in the recreation plan and would provide for public interaction with nature while protecting valuable wildlife habitat.

5.1.10 Cultural Plan

Key elements of Chelan PUD's Cultural Plan include: (1) formation of a RR Cultural Forum, comprising representatives from Chelan PUD and several agencies and tribes; (2) appointment of a Cultural Resources Coordinator; (3) development and implementation of treatment plans in consultation with the RR Cultural Forum for currently identified eligible sites, and for any eligible sites discovered in the future; (4) implementation of the Cultural Plan's archaeological monitoring program; (5) development and implementation of a management plan for TCPs; (6) development of a curation plan; (7) development of an integrated cultural resources information management system; (8) development and implementation of a cultural resources interpretive plan and educational program; and (9) site treatment measures. Implementing the Cultural Plan is estimated to have a total annualized cost of approximately \$35,010 and we find that the benefits of the plan would be worth the cost.

5.1.11 Recreation Plan

Early in the relicensing process, Chelan PUD convened the Social Sciences Working Group to develop, conduct, and review project-related recreational studies. The Recreation Plan, as described in the Settlement Agreement, includes continued O&M of existing recreational facilities, expansion/revitalization of some existing park facilities, and creation/extension of multi-use trails, and addresses the need for future evaluation of recreational use and needs. The annualized cost of implementing the proposed Recreation Plan would be approximately \$1,652,720. We find that in section 3.8, *Recreational Resources*, implementing the proposed plan would substantially improve recreational resources at the project.

However, we note that many aspects of the Recreation Plan have not been finalized, including the scope of measures to be implemented at the 40-acre Entiat Park per Article 9(e) of the Settlement Agreement. Therefore, we recommend that Chelan PUD include in a Revised Recreation Plan a description and location of project-related recreation facilities, including interpretive trails and public access; cost estimates and detailed drawings of these facilities; identification of the entity responsible for O&M of the recreation facilities; a discussion of how the needs of the disabled were considered in the planning and design of each recreation facility; and documentation of consultation with at least, but not limited to, WDFW, Washington State Parks, NPS, BLM, and the City of Entiat. Components of the plan should be consistent with the proposed Recreation Plan implementation schedule in the Settlement Agreement. Although not explicit in the Settlement Agreement or the proposed Recreation Plan, Chelan PUD appears to have anticipated the need to update the Recreation Plan with Commission approval over time as measures are finalized. Consequently, there would be no additional cost associated with this recommendation.

In concert with Article 9(g) (Recreation Resources Monitoring and Evaluation Program) of the Settlement Agreement, we recommend that Chelan PUD monitor recreation use on an estimated 150 acres of BLM-administered lands, located adjacent to the Rocky Reach Project reservoir and within the project boundary. As discussed in section 3.8.1, project-related dispersed recreational use at the project reservoir is projected to increase. Monitoring recreation use on these BLM lands, as well as all other lands adjacent to the project reservoir, would address the need for future evaluation of dispersed recreational use and needs. The annualized cost of this measure is \$3,070 and we find the benefits of monitoring recreation use on these lands to be worth the cost.

We have not adopted the Forest Service's recommendations, pursuant to section 10(a) of the FPA, for a comprehensive Information and Education program and a Recreation Enhancement Fund, as discussed in section 3.8.2 of the EIS. The annualized costs of implementing these measures are \$2,000 and \$294,830, respectively, which would not fulfill any demonstrated project need and are not worth the costs. Therefore, we are not recommending that these measures be included in any new license for the project.

5.2 FISH AND WILDLIFE AGENCY RECOMMENDATIONS

Under the provisions of the FPA, each hydroelectric license issued by the Commission shall include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project.

In response to our REA notice, the following fish and wildlife agencies submitted recommendations for the project: NMFS (letter filed March 9, 2005), Interior (letters filed March 14, 2005 and June 1, 2005), and WDFW (letter filed March 9, 2005). As a party of the Settlement Agreement, WDFW filed modified terms and conditions in a letter filed May 24, 2006. Interior, in letters filed December 28, 2005 and January 17, 2006, indicated its intention to file modified conditions and prescriptions at a later date. However, in a letter filed May 24, 2006, Interior stated that because of its successful involvement in the Settlement Agreement, it believes that the measures contained therein address the substantive issues. In this final EIS, we assume that Interior's June 1, 2005, recommendations are superceded by the relevant provisions of the Settlement Agreement.

Section 10(j) of the FPA states that whenever the Commission believes that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency shall attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency. Table 20 lists the federal and state recommendations filed subject to section 10(j), and whether the recommendations are adopted under the Staff Alternative. Environmental recommendations that we

Table 20. Fish and wildlife agency recommendations for the Rocky Reach Project. (Source: Staff)

Recommendation	Agency	Within the Scope of 10(j)?	Annualized Cost	Staff Recommendation^a
1. Limit the term of the new license to not extend beyond 2054, the term of the HCP.	NMFS (1)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources.	\$0	The Commission will make its determination regarding the term of any new license in the license order, based on the record.
2. Carry out the Tributary Conservation Plan and the Hatchery Compensation Plan, in their entirety, as set forth in the Rocky Reach anadromous fish HCP.	NMFS (2,3)	Yes	\$15,014,120	Adopted.
3. Article 2(e) – develop and implement an Aquatic Invasive Species Plan	WDFW	Yes	\$640	Adopted
4. Article 3, subparts (a), (b)(1), (b)(2), (c)(1), (c)(2), and (d) – White Sturgeon Plan	WDFW	Yes	\$61,440	Adopted
5. Article 3, subpart (b)(3) – determine a long-term source for hatchery sturgeon	WDFW	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	Included in Cost for No. 4	Adopted
6. Article 3, subpart (c)(3) – compile information on regional white sturgeon programs	WDFW	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$26,160	Not adopted

Recommendation	Agency	Within the Scope of 10(j)?	Annualized Cost	Staff Recommendation^a
7. Article 3, subpart (e) – prepare an annual summary report of sturgeon activities	WDFW	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$10,240	Adopted
8. Article 4, subparts (a), (b)(1), (c), (d), and (e)(3) – Bull Trout Plan	WDFW	Yes	\$79,260	Adopted
9. Article 4, subpart (b)(2) – prepare an annual report of adult bull trout monitoring	WDFW	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	Included in Cost for No. 8	Adopted
10. Article 4, subpart (e)(1) – attend meetings of the Upper Columbia River Bull Trout Recovery Team	WDFW	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$1,690	Not adopted
11. Article 4, subpart (e)(2) – study the feasibility of collecting large woody debris from Rocky Reach reservoir for tributary enhancements	WDFW	No, study could have been done during pre-filing	Included in Cost for No. 8	Adopted
12. Article 4, subpart (e)(4) – participate in regional information exchange and development of methods	WDFW	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	Unknown	Not adopted
13. Article 5, subparts (a)(1), (a)(2), (a)(4), (a)(5), (a)(6), (a)(7), and (b) – Pacific Lamprey Plan	WDFW	Yes	\$83,990	Adopted

Recommendation	Agency	Within the Scope of 10(j)?	Annualized Cost	Staff Recommendation^a
14. Article 5, subpart (a)(3) – complete a literature review of upstream lamprey passage at other projects	WDFW	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$1,700	Not adopted
15. Article 5, subpart (c) – survey juvenile lamprey in habitat that may be affected by the project	WDFW	No, study could have been done during prefiling	\$4,250	Not adopted
16. Article 5, subpart (d) – collect information regarding lamprey distribution, population status, and juvenile migration timing and collect tissue samples	WDFW	No, study could have been done during prefiling	Unknown	Not adopted
17. Article 6, subpart (a) – provide annual funding to WDFW to rear and plant fish in water bodies in Chelan and Douglas counties	WDFW	No, no nexus to project resources and funding is not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$100,000	Not adopted
18. Article 6, subpart (b) – implement resident fish enhancement measures at Lake Chelan or within the project boundary	WDFW	No, unclear nexus to project resources and is not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$3,820	Not adopted

Recommendation	Agency	Within the Scope of 10(j)?	Annualized Cost	Staff Recommendation^a
19. Article 6, subpart (c) – create additional recreational opportunities in the reservoir by introducing new fish species	WDFW	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$5,100	Not adopted
20. Article 6, subpart (d)(1) – conduct a resident fish survey to determine the effects of predatory resident fish on juvenile salmon and steelhead	WDFW	No, study could have been done during pre-filing	Included in Cost for No. 21	Adopted
21. Article 6, subpart (d)(2) – develop and implement measures to reduce predation on juvenile salmon and steelhead and monitor effectiveness	WDFW	Yes	\$6,140	Adopted
22. Article 6, subpart (d)(3) – conduct 3, one-year surveys to monitor resident fish abundance and species composition	WDFW	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	Included in Cost for No. 21	Not adopted
23. Article 7, subpart (a) – fund WDFW’s restoration, maintenance, and improvement of Chelan WMA	WDFW	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$75,780	Funding not adopted. Adopted the measure plus 5-year management plan with updates
24. Article 7, subpart (b) – fund WDFW’s restoration of cultivated lands on Chelan WMA	WDFW	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$59,230	Same as No. 23

Recommendation	Agency	Within the Scope of 10(j)?	Annualized Cost	Staff Recommendation^a
25. Article 7, subpart (c) – fund habitat restoration on BLM lands	WDFW	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$40,960	Same as No. 23
26. Article 7, subpart (d) – fund habitat restoration on FS lands	WDFW	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$10,240	Same as No. 23
27. Article 7, subpart (e) through (j) – Wildlife Plan	WDFW	Yes	\$25,540	Adopted
28. Article 9 – Recreation Plan	WDFW	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	\$1,646,790	Adopted with the provision to file a Revised Recreation Plan

^a Many of the measures recommended under section 10(j) of the FPA include specific dollar limitations. While we are recommending adopting several of these measures, the Commission has stated previously that it considers it the licensee's obligation to complete the measures required by a license and that dollar figures are not absolute limitations (that is, the Commission reserves the authority to require licensees to fulfill the requirements of the license notwithstanding any limitations on expenditures either proposed by the applicant or recommended by others).

consider outside the scope of section 10(j) have been considered under section 10(a) of the FPA and are addressed in the specific resource sections of this document. We adopted all the recommendations that we considered to be within the scope of section 10(j).

5.3 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2) of the FPA requires the Commission to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, or conserving waterways affected by the project. Under section 10(a)(2), federal and state agencies filed comprehensive plans that address various resources in Washington. Thirty-nine of those plans address resources applicable to the project (table 21). We did not find any conflicts.

Table 21. FERC comprehensive plans considered for the Rocky Reach Hydroelectric Project.

Comprehensive Plan	Contact Agency
Spokane Resource Area Management Plan and Final Environmental Impact Statement. 1985.	U.S. Department of Interior Bureau of Land Management Spokane, WA
Okanogan National Forest land and resource management plan. 1989.	U.S. Department of Agriculture Forest Service Okanogan, WA
The Nationwide Rivers Inventory. January 1982.	U.S. Department of the Interior National Park Service Washington, DC
Wenatchee National Forest Land and Resource Management Plan. 1990.	U.S. Department of Agriculture Forest Service Wenatchee, WA
An assessment of outdoor recreation in Washington State: A State Comprehensive Outdoor Recreation Planning Document 2002–2007. October 2002.	Interagency Committee for Outdoor Recreation Olympia, WA
Voices of Washington: Public Opinion on Outdoor Recreation and Habitat Issues, 1995.	Interagency Committee for Outdoor Recreation Olympia, WA
Washington Outdoors: Assessment and Policy Plan, 1990-1995. April 1990.	Interagency Committee for Outdoor Recreation Tumwater, WA

Comprehensive Plan	Contact Agency
State of Washington, Outdoor Recreation and Habitat: Assessment and Policy Plan, 1995–2001. November 1995.	Interagency Committee for Outdoor Recreation Olympia, WA
Washington State Trails Plan: Policy and Action Document. June 1991.	Interagency Committee for Outdoor Recreation Tumwater, WA
Final Environmental Impact Statement and Fishery Management Plan for Commercial and Recreation Salmon Fisheries off the Coasts of Washington, Oregon and California Commencing in 1978. March 1978.	U.S. Department of Commerce National Oceanic & Atmospheric Administration National Marine Fisheries Service Seattle, WA
The fifth Northwest Electric Power and Conservation Plan. Council Document 2005-07.	Northwest Power and Conservation Planning Council Portland, OR
Columbia River Basin Fish & Wildlife Program. Council Document 2000-19.	Northwest Power and Conservation Planning Council Portland, OR
Columbia River Basin Fish & Wildlife Program. Council Document 2003-11.	Northwest Power and Conservation Planning Council Portland, OR
Protected Areas Amendments and Response to Comments. Council Document 88-22.	Northwest Power and Conservation Planning Council Portland, OR
Statute Establishing the State Scenic River System, Chapter 79.72 Revised Code of Washington. 1977.	Washington State Department of Fish & Wildlife Olympia, WA
Eighth amendment to the fishery management plan for commercial and recreational salmon fisheries off the coasts of Washington, Oregon, and California commencing in 1978. January 1978.	Pacific Fishery Management Council Portland, OR

Comprehensive Plan	Contact Agency
Settlement Agreement Pursuant to the September 1, 1983, Order of the U.S. District Court for the District of Oregon in Case No. 68-513. Columbia River fish management plan. November 1987.	State of Washington. State of Oregon. State of Idaho. Confederated Tribes of the Warm Springs Reservation of Oregon. Confederated Tribes of the Umatilla Indian Reservation. Nez Perce Tribe. Confederated Tribes and Bands of the Yakama Indian Nation. Portland, OR
A Resource Protection Planning Process Identification of Prehistoric Archaeological Resources in the Lower Columbia Study Unit. 1987.	Washington State Dept. of Community Development, Office of Archaeology & Historic Preservation Olympia, WA
Resource Protection Planning Process—Paleoindian Study Unit. 1987.	Washington State Dept. of Community Development, Office of Archaeology & Historic Preservation Olympia, WA
Resource Protection Planning Process Mid-Columbia Study Unit. 1987.	Washington State Dept. of Community Development, Office of Archaeology & Historic Preservation Olympia, WA
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State of Washington Natural Heritage Plan. 1987.	Washington State Department of Natural Resources Olympia, WA
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5.4 RELATIONSHIP OF LICENSE PROCESS TO LAWS AND POLICIES

5.4.1 Water Quality Certification

The status of the water quality certification for the project is discussed in section 2.3.1.1, *Water Quality Certification*.

5.4.2 Coastal Zone Consistency Certification

According to an electronic communication on July 2, 2003, between WDOE and Chelan PUD, WDOE does not intend to require a Coastal Zone Management Consistency Statement for the project because the project is not located in Washington's coastal zone (Chelan PUD, 2003c, as cited in Chelan PUD, 2004a).

5.4.3 Section 18 Fishway Prescriptions

Fishway prescriptions are discussed in section 2.3.1.2, *Section 18 of the Federal Power Act—Authority to Require Fishways*.

5.4.4 Endangered Species Act

Section 7 of the ESA requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered and threatened species or cause the destruction or adverse modification of the critical habitats of such species. Three federally listed fish species (Upper Columbia River spring Chinook salmon, Upper Columbia River steelhead, and bull trout), six federally listed wildlife species (gray wolf, Canada lynx, northern spotted owl, grizzly bear, pygmy rabbit, and bald eagle), and three federally listed plants (Ute ladies'-tresses, showy stickseed, and Wenatchee Mountains checker-mallow) could occur in the project area. Our assessment of effects on listed species is discussed in section 3.6, *Threatened and Endangered Species and Essential Fish Habitat*, and our final recommendations are presented in section 5.1, *Comprehensive Development and Recommended Alternative*.

NMFS concluded in its HCP final EIS (NMFS, 2002) that implementation of the HCP measures would result in incidental take of all Permit Species (including Upper Columbia River spring Chinook salmon and Upper Columbia River steelhead) through direct, indirect, and delayed mortality caused by the project dam. NMFS issued a Section 10(a)(1)(B) permit for the HCP, finding that the HCP measures would, to the maximum extent practicable, monitor, minimize, and mitigate the effects on Plan Species resulting from the otherwise lawful operation of the project. Chelan PUD's proposal to the Commission incorporates all the measures of the HCP, and our conclusions are the same.

FWS issued a biological opinion on May 12, 2004, stating that “implementing the proposed action (incorporating the HCP into the existing FERC license for Rocky Reach) is not likely to jeopardize the continued existence of the Columbia River distinct population segment of bull trout, and is not likely to destroy or adversely modify proposed critical habitat for bull trout” (letter from J. Gonzales, FWS, Wenatchee, WA, to M. Salas, Secretary, Commission, Washington, DC, dated May 12, 2004). Chelan PUD’s proposal before the Commission incorporates all the measures listed in the FWS biological opinion, including implementation of the Bull Trout Management Plan, and our conclusions are the same.

In a letter dated October 17, 2005, FWS indicated that it disagreed with our determinations and it initiated formal consultation. In that letter, FWS indicated that the agency would provide its biological opinion no later than March 4, 2006. In a letter dated March 9, 2006, FWS indicated that a Settlement Agreement was forthcoming and that the timeline for completing the biological opinion was moot. FWS recommended that the Commission reinstate consultation based on the final EIS. In a May 3, 2006 letter, we indicated that our recommended action (proposed action for ESA consultation) was unchanged and we requested that FWS complete the consultation initiated by the October 17, 2005, letter.

We conclude that relicensing the project with our recommended measures would not affect the gray wolf, Canada lynx, northern spotted owl, grizzly bear, pygmy rabbit, showy stickseed, or Wenatchee Mountains checker-mallow and would not be likely to adversely affect bald eagles or Ute ladies’-tresses.

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APPENDIX A

STAFF RESPONSES TO COMMENTS ON THE DRAFT EIS

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**STAFF RESPONSES TO COMMENTS
ON THE ROCKY REACH PROJECT DRAFT EIS**

The U.S. Environmental Protection Agency's (EPA) notice of availability of the draft environmental impact statement (EIS) was issued on September 9, 2005. Comments on the draft EIS were due on November 8, 2005. The following entities filed comments pertaining to the draft EIS.

Commenting Entity	Filing Date
Washington State Department of Ecology (WDOE)	October 25, 2005
Bonneville Power Administration (BPA)	October 28, 2005
Public Utility District No. 1 of Chelan County (Chelan PUD)	October 28, 2005
City of Entiat, including the Entiat High School Class of 2006, the Entiat Middle School 6th Graders, Keith Vradenburg, and Carol Long	October 28, 2005
Lee Tideman, private individual	October 28, 2005
Washington Department of Fish and Wildlife (WDFW)	October 28, 2005
U.S. Forest Service, Pacific Northwest Region (Forest Service)	October 31, 2005
Confederated Tribes and Bands of the Yakama Nation (Yakama Nation)	October 31, 2005
U.S. Department of the Interior (Interior)	November 1, 2005
Public Utility District No. 1 of Douglas County (Douglas PUD)	November 4, 2005
The Confederated Tribes of the Umatilla Indian Reservation (Umatilla Tribes)	November 8, 2005
Entiat School District No. 127	November 8, 2005
Public Utility District No. 2 of Grant County (Grant PUD)	November 8, 2005
Timothy James, private individual	November 8, 2005
Ellen Reynoldson, private individual	November 8, 2005
Rowley & Klauser, LLP on behalf of Jack Feil, private individual	November 15, 2005
William Walter, private individual	November 16, 2005
Blue Star Growers, Inc.	November 18, 2005
Wenatchee Sportsmen's Association	November 22, 2005
U.S. Environmental Protection Agency	November 23, 2005
Washington State Attorney General's Office	November 30, 2005
Thomas Feil, private individual	January 19, 2006
Andy Dappen, private individual	January 27, 2006

On January 13, 2006, Chelan PUD filed reply comments to the resource agencies, tribes, and other entities' comments on the draft EIS.

In this appendix, we summarize the comments received, provide responses to those comments, and indicate, where appropriate, how we modified the text of the final EIS. The comments are grouped by topic for convenience.

PROCEDURAL AND GENERAL

Comment 1: Interior (Staff Alternative and section 4(e) Conditions, first paragraph) comments that the Federal Energy Regulatory Commission (Commission or FERC) staff should analyze the 4(e) conditions as mandatory conditions in the final EIS instead of as recommendations. Although the applicant has stated that the Bureau of Land Management (BLM) has no mandatory conditioning authority pursuant to section 4(e) of the Federal Power Act (FPA), Interior states that this assertion was based on an erroneous conclusion that there are no reservation lands within the Rocky Reach Hydroelectric Project (Rocky Reach Project or project) boundary. Interior comments that lands within the project boundary that were withdrawn under Executive Order and by Power Site Classification meet the conditions of a "reservation" according to the FPA. Interior's comment includes an analysis of BLM-administered land (see tables, Staff Alternative, and section 4(e) conditions), which Interior indicates should assist the Commission in identifying appropriate protection and mitigation.

Response 1: Although a Commission license must include valid terms and conditions submitted pursuant to section 4(e) of the FPA, Commission staff still has the responsibility in its environmental documents to make recommendations to the Commission that in its view would "be best adapted to a comprehensive plan for improving or developing a waterway or waterways" as provided for by section 10(a)(1) of the FPA. Our recommendations reflect this consideration. All of Interior's terms and conditions are referenced in section 2.3.1.3 and were fully described and analyzed in section 3 of the draft EIS. We note that in its May 24, 2006, filing with the Commission, Interior indicated that the Rocky Reach Comprehensive Settlement Agreement (Settlement Agreement) addresses the substantive issues Interior intended to address through its preliminary conditions. Interior therefore withdrew its conditions.

Comment 2: The Yakama Nation (page 4, paragraph 2) comments that the draft EIS incorrectly states that it represents "the views of the ... affected Indian tribes." Instead, the final EIS should state that it attempts to capture the views of the affected Indian Tribes. In addition, the omissions in the draft EIS of many of the Yakama Nation's comments create a bias in the representation of their views.

Response 2: We modified the Notice of Availability to reflect this comment.

Comment 3: The Yakama Nation (page 5, paragraph 1) states that the sentence on page 13 (second paragraph) of the draft EIS stating “Indian tribes... have agreed on an artificial production program...” is misleading because only two tribes have agreed upon this.

Response 3: We amended the text to clarify this point.

Comment 4: The Yakama Nation (page 4, paragraph 3) strongly disagrees with FERC’s statement that the staff alternative would “adequately protect and enhance environmental resources and mitigate impacts of the project.”

The Yakama Nation (page 10) also concludes that all issues identified in the Rocky Reach Water Quality Management Plan (Water Quality Plan), Rocky Reach White Sturgeon Management Plan (White Sturgeon Plan), and Rocky Reach Pacific Lamprey Management Plan (Pacific Lamprey Plan) are a result of cumulative effects of all hydro-operations in the system. Regional efforts and cooperation are essential. The Yakama Nation indicates that the final EIS must: (1) better recognize and document the remaining uncertainties surrounding project effects, (2) recognize the need and require Chelan PUD to maintain steady progress in identifying these effects through the adaptive management process in cooperation with other federal and private hydroelectric interests, and (3) provide an alternative that ensures mitigation will be required in the new FERC license.

Response 4: We conclude that the staff recommended alternative “would adequately protect and enhance environmental resources and mitigate impacts of the project”; therefore, we did not revise the text of the EIS.

Comment 5: Douglas PUD (pages 2–3, Public Meeting and section 10(j) Meeting) comments that Chelan PUD’s Anadromous Fish Agreement and Habitat Conservation Plan for the Rocky Reach Project (HCP) Tributary Conservation Fund and the Recreation Fund as identified in the draft EIS are not analogous as was suggested at the section 10(j) Meeting. The HCP Tributary Conservation Fund is tied to a specific project-related effect.

Response 5: The HCP Tributary Conservation Fund and the proposed Recreation Fund evaluated in the draft EIS are not analogous. The HCP Tributary Conservation Fund is tied to a specific project-related effect, while we conclude in the draft EIS that the scope of the proposed Recreation Fund extends beyond the project boundary to areas that lack nexus with project operations. We conclude that this point is clear in the draft EIS and no modification is required.

Comment 6: The City of Entiat (page 2, Project Boundary) suggests a change to the project boundary to include the parcels in and around the city that Chelan PUD purchased as part of the original Rocky Reach dam construction.

Response 6: The Commission defines a project boundary as those lands necessary for construction, operation, and maintenance of the project and for other project purposes such as recreation, shoreline control, or protection of environmental resources. A boundary surrounding a reservoir generally must be located no more than 200 feet (horizontal measurement) from the exterior margin of the reservoir at the normal maximum reservoir surface elevation. Deviations from this requirement may be approved when deemed necessary to accommodate project purposes. Even within the 200-foot margin, lands are included in the project boundary only when they serve a project purpose, as described above. The City of Entiat has not offered any evidence that the lands in question are needed for project purposes, and, in the absence of such evidence, Commission policy argues against including such lands in the project boundary. Staff concludes that this does not require additional modification to the EIS text.

Comment 7: Chelan PUD (page 2, second paragraph; page 3, Chelan PUD Responses 6 and 7) comments that it continues to work with the settlement parties and hopes that FERC will consider the final Settlement Agreement that will be submitted on or before December 31, 2005. Chelan PUD notes that the Wildlife, Recreation Resources and White Sturgeon Plans may be modified at that time.

Response 7: Chelan PUD filed a Settlement Agreement with the Commission on March 22, 2006, modifying its proposal. In this final EIS, we list the terms of the Settlement Agreement in section 2.2, *Chelan PUD's Proposal*, and analyze the individual elements in subsequent sections of the EIS.

Comment 8: Consistent with FERC's consultation policy with tribal sovereigns, the Umatilla Tribes request a meeting with FERC staff to discuss and attempt to resolve critical issues in the very near future.

Response 8: We consulted with the Umatilla Tribes on June 29, 2004, and have considered their comments and concerns in the EIS.

Comment 9: EPA recommends that the Water Quality Plan and the 401 water quality certification be included as appendices in the final EIS.

Response 9: In the interests of keeping our National Environmental Policy Act (NEPA) documents a reasonable size and not including supporting documents that are readily available elsewhere, we do not generally append either the 401 water quality certification or management plans to an EIS. Both of these documents, if filed with the Commission, would be available on FERC's web site. Consequently, we did not include these items as appendices to the EIS.

PURPOSE OF ACTION AND NEED FOR POWER

Comment 10: Chelan PUD (page 5, second paragraph) comments that footnote 7 on page 4 should be corrected to state that in its December 27, 2004, AIR response, Chelan PUD estimated that the average annual generation is expected to be 6,031,706 megawatt-hour (MWh) under both the "no-action" and "proposed 50-year alternative."

Response 10: We revised the text to clarify that the MWh figure provided in the December 27, 2004, AIR response applies to both the no action and proposed 50-year alternatives, but we did not revise our generation figure (6,030,896 MWh, which we rounded to 6,030,900 MWh). Reviewing the second and fourth paragraphs of the AIR response, the correct calculation of expected average annual net generation appears to require that we subtract losses due to flow reduction (9,180 MWh) and losses due to energy consumption (3,724 MWh) from the gross generation estimate of 6,043,800 MWh. Thus, 6,043,800 MWh gross generation less 12,904 MWh losses equals 6,030,896 MWh net generation. Chelan PUD appears to have transposed a figure in total generation losses, such that its calculation is 6,043,800 MWh gross generation less 12,094 MWh losses equals 6,031,706 MWh net generation.

Comment 11: The Umatilla Tribes (page 6, Purpose of Action; page 5, paragraph 2) comment that they find no consideration for energy conservation in any of the alternatives and that there should be an alternative that rigorously analyzes energy conservation and other power sources as a means of replacing project power.

Response 11: Our determination that combustion turbines fueled by natural gas would be the most likely resource to replace the project power is based on the probability that the project is used to displace fossil-fuel generation. We conclude that it is unlikely that renewable generation resources or conservation would replace hydropower as long as there are fossil-fuel generators available to off load. Therefore, we did not revise the text of the EIS.

CUMULATIVE EFFECTS

Comment 12: WDOE (General) comments that the Rocky Reach settlement group finds it appropriate to study fish, including listed salmonids, white sturgeon and Pacific lamprey on a regional basis due to cumulative effects of the Columbia River hydropower projects. WDOE agrees with the Commission that cumulative effects of the Columbia River hydropower projects may also affect water quality. WDOE notes the Rocky Reach Project's possible contribution to flow fluctuations under the Hanford Reach Fall Chinook Protection Program Agreement (Hanford Reach Agreement), which could cause significant entrapment/stranding and loss of spawning of fall Chinook in the Hanford Reach, is not known and is not addressed in the draft EIS. WDOE states that cumulative effects on the Hanford Reach, including those of Grant County PUD's project, should be discussed in the final EIS.

Response 12: We added a discussion of the Hanford Reach Agreement and project effects on the Hanford Reach to section 2.1.3.1 of the EIS.

Comment 13: WDFW (page 10, Cumulative Effects) comments that the Pacific Lamprey Plan, along with the HCP and the White Sturgeon Plan, will contribute to mitigating cumulative effects on fisheries resources. WDFW notes that several factors contribute to adverse effects to Pacific lamprey. The Yakama Nation (page 4, paragraph 4) disagrees with FERC's omission of the Rocky Reach Project in contributing to cumulative effects on Pacific lamprey. The Yakama Nation states that if FERC maintains this conclusion in the final EIS, FERC should provide an in-depth discussion to support their reasoning. Similarly, the Umatilla Tribes (page 6, Cumulative Effects) state that FERC should incorporate the cumulative effects of the project on Pacific lamprey in the final EIS.

Response 13: We revised the EIS discussion of cumulative effects to include Pacific lamprey.

Comment 14: The Umatilla Tribes (page 7, first two paragraphs) comment that FERC does not describe the full scope of the project's effect on anadromous fish. The Tribes state that project operations above the Hanford Reach affect the Hanford fall Chinook population, but point out that the draft EIS does not address operations that would benefit the Hanford fall Chinook. In addition, the Umatilla Tribes comment that the scope of the project effects includes a large geographical area. The Tribes state that the draft EIS failed to examine how different alternatives might affect the Pacific Northwest Coordination Agreement (PNCA), operations that are in turn based on the Assured Operating Plan and the Detailed Operating Plan of the Columbia River Treaty. The Tribes state that the final EIS should examine these issues.

Response 14: We revised section 2.1.3.1 of the EIS to include a discussion of the Hanford Reach Agreement. The PNCA was developed to optimize federal and non-federal hydropower projects to meet both power and nonpower demands on the river. The PNCA develops an annual plan that considers the Mid-Columbia Hourly Coordination Agreement (Hourly Coordination Agreement), which optimizes the hydraulic operation of Grand Coulee, Chief Joseph, Wells, Rocky Reach, Rock Island, Wanapum, and Priest Rapids dams. The PNCA considers recommendations from an interagency technical group to optimize passage conditions for juvenile and adult anadromous fish. A complete reevaluation of PNCA operations is beyond the scope of this proceeding.

PROPOSED ACTION AND ALTERNATIVES

Comment 15: The Umatilla Tribes (pages 4–6; page 8, first paragraph) comment that the draft EIS should have considered a decommissioning alternative.

Response 15: Section 2.4.3, *Project Retirement*, in the draft EIS includes a discussion of decommissioning and why it is not considered a reasonable alternative.

Comment 16: The Umatilla Tribes (pages 4–6; page 8, first paragraph) comment that the draft EIS failed to include a cumulative effects analysis in its alternatives.

Response 16: In the draft EIS, section 1.5, *Cumulative Effects*, describes our approach to analyzing cumulative effects. Cumulative effects on water quality are discussed in section 3.3.3 of the draft EIS, while cumulative effects on salmonids and white sturgeon are discussed in section 3.4.3. In section 3.4.3 of the final EIS, we have added a discussion of cumulative effects on Pacific lamprey.

Comment 17: The Umatilla Tribes (pages 4–6; page 8, first paragraph) comment that the draft EIS fails to include a proper geographic scope for all alternatives.

Response 17: In the draft EIS, section 1.5.1, *Geographic Scope*, defines the geographic scope of the cumulative effects analysis for all alternatives.

Comment 18: The Umatilla Tribes (pages 4–6; page 8, first paragraph) comment that the draft EIS failed to create and analyze an alternative that contains critical tribal recommendations that are supported by scientific evidence.

Response 18: In the draft EIS, we analyzed all of the Tribes' recommendations based on our understanding of those recommendations and supporting evidence. The final EIS includes revised sections where the Tribes provided additional information.

Comment 19: The Umatilla Tribes (pages 4–6; page 8, first paragraph) comment that the draft EIS is deficient in terms of consistency with other recently submitted settlement agreements for new licenses, such as that for the Willamette Falls Hydroelectric Project.

Response 19: Commission staff has based all its recommendations on existing Commission precedent in other proceedings, including the Willamette Falls Project.

Comment 20: The Umatilla Tribes (pages 4–6; page 8, first paragraph) comment that the draft EIS should have considered an alternative that fully adopts the terms, conditions and recommendations submitted by state and federal fish and wildlife agencies.

Response 20: A separate alternative is not needed that fully adopts the terms, conditions and recommendations submitted by state and federal fish and wildlife agencies because the agencies did not suggest a clear alternative to Chelan PUD's proposal. Instead, they included a variety of environmental enhancement and protection measures that reflected individual issues and interests of the agencies. In the absence of a clear alternative, we analyzed in section 3 of the draft EIS the preliminary terms, conditions, and recommendations filed under sections 4(e), 10(j), 10(a), and 18 of the FPA. In the final EIS, we also analyzed the terms, conditions, and recommendations submitted by the agencies in response to publication of the draft EIS.

Comment 21: The Umatilla Tribes (page 7, Existing Fish Facilities and Programs) comment that the draft EIS failed to analyze an alternative that called for in-kind mitigation for losses of summer Chinook from project passage as called for in the Pacific Salmon Treaty. They state that since mid-Columbia summer Chinook naturally and historically outmigrated as subyearlings, that yearling fish should not be substituted for naturally-produced salmon.

Response 21: We revised section 3.4.2.1 of the final EIS to address this comment.

GEOLOGICAL AND SOIL RESOURCES

Comment 22: Chelan PUD (page 5, fourth paragraph) comments that the first sentence on page 28, stating that “backwater effect corresponds to the project boundary” would be more accurate if rewritten to say the “backwater effect is within the project boundary.” In addition, Chelan PUD (page 5, sixth paragraph) would like to correct the sentence (page 29, third paragraph) “The easements... specifically do not include any damage to ‘improvements, appurtenances and personal property.’” To make it clearer, Chelan PUD suggests deleting “do not include” and substituting “cover” so the sentence reads “The easements... specifically cover any damage to ‘improvements....’”

Response 22: We revised section 3.2.1 of the EIS to reflect this comment.

Comment 23: Chelan PUD (page 5, last paragraph) corrects the spelling of “erodable” on page 30, first paragraph. In addition, Chelan PUD (page 6, second paragraph) would like to clarify the sentence on page 33, third paragraph to read “While this phenomenon is likely occurring, it does not appear to be producing substantial deposition because several large storage reservoirs upstream of the project remove sediment from the water that would otherwise pass downstream to the Project.”

Response 23: We revised sections 3.2.1 and 3.2.2.2 of the EIS to reflect these comments.

WATER RESOURCES

Comment 24: WDOE (Recommendations) states that the following items should be updated in the final EIS:

1. The analysis of project effects on temperature can be updated (page 46) based on modeling results of CE-QUAL-W2;
2. The Spill Prevention Control Countermeasure Plan (SPCCP) (page 49) was updated this year. In addition, the PUD intends to cooperate with the Columbia-Snake River Spill Response Initiative (SPI);
3. The “tailrace” monitoring point is to be moved into the actual tailrace;
4. There is new information on the ability of the PUD to meet the total dissolved gas (TDG) standards, and the options available to them;
5. CE-QUAL-W2 temperature modeling did not identify measures to meet standards (page 69), but rather showed that the project was very close to meeting standards and that further studies were needed to determine the level

of compliance. (As part of the adaptive management process, if the additional studies show a significant impact on water temperature and there are reasonable and feasible measures to be implemented, the PUD is expected to address these); and

6. The timing of the adaptive management procedure for TDG and temperature is still under discussion with the PUD.

Response 24: We revised the EIS to include discussions of the new study results and the new location for the TDG monitoring station.

Comment 25: EPA recommends that the FERC license support WDOE's conditions allowing for subsequent mitigation of adverse impacts as provided in the water quality certification through additional WDOE approvals (for example, 401 certification general requirement 5), additional monitoring or studies (general requirement 7), or revisions to the water quality certification (general requirement 8, section 5.2, and section 5.5, item 2). EPA states that such provisions are critical elements to ensure water quality is maintained over the life of the 50-year span of the proposed license.

Response 25: The environmental effects of WDOE's recommendations are evaluated in the EIS. The ability of WDOE to modify the 401 certification conditions would be addressed in any license order that is issued and we did not address this in the final EIS.

Comment 26: WDOE ("Tailrace" Monitoring) notes that there seems to be confusion regarding where "tailrace" data have come from. WDOE states that Chelan PUD refers to "tailrace" data as a point 4 miles downstream, not to the actual tailrace, and that the current Water Quality Plan has clarified this point.

Response 26: We revised section 3.3.1.3 of the EIS to indicate that the downstream fixed monitoring site for TDG and water temperature is located approximately 4 miles downstream of the Rocky Reach dam.

Comment 27: Chelan PUD (page 15, second and fourth paragraph; page 17, fourth paragraph; page 17, sixth paragraph) comments that in the September 26, 2005, Water Quality Plan, hourly temperature monitoring from April through October is proposed for at least 3 years. In addition, items that should fulfill the requirement to annually develop/revise an operations plan are proposed.

Response 27: On March 22, 2006, Chelan PUD filed a Settlement Agreement that included the February 3, 2006, version of the Water Quality Plan. We revised

section 5.1.2 of the EIS using information from this version of the Water Quality Plan to indicate that Chelan PUD proposes to conduct hourly temperature monitoring from April through October for the term of the new license or until such monitoring is no longer required by WDOE.

Comment 28: Interior (Columbia River and Rocky Reach Project Hydrology) comments that minimum flow data presented in the draft EIS represents the entire Entiat River Basin but the maximum flow presented in the draft EIS represents only the upper 60 percent of the basin. Interior recommends that the final EIS provide “parallel” data from the two streamflow gaging stations, such as the maximum, minimum, and average daily streamflow, for comparability purposes. In addition, Interior comments that it is unclear where the 60 percent value originated. Interior’s comment provides web sites from which data for the two stations that were used, Entiat and Ardenvoir, can be found.

Response 28: In section 3.3.1.1 of the EIS, we revised the text incorporating daily flow data for the overlapping period of March 15, 1996, through September 30, 2004, to clarify the contribution of flow originating from upstream of the upper U.S. Geological Survey gaging station.

Comment 29: WDOE (gas bubble trauma [GBT]) states that the EIS should make note that the Federal Columbia River Power System (FCRPS) studies focused on mortality (relative to fish passing through the turbines) and states that Chelan PUD studies of biological effects of TDG were not reviewed by experts in the field and thus were lacking in rigor. WDOE requests that future study plans and results be peer reviewed, and states that Chelan PUD has agreed with that request. In addition, WDOE states that because fish survival is based on both fish passage and TDG levels, it is important to address both measures simultaneously in Chelan PUD’s proposal to model and test specific technologies for TDG.

Response 29: We revised section 3.3.2.2 of the EIS to provide a more comprehensive discussion of the effects of TDG levels on juvenile and adult salmonids based on studies conducted for the FCRPS. We also incorporated WDOE’s recommendations that future study plans and reports be peer reviewed and that TDG and fish passage be addressed simultaneously.

Comment 30: The Umatilla Tribes (page 12, Total Dissolved Gas) comment that the draft EIS is incorrect in stating “results have not demonstrated a strong causal relationship between the project spill rate and TDG levels in the forebay of Rock Island Dam.” The Columbia River Inter-Tribal Fish Commission’s (CRITFC) September 23, 2005, comments to Chelan PUD on the July 28, 2005, Water Quality Plan state that “the

Project increased TDG saturation by 1 to 3 percent during spill and TDG from the Project ranged from 100 to 120 percent saturation.”

Response 30: We revised section 3.3.1.3 of the EIS to clarify that although the effects of spill at the Rocky Reach dam are sometimes evident at the forebay of Rock Island dam, the TDG level in the Rock Island forebay is primarily determined by the TDG level at the Rocky Reach forebay, not spill at the Rocky Reach dam.

Comment 31: Both the Forest Service (pages 20–21, Heavy Metals, Pesticides and Contaminants) and the City of Entiat (page 6, Heavy Metals, Pesticides and Contaminants) take issue with the reference to potential negative effects of agricultural chemicals on water quality without mentioning the high standards farmers must adhere to use these chemicals. In addition, the City of Entiat comments that the draft EIS does not mention that farmers attempt to reduce their use of chemicals by a number of means, including participating in an integrated pest management program. The City of Entiat comments that the draft EIS does not discuss Chelan PUD’s use of agricultural chemicals on project lands, which have the same potential to negatively affect the aquatic ecosystem. The Forest Service and the City of Entiat ask what data were used by the Commission to reach the conclusion that residual lead-arsenic found in clay soils at depth was a result of orchard operations and not an upstream Canadian mining operation, especially since orchard operations have not used lead or arsenic for decades, a fact the draft EIS fails to mention. The Forest Service and the City of Entiat note that there are multiple sources of heavy metals, pesticides, and contaminants, only two of which are discussed in the draft EIS.

Response 31: In the draft EIS, we discussed the potential orchard sources because of their proximity to the project area and the potential contamination of soils that may be converted to other uses, and thus may be disturbed and increase the likelihood of acting as a significant source of contamination to the Columbia River. We revised section 3.3.1.3 of the EIS to indicate that the project reach of the Columbia River has the potential to receive heavy metals, pesticides, and herbicides from numerous sources.

Comment 32: The Forest Service and the City of Entiat comment favorably on the discussion of Chelan PUD’s Spill Prevention Plan but indicate that they would like to see a discussion of the effects these chemicals would have on the aquatic ecosystem if they were allowed to concentrate in the river at high levels. The Forest Service and the City of Entiat ask whether there have been very recent PCB (polychlorinated biphenyl) or petroleum spills by Chelan PUD that have contaminated the Columbia River.

Response 32: We revised section 3.3.1.3 of the EIS to address these comments. In the past 10 years, there have been two oil spills of greater than 10 gallons at Rocky Reach dam, but no PCB spills.

Comment 33: Both the Forest Service (page 21, Consumptive Use of Project Waters) and the City of Entiat (page 7, Consumptive Use of Project Waters) question the statement that agriculture is the largest consumptive user of project waters. They note that irrigation systems have transmission losses of up to 85 percent and that this water is returned to the river. Further, both entities comment that the draft EIS does not identify the project's water use.

Response 33: We revised section 3.3.1.2 of the EIS to distinguish between allocated and actual consumptive water uses and expanded our discussion of the project's water uses.

Comment 34: The Forest Service (page 22, General Comments) and the City of Entiat (page 8, General Comments on Draft EIS) comment favorably on the back water effect analysis but comment that a discussion of anchor ice on the Entiat River and how it relates to flooding and backwater effects should be included in the final EIS.

Response 34: We revised section 3.3.1.1 of the EIS to indicate that anchor ice can affect both extreme high and low flows in the Entiat River.

Comment 35: BPA (page 1) comments that the following statement on page 54 of the draft EIS is not accurate:

“The Hourly Coordination Agreement allows the project to meet a high proportion of the peaking load of Grant PUD's power purchasers when the Priest Rapids and Wanapum projects are constrained by the Hanford Reach Agreement's anti-stranding provisions.”

BPA indicates that the terms of the Hourly Coordination Agreement specifically require “a loss of purchasers' capabilities at one project to reduce their total Hourly Coordination system capabilities by a like amount.” BPA comments that the proper characterization would be that as Grant's purchasers lose some of their ability to request power for their needs at the Priest Rapids and Wanapum developments, those who also have purchased generation rights to Rocky Reach Project may choose to exercise more of their rights at Rocky Reach Project to continue to meet their power requirements. Douglas PUD (page 2, third paragraph) and Grant PUD (page 2, third paragraph) suggest this sentence should read as follows:

“The Hourly Coordination Agreement allows the project to meet a high proportion of the peaking load of power purchasers who have rights to the output of both the Rocky Reach Project and Grant PUD’s projects when the Priest Rapids and Wanapum Developments are constrained by the Hanford Reach Agreement’s anti-stranding provisions.”

Chelan PUD (page 6, fourth paragraph) suggests basically the same sentence changes as Douglas PUD.

Response 35: We revised section 3.3.2.1 of the EIS to address these comments.

Comment 36: BPA comments that another statement on page 54 of the draft EIS is not accurate:

“Because flow releases from the federal projects (Grand Coulee and Chief Joseph) establish flow patterns that are greater than the ability of the Priest Rapids Project to reregulate, the cooperation of the coordinated system (via the Hourly Coordination Agreement) is necessary to accomplish the objectives of the Vernita Bar Agreement and protection of Chinook salmon fry from stranding.”

BPA states that it is incorrect to say that inflow patterns are greater than the Priest Rapid Project’s ability to reregulate, and this statement should be modified to describe the project’s capability to reregulate inflows. BPA comments that it is also incorrect to say that the cooperation of the coordinated system (via the Hourly Coordination Agreement) is necessary to protect salmon fry from stranding. Grant PUD (page 2, last paragraph) suggests that these statements be modified to reflect the Priest Rapids Project’s inability to meet minimum flow requirements during the spring emergence period or to hold specific fluctuation requirements without participation of upstream projects. Chelan PUD (page 6, sixth paragraph) basically agrees with Grant PUD’s comment and adds that the Hanford Reach Agreement provides for the release of water to supplement flows, when needed, after active storage at the Priest Rapids and Wanapum developments has been used.

Douglas PUD (page 2, fifth paragraph) suggests this sentence should read:

“The Priest Rapids Project does not have the physical ability to re-regulate the daily flow releases from the federal projects, with the exception of maintaining flows below Priest Rapids on some weekends when Grand Coulee flows are reduced. For this reason, the Hanford Reach Agreement provides for the release of water from one foot of active storage at the Rocky Reach Project to supplement flows, when needed, after active storage at the Priest Rapids and Wanapum Developments have been used.”

Response 36: We revised section 3.3.2.1 of the EIS to address these comments.

Comment 37: The Umatilla Tribes (page 13, first full paragraph) comment that the draft EIS misinterprets their recommendation that the project should not deviate from hourly coordination during the susceptible period for Hanford fall Chinook spawning and rearing migration. The Tribes state that it is not enough to operate the project “in accordance” with the Hourly Coordination Agreement, because the Agreement allows individual parties the latitude to “go off” coordination for spot market sales or other power purposes. The Umatilla Tribes’ comment that FERC’s final or supplemental EIS should correct this misunderstanding and reconsider the Tribes’ section 10(a) recommendation.

Response 37: We revised section 3.3.2.1 of the EIS to clarify this recommendation of the Umatilla Tribes.

Comment 38: The Yakama Nation (page 4, first paragraph; page 9, first full paragraph) comments that the project has created substantial backwater areas that thermally stratify and that aquatic vegetation has become well established in these shallow areas. The Yakama Nation suggests that the concentration of aquatic vegetation may result in reduced dissolved oxygen (DO) levels. The Yakama Nation recommends that a more site-specific analysis be completed to address these project effects in the final EIS, because they were not considered in the draft EIS.

Response 38: We expanded our EIS discussion in section 3.3.2.2 of the lateral temperature differences across the Rocky Reach reservoir and incorporated an analysis of DO along the margins of the reservoir into the EIS.

Comment 39: The Yakama Nation (page 9, second full paragraph) indicates that infra-red techniques would not be the best method to identify differences in water temperature within the fishway. The Yakama Nation states that FERC misinterpreted this comment on page 68 (fourth paragraph) and page 69 (last paragraph) of the draft EIS. The Umatilla Tribes (page 19) comment that they clearly recommended evaluation of areas throughout the project reservoir, not just “hot spots,” using infra-red technology to determine if these areas exceeded temperature standards and were used as important fish habitat.

Response 39: We revised section 3.3.2.2 of the EIS to make it clear that the Umatilla Tribes’ recommendation for infra-red imaging pertains to the entire Rocky Reach reservoir and added discussion to address this issue.

Comment 40: The Yakama Nation (page 9, third full paragraph) indicates that it understands that cumulative effects affect water quality yet disagrees with FERC’s policy

that each project is evaluated in a manner that is isolated from the rest of the system. The Yakama Nation states that this does not allow cumulative effects of other hydroelectric projects to be addressed.

Response 40: The TDG total maximum daily load (TMDL) issued by EPA in 2004 and the temperature TMDL, once issued, will address these water quality parameters in large portions of the Columbia River basin. The effects of other FERC projects on water quality would be addressed during relicensing or through license amendments, as necessary; therefore, we did not revise the text of the EIS.

Comment 41: The Yakama Nation (page 9, last paragraph) disagrees with FERC's conclusion on page 76 of the draft EIS (second paragraph) that over time the gain in knowledge of water quality issues would decrease. The Yakama Nation states that FERC must consider in the final EIS that Chelan PUD is required to complete survival studies on ocean-type (sub-yearling) Chinook and sockeye salmon, which will not occur until several years into the future.

Response 41: We revised section 3.3.2.2 of the EIS to account for the possibility that the gain in knowledge of water quality issues may extend beyond 10 years.

Comment 42: Chelan PUD (page 2, fourth paragraph) comments that it has made proposals in the September 26, 2005, Water Quality Plan to fulfill the requirement to annually develop/revise an operations plan.

Response 42: We revised the EIS to indicate that in the Settlement Agreement Chelan PUD proposes to annually file a Gas Abatement Plan that would be accompanied with an up-to-date Operations Plan, Fisheries Plan, Physical Monitoring Plan, and Biological Monitoring Plan.

Comment 43: Chelan PUD (page 3, Chelan PUD Response) indicates that it currently has programs to monitor and control aquatic invasive species.

Response 43: We revised sections 3.3.2.2 and 3.4.2.7 of the EIS to describe Chelan PUD's current monitoring and control program for aquatic invasive species, and section 3.3.2.2 of the EIS to address the potential reduction of DO levels caused by macrophytes.

Comment 44: Chelan PUD (page 7, second paragraph) comments that the following two additional studies should be added to the list of six studies developed by the Natural Science Working Group:

1. *Rocky Reach Dam: Operational and Structural Total Dissolved Gas Management* (Schneider and Wilhelms, 2005).
2. *Technical Report on the Development of a CE-QUAL-W2 Model for the Rocky Reach Hydroelectric Project* (West, 2005).

In response to a statement on page 232 of the draft EIS, Chelan PUD (page 17, second paragraph) comments that with the new inclusion of two TDG studies (MWH, 2003; Schneider and Wilhelms, 2005) and a new temperature study (West, 2005), there are nine studies at present, not six. In addition, Chelan PUD (page 9, second paragraph) also notes that final TDG study has been completed and incorporated into the September 26, 2005, Water Quality Plan; therefore, six studies were designed and reviewed as opposed to the four noted in the draft EIS.

Response 44: We updated section 3.3.2.2 of the EIS to include these studies.

Comment 45: Chelan PUD (page 9, fourth paragraph) recommends including the new TDG information provided by Schneider and Wilhelms (2005) in the final EIS. Chelan PUD indicates that the findings are presented in the September 26, 2005, Water Quality Plan submitted with its comments on the draft EIS. Chelan PUD suggests revising the EIS to reflect the operational modifications (maximizing powerhouse discharge and using spill from gates 2–12) described in the September 26, 2005, version of the Water Quality Plan.

Response 45: In section 3.3.2.2 of the final EIS, we incorporate the results of the Schneider and Wilhelms (2005) report and discuss the provisions of the Water Quality Plan included in the Settlement Agreement.

Comment 46: Chelan PUD (page 7, fourth paragraph) reports that a CE-QUAL-W2 model was completed and the results were incorporated into the September 26, 2005, version of the Water Quality Plan that was submitted by the PUD with its comments on the draft EIS. Chelan PUD indicates that 5 years (2000–2004) were modeled.

Response 46: We incorporated into section 3.3.2.2 of the EIS the results of the CE-QUAL-W2 modeling conducted for the 5-year period.

Comment 47: The Umatilla Tribes (page 19, fourth full paragraph) comment that the draft EIS is incorrect when it states that it appears that Chelan PUD acquired additional temperature data in 2005. The Umatilla Tribes state that the CE-QUAL-W2 model analyses are based on a dearth of data and that additional monitoring is necessary in order to assess Chelan PUD's compliance with temperature standards.

Response 47: We revised section 3.3.2.2 of the EIS to address this comment.

Comment 48: Chelan PUD (page 8, Chelan PUD Response) recommends edits to discuss the CE-QUAL-W2 model and results.

Response 48: We revised section 3.3.2.2 of the EIS to address this comment.

Comment 49: The Umatilla Tribes (page 18, last paragraph through page 19) state that FERC should require Chelan PUD to create a separate water quality committee with water quality experts from the Tribes and agencies to ensure compliance with the Clean Water Act (CWA). Chelan PUD indicates that the Rocky Reach Fish Forum (RR Fish Forum) would also be available if additional input is needed to assist WDOE and Chelan PUD.

Response 49: A separate water quality committee to ensure compliance would be unnecessary because it would be redundant with WDOE's water quality certification and TMDL processes and result in an additional layer of oversight and burden on Chelan PUD and resource agencies.

Comment 50: Chelan PUD (page 11, second paragraph) states that the following points should be added to the list of measures to address TDG on pages 74–75 of the draft EIS: (1) Maximize powerhouse discharge, and (2) Spill from gates 2 through 12.

Response 50: We revised section 3.3.2.2 of the EIS to discuss the measures proposed in the Settlement Agreement.

Comment 51: Chelan PUD (page 11, fourth paragraph) indicates that operational and structural modifications have been identified and are now included in the September 26, 2005, Water Quality Plan, which includes the review and development of an annual Gas Abatement Plan if required by WDOE.

Response 51: We revised section 3.3.2.2 of the EIS by incorporating a discussion of the operational and structural modifications proposed by Chelan PUD in the Settlement Agreement.

Comment 52: The Umatilla Tribes (pages 8–9, Groundwater and Coldwater Refugia) state that the draft EIS is not clear about the total allowable volume pumped from groundwater. The Umatilla Tribes indicate that they are concerned about the loss of cold

groundwater entry to the reservoir and the long-term diminishment of coldwater refugia for fish and that a conservation or restoration plan has not been discussed in the draft EIS. The Tribes also discuss the very limited data set for temperature in the near shore areas that are inhabited by rearing Chinook salmon and the inappropriateness of applying mean temperatures at the thalweg.

Response 52: The existing project is the baseline for this NEPA evaluation. Because water use in the project area is not expected to substantially change, there is no reason to conclude that coldwater refugia will be eliminated or substantially reduced compared to existing conditions. In addition, we are not aware of any evidence that the coldwater refugia in the reservoir have been substantially reduced since the project was constructed. We also note that the Settlement Agreement shows that Chelan PUD has revised its proposal to include monitoring of water temperature, DO, and pH in shallow waters of the reservoir, and we have added a discussion of this monitoring to section 3.3.2.2 of the EIS.

Comment 53: The Umatilla Tribes (pages 10–11, Temperature) state that the allowable increase for water temperature is greater than 0.3°C in some cases and that these should be a cumulative increase from all sources combined. They indicate that if Rocky Reach reservoir is already causing thermal increases of this magnitude on occasion, then river operations should attempt to produce somewhat less effect to accommodate other users. The Umatilla Tribes state that Chelan PUD has not identified the reasons for the exceedances that have occurred and that the draft EIS needs to consider alternatives to river management that would permit greater control over temperature exceedances, and not limit its alternatives by limiting pool elevations. The Umatilla Tribes indicate that it is not acceptable to state that the sustained high temperatures are an unavoidable product of having a reservoir system now instead of the flowing historic river. The Umatilla Tribes (page 14, second paragraph) also state that whether or not Chelan PUD is fully capable of meeting the natural thermal regime on its own and reducing dam-related temperature increases, standards should be set in relationship to the pre-dam natural thermal potential rather than what is most convenient to meet.

Response 53: WDOE interprets Washington State water quality standards and is the state agency with the responsibility of issuing federal CWA section 401 water quality certifications. WDOE, which issued 401 certification on March 17, 2006, based its Section 401 certification on CE-QUAL-W2 model results for with and without Rocky Reach dam conditions, using the existing inflowing water temperature and flow regimes. This analysis of the 2000–2004 period indicates that the project generally satisfies the existing and proposed water temperature standards. We revised section 3.3.2.2 of the EIS to incorporate these data, which became available after the draft EIS was issued.

Comment 54: The Umatilla Tribes (pages 13) comment that the draft EIS statement that the project reservoir “meets the objectives of the water quality standards by supporting a healthy, diverse aquatic community” is not substantiated by the existing micro- and macro-invertebrate data that compare free flowing reaches of the Columbia River to the portion of the river impounded by the project or the extremely poor productivity of salmon and Pacific lamprey stocks that must use the project area as critical habitat.

Response 54: We revised section 3.3.2.2 of the EIS to incorporate this information.

Comment 55: The Umatilla Tribes (pages 14, last paragraph, through 18) indicate that many of Chelan PUD’s conclusions regarding water quality are misleading and inadequately addressed, including conclusions that littoral stations are only slightly warmer than the thalweg. The Umatilla Tribes suggest that data indicate that warming of marginal waters exists; however, these data are scant and inadequate to reveal potential effects. The Tribes recommend that temperature effects within the narrow river margin area be part of a monitoring and mitigation plan.

Response 55: We revised section 3.3.2.2 of the EIS discussion of lateral differences in water temperatures with information that has become available since the draft EIS was issued. We also revised the EIS to discuss the Tribes’ recommendation to evaluate water temperatures along the margin of the reservoir, along with Chelan PUD’s proposed monitoring of water temperature, DO, and pH in shallow water habitats of the reservoir, as described in the February 3, 2006, Water Quality Plan (Chelan PUD, 2005a) that is part of the Settlement Agreement.

Comment 56: The Umatilla Tribes (page 19, Biological Effects Studies) indicate that none of the alternatives evaluated in the draft EIS includes monitoring the effect of TDG on adult salmon, steelhead, or Pacific lamprey. They state that the proposed alternative should be modified to include a requirement to monitor TDG.

Response 56: In the Settlement Agreement, Chelan PUD proposes to monitor TDG hourly from April through August at fixed monitoring stations in the Rocky Reach forebay and tailrace, and monitor the effects of TDG on salmonids, resident fish, and macroinvertebrates. We revised section 3.3.2.2 of the EIS to include the revisions to Chelan PUD’s proposal and address the need for monitoring the effects of GBT.

FISHERIES RESOURCES

Comment 57: WDFW (page 9, Other Fisheries Issues) indicates that the RR Fish Forum membership should include Chelan PUD and should serve as a means to coordinate

efforts, share information, and resolve disputes in implementing the Rocky Reach Resident Fish Management Plan (Resident Fish Plan).

Response 57: We revised section 3.4.2.7 of the EIS to incorporate this recommendation.

Comment 58: WDFW (page 6, Pacific Lamprey Measures) and Chelan PUD (page 3, Chelan PUD Response, page 18, third paragraph) indicate that a radio telemetry study should be conducted to assess fishway passage success for adult lamprey after modification to the fishway to improve lamprey passage. The Umatilla Tribes (page 7, Staff Alternative; page 24 first paragraph) and Yakama Nation (page 6, last paragraph) comment that an adult lamprey passage study needs to be implemented on a more frequent basis than every 10 years. The Umatilla Tribes (pages 23–25, page 237–8) state that additional studies are needed to further examine and rectify problem lamprey passage areas within the fishway, and that the draft EIS fails to approach the project effects on lamprey passage from an adaptive management scientific perspective and methodology.

Response 58: Studies, including but not limited to radio-telemetry, to evaluate the efficacy of fishway modifications implemented to facilitate fish passage would identify problem areas as well as the success of implemented measures. We modified the text to recommend inclusion of such studies as described in the Pacific Lamprey Plan included in the Settlement Agreement. Once passage impediments at the Rocky Reach Project have been identified and addressed, monitoring once every 10 years or in response to significant fishway modifications would be sufficient to ensure that implemented measures are still effective.

Comment 59: The Umatilla Tribes indicate that the draft EIS is incorrect when it states that the Tribes did not specify the frequency of the studies.

Response 59: We revised section 3.4.2.3 of the EIS to indicate that the Tribes specified the frequency of the requested lamprey passage studies.

Comment 60: WDFW (pages 6-7) comments that a lamprey habitat assessment should be included in the final EIS. WDFW states that such an assessment would improve understanding of project effects on all life stages of Pacific lamprey.

Response 60: A measure to assess ongoing project impacts on existing reservoir habitat for juvenile lamprey is included in the Pacific Lamprey Plan included in the Settlement Agreement. There is no evidence in the record that there are adverse project effects on lamprey and associated habitat; therefore, we do not recommend including this measure in any license issued for the project.

Comment 61: WDFW (page 7) disagrees with the Commission's conclusion that adult lamprey counts at mid-Columbia dams have increased to levels similar to those observed in the 1960s. Further, WDFW comments that mitigation should be provided for the direct, indirect, and cumulative effects on Pacific lamprey that are discussed in the draft EIS.

Response 61: We revised section 5.1.5 of the EIS to indicate that adult lamprey passage counts at Rocky Reach dam have increased since the mid-1970s, although they are still below most of the high counts recorded in the 1960s, when the range was 1,000 to 17,000 adult lamprey.

Comment 62: The Yakama Nation (page 5) indicates that they support the draft Pacific Lamprey Plan and all the elements therein. They recommend FERC adopt the final Pacific Lamprey Plan, and they state that the rejection of certain measures in the draft EIS, including additional telemetry studies and juvenile lamprey habitat assessment, create a plan that does not fully address project impacts. The Yakama Nation also states that Chelan PUD should contribute to regional research efforts and that the settlement parties should be allowed to respond to such research results in the most appropriate manner.

Response 62: The Pacific Lamprey Plan included in the Settlement Agreement includes monitoring studies to evaluate the effectiveness of fishway modifications implemented at the project to facilitate upstream passage. In the final EIS we recommend these measures because they would provide information about identified ongoing project effects on Pacific lamprey and would help identify appropriate mitigation measures. The Yakama Nation does not indicate how juvenile habitat assessments would be used to benefit lamprey. Additionally, there is no information in the record that provides evidence or establishes a nexus between the effects of the project on juvenile lamprey and available habitat in the reservoir. Consequently, we did not revise the EIS text on this issue.

Comment 63: The Yakama Nation indicates the final EIS should revise the statements on page 89, third paragraph of the draft EIS to reflect the Yakama Nation's position that Pacific lamprey historically were, and could again be, an important commercial species, but because of their low abundance in the Columbia Basin, they are currently used primarily for ceremonial purposes.

Response 63: We revised section 3.4.1.4 of the EIS to reflect the current tribal ceremonial use of lamprey.

Comment 64: The Yakama Nation indicates the draft EIS is incorrect in stating that there are currently no lamprey studies being conducted at the project, and this should be corrected in the final EIS. The Yakama Nation states that ongoing monitoring is occurring.

Response 64: We revised section 3.4.2.3 of the EIS to indicate there is ongoing monitoring related to Pacific lamprey at the project.

Comment 65: The Yakama Nation indicates the draft EIS states that it is unclear how regional research would benefit lamprey populations, yet at the same time notes the uncertainties surrounding lamprey ecology and population declines. FERC should require Chelan PUD to implement studies independent of other mid-Columbia PUDs or work with participants of the Pacific Lamprey Plan to coordinate a regional, cost-effective strategy that would benefit the species.

Response 65: As stated in the EIS, coordination with regional experts and managers, integrating project efforts with regional lamprey programs, and seeking cost-sharing and matching funds would not be necessary to address or mitigate for project effects on lamprey. Thus, staff does not recommend inclusion of such provisions as a requirement in any license issued for the Rocky Reach Project, and we did not revise the text in the EIS. However, we have no objection to Chelan PUD pursuing such activities on its own.

Comment 66: The Yakama Nation indicates that FERC's draft EIS recommendations contain flaws in that FERC's reluctance to provide for continued development of acoustic, Passive Integrated Transponder, and/or radio tags will limit the ability to identify and mitigate project effects. They also disagree (page 7, first paragraph) with the statement on page 122, first paragraph of the draft EIS, which states that measures 9–11 would not benefit Pacific lamprey. The Yakama Nation states that substantial evidence must justify this conclusion if FERC maintains this position in the final EIS. The Yakama Nation also states, (page 7, second paragraph) and the Umatilla Tribes agree (page 25, first full paragraph) that Pacific lamprey production facilities are essential for production of juvenile lamprey to test for juvenile lamprey survival through the Rocky Reach dam.

Response 66: The Commission requires licensees to mitigate for project effects that are identifiable using current technologies, and not for conducting general research using unproven or experimental technologies. Funding basic physiological or behavioral research, or artificial propagation of lamprey for research are not specific measures that serve project purposes, nor would they specifically mitigate any identified project effects, and we do not recommend that such funding be included in the license. We revised section 3.5.2.3 to provide clarification on this topic.

Comment 67: Chelan PUD (page 11, last paragraph) comments that FERC should include funding for regional lamprey studies and that integrating with regional efforts is one of the most effective and efficient means of furthering mitigation for project effects on lamprey. Chelan PUD (page 18, first paragraph) comments that participation in regional research and coordination would help the RR Fish Forum implement the White Sturgeon Plan.

Response 67: While integrating project activities with regional research efforts may be beneficial, it is not directly associated with mitigating for project effects or serving project purposes and does not need to be included in the project license. As indicated in the EIS, we would not object to a licensee pursuing such activities on its own, and we did not revise the text of the EIS.

Comment 68: The Umatilla Tribes (page 20, Pacific Lamprey) state that FERC should require Chelan PUD to conduct the research it has agreed to conduct on project effects on juvenile lamprey.

Response 68: Studies to evaluate the efficacy of project fishway modifications implemented to facilitate fish passage would identify problem areas as well as the success of implemented measures. As indicated in section 5.1.5 of the final EIS, we recommend inclusion of such studies.

Comment 69: The Umatilla Tribes state that FERC should acknowledge CRITFC's research documenting the outmigration of hundreds of juvenile lamprey from the Methow River upstream of the project. The Tribes state that the impacts on outmigrating juvenile lamprey should be studied and mitigated.

Response 69: The Tribes did not provide any detail on such studies in their comment letter, nor has any information on such studies been filed for the record with the Commission. Therefore, we are unable to comment on this research and did not revise the EIS text.

Comment 70: WDFW (pages 7–9, White Sturgeon Measures) comments that FERC's recommended White Sturgeon Plan did not incorporate WDFW's recommendations to include a hatchery construction schedule or a condition that Chelan PUD coordinate with other entities involved in white sturgeon management. Specifically, WDFW states that broodstock collection and mating scheme protocols contained in the Breeding Plan (Appendix A of the Comprehensive Rocky Reach White Sturgeon Plan, September 23, 2005) need to be followed in the white sturgeon supplementation program, and the best way to do this is through a white sturgeon hatchery facility. WDFW (page 9) offers

considerations in the breeding program protocols that it states would make the supplementation program more efficient. The Umatilla Tribes (pages 22–23, White Sturgeon) state that a hatchery for white sturgeon is critical to the survival of this population, and that the revised draft EIS or final EIS should include requirements for quick construction of these facilities.

Response 70: The draft EIS indicated that if Chelan PUD failed to acquire enough sturgeon for release as recommended by the Commission staff, construction of a hatchery may be appropriate. The White Sturgeon Plan included in the Settlement Agreement identifies the need for a supplementation program in the reservoir, and lists potential sources for brood stock, including obtaining fish from new or existing Chelan PUD-funded hatcheries retrofitted for white sturgeon. Using adaptive management, the RR Fish Forum would specify the most appropriate action for obtaining the brood stock, and in the final EIS we are recommending this approach.

Comment 71: The Yakama Nation (page 8) states that project effects on white sturgeon are a result of habitat modification, inability for upstream passage, and turbine mortality, all of which are caused by the presence of the dam. Noting that mitigations for these issues would require substantial changes in project operations, which seem infeasible, the Yakama Nation recommends that the final EIS consider production facilities. The Yakama Nation states that FERC's rationale for its opposition of production facilities is unclear.

Response 71: The White Sturgeon Plan included in the Settlement Agreement identifies the need for a supplementation program in the reservoir, and lists potential sources for brood stock, including obtaining fish from new or existing Chelan-funded hatcheries retrofitted for white sturgeon. Using adaptive management, the RR Fish Forum would specify the most appropriate action for obtaining the brood stock, and in final EIS section 5.1.4 we recommend this approach. We do not oppose construction of a hatchery for white sturgeon production in the future should Chelan PUD fail to meet its supplementation obligation through other means.

Comment 72: The Yakama Nation (page 3, second paragraph) indicates that Chelan PUD should use adaptive management to implement the protection, mitigation, and enhancement (PME) measures incorporated into the drafts of the Pacific Lamprey and White Sturgeon Plans. They state that all possible mitigation measures should be discussed in the Settlement Agreement, and they find the Settlement Agreement lacking in clarity and specific information in the identification and sequencing of appropriate actions. They encourage the Commission to require Chelan PUD to provide additional information.

Response 72: We find that the Pacific Lamprey Plan and White Sturgeon Plan included in the Settlement Agreement contain enough specificity in the measures to assure appropriate action would be taken to address effects of the project on Pacific lamprey and white sturgeon. The White Sturgeon Plan contains measures to use adaptive management to assess sources of brood stock for the supplementation program. The final EIS contains adequate discussion of those measures.

Comment 73: WDFW (page 9, Predation) states that the size of the walleye population in the Rocky Reach reservoir is significantly under-represented by the fish presence surveys performed to date (Burley and Poe, 1994; BioAnalysts, 2000). WDFW indicates FERC should adopt a new license condition that Chelan PUD, in consultation with the RR Fish Forum, develop and implement surveys to determine the abundance of walleye in the reservoir, evaluate the potential effect of walleye predation on native fish species abundance and composition in the reservoir, and conduct periodic monitoring and evaluation surveys over the course of the new license.

Response 73: We revised section 3.4.2.5 of the EIS to include a discussion of this issue.

Comment 74: Chelan PUD (page 11, sixth paragraph) comments that "...Wells dam to the Rock Island dam." on page 78 of the draft EIS should be changed to "...Wells dam to the Rocky Reach tailrace."

Response 74: We revised section 3.4.1.1 of the EIS to address this comment.

Comment 75: With respect to measures that would replace the Twentyfive Mile Creek spawning channel, Chelan PUD (page 18, last paragraph, through page 19) indicates that these enhancement areas do not need to be incorporated into the Rocky Reach Project because it would involve a one-time payment for off-site enhancement.

Response 75: We revised section 5.1.6 of the EIS to incorporate this comment. Any need to modify the project boundary would be addressed in any order that is issued.

Comment 76: Chelan PUD (page 12, fourth paragraph) states that the Rocky Reach Fish Forum should have decision-making authority.

Response 76: As described in the Settlement Agreement, the Rocky Reach Fish Forum would assume responsibility for meeting to share information, coordinate efforts, and make decisions regarding the implementation of the provisions of the Resident Fish Plan, the White Sturgeon Plan, the Pacific Lamprey Plan, and the Rocky Reach Bull Trout

Management Plan, as long as such implementation is consistent with the conditions of the new license. Measures recommended by the forum but not allowed under the current license would require Commission approval. We revised section 3.4.2.7 of the EIS to clarify this point.

Comment 77: The Umatilla Tribes (page 20, Anadromous Fish Species) indicate that the draft EIS fails to address the status of anadromous fish stocks with respect to known stock status. The Tribes state that there was no information in the draft EIS regarding stock productivity metrics, such as smolt-to-adult returns, spawner-to-spawner evaluations or spawner-recruit functions, that are essential measures of productivity. In addition, the Tribes state that the draft EIS does not establish the foundation of the critical state of anadromous fish stocks that are Endangered Species Act listed.

Response 77: The information in the draft EIS regarding the current status of salmon and steelhead stocks is appropriate for identifying project effects or appropriate mitigation. We did not change the text of the EIS in this regard.

Comment 78: The Umatilla Tribes (pages 20) comment that the draft EIS failed to evaluate the additional overall increases that would occur if the Tribes' juvenile and adult passage standards for salmon and steelhead were implemented. In addition, the Tribes note the draft EIS is incorrect in stating that no method exists for accurately differentiating project caused mortality and natural mortality. For adult passage, the 2000 FCRPS BiOp establishes a specific per project passage standard using radio-telemetry methods for evaluation.

Further, the Umatilla Tribes provide specific recommendations for passage measures to meet their goals and state that FERC cannot balance fish and wildlife alternatives with power and other alternatives by merely dismissing the Tribes' more stringent standards as having "unknown costs and benefits." The Tribes state that FERC cannot dismiss the evidence of delayed mortality based upon the best available science. Without conducting the analyses of the costs and benefits of the Umatilla Tribes' fish passage and survival standards to increase salmon populations that are affected by the project for all alternatives, the Tribes state that FERC fails to provide an indication of what public benefits would accrue from the Tribes' recommended alternative. The Tribes comment that FERC must fully analyze the Tribes' standards in comparison with the HCP alternative, and that this is a significant deficiency that must be rectified in a supplemental or final EIS.

Response 78: We revised sections 3.4.2.1 and 5.1.3 of the EIS to clarify our reasoning on this issue.

Comment 79: The Umatilla Tribes (page 22) comment that the Tribes' recommendation for state-of-the-art hatchery bioengineering and production methods be implemented is not the same as an HCP goal. The Tribes state that FERC needs to provide a supplemental or final EIS that examines the specific suggestions provided in the Umatilla Tribes' recommendations with respect to replacing the existing deficient production facilities with state-of-the-art facilities that will increase the number and survival of fish produced to mitigate for project losses and provide for recovery of depleted populations above the project.

Response 79: We revised section 3.4.2.1 of the EIS to clarify that the Tribes' recommendation is not the same as the HCP. We also expanded the discussion to address the need for state-of-the-art hatchery facilities.

Comment 80: WDOE (Recommendations) states that under the current Settlement Agreement discussion, bull trout, Pacific lamprey and white sturgeon management would also be coordinated through the Rocky Reach Fish Forum (page 230).

Response 80: We modified the text of the EIS to reflect the duties of the Rocky Reach Fish Forum as described in the Settlement Agreement.

TERRESTRIAL RESOURCES

Comment 81: Chelan PUD (pages 3, 13, 15, and 16) indicates that it currently has programs to monitor and control aquatic invasive species, such as Eurasian watermilfoil, zebra mussels, and purple loosestrife. Chelan PUD states that the integrated noxious weed control program and the program to protect *Spiranthes* would control other noxious weeds. Chelan PUD indicates that it would develop all of its programs into a consolidated plan covering all the ongoing and proposed programs to monitor and manage invasive species.

Response 81: We revised section 3.5.2.5 of the EIS to reflect Chelan PUD's proposal to develop an integrated noxious weed control plan. Staff supports the development and implementation of such a plan.

Comment 82: Interior (Wildlife Resources) and Chelan PUD (page 12, last paragraph; page 20, second paragraph) comment that maintaining native upland habitat on Chelan PUD property near Sun Cove does not contribute to the shared objective that was negotiated among the settlement parties to maintain the integrity of native shrub-steppe habitat and related species. Chelan PUD states that restoration activities focusing on Chelan Wildlife Management Area (Chelan Wildlife Area) lands would provide restored shrub-steppe habitat with high connectivity to existing habitats, which, in turn, would provide significantly greater benefit to terrestrial resources in Chelan County than the

property owned by Chelan PUD near Sun Cove. Chelan PUD comments that a 50-foot riparian habitat easement, as proposed in the Rocky Reach Wildlife Management Plan (Wildlife Plan), would protect the shoreline riparian area that is immediately adjacent to the reservoir. Also in reference to Sun Cove, the Forest Service and the City of Entiat note that the “high quality riparian habitat” referred to in the draft EIS is not native habitat but was created as a result of the project.

WDFW (pages 11–12) states that if Chelan PUD is required to maintain the Sun Cove properties as native habitat, then Chelan PUD should be entirely responsible, as landowners of those properties, to implement all measures necessary to maintain the native wildlife and their habitats in a functioning condition. With regard to FERC staff’s calculation of an annual operational budget for “maintaining Sun Cove properties in its current state,” WDFW recommends an operating budget of \$15 per acre per year as the funding level necessary to achieve and sustain the wildlife productivity potential of the Sun Cove properties.

Response 82: WDFW recommends that Chelan PUD protect and maintain the Sun Cove properties in their natural state, while also recommending that Chelan PUD provide financial support for the restoration and maintenance of the Chelan WMA. WDFW initially stated that the Sun Cove properties supported important wildlife habitat despite their proximity to development. Thus, the draft EIS analyzed the costs and benefits of protecting the Sun Cove properties separately from the measures proposed for the Chelan WMA. The protection and maintenance of Sun Cove is not intended to be viewed as an alternative to recommending Chelan Wildlife Area measures.

However, in light of the comments provided on the draft EIS and at the technical conference, it has become clear to Commission staff that protecting the upland habitat associated with Sun Cove would provide little benefit to wildlife; therefore, we no longer recommend the protection and maintenance of the upland habitat (see section 5.1.9 of the final EIS). We revised the EIS to recommend that riparian buffer be established and maintained by Chelan PUD on the Sun Cove properties. As a result, an operating budget of \$15 per acre, as recommended by WDFW, would not be necessary. Maintaining the riparian zone as a buffer would protect this habitat from development to act as a buffer along the shoreline.

Comment 83: The Forest Service (page 21, Sun Cove) and the City of Entiat (pages 7–8, Sun Cove) comment that the Sun Cove site has evidence of ATV use, which affects wildlife use of the site.

Response 83: The draft EIS already acknowledges ATV use on the Sun Cove properties and the resulting disturbance to wildlife habitat; therefore, we did not revise the EIS text.

Comment 84: Chelan PUD (page 12, last paragraph; page 20, second paragraph) also comments that it owns 164 acres at this site, not the 111 acres stated on page 243 of the draft EIS.

Response 84: We revised section 5.1.9 of the EIS to remove reference to the acreage of land owned by Chelan PUD within the Sun Cove properties.

Comment 85: Interior states that FERC staff omitted from the draft EIS Interior's recommendation that Chelan PUD contribute \$20,000 to BLM and make another \$20,000 available on a cost share basis for shrub-steppe habitat protection, mitigation, and enhancement on BLM-administered lands within the Rocky Reach Wildlife Area (RR Wildlife Area). Interior indicates that the condition was submitted in order to provide for reimbursement of federal dollars and/or resources expended to implement the terms of Interior's MOU with WDFW to mitigate for continuing impacts resulting from project operations. Interior recommends that this condition be included and analyzed in the final EIS.

Response 85: In its May 24, 2006, letter, Interior withdrew its preliminary 4(e) conditions because it had successfully participated in the development of the Settlement Agreement. As such, sections 3.5.2.1 and 5.1.9 of the EIS have been revised to reflect the measures contained in the Settlement Agreement. The MOU is not between Interior and Chelan PUD or FERC.

Comment 86: Interior (Noxious weeds) notes that the draft EIS lacks specific reference to federal provisions for managing noxious weeds and that the final EIS should include these provisions to comply with federal standards, policy, and guidance for management of noxious weeds.

Response 86: We revised the wording in section 5.1.9 to specify that the noxious weed plan should be prepared in consultation with BLM, WDFW, and the Forest Service to ensure that all federal standards, policy, and guidance are included, as appropriate. We do not agree that the federal statute requirements need to be specifically referenced in the EIS.

Comment 87: The City of Entiat (page 2, third paragraph) comments that FERC should reconsider requiring Chelan PUD to create undisturbed riparian habitat near the Entiat city limits and Entiat School because of the possible presence of large carnivores. Additionally, William Walter, commenting on the draft EIS disagrees with fencing at Lincoln Rock and Entiat parks for the maintenance of wildlife habitat.

Response 87: We revised sections 3.5.2.6 and 5.1.9 of the EIS to reflect the measures contained within the Settlement Agreement, to which Chelan PUD, WDFW, and Interior are parties. Although we recommend renovations at Lincoln Rock and Entiat parks, we do not conclude that it would encourage the presence of large carnivores near the city and school.

Comment 88: WDFW (page 2, A.1.) states that maintaining baseline conditions (pages 2–4) requires the continued implementation of PME measures on Chelan Wildlife Area mitigation lands to preserve and enhance ecosystem functions thereby maintaining the original mitigation value. The original filling of the reservoir in 1961 altered the character of the shoreline and shrub-steppe habitat that provided valuable mule deer habitat, especially when snowfall conditions would drive deer close to the river. The availability and quality of wintering habitats are what ultimately limit mule deer populations in the Chelan Wildlife Area and surrounding lands. A one-time funding for acquisition of land does not ensure that the habitat will continue to mitigate for the effects of project inundation and impoundment, and land management practices have evolved significantly since the original license was issued. In addition to mitigating the effects of inundation on the migratory mule deer herd, the Chelan Wildlife Area is intended to mitigate for original project effects on upland game bird populations. To maintain the condition considered baseline for the purpose of relicensing of the Rocky Reach Project, the measures that maintain upland game bird habitat on the Chelan Wildlife Area mitigation lands in functioning condition must be continued.

WDFW also states that there are cumulative and/or indirect project effects from the project on wildlife habitat (page 5). Increased human population as an indirect result of project related benefits, such as a reliable water and energy source, has increased management demands on adjacent wildlife lands. Protecting and enhancing the habitat on Chelan Wildlife Area lands can mitigate these indirect effects.

Additionally, an individual commenting on the draft EIS disagrees that Chelan PUD should pay money to WDFW for management of WDFW's games lands.

Response 88: The Commission has established that the baseline for our environmental analysis is the project as it exists today, not conditions without the project. The Chelan Wildlife Area lands are outside the project boundary and project operations do not affect the condition of those lands as they currently exist. However, for the reasons described in section 5.1.9.1, we have included Chelan PUD support for habitat improvements of the Chelan Wildlife Area in our recommendation.

Comment 89: WDFW comments that current project effects (page 4) include energy expenditures of the migratory deer population, which likely crossed the Columbia River

in the past to get to winter forage. WDFW states that the deer likely expend more energy now that the river impoundment is more than twice as wide and there is no current. WDFW comments that the impediment, if unmitigated, can significantly adversely affect the survival of the mule deer herd that ranges between the forested uplands and low elevation habitats of the region surrounding the Chelan Wildlife Area and the Rocky Reach Project. Additionally, mule deer energy expenditures are increased due to the project because water turbulence from flowing water created a warmer microclimate along the river corridor. Now that the river is impounded, this has disappeared and thus mule deer have to expend more energy to maintain their core body temperature.

Response 89: The mule deer study conducted by WDFW in 2003 (Myers, 2003) did not identify either a difficulty in crossing the reservoir or the loss of a warmer microclimate as factors in the survival of wintering mule deer in Chelan County, Washington. The study identified decreased winter survival due to loss of wintering habitat from fire and energy expenditure due to snow depth and winter temperatures. There is no information in the record to indicate that mule deer are actively seeking to cross the project reservoir to access winter forage or use the riparian habitats associated with the project as winter refugia even during the harshest winters. However, we also note that this may occur during extremely severe winters. On page 10 of its comment letter, WDFW indicates that mule deer use of riparian habitat along the Columbia River adjacent to the project is “very limited” and the current riparian habitat in the project boundary has “very limited benefit to migratory mule deer.” WDFW further states that habitat in the Chelan Wildlife Area fulfills mule deer needs for thermal and hiding protection and that residential development, highways paralleling both shores of the project, and a railroad paralleling the west shoreline greatly limit the accessibility of the shoreline to mule deer. WDFW also states that it wishes to discourage big game from crossing the highway to get to the river. Based on these points, we conclude that continued project operation is not affecting wintering mule deer. Nonetheless, because there are limited opportunities to enhance mule deer wintering habitat and such enhancement measures could delay migration and dependence on riparian habitat adjacent to the project, we are now recommending Chelan PUD file a final management plan that includes the Chelan and RR Wildlife Areas.

We modified section 3.5.2.1 to reflect WDFW’s observations on the quality of existing riparian habitats.

Comment 90: WDFW comments that Chelan PUD will have oversight over all wildlife measures to be implemented. WDFW states that any entity responsible for implementing the measures would be accountable to Chelan PUD for ensuring that all measures are consistent with the new license. These measures include: (a) reimbursable funding for entities responsible for performing work consistent with the Wildlife Plan (such entities would submit planning reports to Chelan PUD, containing a description and cost estimate

of the work; and (b) establishment of a Rocky Reach Wildlife Forum (RR Wildlife Forum) to coordinate implementation of the Wildlife Plan between Chelan PUD and other parties.

Response 90: We revised section 5.1.9 of the EIS to reflect the role of the RR Wildlife Forum. We note that a licensee is free to work with other entities to fulfill the requirements of its license, but the licensee is ultimately responsible for complying with the terms of the license.

Comment 91: WDFW (pages 10–11, Rocky Reach Wildlife Habitat Plan, fourth paragraph) provides clarifications to the statement on page 241, fourth paragraph, of the draft EIS, “Riparian habitats adjacent to the project used by wintering mule deer are stable, well developed, and similar to those found prior to project construction.” WDFW states that mule deer use of riparian habitat along to the Columbia River adjacent to the Rocky Reach reservoir is limited. In addition, WDFW notes that habitat quality has not been evaluated by the applicant and comments that agriculture, recreation, and residential developments have diminished the wildlife benefit of this habitat. The benefits of riparian habitat for large game animals are very limited because access is restricted due to development, highways, and a railroad between the shorelines and the uplands. WDFW states that the stability and quality of this habitat cannot be ensured because it is subject to aging, noxious plant invasion, windfall, beaver harvest, and development.

Response 91: We revised section 3.5.2.1 of the EIS to reflect the limited nature of mule deer use of project lands. The statement regarding the condition of the riparian habitat refers to the existing condition. Chelan PUD does not propose any measures that would adversely affect riparian habitat. Noxious weed control measures and the conservation of the Sun Cove riparian habitat, as recommended by the staff, would improve riparian conditions over the course of the new license.

Comment 92: WDFW states that Chelan PUD would not be “entirely responsible financially for annual operations, maintenance, and restoration of state [CWA] ... lands” as concluded by FERC staff in the draft EIS. WDFW indicates that the agency would continue to fund the O&M of Chelan Wildlife Area lands for the duration of the new license in a manner consistent with maintaining Chelan PUD’s license obligations and at the current funding level. Interior (Rocky Reach Wildlife Habitat Plan) states that funding provisions for a Wildlife Plan for the Chelan Wildlife Area are intended to supplement the agencies’ costs of developing mitigation projects, not to make Chelan PUD entirely responsible for management of state and federal lands as stated in the draft EIS.

Response 92: Neither Chelan PUD nor WDFW provided a basis for the costs included in their recommendations for managing the Chelan Wildlife Area. Staff noted a memorandum included as appendix A of the fourth draft of the Wildlife Plan between Paul Fielder of Chelan PUD and Marc Hallet of WDFW (dated February 6, 2004) that indicates that the total annual operations and maintenance budget for the Chelan Wildlife Area would need to be \$110,000 and that the current WDFW budget is \$50,000 annually for O&M. WDFW's recommendation that Chelan PUD provide \$110,000 annually for the operations and maintenance of the Chelan Wildlife Areas indicated to us that Chelan PUD would be substantially, if not entirely, financially responsible for this funding. However, based upon WDFW's comment, we removed this discussion from the analysis.

Comment 93: Interior states that in section 5.1.9 of the draft EIS, the document suggests that the "funding levels identified by WDFW, BLM, and the Forest Service would make Chelan PUD entirely responsible financially for the operation, maintenance, and restoration of state and federal lands." However, these funds are intended to supplement the agencies for additional costs incurred to develop habitat restoration and improvement projects to mitigate for project related impacts to wildlife and their habitats. The draft EIS suggestion that Chelan PUD may elect to assist the WDFW, Forest Service, and BLM outside the new license is not enforceable. Interior states that since the funding is necessary to mitigate for impacts from project operations, the funding provisions should be included as an enforceable license article, and the establishment of this funding mechanism should be analyzed in the final EIS.

Response 93: We have revised section 5.1.9.1 of the EIS in partial response to this comment.

Comment 94: WDFW (page 11) states that they appreciate and value the efforts spent and the data collected by Chelan PUD through their eagle and goose surveys under the original license, but they suggest that the measures that would support the wildlife survey activity under the new license not be specific to certain species, but allow Chelan PUD survey efforts to be directed toward priorities identified through the RR Wildlife Forum, per WDFW's March 11, 2005 Recommended Terms and Conditions.

Response 94: Without knowing what these survey efforts may be, staff cannot evaluate the benefits or costs of the measures. In this instance, because we find benefits in continuing the current eagle and goose surveys, we recommend that the surveys continue under the new license. Our recommendation also allows for other surveys that may be recommended by the RR Wildlife Forum.

Comment 95: The City of Entiat (page 8, General Comments on the draft EIS) comments that arson caused the 1988 wildfire that the draft EIS mentions in reference to winter habitat losses. The draft EIS states that bitterbrush was dramatically reduced by wildfires, but the City of Entiat comments that the Federal Power Commission's *Environmental Report for Exhibit R Recreation Plan Rocky Reach Hydroelectric Power Project*, December, 1974, indicated only a trace of bitterbrush was expected to occur in the project area.

Response 95: The information regarding bitterbrush being reduced by fire came from the WDFW report *Observations of Mule Deer Habitat Use, Movements, and Survival in Chelan County, Washington* (Myers, 2003). We note that the EIS refers to "fires," which would encompass fires caused by arson. No text change was necessary.

Comment 96: Chelan PUD (page 3, Chelan PUD Response 5) states that the Wildlife Plan includes measures to continue wildlife surveys similar to those conducted during the existing license for the project at an estimated cost of \$10,500 to survey and monitor threatened, endangered, and sensitive species on a periodic schedule as directed by the RR Wildlife Forum. Chelan PUD recommends that this should also be modified in the staff alternative described in the Executive Summary.

Response 96: The Executive Summary describes measures that we did not recommend or that we recommended be modified. Based on Chelan PUD's proposal included in the Settlement Agreement, we revised the Executive Summary to clarify our recommendation with respect to wildlife surveys. See also the response to WDFW comments on wildlife surveys.

Comment 97: Chelan PUD (page 19) notes that the key reason for implementing the Wildlife Plan is to provide far greater wildlife benefits than could be implemented within the project boundary.

Response 97: Section 5.1.9 of the EIS has been revised to reflect this reasoning.

Comment 98: The Chelan's Sportmen's Association supports the inclusion of funding for habitat maintenance and improvement in the Chelan Butte, Oklahoma Gulch, Entiat, and Swakane Canyon. They state that there is a nexus between the project and these areas because the project flooded Chelan County's best winter range for mountain goats, mule deer and upland birds along the reservoir. These animals and their predators are now concentrated in condensed areas.

Response 98: See response to WDFW regarding baseline conditions, above. Mitigation for impacts of original construction was provided under the current license with the purchase of the Chelan Wildlife Area.

THREATENED AND ENDANGERED SPECIES

Comment 99: Interior (Threatened and Endangered Species, first paragraph) informs the Commission of the discovery of an additional population of Ute ladies'-tresses (*Spiranthes diluvialis*), a federally listed threatened species, on BLM lands within the project area. Interior attached a copy of the BLM Field Report documenting this discovery along with its general location and other pertinent information as part of Interior's comments. Interior agrees with the PME measures proposed by the applicant to protect three sub-populations of Ute ladies'-tresses and recommends that these same measures be applied to this newly discovered fourth sub-population. Interior recommends that both the new information regarding the discovery of a fourth sub-population of Ute ladies'-tresses in the project area and any additional measures to ensure the protection of all four sub-populations be addressed in the final EIS, and that subsection *Rare Plant Species* in section 3.5.1.2, *Botanical Resources*, section 3.6.1.12, and all related sections should be modified in the final EIS to reflect the discovery of this fourth population.

Response 99: Section 3.6.1.9 of the EIS has been revised to include this new information about the fourth sub-population of Ute ladies'-tresses. The protective measures would be applied to this new population.

Comment 100: Chelan PUD (page 13, fourth paragraph) suggests the following concluding statement regarding bald eagle night roosts:
"Therefore, no bald eagle night roosts exist in the Project Boundary or vicinity, and the one potential night roost that was included on the WNHP list, based on speculation, has been removed from that list."

Response 100: The section 3.6.1.8 of the EIS has been revised to include the information that the one potential night roost has been removed from the Washington Natural Heritage Program list.

CULTURAL RESOURCES

Comment 101: Interior (Operational and Environmental Enhancement Measures) comments that the erosion control work at a BLM-owned site that is proposed in the Shoreline Plan does not specify that the work is necessary to protect cultural site 45CH254, which is being affected by changes in surface water elevation and wave action along the project shoreline. Interior notes that the Commission's failure to specifically identify this site could imply that cultural resources are being addressed "in general." Interior also notes that, since the August 31, 2005, issuance of the draft EIS, cultural site 45DO504 has been identified as being affected by project-related erosion. Interior recommends that the final EIS analysis include the implementation of erosion control projects specifically at cultural resource sites 45CH254 and 45DO504. In addition, Interior recommends that Chelan PUD address erosion caused by project operations affecting cultural sites on BLM-administered land adjacent to the Rocky Reach pool.

Response 101: On page 171 of the draft EIS, we noted that Chelan PUD proposes to stabilize archaeological site 45CH254. Chelan PUD's Rocky Reach Historic Properties and Cultural Resources Management Plan (Cultural Plan), filed with the Commission on August 5, 2005, also specifies (page 38) that Chelan PUD would develop and implement, in consultation with the Rocky Reach Cultural Forum (of which BLM would be a member) treatment plans for currently identified, potentially eligible sites, within 1 year of license issuance. According to the Cultural Plan filed in March 2006, archaeological sites 45CH254 and 45DO504 are among those eligible sites for which treatments would be developed as necessary to protect them from project-related effects. We revised the EIS to address both sites.

Comment 102: Consistent with the Cultural Plan, Interior (Environmental Effects, Cultural Resources) recommends that the final EIS include a provision for compliance with federal standards, policy, and guidance for management of cultural resources, specifically the Native American Graves Protection and Repatriation Act (NAGPRA) and the Archaeological Resources Protection Act (ARPA).

Response 102: Section 4.4 of Chelan PUD's final Cultural Plan provides for notification of the relevant land management agency if archaeological deposits are encountered in the course of any project-related actions. The Cultural Plan also specifies that Chelan PUD would notify the State Historic Preservation Officer, Tribal Historic Preservation Officer, Confederated Tribes of the Colville Reservation, and Yakama Nation of any such discoveries. No text changes were necessary.

RECREATION RESOURCES

Comment 103: Interior (Staff Alternative) agrees with the need for monitoring recreational use and effects on lands within the project boundary as one component of the Rocky Reach Recreation Resources Management Plan (Recreation Plan). However, Interior comments that establishment of a recreation fund should be included and analyzed in the final EIS to address project-related effects and to ensure that BLM can respond to any increased use of federal land as a result of the project, as indicated through monitoring.

Response 103: In section 3.8.2.3, *Recreation Enhancement Fund*, of the draft EIS, we consider the environmental effects of the recreation enhancement fund. We recognize that the fund, as proposed, could have a cumulative beneficial effect on recreational resources within the river basin. However, we point out that the fund could be used for recreational enhancements outside of the project boundary with no clear nexus to project operations.

The proposed Recreation Plan, as part of the Settlement Agreement, stipulates that Chelan PUD provide funds for O&M of project-related recreation facilities. O&M required to address project-related effects during the license term would be identified and implemented in the appropriate project-related resource management plans, including the Recreation Plan.

Comment 104: The Forest Service (page 22, General Comments) comments that its interest in the recommended interpretation and education program is “in providing the public with ‘holistic’ recreation information about the entire area and in part to redeem our mission under the Farm Bill to assist with rural community development.” The Forest Service (page 9, Recreation Plan) recommends that the Recreation Plan should (1) address development, funding, and implementation of a comprehensive interpretation and education package in coordination with local efforts; and (2) address appropriate types and levels of information available to the public about the recreation facilities and opportunities at or near the project.

Response 104: In section 3.8.2.5, *Other Measures*, of the draft EIS, we acknowledge that the interpretation and education program recommended by the Forest Service would integrate delivery of these services between National Forest System lands and project lands. However, we find that the need for an interpretation and education program of this scope does not appear to be warranted, given the varied types of recreational opportunities at the project and the diverse land management entities with oversight of recreational facilities. Currently, all of the existing public recreational sites include educational signage consistent with the recreational opportunities at the site, such as acceptable and prohibited uses. In addition, many of the existing sites, including the

Rocky Reach dam site, already include interpretive and educational signs and trails. As part of the proposed Recreation Plan contained in the Settlement Agreement, Chelan PUD proposes to expand interpretation and education opportunities at the project. Therefore, we conclude that an additional interpretation and education program with the goal of coordinating Chelan PUD's interpretation and education program with local, state, and federal agencies' interpretation and education program is not warranted. The proposed measures would substantially enhance recreational opportunities at the project and would contribute to a beneficial effect on recreation resources within the river basin. Therefore, no text changes are necessary.

Comment 105: The Forest Service (page 20, Entiat City Park) states that Commission staff may be confused about the role of Entiat City Park, which has been incorrectly referred to as Entiat *State* Park at least twice in the draft EIS (on page 22 Entiat State Park should read Entiat *City* Park and on page 231, item 7 Entiat State Park should read Entiat *City* Park). The City of Entiat makes the same corrections.

Response 105: Chelan PUD refers to the park throughout the license application and the Recreation Plan as Entiat Park. We revised the text to replace all references to "Entiat City Park" and "Entiat State Park" with "Entiat Park."

Comment 106: The City of Entiat and William Walter recommend not fencing Entiat City Park.

Response 106: Although from a recreational and aesthetic perspective, fencing may have some adverse effects, in section 5.1.9 of the draft EIS, *Rocky Reach Wildlife Habitat Plan*, we conclude that these effects are minor compared to the benefits from limiting recreational use in sensitive areas. Any fence at Entiat Park should be sized to discourage (rather than prohibit) off-site recreational use and designed to blend with the surrounding landscape. Interested parties would have opportunities to consult with Chelan PUD about fencing design through the mechanisms described in the Recreation Plan. No additional text changes were required.

Comment 107: The City of Entiat (page 2, second paragraph) comments that Entiat City Park should maintain its role as a local park and the surrounding state and federal lands should fulfill their role in providing natural areas.

Response 107: We discuss land ownership and use in section 3.9 of the draft EIS, and did not revise the text in response to this comment.

Comment 108: The City of Entiat (page 8, General Comments on the draft EIS) and Keith Vradenburg (page 9) comment that the phrase “except the lower Entiat River” should be added to the statement on page 173 “Washington fishing regulations allow for some recreational fishing in the tributaries.”

Response 108: We revised section 3.8.1.1 of the EIS to reflect this change.

Comment 109: The City of Entiat (page 8, General Comments on the draft EIS) and Keith Vradenburg (page 9) request that the following be added as a license article: “Chelan PUD shall meet with Entiat community every 6 months and report on progress in Entiat City Park, HCP, and other Chelan PUD topics of community interest.”

Response 109: Based on the Settlement Agreement, we conclude that the City’s recommended license article is not needed to provide adequate forums for communication between the City of Entiat and Chelan PUD. Therefore, we did not revise the EIS text.

Comment 110: Carol Long comments that the following recreational facility improvements are needed at Entiat Park: protected swimming areas; more boat docks; clear milfoil from the lake; barrier-free fishing docks; lighted softball fields and a lighted soccer field; a walking trail from the Entiat River to the Columbia Breaks; and geese management.

Response 110: Licensees are required to provide reasonable public access to project lands and waters. As proposed in the Recreation Plan, the park would have designated swimming areas, new boat docks and fishing docks, and walking trails, as well as designated sports areas and open playing fields. Chelan PUD also proposes a milfoil abatement program as part of the proposed weed management program, which is part of the Wildlife Plan. In the draft EIS, we find that the proposed facilities and site improvements to the park would provide reasonable public access to the project. Although the Recreation Plan is not finalized, we understand that these measures are the minimum level of improvement that would be achieved. Chelan PUD proposes to consult with agencies and stakeholders to finalize the site enhancements at Entiat Park, which would allow stakeholders to recommend other improvements, such as lighted sports areas. Therefore, we did not revise the text of the final EIS.

Ms. Long’s recommendation that recreational uses have appropriate separation would help improve public safety at the site. We have included this measure in section 3.8.2.2 of the final EIS.

Comment 111: Keith Vradenburg (page 2) recommends that Entiat City Park provide: four lighted tennis courts, four lighted softball fields, soccer fields, four lighted basketball courts, swimming beach with beach volleyball, milfoil eradication from water and swimming areas, walking/running trail, docking/moorage facilities for the Princess Entiat, interpretation of historic Entiat, improved/expanded parking and museum facilities, picnic shelters, playground equipment, fishing piers, educational/interpretive/restroom facilities associated with the Entiatqua Trail, and universally accessible viewing platforms/fishing piers on the Entiatqua Trail.

Response 111: As proposed, Entiat Park would include public fields, docks and fishing areas, a boardwalk, benches and picnic areas, and substantial rehabilitation of existing facilities. The proposal also includes improvements to interpretation and education materials and noxious weed management. In section 3.8.2.2 of the draft EIS, *Recreational Facility Measures*, we find that the proposed enhancement measures at Entiat Park would improve the quality of recreational resources by ensuring that the sites remain open to public access; replacing worn equipment; modernizing the site layout; adding new recreational facilities, including camping sites and facilities, cabins, and multiple-use trails; providing barrier-free facilities, where appropriate; and addressing deferred maintenance needs for major infrastructure, such as wastewater treatment facilities, trails, and irrigation systems. Chelan PUD has proposed to consult with agencies and stakeholders to finalize the site enhancements at Entiat Park, which would allow stakeholders to recommend other improvements to address project-related effects on recreational resources. Consequently, we did not revise the text of the EIS.

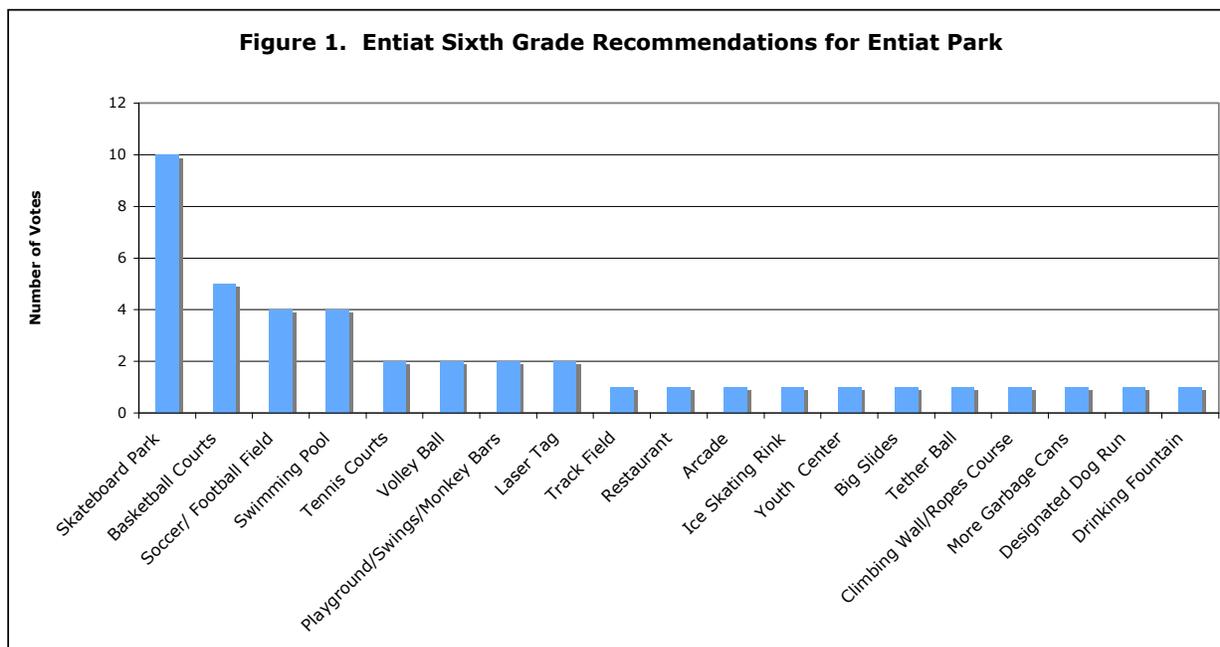
Comment 112: Keith Vradenburg (pages 2 and 8) suggests that chain link fencing is unnecessary and that the Entiat River provides adequate undisturbed riparian habitat.

Response 112: See response to City of Entiat regarding the chain link fence.

Comment 113: The Entiat Sixth Grade filed a group of letters recommending site improvements to Entiat Park. Three comment letters focused on basic infrastructure needs (e.g., more garbage cans and drinking fountains, and a dog-run area) and the majority of letters recommended new recreational facilities, including a skateboard park, basketball courts, sport fields, and swimming pools (figure 1).

Response 113: Chelan PUD proposed to implement substantial site enhancements at Entiat Park, as described to a conceptual level in the Recreation Plan. Plans for the park are not finalized and Chelan PUD proposes to develop the final measures in consultation with agencies and stakeholders in the City of Entiat. Although we find in the draft EIS that the proposed measures would improve recreational resources and expand recreational opportunities at the park, additional consultation with stakeholders in Entiat would help refine the final plan to be more consistent with the community vision for the park.

Therefore, in section 3.8.2.2 in the final EIS, we expanded the consultation list to include the Entiat School District.



Comment 114: The Entiat High School Class of 2006 recommends implementing numerous improvements at Entiat Park as summarized in table 2.

Response 114: Regarding the Class of 06's recommendations for site enhancements, please see our response to the Entiat Sixth Grade above.

The recommendation to consult with the class through weekly letters, bulletins, and visits to the school may improve the class's understanding of the licensee's responsibility to provide reasonable public access to project lands and waters and may allow for further input by the class into the final design of the park. However, the extent of the recommended communication measures does not appear to be warranted and may actually slow down the process of finalizing the Entiat Park plan and implementing the measures. In the final EIS, we recommend that Chelan PUD develop a consultation and communication schedule that would allow for reasonable public input into the final site design.

Table 2. Entiat High School Class of 2006 recommendations for Entiat Park.

Recommended Measures		Communication	Comment
Soccer Fields	Racket ball Court	Come Talk to the School	Less Camping Spots
Softball Field	Tennis Court	Weekly Letter	
Skate Park	Wall Ball Area	Bulletin	
Facilities for Young Kids	Jet Ski Rental	Chelan PUD should follow through with what they are going to do.	
Horseshoe	Entiat Princess Dock		
Public Swimming Pool	Gym		
	Weight Room		
Trails	Mexican Restaurar		
Bridge from the Park to Orondo	Concessions		
Paintball Arena	Water Trampoline Rental		
Basketball Court	Go Cart Track		
Fishing	Beach Volley Ball		
Milfoil removal	Bathrooms		
Sandy Beach			
Ice Skating Rink			

Comment 115: Chelan PUD (page 3, Chelan PUD Response 8) states that the Recreation Plan includes a provision for monitoring and evaluating recreational use within the project boundary and submitting a report to FERC consistent with FERC Form 80 requirements.

Response 115: In section 3.8.2.4 of the draft EIS, *Recreation Use Study and Long-term Monitoring*, we discuss Chelan PUD's monitoring proposal and find that, as proposed, it would allow stakeholders to consider the adequacy of public access and recreational facilities; address project-related recreation and other environmental resource issues; and provide a basis from which Chelan PUD could consider and prioritize new projects.

We note, however, that Chelan PUD's proposal does not include any mechanism for reporting to the Commission on the activities and progress of the Rocky Reach Recreational Forum. We revised section 3.8.2.2 of the EIS to reflect the review and evaluation of recreational use within the project boundary and submittal of a report consistent with FERC Form-80 (Recreation Report).

Comment 116: Chelan PUD (page 13, last paragraph) comments that a ball field facility could be located on land owned by the Entiat School District immediately adjacent to Entiat City Park.

Response 116: In section of 3.8.2.2 of the draft EIS, *Recreational Facility Measures*, we find that the proposed ball field would not mitigate any project-related effect on recreational resources. Chelan PUD maintains a number of recreational sites within the project boundary that includes ball fields, and the proposed measure does not appear to have any nexus with project operations. Therefore, we do not recommend including this measure in any license issued for the project.

Under the Settlement Agreement, the ball field is no longer proposed; therefore, we revised section 3.8.1.2 of the EIS to reflect this change.

Comment 117: Ellen Reynoldson comments that Entiat City Park serves little benefit to local residents. She recommends several park improvements including sports fields and courts, a beach area for swimming, wheel chair and walker friendly facilities and walkways, and fishing platforms.

Response 117: Section 3.8.2.2 of the EIS describes and evaluates proposed improvements at Entiat Park, including construction of the Entiatqua Trail linking the Entiat River Outdoor Learning Center to Entiat Park. We find that the proposed measures at Entiat Park would improve the quality of recreational resources by continuing to provide public access and providing barrier-free facilities, where appropriate. Consequently, we did not revise the text of the EIS.

Comment 118: Rowley & Klauser, LLP, representing Mr. Jack Feil, owner of Feil Orchards, Inc., requests that FERC staff immediately revise its report to withdraw its endorsement of illegal trail funding and states that FERC should not grant such funding.

Response 118: In the draft EIS, we find that Chelan PUD's proposal for a trail could create new recreational opportunities consistent with the Washington Statewide Comprehensive Outdoor Recreation Plan and other plans. The proposed approximately 1-mile-long trail would run from Lincoln Rock State Park south to a fish bypass viewing station about 300 feet downstream of Rocky Reach dam on Chelan PUD-owned property within the project boundary. We find that the trail would serve project-related recreational use and address the need for public access to the shoreline near the project dam.

Comment 119: The Board of Directors of Blue Star Growers, Inc., representing 115 apple and pear growers in the Upper Wenatchee River Valley since February of 1907, opposes the proposed bicycle trail between Wenatchee and Leavenworth.

Response 119: The referenced bicycle trail is not part of Chelan PUD's proposal, and has not been recommended in this proceeding by any party. Therefore, we do not address the referenced trail in the EIS.

Comment 120: Tom Feil and Andy Dappen disagree with the staff's conclusion not to adopt the Recreation Enhancement Fund. They note the fund is a tool that could address regional recreation needs in the future.

Response 120: In section 3.8 of the draft EIS, we find that the proposed recreational measures, along with additional staff-recommended environmental measures, would provide substantial improvements to recreational opportunities at the project and contribute to a cumulative beneficial effect on recreational resources within the river basin. However, we also conclude in the draft EIS that the geographic scope of the proposed funds extends beyond the project boundary, and there is no indication of displaced recreational effects from the project to non-project lands.

We note the fund is no longer a component of Chelan PUD's proposal. We modified section 3.8 of the EIS to reflect this change.

SOCIOECONOMIC RESOURCES

Comment 121: The City of Entiat (page 3, Socioeconomics) comments that the socioeconomic effects of relocation have not been temporary and that the community has been struggling since relocation.

Response 121: In section 3.10 of the draft EIS, *Socioeconomic Resources*, we acknowledge that the City of Entiat and some lands in the area of Orondo were affected by the initial development of the project and that Chelan PUD compensated affected property owners monetarily and provided funding for planning assistance. Based on existing conditions, we find that relicensing the project with the proposed measures would enhance socioeconomic resources of the region. The project would continue to provide relatively low cost electricity to the agricultural, basic metals (aluminum) manufacturing, tourism, and recreation industries, as well as residential and commercial customers. In addition, the proposed measures would attract new visitors to the area, and, in this way, contribute positively to the socioeconomic resources of Chelan and Douglas counties. Therefore, we did not revise the EIS text.

Comment 122: Entiat School District No. 127 offers two solutions to mitigate the project's original impact on the Entiat School District tax base: annual payment of Payments In-Lieu of Taxes monies directly to the school district and/or a one time payment of back taxes to be placed in an endowment fund.

Response 122: Nothing in the FPA requires a licensee to make whole every party affected by a project, and the Commission has consistently denied claims for money damages or requests that licensees be required to make payments in lieu of taxes. We therefore conclude that additional monies in the form of payments in-lieu of taxes and/or a one time payment are not warranted.

DEVELOPMENTAL ANALYSIS

Comment 123: Lee Tideman comments that he is concerned about keeping his electric rates low and praises FERC's decision to exclude some of the environmental measures recommended by state agencies and others.

Response 123: We note Mr. Tideman's concern about keeping electric rates low. Commission policy requires a balancing analysis that considers the comparative environmental effects of the alternatives, their economic viability (including the costs and power benefits of each alternative), and their consistency with relevant agency recommendations, comprehensive plans, and laws and policies. No revision to the EIS text was necessary.

Comment 124: Chelan PUD (page 14, last paragraph) comments that items 1 through 3 in Table 19, *Erosion Control Demonstration Projects, Distribution of Erosion Control Information and Shoreline Erosion Monitoring*, are proposed by Chelan PUD for inclusion under a 50-year license, not for a shorter license term.

Response 124: The Commission staff understands that Chelan PUD's proposal is for a 50-year license term. However, it is up to the Commission to make the final determination of any new license term. No revision to the EIS text was necessary.

Comment 125: WDFW (page 10) notes that the draft EIS (section 4.1, *Power and Economic Benefits of the Project*) states, "Most of the measures proposed by Chelan PUD and the staff would *reduce* (WDFW italics) the net benefits of the project. We discuss the most substantive of these measures in the following text." WDFW states that "reduce" should be replaced with "improve", and that the statement is confusing as written, in that the "following text" referred to in the draft EIS goes on to highlight those

measures recommended for adoption by FERC staff as “worth the associated cost,” which implies the measures would improve not reduce the net benefit of the project.

Response 125: We revised section 5.1 of the text to clarify that the measures would reduce the net power benefits of the project.

Comment 126: The Umatilla Tribes (pages 25) emphasize the necessity of integrating the passage and habitat needs of salmon, steelhead, lamprey, and sturgeon into one passage plan and state that a comprehensive fisheries and aquatics committee should be created. They state that currently the Tribes have no venue for providing input regarding salmon and steelhead because the Tribes are not signatories to the HCP, and that it is FERC’s responsibility to ensure that the Tribes have an appropriate voice regarding the management of these resources. FERC’s position in the HCP order suggests that the trust responsibility toward the Tribes can be satisfied through consultations between the federal fisheries agencies and the Tribes themselves. However, the Tribes state that such consultations do not satisfy the government’s trust responsibility to the Tribes.

The Tribes further state that FERC should require Chelan PUD to offer a detailed fishery operations plan to the Umatilla Tribes and other intervening parties in the licensing process, regardless of whether they are signatories to the HCP.

Response 126: Under the staff alternative, Chelan PUD, coordinating with the HCP Coordinating Committee and the Rocky Reach Fish Forum, would be responsible for ensuring that actions relating to plan species as well as bull trout, Pacific lamprey, white sturgeon, and resident fish are implemented in accordance with the provisions of any new license.

We addressed the issue of a tribal venue for management of fisheries resources at the project in our Order on rehearing (109 FERC ¶ 61,208), where we concluded that the HCP parties’ offer of non-voting membership on the Tributary and Hatchery Committees is a reasonable means of ensuring that the views of the CRITFC tribes are heard on these committees and that their expertise and experience continue to be a factor in decisions.

As stated in the draft EIS, Chelan PUD stated in its response to comments (April 17, 2005) that it annually produces a Fish Passage Plan that is developed and reviewed in conjunction with state and federal fishery agencies and Tribes and must be approved by NOAA Fisheries. We note in section 5.1.8 that any order issued for the Rocky Reach Project will consider the need for Chelan PUD to consult with the Umatilla Tribes on the Fish Passage Plan.

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APPENDIX B

ANADROMOUS FISH AGREEMENT AND HABITAT CONSERVATION PLAN

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Anadromous Fish Agreement and Habitat Conservation Plan

Rocky Reach Hydroelectric Project

FERC License No. 2145

Offered for Signing
March 26, 2002

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LIST OF SUPPORTING DOCUMENTS58

- Supporting Document A Tributary Plan, Project Selection, Implementation and Evaluation (1998).
- Supporting Document B Aquatic Species and Habitat Assessment: Wenatchee, Entiat, Methow, and Okanogan Rivers (1998).
- Supporting Document C Biological Assessment and Management Plan (BAMP: Mid-Columbia Hatchery Programs (1998).
- Supporting Document D Briefing Paper Estimating Survival of Anadromous Fish through the Mid-Columbia PUD Hydropower Projects (2002).
- Supporting Document E Rocky Reach Background Biology (1998).

**Anadromous Fish Agreement and Habitat Conservation Plan
Rocky Reach Hydroelectric Project, FERC No. 2145**

THIS AGREEMENT for the Rocky Reach Hydroelectric Project (Project) is entered into between the Public Utility District No. 1 of Chelan County, Washington, (District) a Washington municipal corporation; and the United States Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), the Washington Department of Fish and Wildlife (WDFW), the Confederated Tribes of the Colville Reservation (Colville), the Confederated Tribes and Bands of the Yakama Indian Nation (Yakama), the Confederated Tribes of the Umatilla Indian Reservation (Umatilla) (collectively, the Joint Fisheries Parties or the JFP); and American Rivers, Inc., a Washington D.C., nonprofit corporation, (the JFP and American Rivers, are the fisheries parties (FP)). All entities are collectively referred to as the Parties.

INTRODUCTION

A. The site of the Project is habitat for Plan Species. Prior to this Agreement the needs of the Plan Species have been addressed through litigation and agreement. This Agreement is intended to constitute a comprehensive and long-term adaptive management plan for Plan Species and their habitat as affected by the Project.

B. The objective of this Agreement is to achieve No Net Impact (NNI) for each Plan Species affected by the Project on the schedule set out herein and to maintain the same for the duration of the Agreement. NNI consists of two components: (1) 91% Combined Adult and Juvenile Project Survival achieved by project improvement measures implemented within the geographic area of the Project, (2) 9% compensation for Unavoidable Project Mortality provided through hatchery and tributary programs, with 7% compensation provided through hatchery programs and 2% compensation provided through tributary programs. The Parties intend these actions to contribute to the rebuilding of tributary habitat production capacity and basic productivity and numerical abundance of Plan Species.

C. The District will receive a Permit for Permit Species upon this Agreement becoming effective. If the District carries out its responsibilities for fish protection and mitigation Measures set out in this Agreement, and provides the necessary monitoring and evaluation all according to the time frames set out for each Measure, the Permit shall continue for the full term of this Agreement subject to Section 2 "Withdrawal From Agreement" and Section 10 "Endangered Species Act". The Parties shall take the actions set out in this Agreement in support of the District before the Federal Energy Regulatory Commission (FERC) and in other forums.

D. Capitalized terms used in this Agreement are defined in Section 13 "Definitions".

NOW, THEREFORE, IN CONSIDERATION of the mutual promises and conditions set forth herein, the Parties agree as follows:

SECTION 1 DURATION OF AGREEMENT

1.1 Term. This Agreement shall commence on the date the last Party signs this Agreement as more fully described in Section 1.2 “Staggered Effective Date” and shall continue for a period of fifty- (50) years, unless the Agreement terminates early. In addition, entities listed above that do not sign this Agreement are not a Party to this Agreement.

1.2 Staggered Effective Date.

1.2.1 Upon Signing. The portions of Section 5.4 “Phase 1 Plan to Achieve Survival Standard” related to 2002 operations, Section 4 “Coordinating Committee”, and Section 11 “Dispute Resolution” shall become effective immediately upon at least NMFS, USFWS, WDFW and the District signing this Agreement, to the extent that it does not require substantial construction or structural modification of the Dam.

The Parties agree to join with the District’s filing with FERC requesting that FERC issue appropriate orders: (1) to amend the Project’s existing license to include this Agreement as a condition thereof, and (2) to terminate the Mid-Columbia Proceeding as it relates to the Project.

The District shall revise its incidental take permit application for Permit Species based upon this Agreement, and submit a direct take application for the Hatchery Compensation Program. This Agreement and its figures, tables and appendices shall constitute the District’s habitat conservation plan in support of the District’s incidental take permit application. The Supporting Documents are to be used as supporting documents to the Agreement and as such, do not by themselves, create contractual obligations under this Agreement or through the Permit issued by NMFS.

The Parties shall provide reasonable efforts to expedite any NEPA, SEPA, and other regulatory processes required for this Agreement to become fully effective. The Parties (except the lead agency) may file comments with the lead agency. Such comments will not advocate additional Measures or processes for Plan Species. The Parties shall provide reasonable efforts to expedite the approval process of the District’s incidental take permit application.

1.2.2 Upon Completion of Regulatory Reviews. The remainder of this Agreement shall become effective on the later of the follow dates (the latter date is the “Effective Date”) that: (1) the FERC issues a final order approving this Agreement and incorporating it into the Project’s license, (2) the NMFS issues the District a Permit for the Project based upon this Agreement, and (3) the USFWS completes necessary consultations under the ESA.

However, any Party may withdraw from this Agreement within sixty- (60) days of the Effective Date in the event that: (1) the NMFS issues the District a Permit with terms and conditions in addition to or different from those set forth in this Agreement, (2) the FERC fails to include this Agreement, in its entirety, or adds terms or conditions

inconsistent with this Agreement as a license condition of the current Project license or a new long term Project license approved within the term of this Agreement, or (3) a Party as a result of compliance with NEPA or SEPA requires a material change to the terms or conditions of this Agreement. In order to withdraw from this Agreement, a Party shall provide all other Parties with notice of withdrawal and state in the notice the reason for withdrawal. The ability of a Party to withdraw from this Agreement pursuant to this paragraph terminates if not exercised within said period. The notices required by this section shall be in writing and either served in person or provided by U.S. Mail, return receipt requested.

1.3 Early Termination Events. This Agreement shall terminate automatically before the end of its term: (1) in the event the FERC issues the District a non-power license for the Project, (2) in the event the FERC orders removal of the Project, (3) in the event the FERC orders drawdown of the Project, or (4) the District withdraws from this Agreement based on Section 2 “Withdrawal From Agreement”.

1.4 Termination or Transfer of License. The District’s obligations under this Agreement shall terminate in the event its FERC license is terminated or transferred to another entity. The Parties agree that the terms of this Agreement shall be binding on their respective successors and assigns.

1.5 Continuation of Measures Upon Termination. Except as set forth in Section 7.4.5 “Account Status Upon Termination”, Sections 9.1.1 and 9.1.3, Section 10.4 “Permit Suspension, Revocation and Re-Instatement” and Section 10.5 “Early Termination Mitigation”, upon expiration of this Agreement, or in the event this Agreement is terminated, voided or determined for any reason to be unenforceable before the end of its term, then: (1) the District shall continue to implement the last agreed to Measures until the FERC orders otherwise, and (2) the Parties are not restrained in any manner from advocating to the FERC measures to replace the Agreement.

SECTION 2 WITHDRAWAL FROM AGREEMENT

2.1 Enough Already.

2.1.1 A Party may withdraw from this Agreement when at least fifteen- (15) years have elapsed from March 1, 1998, subject to the following conditions: (1) No Net Impact (NNI) has not been achieved or has been achieved but has not been maintained, or (2) the Project has achieved and maintained NNI but the Plan Species are not rebuilding and the Project is a significant factor in the failure to rebuild.

2.1.2 If NMFS and the District are in agreement as to specific Measures to remedy the failure to achieve or maintain NNI and the District promptly implements agreed measures that are applicable to the District, NMFS will refrain from suspending or revoking the Permit. In the event that NNI has not been achieved or has been achieved but has not been maintained by March 1, 2013, but the District is otherwise performing all obligations assigned to it in the Permit, and is otherwise in full compliance with all

terms and conditions of this Agreement and the Permit, NMFS and USFWS will not exercise their right to withdraw from this Agreement or revoke the Permit unless such withdrawal is to seek drawdown, dam removal, non-power operations, or actions for achievement of NNI. Should the District, NMFS, and USFWS agree under these circumstances, such actions may be pursued without withdrawal from the Agreement or suspension or revocation of the Permit.

2.2 Non-Compliance. A Party may elect at any time to withdraw from the Agreement based on non-compliance of another Party with the provisions of the Agreement, but only subject to the following procedures: (1) a Party asserts that another Party is not complying with the terms of the Agreement, (2) the Party documents and presents evidence supporting assertion of non-compliance in writing, (3) the issue of non-compliance is taken to dispute resolution, Section 11 "Dispute Resolution", unless waived. Following dispute resolution, a Party choosing to withdraw shall provide all other Parties with notice of withdrawal. The notice shall be in writing and either served in person or provided by U.S. Mail return receipt requested. The right to withdraw shall be waived if not exercised within sixty- (60) days of dispute resolution being completed. Section 2.6 "Withdrawal of Another Party" applies upon a Party's receipt of the notice provided in this section.

2.3 Governmental Action. A Party may elect to withdraw from this Agreement in the event that an entity with regulatory authority takes action that (1) is detrimental to the achievement of the obligations set forth in this Agreement and (2) that materially alters or is contrary to one or more terms set forth in this Agreement.

2.4 Impossibility. A Party may elect to withdraw from the Agreement in the event the Parties agree in writing that the obligations imposed by this Agreement are impossible to achieve.

2.5 Revocation of Permit. A Party may elect to withdraw from the Agreement if the NMFS revokes the Permit.

2.6 Withdrawal of Another Party. Upon receipt of such notice any other Party shall have 120 days from the date of a Party's notice of intent to withdraw, to provide notice to all Parties of its intention to withdraw from this Agreement, or this right to withdraw shall be waived.

2.7 Conditions Precedent to Withdrawal. Two conditions must be satisfied before a Party can withdraw from the Agreement pursuant to Sections 2.3 "Governmental Action", 2.4 "Impossibility", 2.5 "Revocation of Permit" or 2.6 "Withdrawal of Another Party". First, the Party desiring to withdraw from the Agreement shall provide notice to all other Parties of its intent to withdraw. The notice shall be in writing and either served in person or provided by U.S. Mail return receipt requested. The notice shall state the date upon which the Party's withdrawal shall become effective. The date upon which the Party's withdrawal becomes effective shall be no less than sixty- (60) days from the date the notice was provided to all other Parties. Second, prior to the date upon which the

Party's withdrawal becomes effective the withdrawing Party (Parties) must make itself (themselves) available for at least one policy meeting to allow remaining Parties to attempt to persuade the withdrawing Party (Parties) not to withdraw. The policy meeting must take place within the sixty- (60) day period or it is waived.

2.8 Effect of Withdrawal. Except as set forth in Section 1.5 "Continuation of Measures Upon Termination", Sections 9.1.1 and 9.1.3, Section 10.4 "Permit Suspension, Revocation and Re-Instatement" and Section 10.5 "Early Termination Mitigation", in the event a Party withdraws from this Agreement, this Agreement places no constraints on the withdrawing Party, shall not thereafter be binding on the withdrawing Party, and the withdrawing Party may exercise all rights and remedies that the Party would otherwise have.

SECTION 3 SURVIVAL STANDARDS AND ALLOCATION OF RESPONSIBILITY FOR NO NET IMPACT

3.1 No Net Impact ("NNI") shall be achieved on the schedule set out herein and maintained for the duration of the Agreement for each Plan Species affected by the Project. NNI consists of two components: (1) 91% Combined Adult and Juvenile Project Survival achieved by project improvement Measures implemented within the geographic area of the Project, (2) 9% compensation for Unavoidable Project Mortality provided through hatchery and tributary programs, with 7% compensation provided through hatchery programs and 2% compensation provided through tributary programs. Measures and survival standards, as provided in Section 5 "Passage Survival Plan", Section 7 "Tributary Conservation Plan" and Section 8 "Hatchery Compensation Plan", shall be evaluated, as provided in Section 4.7 "Progress Reports", and achieved no later than March 2013. The inability to measure a standard due to limitations of technology shall not be construed as a success or a failure to achieve NNI as further explained in Section 5.2.1 91% Combined Adult and Juvenile Survival and Section 5.2.2 "93% Juvenile Project Survival and 95% Juvenile Dam Passage Survival".

3.2 The District shall be responsible for achieving 91% Combined Adult and Juvenile Project Survival, or 93% Juvenile Project Survival or 95% Juvenile Dam Passage Survival as provided in Sections 3 and 5 for each Plan Species affected by the Project. The District shall implement measurement and evaluation programs once approved by the Coordinating Committee. The District shall also be responsible for (1) funding the Tributary Conservation Plan as provided in Section 7; (2) providing the capacity and funding for the 7% Hatchery Compensation Plan as provided in Section 8; and (3) making capacity and funding adjustments to the Hatchery Compensation Plan to reflect and fully compensate for future increases in the run size of each Plan Species as provided in Section 8.3 "Hatchery Production Commitments". If the District is unable to achieve 91% Combined Adult and Juvenile Project Survival or 93% Juvenile Project Survival or 95% Juvenile Dam Passage Survival then the District shall consult with the Parties through the Coordinating Committee to jointly seek a solution. If a solution cannot be

identified to achieve the survival standards identified herein any Party may take action under Section 2.4 “Impossibility” or other provisions of this Agreement.

3.3 The Tributary Committee and Hatchery Committee shall develop plans and programs, which must include evaluation procedures, necessary to implement the Tributary Conservation Plan and the Hatchery Compensation Plan, respectively to compensate for Unavoidable Project Mortality. If Unavoidable Project Mortality is not compensated for through the Hatchery Compensation Plan and the Tributary Conservation Plan, the Hatchery Committee and the Tributary Committee, respectively may examine additional hatchery and tributary improvements to meet the obligation. If the Hatchery Committee and the Tributary Committee are unable to develop plans and programs to fully implement the Hatchery Compensation Plan and Tributary Conservation Plans, respectively, to meet compensation levels necessary to compensate for Unavoidable Project Mortality, then the respective committees may consult with the Coordinating Committee to jointly seek a solution.

3.4 Implementation of Measures to meet NNI shall follow the time frames set out in the Agreement. Where a deadline is not specified, implementation of Measures shall occur as soon as is reasonably possible.

SECTION 4 COORDINATING COMMITTEE

4.1 Establishment of Committee. There shall be a Coordinating Committee composed of one (1) representative of each Party, provided, that the Power Purchasers may participate as a non-voting observer through a single representative, whom they will designate from time to time. Each representative shall have one vote. Each Party shall provide all other Parties with written notice of its designated representative to the Coordinating Committee.

4.2 Meetings. The Coordinating Committee shall meet whenever requested by any two-(2) members following notice.

4.3 Meeting Notice. The Chair of the Coordinating Committee shall provide all committee members with a minimum of ten- (10) day’s advance written notice of all meetings unless a member waives notice in writing or reflects the waiver in the approved meeting minutes. The notice shall contain an agenda of all matters to be addressed and voted on during the meeting.

4.4 Voting. The Coordinating Committee shall act by unanimous vote of those members present in person or by phone for the vote and shall develop its own rules of process, provided, that the chair shall ensure that all members are sent notice of all Coordinating Committee meetings. Abstention does not prevent a unanimous vote. If a Party or its designated alternate cannot be present for an agenda item to be voted upon it must notify the Chair of the Coordinating Committee who shall delay a vote on the agenda item for up to five- (5) business days on specified issues to be addressed in a

meeting or conference call scheduled with all interested parties, or as otherwise agreed to by the Coordinating Committee. A Party may invoke this right only once per delayed item. If the Coordinating Committee cannot reach agreement, then upon request by any Party that issue shall be referred to Dispute Resolution.

4.5 Chair of Coordinating Committee. The Parties shall choose and the District shall fund a neutral third party to act as the Chair of the Coordinating Committee. The Chair is expected to prepare an annual list of understandings based on the results of studies, prepare progress reports, prepare meeting minutes, facilitate and mediate the meetings, and assist the members of the Coordinating Committee in making decisions. At least every three years, the Coordinating Committee shall evaluate the performance of the Chair of the Coordinating Committee.

4.6 Use of Coordinating Committee. The Coordinating Committee will be used as the primary means of consultation and coordination between the District and the FP in connection with the conduct of studies and implementation of the Measures set forth in this Agreement and for dispute resolution. Any entity not executing this Agreement shall not be a Party to this Agreement and shall not be entitled to vote on any committee established by this Agreement. However, any committee established by this Agreement may agree to allow participation of any governmental entities not a Party to this Agreement.

4.7 Authority. The Coordinating Committee shall oversee all aspects of standards, methodologies, and implementation (see Section 4.9 “Methodologies”). The Coordinating Committee shall: (1) establish the protocol(s) and methodologies to determine whether or not the survival standards contained in Section 5 “Passage Survival Plan” are being achieved for each Plan Species; (2) determine whether the Parties are carrying out their responsibilities under this Agreement; (3) determine whether NNI is achieved (see definition “NNI Achieved”); (4) determine the most appropriate standard in Section 5 “Passage Survival Plan” to be measured for each Plan Species; (5) approve all studies prior to implementation; (6) review study results, determine their applicability, and develop an annual list of common understandings based on the studies; (7) provide input on the District’s choice of Measures during Phase I; (8) periodically adjust the Measures (after Phase I) to address survival and Unavoidable Project Mortality as provided herein; provided that no more than 9% Unavoidable Project Mortality shall be made up through hatchery and tributary compensation without concurrence of the Coordinating Committee, and hatchery compensation shall not exceed 7% and tributary funding shall not exceed 2% unless agreed to by the Coordinating Committee; (9) resolve disputes brought by the Hatchery and Tributary Committees, and (10) adjust schedules and dates for performance. If the Coordinating Committee cannot reach agreement, then these decisions shall be referred to dispute resolution as set forth in Section 11 “Dispute Resolution”.

4.8 Progress Reports. Each year, with the assistance of the Chair of the Coordinating Committee, the Hatchery Committee and the Tributary Committee shall prepare an annual report to the Coordinating Committee describing their progress. Each year, the Coordinating Committee shall prepare an annual report to the Parties describing the progress toward achieving the survival standards contained in Section 5 “Passage Survival Plan”, and common understandings based upon the studies. Annual progress reports shall include information learned from all studies, even those that were not considered to be valid tests. By March 2013, a comprehensive progress report shall be prepared by the District, at the direction of the Coordinating Committee assessing overall status in achieving NNI, and shall include the status of each Plan Species. Comprehensive progress reporting shall continue to occur at successive ten-year intervals.

4.9 Studies and Reports. All studies and reports prepared under this Agreement will be available to all members of the Coordinating Committee as soon as reasonably possible. Draft reports will be circulated through the Coordinating Committee representatives for comment, which shall be due within sixty- (60) days unless the Coordinating Committee decides otherwise, and comments will either be addressed or made an appendix to the final report. All reports will be finalized by March 31 of the year following the year the studies were performed, unless otherwise agreed to by the Coordinating Committee. The reports will be kept on file at the District. All studies will be conducted following techniques and methodologies accepted by the Coordinating Committee. All studies will be based on sound biological and statistical design and analysis. The Coordinating Committee shall have the ability to select an independent, third party for the purpose of providing an independent scientific review of any disputed survival studies results and/or reports.

4.10 Methodologies/Test Fish. The Coordinating Committee shall approve and the District shall implement the measurement of the survival standards contained in Section 5 “Passage Survival Plan” using best available technology and study designs. The Coordinating Committee shall attempt whenever possible to coordinate studies with other studies being performed within the Columbia River basin. The Coordinating Committee shall facilitate the availability of test fish for studies, which may include the rearing of additional fish.

SECTION 5 PASSAGE SURVIVAL PLAN

5.1 Survival Standard Decision Matrix. The decision making process for implementation of the survival standards explained in Sections 5.2 “Implementation of the Survival Standards” and 5.3 “Phased Implementation of Measures to Achieve the Survival Standards” is graphically depicted in Figure 1 “Survival Standard Decision Matrix”.

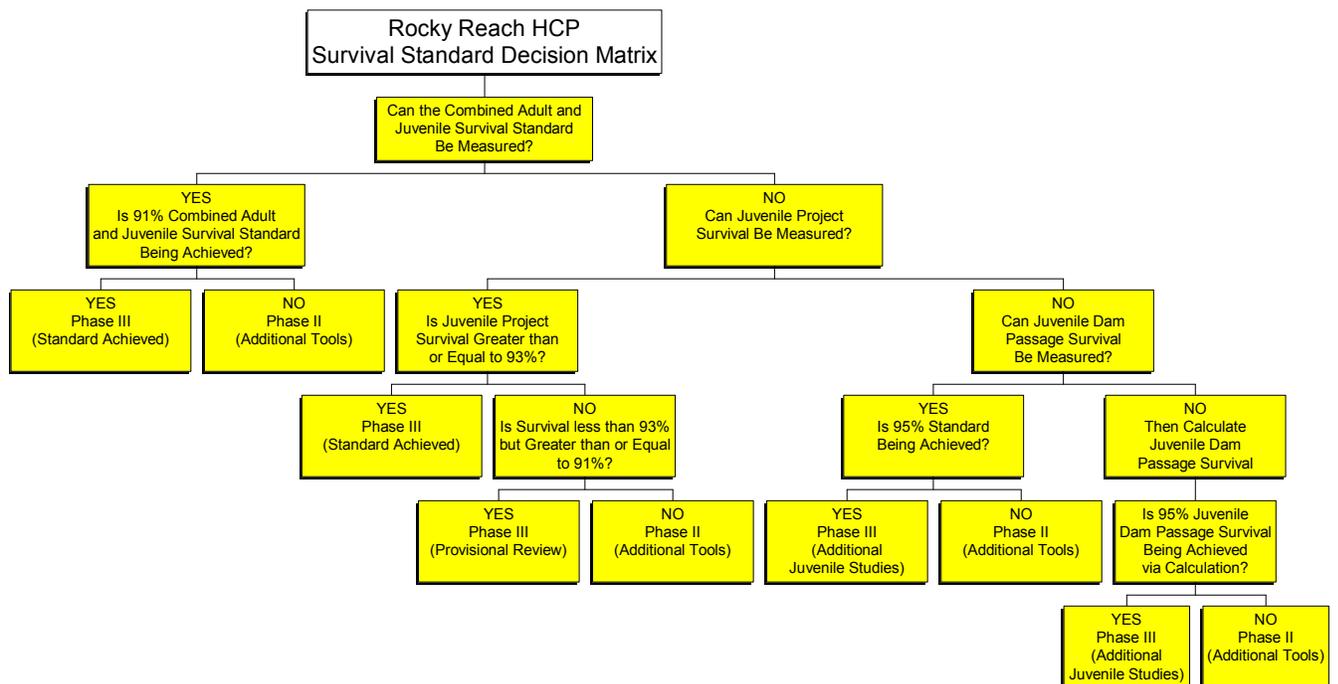


Figure 1, Survival Standard Decision Matrix.

5.2 Implementation of the Survival Standards

5.2.1 91% Combined Adult and Juvenile Survival. The District shall achieve and maintain Combined Adult and Juvenile Project Survival. The Combined Adult and Juvenile Survival standard is 91%. As of 2002, the Parties agree that adult fish survival cannot be conclusively measured for each Plan Species. Based on regional information, the Parties agree that adult survival is estimated to be 98-100%. Until technology is available to differentiate hydro-related mortality from natural adult losses, the District will implement the adult passage plan identified below. Given the present inability to differentiate between the sources of adult mortality, initial compliance with the Combined Adult and Juvenile Survival standard will be based upon the measurement of juvenile survival as provided below, Section “93% Juvenile Project Survival and 95% Juvenile Dam Passage Survival”. The District shall implement the measurement of adult survival at some time in the future if methodologies and study plans are agreed to by the Coordinating Committee. Mitigation measures will be adjusted at that time, if necessary, to address the new information.

5.2.2 93% Juvenile Project Survival and 95% Juvenile Dam Passage Survival.

Limitations associated with the best available technology have required the development of the following metrics for assessing juvenile fish survival standards at the Project. In order of priority they are (1) measured Juvenile Project Survival; (2) measured Juvenile Dam Passage Survival; and (3) calculated Juvenile Dam Passage Survival. The survival of each Plan Species shall be determined by the Coordinating Committee using one of these metrics, with subsequent evaluations implemented as appropriate, per the following guidelines. If the Combined Adult and Juvenile Project Survival cannot be measured, then Juvenile Project Survival shall be measured as the next best alternative until adult survival measurement is possible.

If Juvenile Project Survival for each Plan Species is measured to be greater than or equal to 93%, then the District will proceed to Phase III (Standard Achieved). The Juvenile Project Survival Standard is 93%. If Juvenile Project Survival is measured at less than 93% but greater than or equal to 91%, then the District will proceed to Phase III (Provisional Review). If Juvenile Project Survival is measured at less than 91%, then the District will proceed to Phase II (Additional Tools).

If Juvenile Project Survival cannot be measured, then Juvenile Dam Passage Survival shall be measured as the next best alternative until project measurement is possible. The Juvenile Dam Passage Survival standard is 95%.

For some Plan Species such as sockeye and sub-yearling chinook where measurement of Juvenile Dam Passage Survival and Juvenile Project Survival is not yet possible, the Juvenile Dam Passage Survival Standard will be calculated based on the best available information (including the proportion of fish utilizing specific passage routes and the use of off-site information), as determined by the Coordinating Committee. This calculation will consider the same elements as measured Juvenile Dam Passage Survival, except that off-site information may be used where site-specific information is lacking.

5.2.3 Methodologies. The survival standards set forth in Section 5 “Passage Survival Plan” shall be measured using the best available technology and study designs approved by the Coordinating Committee. Current methodologies are summarized in Supporting Document D “Briefing Paper Estimating Survival of Anadromous Fish through the Mid-Columbia PUD Hydropower Projects”. These methodologies are not exclusive, and may be updated based on new information or techniques.

A valid study is one in which the study design, implementation, and criteria are determined to have been met by the Coordinating Committee, and one in which the study took place during Representative Flow Conditions and normal project operating conditions consistent with the approved study design. The Coordinating Committee will evaluate each study after it is completed to see if previously agreed-to criteria are met. All studies will be evaluated for quality control. If the Committee agrees that critical criteria were violated, then the study will not be included in the overall average over the

three years of testing, and an additional year of testing will take place. In the event that the additional year's test is invalid, the Coordinating Committee will decide how to address the requirement for three years of testing.

Survival studies shall be measured at a ninety-five percent (95%) confidence level, with a standard error of the estimate that shall be not more than plus or minus 2.5% (i.e. 5% error). A study result meeting this precision level will automatically be included in the three-year average, unless the study is determined to be invalid by the Coordinating Committee for other reasons. If, however, a study is considered to have met all other testing protocols, and the Coordinating Committee agrees, it may be included in the calculation of the three-year average so long as the standard error around the point estimate does not exceed plus or minus 3.5%. This decision is not subject to Dispute Resolution.

Point estimates of survival measurements from the three years of studies shall be averaged (arithmetic mean). The point estimate of the average will be used to compare against the pertinent survival standard. If the averaged point estimates equals or exceeds the survival standard, then the standard has been achieved. If the average of the 3 years of survival measurements is no more than 0.5 percent below the survival standard, the Coordinating Committee may decide whether an additional year of study is appropriate. If an additional year of study is undertaken, the study result (if valid) will be included in the calculation of the arithmetic mean.

5.3 Phased Implementation of Measures to Achieve the Survival Standards. The survival standards contained in this Section 5 "Passage Survival Plan" will be achieved in three phases. Under Phase I, the District shall implement the "Phase I Plan to Achieve the Survival Standards" set forth in Section 5.3.1. Studies will be conducted to determine the survival rates beginning in 2004 and lasting for three years, unless additional years of studies are agreed to by the Coordinating Committee. Following the completion of the three-year studies, the Coordinating Committee will determine whether the pertinent survival standards have been achieved. Depending on the results of this determination, the District will either proceed to Phase II (if the applicable survival standard has not been achieved) or Phase III (if the applicable survival standard has been achieved). Phase III also includes steps designed to address gaps in the available information. Juvenile survival studies conducted during Phase I may result in different phase designations for each of the plan species. For example, the District may move to: Phase II (Additional Tools); Phase III (Standard Achieved); Phase III (Provisional Review); or to Phase III (Additional Juvenile Studies) as described in Figure 1, depending on the survival results for individual plan species. If the Coordinating Committee cannot agree on Phase designation, the Coordinating Committee may agree to require an additional year of study to resolve the disagreement, or a Party may institute Section 11 "Dispute Resolution" to determine the Phase designation or address the need for Additional Tools during the period of measurement and evaluation.

5.3.1 Phase I Testing. Assuming that the final bypass construction is completed by the 2003 juvenile migration, the District will use the first year of the operation (2003) of the juvenile bypass system to identify operational and maintenance modifications that may be needed. The District will conduct a pilot study, estimating the parameters that will be used in future survival studies. The District will begin testing the applicable survival standard in 2004.

Beginning in 2004, the District proposes to use acoustic tag technology to measure Juvenile Dam Passage Survival or Juvenile Project Survival. Current coordination between the District, consultants, NMFS Science Center, and the USGS Biological Research Division is ongoing to design and develop the acoustic tag survival methodology. The results of this effort will then be presented to the Coordinating Committee before study implementation for approval. Between 2004 and 2006, chinook yearlings will be tested. Steelhead tests will begin between 2004 and 2006 as determined by the Coordinating Committee. Sockeye and sub-yearling chinook will be tested if technology exists, or will be calculated as discussed above if not measured by the end of Phase I testing.

5.3.2 Phase II (Additional Tools). If the Coordinating Committee has determined, based on Phase I monitoring and evaluation or Phase III periodic monitoring, that Juvenile Project Survival is less than 91% or Juvenile Dam Passage Survival (measured or calculated) is less than 95%, the District shall move to Phase II for that Plan Species.

(Phase II Additional Tools). If measurement and evaluation concludes that the survival standard(s) being evaluated are not achieved, the Coordinating Committee shall decide on additional Tools for the District to implement in order to achieve the survival standard(s) being evaluated using the following criteria: Likelihood of biological success; Time required to implement; and Cost-effectiveness of solutions, but only where two or more alternatives are comparable in their biological effectiveness. Until the survival standard(s) being evaluated are achieved, the Parties shall continue to implement Phase II (Additional Tools) for the standard and for each Plan Species that is not meeting the pertinent survival standard, except as set forth in Section 2.4 "Impossibility". The Coordinating Committee will determine the number of valid studies (not to exceed three years) necessary to make a phase determination following the implementation of Additional Tools.

5.3.3 Phase III (Standard Achieved or Provisional Review or Additional Juvenile Studies). The District proceeds to Phase III upon a determination by the Coordinating Committee that the District has (1) verified compliance with the Combined Adult and Juvenile Survival or measured Juvenile Project Survival (Standard Achieved), (2) has evaluated Juvenile Project Survival at less than 93% but greater than or equal to 91% (Provisional Review), or (3) has measured or calculated 95% Juvenile Dam Passage Survival (Additional Juvenile Studies). In short, Phase III indicates that the appropriate standard has either been achieved or is likely to have been achieved and provides additional or periodic monitoring to ensure that survival of the Plan Species remains in

compliance with the survival standards in this Section 5 “Passage Survival Plan” for the term of the Agreement.

(Phase III Standard Achieved). The District shall proceed to Phase III (Standard Achieved) following measurement and evaluation that indicate that either the 91% Combined Adult and Juvenile Survival Standard or 93% Juvenile Project Survival is being achieved. In this case, the District shall re-evaluate survival under the applicable standard every 10 years. Representative species shall be picked by the Coordinating Committee. This re-evaluation will occur over one year and be included in the pertinent average for that particular species. If the survival standard is met, then Phase III (Standard Achieved) status will remain. If the survival standard is not met, then an additional year of testing will occur. If the survival standard remains unmet over three years of re-evaluation, then Phase II designation will take affect for the representative species, and the Coordinating Committee shall re-evaluate the survival of other Plan Species, as appropriate. If the survival standard has been exceeded, the Coordinating Committee shall reduce spill for the next juvenile migration so that the survival standard is achieved, but not exceeded; provided that, if multiple species are migrating at the same time, the Coordinating Committee cannot reduce spill during a time at which a reduction would prevent another species from achieving the survival standard (see Example 1 below).

Example 1. Steelhead and sockeye migrate during the spring but at different times. Steelhead and sockeye will likely require different levels of spill. It could be possible to reduce spill during the portion of the steelhead migration that does not overlap with sockeye so that the survival standard for steelhead is achieved during this portion of its migration. But, during the period where the sockeye migration overlaps with the steelhead migration, the spill needs of sockeye control the amount of spill provided at the Project. It is accepted by the District that this greater level of spill will result in steelhead exceeding the survival standard during the period of the steelhead migration where steelhead and sockeye are migrating together. The increase in steelhead survival during this period of combined migration will not result in a reduction of spill during the portions of the steelhead migration where steelhead are migrating alone so that the average survival of steelhead throughout their migration achieves the survival standard.

If spill is reduced, the Coordinating Committee shall oversee additional one to three years of testing to confirm achievement of the survival standard under the new operations.

(Phase III Provisional Review.) The District shall proceed to Phase III (Provisional Review) when Juvenile Project Survival studies indicate that Plan Species survival is less than 93% but greater than or equal to 91%. Provisional Review allows the District a one time (plan species specific) five-year period to implement additional measures or conduct additional juvenile or additional adult survival studies to more accurately determine whether the pertinent survival standard is being achieved. If at the end of this period Juvenile Project Survival is still less than 93% but greater than or equal to 91% and the Combined Adult and Juvenile Survival Studies are inconclusive, then the District will move to Phase II (Additional Tools). When the Provisional Review Studies indicate that the Combined Adult and Juvenile Survival estimates are greater than or equal to 91% or when the Juvenile Project Survival Studies indicate that survival is greater than or equal to 93% then the District shall proceed to Phase III (Standard

Achieved). If the Provisional Review Studies indicate that the 95% Juvenile Dam Passage Survival Standard has been achieved through direct measurement or calculation, then the District shall proceed to Phase III (Additional Juvenile Studies).

(Phase III Additional Juvenile Studies). The District shall proceed to Phase III (Additional Juvenile Studies) when Juvenile Dam Passage Survival studies or Juvenile Dam Passage calculations indicate that Juvenile Dam Passage Survival is greater than or equal to 95%. Because measurement or calculation of Juvenile Dam Passage Survival does not address juvenile mortality in the pool or the indirect effects of juvenile project passage, the District will evaluate either the 91% Combined Adult and Juvenile Project Survival or the 93% Juvenile Project Survival as determined appropriate by the Coordinating Committee. If at any time during Phase III (Additional Juvenile Studies), the Coordinating Committee approves the use of new survival methodologies, the District will have five years to conduct the appropriate evaluations. The Parties will then proceed based upon the results of these new studies. This re-evaluation will occur over one year. If the survival standard is met, then Phase III (Standard Achieved) status will remain. The Coordinating Committee will determine the number of valid studies (not to exceed three years) necessary to make a phase determination following the implementation of Additional Tools.

5.4 Phase 1 Plan to Achieve Survival Standards. The District shall implement the following activities starting in 2002 and continuing until at least the conclusion of Phase I studies.

5.4.1 Juvenile Measures

a. Adjustment Period. During the 2002 juvenile migration, the District shall operate its prototype bypass system as set forth in Section 5.4.1(b) below, provide the spill as set forth in Section 5.4.1 (c) below, and provide the predator control as set forth in Section 5.4.1 (d) below.

In December of 2001, the District has pending before FERC an application to amend its license for the Project to install a permanent bypass system. Upon construction of the final bypass for the 2003 juvenile migration as scheduled, the District will operate the bypass, provide spill, and provide predator control as it did in 2002. In order to obtain information about the newly constructed bypass, in 2003 the District shall also conduct a fish passage efficiency study of the bypass system for each Plan Species. The Coordinating Committee shall approve the study plan.

Upon completion of the 2003 fish passage efficiency study and before March 1, 2004, operation of the bypass and spill for the 2004, 2005 and 2006 juvenile migrations will be decided by the District as follows, unless the Coordinating Committee approves a more accurate method for adjusting the operation of the bypass and spill, if a species' 2003 bypass FPE is less than or greater than the historic total FPE for chinook yearlings (see Table 1 "Historic Total FPE for Chinook Yearlings"), then spill for that species will be adjusted to cover 95% of the migration as follows:

$$\frac{(\text{historic total FPE for chinook yearling}) - (\text{bypass FPE}_{\text{species}})}{\text{spill efficiency}_{\text{species}}}$$

b. Bypass. The District will continue to operate the juvenile salmonid bypass system at Rocky Reach Dam to meet the criteria set out below. The District shall operate the bypass system continuously between April 1 and August 31. Operation of the bypass system outside the specified dates above (either before April 1 or after August 31) will occur when it can be demonstrated it is necessary to encompass 95% of the juvenile migration of a Plan Species. The basis for making this determination shall be based on periodic fish capture information from the bypass system in addition to video counts from 1995-2001, or other empirical information agreed to by the Coordinating Committee. Additional run timing information and species composition monitoring shall be conducted once every 10 years in order to verify that a significant component (greater than 5%) of the juvenile emigration is not present outside the normal bypass operating period (April 1 through August 31) and to verify that the operations established by the Coordinating Committee are adequately protecting 95% of the spring and summer migrations of juvenile Plan Species. Turbine units 1 and 2 will be given high operating preference for project operations during the juvenile salmonid migration (note - “split-station” service needs dictate at least one turbine unit from units 5-11 must operate to maintain plant safety when flows allow only two units to run).

c. Spill. For the 2002 and 2003 juvenile migrations, spill will supplement the bypass system as set forth below. For the 2004, 2005, and 2006 juvenile migrations, spill will supplement the bypass system, as necessary to achieve the fish passage efficiency required by Section 5.4.1 (a) above. For the 2007 juvenile migration and beyond, spill will supplement the bypass system as necessary to achieve the survival standards as set forth in Section 5.3 “Phased Implementation of Measures to Achieve the Survival Standards”(see also Figure 1 “Survival Standard Decision Matrix”).

In the spring 2002 and 2003, the District will spill fifteen percent of the Daily Estimated Flow during a period coinciding with the 95% passage of each spring migrating Plan Species’ juvenile migration. However, spring spill shall be increased to twenty-five percent of the Daily Estimated Flow during the period coinciding with the passage of the juvenile sockeye salmon migration, provided that, twenty-five percent spill not exceed twenty-one (21) days in duration. The Coordinating Committee shall decide when sockeye spill starts and ends. Spring spill shall begin no later than April 20th of each year, but the date may be adjusted by the Coordinating Committee based upon in-season migration information. Spring spill shall generally end no later than June 15th of each year, but the date may be adjusted by the Coordinating Committee based upon in-season migration information.

In the summer 2002 and 2003, the District will spill fifteen percent of the Daily Estimated Flow during a period coinciding with the 95% passage of the sub-yearling chinook juvenile migration. Summer spill shall begin no later than July 1st of each year, but the date may be adjusted by the Coordinating Committee based upon in-season migration information. Summer spill shall generally end no later than August 15th of each

year, but the date may be adjusted by the Coordinating Committee based upon in-season migration information. The Coordinating Committee shall investigate the need for a spill efficiency study in the summer of 2003. The Coordinating Committee shall also investigate the potential for changing spill operations to utilize the agreed to spill levels more efficiently.

d. Predator Control. The District will conduct control efforts for both northern pikeminnow and piscivorous bird populations for the protection of juvenile Plan Species. Northern pikeminnow will be primarily controlled by utilizing anglers at the dam. Northern pikeminnow tend to congregate in the Tailrace and anglers will exploit this population during the spring and summer months. The pikeminnow removal program may also be expanded to include not only the dam itself, but also the whole reservoir. This may be accomplished by implementing a bounty reward program and using sport anglers to assist in our control efforts. Long lines and trapping may also be utilized to supplement the dam angling and further exploit the pikeminnow population. Piscivorous bird populations, which include, Caspian terns, double-crested cormorants, and various gull species will be hazed. Hazing techniques may include elaborate wire arrays in the tailrace to deter foraging, propane cannons, various pyrotechnics, and lethal control when necessary. This program will continue to run during the juvenile outmigration.

5.4.2 Adult Measures. The District shall emphasize adult project passage Measures in order to give high priority to adult survival in the achievement of 91% Combined Adult and Juvenile Project Survival for each Plan Species. To accomplish this, the District shall implement at least the following Tools:

a. The District shall use best efforts to maintain and operate adult passage systems at the Project according to criteria developed through the Coordinating Committee and as provided in the DFOP.

b. Areas within the adult fish passage systems which are identified by the Coordinating Committee as either continuously out of criteria or where significant delay occurs (as it relates the biological fitness of the adult Plan Species) shall be addressed as soon as feasible.

c. The District shall use best efforts to eliminate identified sources of adult injury and mortality during adult migration through the Dam.

d. By the end of Phase I, the District shall identify adult fallback rates at the Dam. This evaluation will include the magnitude of voluntary and involuntary fallback, will assess how ladder trapping, project operations, the influence of the Turtle Rock Fish Hatchery, and the Wenatchee River have upon observed rates of fallback. This assessment will also determine the biological significance of these fallback events on the overall fitness of adult Plan Species. If the observed rates of adult fallback and steelhead kelt loss are determined to make a significant difference in meeting the relevant survival standard, then the Coordinating Committee shall determine the most cost effective

methods to protect adult fallbacks and steelhead kelts at the Dam, and the District shall immediately implement the agreed to Measures. Reduction in fallback rates, mortalities and protection of kelts shall be factored into juvenile bypass and adult passage development and implementation and into Project operation decisions. Before the District is asked to implement additional operation of the bypass system or other measures for kelts or fallbacks, there will need to be a high level of certainty that these Measures will make a significant difference in meeting the relevant survival standard.

e. The Parties to this Agreement recognize that current technology does not allow for a precise estimate of hydroelectric project induced mortality to adult salmonids. Until adult survival studies can accurately differentiate between natural and hydro-project induced mortality, the District shall use the best available technology to conduct, on a periodic basis, adult passage verification studies toward the diagnosis of adult loss, injury and delay at Rocky Reach Dam. Prior to the completion of adult survival studies, compensation for adult mortality shall be assumed completely fulfilled by the District's contribution to the Tributary Fund. Following the completion of adult survival studies, should adult survival rates fall below 98% but the Combined Adult and Juvenile survival rate be maintained above 91%, additional hatchery compensation for that portion of adult losses that exceeds 2%, toward a maximum contribution of 7% hatchery funding and 2% tributary funding, would be utilized to satisfy NNI compensation requirements for each Plan Species.

f. Pursuant to the 2000 Biological Opinion for the Federal Columbia River Power System (the "Bi-Op"), federal action agencies are required to conduct a comprehensive evaluation to assess adult survival at federal dams. The Bi-Op sets forth a series of evaluation methods to be employed. The Coordinating Committee should review the information and techniques utilized in those studies and evaluate their potential for accurately measuring Combined Adult and Juvenile Project Survival. The Coordinating Committee should also evaluate technologies found at the federal dams to increase adult survival for possible implementation at the Project. Based upon those evaluations, the District shall implement as necessary technologies appropriate for the Project.

SECTION 6 RESERVOIR HABITAT AND WATER QUALITY

6.1 When making land use or related permit decisions on Project owned lands that affect reservoir habitat, the District shall consider the cumulative impact effects in order to meet the conservation objectives of the Agreement, requirements of the FERC license, and other applicable laws and regulations. The District further agrees to notify and consider comments from the Parties to the Agreement regarding any land use permit application on Project owned lands.

6.2 The District shall notify all applicants for District permits to use or occupy Project lands or water that such use or occupancy may result in incidental take of species listed as endangered or threatened under the ESA, requiring advance authorization from NMFS or USFWS.

6.3 The Parties recognize that there are potential water quality issues (temperature and dissolved gas) related to cumulative hydropower operations in the Columbia River. The Parties will work together to address water quality issues.

SECTION 7 TRIBUTARY CONSERVATION PLAN

7.1 Tributary Plan. The Tributary Conservation Plan (“Tributary Plan”) consists of this Agreement and is supported by Supporting Document A “Tributary Plan, Project Selection, Implementation, and Evaluation”, and Supporting Document B “Aquatic Species and Habitat Assessment: Wenatchee, Entiat, Methow, and Okanogan Rivers”. The Parties recognize that Supporting Documents A and B do not by themselves create contractual obligations.

7.2 Purpose. Under the Tributary Plan, the District shall provide a Plan Species Account to fund projects for the protection and restoration of Plan Species’ habitat within the Columbia River watershed (from the Chief Joseph tailrace to the Rock Island tailrace), and the Okanogan, Methow, Entiat and Wenatchee River watersheds, in order to compensate for two percent of Unavoidable Project Mortality; provided that the Parties shall not be required to actually measure whether the Tributary Plan compensates for two percent Unavoidable Project Mortality. The Tributary Committee shall make sure that an appropriate amount of projects are chosen above the Rocky Reach Tailrace.

7.3 Tributary Committee

7.3.1 Establishment of Committee. There shall be a Tributary Committee composed of one (1) representative of each Party, provided that an entity eligible to appoint a representative to the Tributary Committee is not required to appoint a representative, and further provided that, representatives from USFWS shall participate in a non-voting, ex-officio capacity unless they otherwise state in writing, and further provided that, the Power Purchasers may participate as a non-voting observer through a single representative, whom they will designate from time to time. The Tributary Committee may select other expert entities, such as land and water trusts/conservancy groups to serve as additional, non-voting members of the Tributary Committee. Each entity eligible to appoint a representative to the Tributary Committee shall provide all other eligible entities with written notice of its designated representative. The Tributary Committee is charged with the task of selecting projects and approving project budgets from the Plan Species Account for purposes of implementing the Tributary Plan.

7.3.2 Meetings. The Tributary Committee shall meet not less than twice per year at times determined by the Tributary Committee. Additionally, the Tributary Committee may meet whenever requested by any two-(2) members following notice.

7.3.3 Meeting Notice. The Chair of the Tributary Committee shall provide all committee members with a minimum of ten- (10) day's advance written notice of all meetings unless a member waives notice in writing or reflects the waiver in the approved meeting minutes. The notice shall contain an agenda of all matters to be addressed and voted on during the meeting.

7.3.4 Voting. Except as set forth in Section 7.4.2 "Prohibited Use of Account", the Tributary Committee shall act by unanimous vote of those members present in person or by phone for the vote and shall develop its own rules of process, provided, that the chair shall ensure that all members are sent notice of all Tributary Committee meetings. Abstention does not prevent a unanimous vote. If a Party or its designated alternate cannot be present for an agenda item to be voted upon it must notify the Chair of the Tributary Committee who shall delay a vote on the agenda item for up to five- (5) business days on specified issues to be addressed in a meeting or conference call scheduled with all interested parties, or as otherwise agreed to by the Tributary Committee. A Party may invoke this right only once per delayed item. If the Tributary Committee cannot reach agreement, then upon request of any Party, that issue shall be referred to the Coordinating Committee.

7.3.5 Chair of Tributary Committee. The Parties shall choose and the District shall fund a neutral third party to act as the Chair of the Tributary Committee. The Chair of the Tributary Committee shall have the same responsibilities and authorities with regard to the Tributary Committee as the Chair of the Coordinating Committee has with regard to the Coordinating Committee. At least every three years, the Tributary Committee shall evaluate the performance of the Chair of the Tributary Committee.

7.4 Plan Species Account.

7.4.1 Establishment of Account. The District shall establish a Plan Species Account in accordance with applicable provisions of Washington State law and this Agreement. Interest earned on the funds in the Plan Species Account shall remain in the Plan Species Account. The Parties to this Agreement may audit the District's records relating to the Account during normal business hours following reasonable notice. The Tributary Committee shall select projects and approve project budgets from the Plan Species Account by joint written request of all members of the Tributary Committee. The Tributary Committee shall act in strict accordance with Section 7.4.2 "Prohibited Use of Account".

7.4.2 Prohibited Uses of Account. No money from the Plan Species Account shall be used to enforce compliance with this Agreement. Members of the Tributary Committee and their expenses shall not be compensated through the Plan Species Account. Administrative costs, staffing and consultants, reports and brochures, landowner assistance and public education costs collectively shall not exceed \$80,000 in 1998 dollars in any given year without the unanimous vote of the Tributary Committee.

7.4.3 Reports. At least annually, the District shall provide financial reports of Plan Species Account activity to the Tributary Committee.

7.4.4 Ownership of Assets. Determinations regarding ownership of real and personal property purchased with funds from the Plan Species Account shall be made by the Tributary Committee. Title may be held by the District, by a resource agency or tribe or by a land or water conservancy group, as determined by the Tributary Committee. Unless the Tributary Committee determines that there is a compelling reason for ownership by another entity, the District shall have the right to hold title. All real property purchased shall include permanent deed restrictions to assure protection and conservation of habitat.

7.4.5 Account Status Upon Termination. Upon the Agreement's termination, (1) the District's unspent advance contributions to the Plan Species Account shall be promptly released to the District, (2) if funds remain in the Plan Species Account after the return of the District's advance contributions, then the Tributary Committee shall remain in existence and continue to operate according to the terms of this Agreement until the funds in the Plan Species Account are exhausted, and (3) all real and personal property which the District holds title shall remain its property.

7.5 Plan Species Account Funding

7.5.1 While this Agreement remains in effect, the District shall contribute \$229,800, in 1998 dollars, annually to the Plan Species Account. By joint written request, the JFP and American Rivers, Inc.'s representatives to the Tributary Committee may elect for the District to contribute, in advance, any of the annual payments to be made during the first fifteen years of the Agreement, provided that, (1) each annual payment shall be adjusted by the District for inflation based upon a nationally recognized index, (2) the total adjusted amount shall be reduced to present value by the actual discount rate applicable to the District, and reduced by the District's actual cost of financing, and (3) each election shall be for a minimum of three annual payments.

7.5.2 The first installment is due within ninety- (90) days of the Effective Date of the Agreement. The rest of the installments are due by the 31st day of January each year thereafter. The dollar figures shall be adjusted for inflation on the 1st day of January each year based upon the "Consumer Price Index for all Urban Consumers" for the Seattle/Tacoma area, published by the U.S. Department of Labor, Bureau of Labor Statistics. If said index is discontinued or becomes unavailable, a comparable index suitable to the Tributary Committee shall be substituted.

7.6 Tributary Assessment Program. The District shall provide support for a tributary assessment program separate from the Plan Species Account. The tributary assessment program will be utilized to monitor and evaluate the relative performance of projects approved by the Tributary Committee and directly funded by the initial contribution to the Plan Species Account. It is not the intent of the tributary assessment program to measure whether the Plan Species Account has provided a 2% increase in survival for Plan Species. Instead, the program has been established to ensure that the dollars allocated to the Plan species Account are utilized in an effective and efficient manner. The District shall develop, in coordination with and subject to an approval by the

Tributary Committee, the measurement protocols for the tributary assessment program. The Tributary Committee may choose to either evaluate the relative merits of each project or it may choose to evaluate an aggregation of projects provided that the total cost associated with the tributary assessment program does not exceed \$200,000 (not subject to inflation adjustment).

7.7 Project Selection.

7.7.1 Geographic Area and Types of Projects. The Tributary Committee shall select projects and approve budgets for expenditure from the Plan Species Account for the following: (1) Any action, structure, facility, program or measure (referred to herein generally as "projects") intended to further the purpose of the Tributary Plan for Plan Species. Projects shall be chosen based upon the guidelines set forth in Supporting Document A "Tributary Plan Project Selection, Implementation, and Evaluation" and Supporting Document B "Aquatic Species and Habitat Assessment: Wenatchee, Entiat, Methow, and Okanogan Rivers". Projects shall not be implemented outside the area specified in Section 7.2 "Purpose". High priority shall be given to the acquisition of land or interests in land such as conservation easements or water rights or interests in water such as dry year lease options; (2) Studies, implementation, monitoring, evaluation, and legal expenses associated with any project financed from the Plan Species Account; and (3) Prior approved administrative expenses associated with the Plan Species Account.

7.7.2 Coordination With Other Conservation Plans. Whenever feasible, projects selected by the Tributary Committee shall take into consideration and be coordinated with other conservation plans or programs. Whenever feasible, the Tributary Committee shall cost-share with other programs, seek matching funds, and "piggy-back" programs onto other habitat efforts.

7.7.3 Conflict of Interest. After full written disclosure of any potential conflict of interest, which shall appear in the minutes of the Tributary Committee and prior to project approval, the Tributary Committee may approve a project that may benefit a person or entity related to a committee member, or an entity which appointed the committee member.

SECTION 8 HATCHERY COMPENSATION PLAN

8.1 Hatchery Objectives

8.1.1 The District shall provide hatchery compensation for Plan Species (spring chinook salmon, summer chinook salmon, fall chinook salmon, sockeye salmon, coho salmon upstream of Rock Island Dam origin, and summer steelhead). This compensation may include Measures to increase the off-site survival of naturally spawning fish or their progeny.

8.1.2 The District shall implement the specific elements of the hatchery program consistent with overall objectives of rebuilding natural populations and achieving NNI. Species specific hatchery programs objectives developed by the JFP may include

contributing to the rebuilding and recovery of naturally reproducing populations in their native habitats, while maintaining genetic and ecologic integrity, and supporting harvest.

8.2 Hatchery Committee.

8.2.1 Establishment of the Committee. There shall be a Hatchery Committee composed of one (1) representative of each Party, provided that a Party is not required to appoint a representative and further provided that the Power Purchasers may participate as a non-voting observer through a single representative whom they will designate from time to time. A Party shall provide all other Parties with written notice of its designated representative.

8.2.2 Responsibilities. The Hatchery Committee shall oversee development of recommendations for implementation of the hatchery elements of the Agreement that the District is responsible for funding. This includes overseeing the implementation of improvements, monitoring and evaluation relevant to the District's hatchery programs, as identified in the Hatchery Compensation Plan, the Permit and this Agreement. Hatchery Committee decisions shall be based upon: Likelihood of biological success; Time required to implement; and Cost-effectiveness of solutions. The Hatchery Committee shall also coordinate in-season information sharing and shall discuss unresolved issues.

8.2.3 Meetings. The Hatchery Committee shall meet twice per year or whenever requested by any two-(2) members following notice.

8.2.4 Meeting Notice. The Chair of the Hatchery Committee shall provide all committee members with a minimum of ten- (10) day's advance written notice of all meetings unless a member waives notice in writing or reflects the waiver in the approved meeting minutes. The notice shall contain an agenda of all matters to be addressed and voted on during the meeting.

8.2.5 Voting. The Hatchery Committee shall act by unanimous vote of those members present in person or by phone for the vote and shall develop its own rules of process, provided, that the chair shall ensure that all members are sent notice of all Hatchery Committee meetings. Abstention does not prevent a unanimous vote. If a Party or its designated alternate cannot be present for an agenda item to be voted upon it must notify the Chair of the Hatchery Committee who shall delay a vote on the agenda item for up to five- (5) business days on specified issues to be addressed in a meeting or conference call scheduled with all interested parties, or as otherwise agreed to by the Hatchery Committee. A Party may invoke this right only once per delayed item. If the Hatchery Committee cannot reach agreement, then upon request of any Party, that issue shall be referred to the Coordinating Committee.

8.2.6 Chair of Hatchery Committee. The Parties shall choose and the District shall fund a neutral third party to act as the Chair of the Hatchery Committee. The Chair of the Hatchery Committee shall have the same responsibilities and authorities with regard to the Hatchery Committee as the Chair of the Coordinating Committee has with

regard to the Coordinating Committee. At least every three years, the Hatchery Committee shall evaluate the performance of the Chair of the Hatchery Committee.

8.3 Hatchery Operations. The District or its designated agents shall operate the hatchery facilities according to the terms of this Section 8 “Hatchery Compensation Plan”, the ESA Section 10 permit(s), and in consultation with the Hatchery Committee.

8.4 Hatchery Production Commitments.

8.4.1 Hatchery Agreements. The District may enter into agreements with other entities for the rearing, release, monitoring and evaluation and research of hatchery obligations. The Hatchery Committee must approve any proposed agreements or trades of production. However, it is the District’s responsibility to ensure that their obligations under Section 8 (Hatchery Compensation Plan) are satisfied.

8.4.2 Calculation of Hatchery Levels. The District shall provide the funding and capacity required of the District to meet the 7% hatchery compensation level necessary to achieve NNI for all Plan Species. As set forth below, the initial estimated hatchery production capacities for Plan Species needed to compensate for Unavoidable Project Mortality are based on average adult returns of Plan Species for a baseline period, a 7% compensation requirement, and baseline adult to smolt survival rates for existing mid-Columbia River hatcheries. Juvenile Project Survival estimates, when available, will be used to adjust hatchery based compensation programs. However, should adult survival rates fall below 98% but the Combined Adult and Juvenile survival rates is maintained above 91%, additional hatchery compensation for adult losses, toward a maximum contribution of 7% hatchery compensation, would be utilized to provide compensation for Unavoidable Project Mortality. The rationale for determining the initial capacity requirement is supported by Supporting Document C, “Biological Assessment and Management Plan (BAMP): Mid-Columbia Hatchery Program”. The Parties recognize that Supporting Document C is a supporting document and does not by itself, create contractual obligations.

8.4.3 Periodic Adjustment of District Hatchery Levels. Hatchery production levels, except for original inundation mitigation, shall be adjusted in 2013 and every 10 years thereafter as is required to adjust for changes in the average adult returns of Plan Species and for changes in the adult-to-smolt survival rate, and for changes to smolt-to-adult survival rate from the hatchery production facilities, considering methodologies described in the BAMP. The Hatchery Committee will be responsible for determining program adjustments considering the methodology described in BAMP and providing recommended implementation plans to the District. The District will be responsible for funding the implementation plan.

a. Coho. Hatchery compensation for Methow River coho will be assessed in 2006 following the development of a continuing coho hatchery program and/or the establishment of a Threshold Population of naturally reproducing coho in the Methow Basin (by an entity other than the District and occurring outside this Agreement). The Hatchery Committee shall determine whether a hatchery program and/or, naturally

reproducing population of coho is present in the Methow Basin. Should the Hatchery Committee determine that such a program or population exists, then (1) the Hatchery Committee shall determine the most appropriate means to satisfy the 7% hatchery compensation requirement for Methow Basin coho, and (2) the District shall have the next juvenile migration to adjust juvenile protection Measures to accommodate Methow Basin coho. Thereafter, Coordinating Committee shall determine the number of valid studies (not to exceed three years) necessary to make a juvenile phase determination. Programs to meet NNI for Methow Basin coho may include but are not limited to: (1) provide operation and maintenance funding in the amount equivalent to 7% project passage loss, or (2) provide funding for acclimation or adult collection facilities both in the amount equivalent to 7% juvenile passage loss at the Project. The programs selected to achieve NNI for Methow Basin coho will utilize an interim value of project survival, based upon a Juvenile Project Survival estimate of 93%, until juvenile project survival studies can be conducted on Methow Basin coho.

b. Okanogan Basin Spring Chinook. Hatchery compensation for Okanogan Basin spring chinook will be assessed in 2007 following the development of a continuing spring chinook hatchery program and/or the establishment of a Threshold Population of naturally reproducing spring chinook in the Okanogan watershed (by an entity other than the District and occurring outside this Agreement). The Hatchery Committee shall determine whether a hatchery program and/or naturally reproducing population of spring chinook is present in the Okanogan Basin. Should the Hatchery Committee determine that such a program or population exists, then the Hatchery Committee shall determine the most appropriate means to satisfy the 7% hatchery compensation requirement for Okanogan Basin spring chinook. Programs to meet the 7% hatchery requirement for Okanogan Basin spring chinook may include but not be limited to: (1) operation and maintenance funding in the amount equivalent to 7% project passage loss or (2) replace project passage losses of hatchery spring chinook with annual releases of equivalent numbers of yearling summer chinook into the Okanogan River Basin or (3) provide funding for acclimation or provide funding for adult collection facilities in the amount equivalent to 7% juvenile passage loss at the Rocky Reach Project. The programs selected to achieve NNI for Okanogan Basin spring chinook will utilize an interim value of project survival, based upon a Juvenile Project Survival estimate of 93%, until project survival studies can be conducted on Okanogan Basin yearling chinook.

8.4.4 Initial Hatchery Program Levels. The District will continue to fund the operation and maintenance of the Rocky Reach Fish Hatchery and a portion of Chelan Fish Hatchery, a portion of the production in excess of 7% currently provided by the Rock Island Hatchery Complex, and other facilities necessary to meet production levels. The Parties agree that the initial production commitments to be provided by the District to satisfy 7% Unavoidable Project Mortality and compensation for original inundation are satisfied with production as follows below (See Table 2 for initial production levels, and production levels necessary to achieve 7% Unavoidable Project Mortality). The initial production levels will be maintained until 2013 unless otherwise agreed to by the Hatchery Committee.

a. Spring chinook: 7,500 pounds at about 12 fish per pound (90,000 fish); (the Hatchery Committee will determine if this commitment can be met through either the Okanogan Spring chinook program (see above), or another program (such as utilizing extra space in the Methow Hatchery) and, until 2013, 9,600 pounds at about 15 fish per pound (144,000 fish) at the Methow Hatchery (50% of proportion raised for Rock Island hatchery program). (The intent of the initial production program is to maintain current production levels of fish reared for the District at the Public Utility District No. 1 of Douglas County, Washington (“Douglas PUD”) owned Methow Hatchery through a contractual agreement between Douglas PUD and the District).

b. Steelhead: 5,800 pounds at about 6 fish per pound (35,000 fish, plus 27,500 pounds (165,000 fish) for original inundation losses;

c. Summer/Fall chinook: 20,000 pounds of yearling summer/fall chinook at about 10 fish per pound (200,000 fish); plus 40,500 pounds of sub-yearling summer/fall chinook at about 40 fish per pound (1,620,000) for inundation and, until 2013, 20,000 pounds at about 10 fish per pound (200,000 fish, a portion of which can be used for studies) at the Carlton Pond (50% of proportion raised for Rock Island hatchery program). (The intent of the initial production program is to maintain current production levels of fish reared for Douglas PUD at the District owned Carlton Pond through a contractual agreement between Douglas PUD and the District).

d. Sockeye: 15,000 pounds at about 20 fish per pound (300,000 fish). Options for long term production of sockeye will be explored by the Hatchery Committee and will be implemented by the District as soon as reasonably practical.

8.5 Monitoring and Evaluation.

8.5.1 The Hatchery Committee shall develop a five-year monitoring and evaluation plan for the hatchery program that is updated every five years (see also Section 8.6 “Program Review”). The first monitoring and evaluation plan shall be completed by the Hatchery Committee within one year of the Effective Date of this Agreement. Existing monitoring and evaluation programs shall continue until replaced by the Hatchery Committee.

8.5.2 The Parties agree that over the duration of this Agreement new information and technologies that are developed will be considered and utilized in the monitoring and evaluation of the hatchery program. The District shall fund hatchery program monitoring and evaluation consistent with this Agreement, the general objectives and guidelines listed for each Plan Species in the BAMP and as determined by the Hatchery Committee.

8.5.3 The Hatchery Committee shall plan and the District implement a study (related to the District’s production program) to investigate the natural spawning success of hatchery reared steelhead relative to wild steelhead. The Hatchery Committee shall coordinate the study with the Wells and Rock Island hatchery committees.

8.6 Program Modification.

8.6.1 Hatchery program modifications shall make efficient use of existing facilities owned by the District or cooperating entities including adult collection, acclimation, and hatchery facilities, provided that the existing facility or the existing facility as modified is compatible with and does not compromise ongoing programs. The District in consultation with the Hatchery Committee shall make reasonable efforts to implement program modifications when needed to achieve overall and specific program objectives. Program modifications may include changes to facilities, release methods, and rearing strategies necessary to achieve NNI as determined by the monitoring and evaluation program.

8.6.2 In December 2001, it is recognized that current monitoring and evaluation programs have identified alternative rearing strategies to be addressed as soon as reasonably possible. These alternative strategies include: the ability to hold steelhead adults on river water prior to spawning; and ability to rear and acclimate steelhead juveniles on Columbia or tributary waters. The District will make every reasonable effort to complete program modifications as soon as reasonably possible following agreement with the Hatchery Committee.

8.6.3 NMFS shall have the opportunity to seek hatchery program modifications (that do not change 7% program levels) but are otherwise necessary to address emergency effects of a hatchery program on listed Permit Species. Such program modifications shall be supported by a minimum of two years of field data from the river or stream in question. Other information documenting a significant and adverse effect on the productivity of listed Permit Species from other rivers can be considered, but only if applicable to the listed Permit Species and stream in question. Any proposal to modify a program will be documented in a memorandum from the Regional Administrator to the Hatchery Committee summarizing the problem, and then followed by up to six months of Hatchery Committee evaluation. The Parties recognize that initially a portion of the production contemplated in this Agreement will be for purposes of supplementation of Plan Species or re-establishing runs in areas from which they have been extirpated. In the event the concerns raised in this Section 8.6.3 involve the use of such a program, NMFS agrees to take the program design and intent into account in reaching any conclusions regarding the need for emergency modifications.

8.7 Program Review. As part of the five year review set forth in Section 8.4 "Monitoring and Evaluation" the Hatchery Committee shall look back comprehensively at the previous five year plan to help prepare the next five year plan. In 2013 as part of the comprehensive review and every ten years thereafter, the hatchery program will undergo a program review incorporating new information from the monitoring and evaluation program. This program review will determine if adult-to-smolt and smolt-to-adult survival standard, and hatchery program goals, and objectives as defined in this document and the Section 10 of the ESA permits have been met or sufficient progress is being made towards their achievement. This review shall include a determination of whether hatchery production objectives are being achieved and a review to identify adjustments to the monitoring and evaluation programs. The Hatchery Committee shall

be responsible for conducting the hatchery program review, and developing a summary report. The Hatchery Committee shall be responsible for recommending alternative plans to the District in the event that program objectives as defined above are not being met or needed modifications to the monitoring and evaluation have been identified. The Hatchery Committee shall be responsible for developing and the District funding implementation plans.

8.8 Changed Hatchery Policies under ESA.

8.8.1 Except in 2013 and every ten years thereafter, NMFS will refrain from applying hatchery policy decisions that would preclude the 7% hatchery levels (as adjusted) from being achieved. During 2013 and every 10 years thereafter (at the time of the program review), if NMFS proposes hatchery policy decisions that would preclude the 7% hatchery levels (as adjusted) from being achieved, NMFS will (a) propose application of the policies to the Hatchery Committee and seek agreement, (b) propose a revised hatchery program consistent with the principles of NNI and an expeditious transition plan from the existing hatchery program to the revised hatchery program, (c) if agreement is not possible discuss the application of the policies with the Coordinating Committee and then with the Policy Committee, if necessary, and (d) if agreement is still not possible then allow elevation to the Administrator of NMFS. The Parties recognize that initially a portion of the production contemplated in this Agreement will be for purposes of supplementation of Plan Species or re-establishing runs in areas from which they have been extirpated. NMFS agrees to take the program design and intent into account in reaching any conclusions.

8.8.2 Through 2013, facility modifications are based on monitoring and evaluation and may not reflect changes in NMFS hatchery policy. During 2013 and every 10 years thereafter (at the time of the program review), facility modifications can also reflect changes in ESA policy with the understanding that a reasonable period of time will be provided to complete the modifications. The 2013 date for achievement of NNI in Section 3.1 will be adjusted if necessary to reflect the time needed to complete such modifications (as determined by the Hatchery Committee).

8.9 New Hatchery Facilities. Before being required to construct new hatchery facilities, the Hatchery Committee shall make efficient use of existing or modified facilities owned by the District or entities consenting to the use of their facilities, including adult collection, acclimation and hatchery facilities, provided that existing or as modified facility use is compatible with and does not compromise ongoing programs.

SECTION 9 ASSURANCES

9.1 Release, Satisfaction and Covenant Not to Sue.

9.1.1 The Parties, within the limits of their authority, shall from the date of construction of the Project to the Effective Date of this Agreement, release, waive, discharge the District and the District's predecessors, commissioners, agents, representatives, employees, and signatory power purchasers from any and all claims,

demands, obligations, promises, liabilities, actions, damages and causes of action of any kind concerning impact of the Project on Plan Species except for the obligation to provide compensation for original construction impacts of the Project implemented through the hatchery component of this Agreement. This release, waiver, and discharge shall not transfer any of the above listed District liabilities or obligations to any other entity.

9.1.2 Provided that the District is in full compliance with its Permit, this Agreement, and its FERC project license provisions relating to Plan Species, each Party agrees not to institute any action under ESA, the Federal Power Act, the Fish and Wildlife Coordination Act, the Pacific Northwest Electric Power Planning and Conservation Act and the Essential Fish Habitat provisions of the Magnuson-Stevens Fishery Conservation and Management Act against the District and its signatory power purchasers related to impacts of the Project on Plan Species from the date this Agreement becomes effective through the date this Agreement terminates.

9.1.3 Termination of this Agreement or withdrawal of a Party shall have no effect upon the release provided for in Section 9.1.1.

9.1.4 This Agreement does not affect, limit or address the imposition of annual charges under the Federal Power Act, or the right of any party in any proceeding or forum to request annual charges.

9.2 Re-Licensing.

9.2.1 With respect to Plan Species, the Parties agree to be supportive of the District's long-term license application(s) to the FERC filed during the term of this Agreement for the time period addressed in this Agreement, provided that the District has adhered to the terms and conditions of this Agreement, the Permit, and the FERC license provisions relating to Plan Species, as well as any future terms, conditions, and obligations agreed upon by the Parties hereto or imposed upon the District by the FERC. To the extent that the District has met such terms and conditions, the Parties agree that the District is a competent license holder with respect to its obligations to Plan Species. If the fifty (50)-year term of this Agreement will expire during a long-term license, any Party may advocate for license conditions that take effect after this Agreement expires.

9.2.2 This Agreement shall constitute the Parties' terms, conditions and recommendations for Plan Species under Sections 10(a), 10(j) and 18 of the Federal Power Act, and the Fish and Wildlife Coordination Act, provided that, NMFS and USFWS maintain the right to reserve their authorities under Section 18 of the Federal Power Act on the condition that such reserved authority may be exercised only in the event that this Agreement terminates, provided further that, the Parties as part of their terms, conditions and recommendations under Section 10(a) of the Federal Power Act may request that Plan Species protection or mitigation measures contained in a competing license application be included as a condition of the District's new long term license.

9.2.3 Notwithstanding Sections 9.2.2 and 9.7 “Drawdowns/Dam Removal/Non-Power Operations”, this Agreement does not limit the participation of any Party in any FERC proceeding to assert: (1) any condition for resources and other aspects of the District’s license other than for Plan Species, and (2) to assert conditions for Plan Species to implement this Agreement.

9.3 Limitation of Reopening. During the term of this Agreement the Parties shall not invoke or rely on any re-opener clause set forth in any FERC license applicable to the Project for the purpose of obtaining additional measures or changes in project structures or operations for Plan Species, except as set forth in Sections 9.2.2 and 9.2.3.

9.4 Additional Measures. This Agreement sets out certain actions, responsibilities, and duties with regard to Plan Species to be carried out by the District and by the JFP to satisfy the legal requirements imposed under the ESA, the Federal Power Act, the Fish and Wildlife Coordination Act, the Pacific Northwest Electric Power Planning and Conservation Act and the Essential Fish Habitat provisions of the Magnuson-Stevens Fishery Conservation and Management Act. This Agreement is not intended to prohibit the Parties from opposing or recommending actions in reference to (1) Project modifications such as pool raises and additional power houses, and (2) activities not related to Project operations that could adversely affect Plan Species. The Parties recognize that various of the JFP have governmental rights, duties, and responsibilities as well as possible rights of action under statutes, regulations, and treaties that are not covered by this Agreement. This Agreement does not limit or affect the ability or right of a Party to take any action under any such law, regulation, or treaties. However, the Party shall use reasonable efforts to exercise their rights and authority under such statutes, regulations or treaties (consistent with their duties and responsibilities under those statutes, regulations and treaties) in a manner that allows this Agreement to be fulfilled.

9.5 Title 77 RCW. Provided the District is in compliance with the Agreement, the Permit, and the FERC license provisions relating to Plan Species, WDFW shall not request additional protection or mitigation for Plan Species under Title 77 RCW as now exists or as may be amended, unless WDFW is required to take such action by statute.

9.6 Cooperation in Studies/Approval/Permits. The Parties shall cooperate with the District in conducting studies and in obtaining any approvals or permits which may be required for implementation of this Agreement.

9.7 Drawdowns/Dam Removal/Non-Power Operations. With respect to Plan Species under the ESA, the Federal Power Act, the Fish and Wildlife Coordination Act, the Pacific Northwest Electric Power Planning and Conservation Act and the Essential Fish Habitat provisions of the Magnuson-Stevens Fishery Conservation and Management Act, each Party during the term of this Agreement will not advocate for or support additional or different fish protection measures or changes in Project structures or operations other than those set forth in this Agreement. For example, the Parties will not advocate or support partial or complete drawdowns, partial or complete dam removal, and partial or complete non-power operations. However, this Agreement does not preclude: spillway or

Tailrace modifications; spill; structural modifications and concrete removal (holes in Dam) to accommodate bypass; structural modifications to accommodate adult passage facility improvements; and future consideration of additional measures that may include reservoir elevation changes if all Parties agree. The Parties agree to work within this Agreement to address any issues that may arise in the future concerning Plan Species.

9.8 Stipulation of Plan Species. Each Party stipulates that the performance of the District's obligations under this Agreement, its Permit, and its FERC license will adequately and equitably conserve, protect, and mitigate Plan Species pursuant to the ESA, the Federal Power Act, the Fish and Wildlife Coordination Act, the Pacific Northwest Electric Power Planning and Conservation Act and the Essential Fish Habitat provisions of the Magnuson-Stevens Fishery Conservation and Management Act as those Plan Species are affected by the Project through the term of the Agreement.

9.9 Vernita Bar. Nothing in this Agreement is intended to affect the protection of Plan Species in the Hanford Reach or the Vernita Bar Agreement, as it exists now or may be modified in the future.

9.10 Non-Plan Species. Non-Plan Species are not addressed in this Agreement.

SECTION 10 ENDANGERED SPECIES ACT

10.1 Permit Issuance.

10.1.1 NMFS issuance of a Permit to the District assures the District that based upon the best scientific and commercial data available and after careful consideration of all comments received, NMFS has found that with respect to all Permit Species that: (i) any take of a Permit Species by the District under this Agreement will be incidental to the carrying out of otherwise lawful activities; (ii) under this Agreement the District will, to the maximum extent practicable, minimize and mitigate any incidental take of Permit Species; (iii) the District has sufficient financial resources to adequately fund its affirmative obligations under this Agreement; (iv) as long as the actions required by this Agreement to minimize/mitigate incidental take are implemented, any incidental take of a Permit Species will not appreciably reduce the likelihood of the survival and recovery of such species in the wild; and (v) other measures and assurances required by NMFS as being necessary or appropriate are included in this Agreement. The hatchery permits are addressed in Section 10.1.4.

10.1.2 After opportunity for public comment, compliance with NEPA and concurrent with the Effective Date of this Agreement, NMFS will issue a Permit to the District pursuant to Section 10(a)(1)(B) of the ESA to authorize any incidental take of listed Permit Species which may result from the District's otherwise lawful operation of the Project, conducted in accordance with this Agreement and the Permit, and NMFS will issue necessary hatchery Permits (incidental and direct). In addition, the Permit shall authorize any incidental take of listed Permit Species which may result from the District's otherwise lawful operation of the hatchery facilities required by this

Agreement, conducted in accordance with this Agreement and the Permit. The Permit and this Agreement shall remain in full force and effect for a period of fifty-(50) years from the Effective Date, or until revocation of the Permit under Section 10.4 “Permit Suspension, Revocation and Re-Instatement”, or the District or NMFS’ withdraws under Section 2.1 “Enough Already”, whichever occurs sooner. Amendments to the Permit or this Agreement shall remain in effect for the then-remaining term of this Agreement or until revocation under Section 10.4 “Permit Suspension, Revocation and Re-Instatement”, whichever occurs sooner. Withdrawal from this Agreement pursuant to Section 2 “Withdrawal From Agreement” and revocation of the Permit is not limited by the no surprises regulation. The Permit shall incorporate by reference the no surprises rule set forth in 50 CFR 222.307(g) (2001). This Agreement provides for changed circumstances and the mitigation measures to respond to changed circumstances. Any circumstance relating to Permit Species not addressed by this Agreement is an Unforeseen Circumstance.

10.1.3 The Permit shall authorize the District to incidentally take Permit Species that are listed under the ESA, to the extent that such incidental take of such species would otherwise be prohibited under Section 9 of the ESA, and its implementing regulations, or pursuant to a rule promulgated under Section 4(d) of the ESA, and to the extent that the take is incidental to the District’s lawful operation of the Project, subject to the condition that the District must fully comply with all requirements of this Agreement and the Permit. The Permit will be immediately effective upon issuance for Permit Species currently listed under the ESA. The Permit will become effective for currently unlisted Permit Species upon any future listing of such species under the ESA.

10.1.4 In the event that an additional or amended Section 10 permit is required for the implementation of any aspect of the Tributary Conservation Plan or Hatchery Compensation Plan, the NMFS shall expedite the processing of such permits or amendments. The hatchery Permits (direct and incidental) will initially be issued to authorized take through 2013. Beginning in 2013 and every ten (10)-years thereafter, the District or its agent shall submit to NMFS hatchery Permit applications incorporating changes to the Hatchery Program identified in the ten (10)-year program reviews (see Section 8.7 “Program Review”).

10.2 Permit Monitoring. Upon issuance of the Permit, the implementation thereof, including each of the terms of this Agreement shall be monitored and evaluated as provided for in Section 5 “Passage Survival Plan”. Any reports the FERC should require regarding this Agreement shall be provided to the NMFS at the time such reports are provided to the FERC.

10.3 Permit Modification.

10.3.1 The Permit issued to the District, shall be amended in conformance with the provisions 50 CFR 222. 306(a) (2001) through 222. 306(c) (2001), provided, that if said regulations are modified the modified regulations will apply only to the extent the modifications were required by subsequent action of Congress or court order, unless the Parties otherwise agree.

10.3.2 This Agreement provides for on-going, active and adaptive management activities. Adaptive management provides for on going modification of management practices to respond to new information and scientific development. Adaptive management will yield prescriptions that may vary over time. Such changes are provided for in this Agreement and do not require modification of the Agreement or amendment of the Permit, provided, that such changes will not result in a level of incidental take in excess of that otherwise allowed by this Agreement and the Permit.

10.4 Permit Suspension, Revocation and Re-Instatement. Except as set forth in Section 2.1 “Enough Already”, the Permit shall be suspended, revoked and re-instated in conformance with the provisions of 50 CFR 220. 306(d) (2001) and 50 CFR 222. 306(e) (2001), provided, that if said regulations are modified the modified regulations will apply only to the extent the modifications were required by subsequent action of Congress or court order, unless the Parties otherwise agree.

10.5 Early Termination Mitigation. If the Permit is terminated early and de-listing has not occurred, NMFS may require the District to mitigate for any past incidental take of Permit Species that has not been sufficiently mitigated prior to the date of termination. Such mitigation may require the District to continue relevant mitigation measures of the Agreement for some or all of the period, which would have been covered by the Permit. NMFS agrees that the District may invoke the dispute resolution procedures of this Agreement to pursue resolution of any disagreement concerning the necessity or amount of such additional mitigation, NMFS reserves any authority it may have under the ESA or its regulations regarding additional mitigation. So long as the District meets and continues to meet the survival standard, its Tributary Plan funding obligations, and its Hatchery Plan funding and capacity obligations early termination mitigation shall not apply to the District.

10.6 Funding. In its current financial position, the District has sufficient assets to secure funding for its affirmative obligations under the Agreement. To ensure notification of any material change in the financial position of the District during the term of the Permit, the District will provide the NMFS with a copy of its annual report each year of the Permit.

10.7 USFWS. USFWS does not exercise ESA authority over Permit Species.

SECTION 11 DISPUTE RESOLUTION

11.1 Stages of Dispute Resolution.

11.1.1 Stage 1: Coordinating Committee. Any dispute regarding this Agreement shall first be referred to the respective committee dealing with that issue (the Coordinating Committee is the committee of default). That committee shall have twenty-(20) days within which to resolve the dispute. If at the end of twenty-(20) days there is no resolution any Party may request that the dispute proceed to Section 11.1.2 “Stage 2:

Policy Committee.” However, Tributary Committee and Hatchery Committee disputes must first proceed to the Coordinating Committee, before the Policy Committee is triggered.

11.1.2 Stage 2: Policy Committee. Following the completion of Stage 1, the Chair of the Coordinating Committee or any Party may refer the dispute to the Policy Committee. The Chair of the Coordinating Committee shall chair all meetings of the Policy Committee. The Policy Committee shall have thirty- (30) days, following the referral, to convene and consider the dispute. The Chair of the Coordinating Committee shall provide advance written notice of all meetings. The notice shall contain an agenda of all matters to be addressed and voted on during the meeting.

Each Party shall designate a policy representative who shall be available to participate on the Policy Committee. Any Party that fails to name a Policy Committee representative or to have its Policy Committee representative participate in the Policy Committee shall waive that Party's right to object to the resolution of the dispute by the Policy Committee.

The Policy Committee shall act by unanimous vote of those members present in person or by phone for the vote and shall develop its own rules of process, provided, that the Policy Committee shall ensure that all Parties are sent notice of all Policy Committee meetings. Abstention does not prevent a unanimous vote. If a Party or its designated alternate cannot be present for an agenda item to be voted upon it must notify the Chair of the Coordinating Committee who may delay a vote on the agenda item for up to five- (5) business days on specified issues to be addressed in a meeting or conference call scheduled with all interested parties. A Party may invoke this right only once per delayed item.

11.1.3 Options following Stage 2. If there is no resolution of a matter following completion of Stage 1 and 2 of this Procedure, then any Party may pursue any other right they might otherwise have. The inability of the Coordinating Committee and Policy Committee to make a decision shall be considered a dispute. The Parties are encouraged to resolve disputes through alternative dispute resolution.

11.2 Implementation of Settlement Dispute. If the Procedure results in a settlement of the dispute then: (1) the Parties shall implement, consistent with the terms of the settlement, all aspects of the settlement that can lawfully be implemented without FERC approval, or the approval of another federal agency; and (2) where FERC or other federal agency approval is needed before some or all of the settlement can be implemented, all settling Parties shall jointly present the resolution of the dispute to FERC or the appropriate federal agency for approval.

11.3 No Intent to Create Jurisdiction. The Parties agree that this Agreement is not intended to create jurisdiction in any court.

SECTION 12 MISCELLANEOUS

12.1 Conflict Between Agreement and Appendix. In the event of a conflict between this Agreement and an appendix to this Agreement, this Agreement shall control and the Parties shall cause the appendix in conflict to be revised accordingly.

12.2 Amendment of Agreement. This Agreement may be amended or modified only with the written consent of the Parties, provided that, Parties who withdraw from the Agreement do not need to, and have no right to, approve any amendments or modifications, provided further, that this Agreement provides for on-going, active and adaptive management activities. Adaptive management provides for ongoing modification of management practices to respond to new information and scientific developments. Adaptive management will yield prescriptions that may vary over time. Such changes are provided for in this Agreement and do not require modification of the Agreement or amendment of the Permit, provided that such changes will not result in a level of incidental take in excess of that otherwise allowed by this Agreement or modify the provisions set out in Section 3 “Survival Standards and Allocation of Responsibility for No Net Impact”, further provided, that unless otherwise agreed to by the Parties NNI applies only to the identified Plan Species on the date this Agreement became effective originally.

12.3 Notices. Except as set forth in Sections 1.2.2 “Upon Completion of Regulatory Reviews,” 2.6 “Withdrawal of Another Party” and 2.7 “Conditions Precedent to Withdrawal” all written notices to be given pursuant to this Agreement shall be mailed by first-class mail, postage prepaid to each Party. Parties shall inform all Parties by written notice in the event of a change of address. Notices shall be deemed to be given three- (3) days after the date of mailing.

12.4 Waiver of Default. Any waiver at any time by any Party hereto of any right with respect to any other Party with respect to any matter arising in connection with this Agreement shall not be considered a waiver with respect to any subsequent default or matter.

12.5 Integrated Agreement. All previous communications between the Parties, either verbal or written, with reference to the subject matter of this Agreement are superseded by the terms and provisions of this Agreement, and once executed, this Agreement and its examples, figures, tables and appendices shall constitute the entire agreement between the Parties, provided, that titles to sections and sub-sections thereof are for the assistance of the reader and are not part of the Agreement.

12.6 Benefit and Assignment. This Agreement shall be binding upon and inure to the benefit of the Parties hereto and their successors and assigns provided, no interest, right, or obligation under this Agreement shall be transferred or assigned by any Party hereto to any other Party or to any third party without the written consent of all other Parties, except by a Party: (1) to any person or entity into which or with which the Party making the assignment or transfer is merged or consolidated or to which such Party transfers

substantially all of its assets, (2) to any person or entity that wholly owns, is wholly owned by, or is wholly owned in common with, the Party making the assignment or transfer, provided that, the assignee is bound by the terms of this Agreement and applies for and receives an incidental take permit for listed Plan Species.

12.7 Force Majeure. For purposes of this Agreement, a “*force majeure*” is defined as causes beyond the reasonable control of, and without the fault or negligence of, the District or any entity controlled by the District, including its contractors and subcontractors. Economic hardship shall not constitute *force majeure* under this Agreement.

In the event that the District is wholly or partially prevented from performing obligations under this Agreement because of a *force majeure* event, the District shall be excused from whatever performance is affected by such *force majeure* event to the extent so affected, and such failure to perform shall not be considered a material breach. Nothing in this Section shall be deemed to authorize the District to violate the ESA or render the standards and objectives of this Agreement unobtainable. The suspension of performance shall be no greater in scope and no longer in duration than is required by the *force majeure*.

The District shall notify the other Parties to this Agreement in writing within seven- (7) calendar days after a *force majeure* event. Such notice shall: identify the event causing the delay or anticipated delay; estimate the anticipated length of delay; state the measures taken or to be taken to minimize the delay; and estimate the timetable for implementation of the measures. The District shall have the burden of demonstrating by a preponderance of evidence that delay is warranted by a *force majeure*.

The District shall use a good faith effort to avoid and mitigate the effects of the delay and remedy its inability to perform. A *force majeure* event may require use of the adaptive management provisions of this Agreement in remedying the effects of the *force majeure* event. When there is a delay in performance of a requirement under this Agreement that is attributable to a *force majeure*, the time period for performance of that requirement shall be reasonably extended as determined by the Coordinating Committee. When the District is able to resume performance of its obligation, the District shall give the other Parties written notice to that effect.

12.8 Appropriations. Implementation of this Agreement by the JFP is subject to the availability of appropriated funds. Nothing in this Agreement will be construed by the Parties to require the obligation, appropriation, or expenditure of any money from federal, state or tribal governments. The Parties acknowledge that the JFP will not be required under this Agreement to expend any of its appropriated funds unless and until an authorized official of that agency or government affirmatively acts to commit to such expenditures as evidenced in writing.

12.9 Legal Authority. Each Party to this Agreement hereby represents and acknowledges that it has legal authority to execute this Agreement and is fully bound by the terms hereof. NMFS is authorized to enter into this Agreement pursuant to the ESA, the Federal Power Act, the Fish and Wildlife Coordination Act, the Pacific Northwest Electric Power Planning and Conservation Act, and the Essential Fish Habitat provisions of the Magnuson-Stevens Fishery Conservation and Management Act.

12.10 Execution. This Agreement may be executed in counterparts. A copy with all original executed signature pages affixed shall constitute the original Agreement. The date of execution shall be the date of the final Party's signature. Upon execution of this Agreement by the Parties, this Agreement shall be submitted to the Secretary of Interior or her designee for any approval, to the extent required by 25 U.S.C. § 81.

12.11 Indian Tribal or Treaty Reserved Rights. Nothing in this Agreement is intended to nor shall it in any way abridge, limit, diminish, abrogate, adjudicate, or resolve any Indian right reserved or protected in any treaty, executive order, statute or court decree. This Section shall be deemed to modify each and every Section of this Agreement as if it is set out separately in each Section.

12.12 No Precedent/Compromise of Disputed Claims. The conditions described and measures proposed to rectify them set forth in this Agreement are fact specific and uniquely tied to the circumstances currently existing at the Project. The Parties agree that the conditions existing here and the proposed actions to deal with them are not intended to in any way establish a precedent or be interpreted as the position of any party in any proceeding not dealing specifically with the terms of this Agreement. Further, the Parties acknowledge that this Agreement is a compromise of disputed claims for which each Party provided consideration to the other as contemplated under Federal Rule of Evidence 408, and will not be used by any Party in a manner inconsistent with the provisions of Federal Rule of Evidence 408.

12.13 U.S. v. Oregon. Nothing in this Agreement is intended by the signatories who are parties to the continuing jurisdiction case of U.S. v. Oregon, 302 F.Supp. 899 (D. OR 1969), to change the jurisdiction of that court or the parties positions therein.

SECTION 13 DEFINITIONS

Capitalized terms are defined as follows:

13.1 "Agreement" means this document, examples, figures, Tables 1 and 2, and Appendices A through C. This Agreement is supported by Supporting Documents A through E but does not incorporate these documents.

13.2 "BAMP" means Document C "Biological Assessment and Management Plan (BAMP): Mid-Columbia Hatchery Program".

13.3 “Combined Adult and Juvenile Project Survival” means that 91% of each Plan Species (juvenile and adult combined) survive Project effects when migrating through the Project’s reservoir, Forebay, Dam and Tailrace including direct, indirect, and delayed mortality whenever it may occur and can be measured (as it relates to the Project) given the available mark-recapture technology.

13.4 “DFOP” means the Detailed Fishway Operating Plan. DFOP is attached hereto as Appendix A “Detailed Fishway Operating Plan” and incorporated herein by this reference.

13.5 “Daily Estimated Flow” means the Bonneville Power Administration’s estimate of the next day’s flow. However, actual flows will be tracked by the District and compared to the estimated flows. Spill will be adjusted based upon the comparison of the actual flows with the estimated flows in order to provide the required amount of spill. Spill will be shaped in steps as agreed to by the Coordinating Committee.

13.6 “Dam” means the concrete structure impounding the Columbia River.

13.7 “ESA” means the Endangered Species Act, 16 U.S.C. ss 1531 through 1543, as amended, and its implementing regulations.

13.8 “Essential Fish Habitat Provisions of the Magnuson-Stevens Fishery Conservation and Management Act” means the Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. § 1801 et seq., as amended by the Sustainable Fisheries Act and as may be amended, and its implementing regulations.

13.9 “Federal Power Act” means the Federal Power Act, 16 U.S.C. §§ 791a - 828c, as amended, and its implementing regulations.

13.10 “FERC” means the Federal Energy Regulatory Commission or its successor.

13.11 “Fish and Wildlife Coordination Act” means the Fish and Wildlife Coordination Act, 16 U.S.C. §§ 661-668c, as amended, and its implementing regulations.

13.12 “Forebay” means the body of water represented in the drawing (which is approximately 500 feet upstream of the Dam), which is attached hereto as Appendix B “Forebay and Tailrace Diagram” and incorporated herein by this reference.

13.13 “Juvenile Dam Passage Survival” means that 95% of each juvenile Plan Species over 95% of each species migration survive Projects effects when migrating through the Project’s Forebay, Dam and Tailrace including direct, indirect and delayed mortality where ever it may occur and can be measured (as it relates to the Project), given the available mark-recapture technology.

13.14 “Juvenile Project Survival” refers to the measurement of survival for juvenile Plan Species over 95% of each species migrating from tributary mouths and through the

Project's reservoir, Forebay, Dam and Tailrace including direct, indirect and delayed mortality, where ever it may occur and can be measured (as it relates to the Project) given the available mark-recapture technology.

13.15 "Juvenile Project Survival Standard" refers to a surrogate measurement of the Combined Adult and Juvenile Survival Standard. If Juvenile Project Survival for each Plan Species is measured to be greater than or equal to 93%, then the District will be assigned to Phase III (Standard Achieved). If Juvenile Project Survival is measured at less than 93% but greater than or equal to 91%, then the District will be assigned to Phase III (Provisional Review). If Juvenile Project Survival is measured at less than 91%, then the District will be assigned to Phase II (Interim Tools).

13.16 "Measures" means any action, structure, facility, or program (on-site or off-site) intended to improve the survival of Plan Species, except those prohibited in Section 9.7 "Drawdowns/Dam Removal/Non-Power Operation". Measures do not include fish transportation unless otherwise agreed by the Coordinating Committee.

13.17 "Pacific Northwest Electric Power Planning and Conservation Act" means the Pacific Northwest Electric Power Planning and Conservation Act, 16 U.S.C. §§ 839 - 839h, 16 U.S.C. §§ 839 - 839h, as amended, and its implementing regulations.

13.18 "Permit" shall mean permit(s) issued to the District by NMFS pursuant to Section 10 of the ESA to authorize take of Permit Species which may result from the District's or its agent's implementation of this Agreement.

13.19 "Permit Species" means all Plan Species except coho salmon (*Oncorhynchus kisutch*). Permit Species do not include coho salmon (*O. kisutch*) since wild coho salmon are extirpated from the Mid-Columbia Region and therefore not protected by the ESA.

13.20 "Plan Species" means spring, summer and fall chinook salmon (*Oncorhynchus tshawytscha*), sockeye salmon (*O. nerka*), coho salmon (*O. kisutch*), and steelhead (*O. mykiss*).

13.21 "Power Purchasers" means Puget Sound Energy, Inc. Portland General Electric, Avista Corp., Colockum Transmission Company, Inc., and PacifiCorp for the term of their existing long-term power sales contracts with the District.

13.22 "Project" means the Rocky Reach Hydroelectric Project owned and operated by the Public Utility District No. 1 of Chelan County, Washington pursuant to FERC Project Number 2145. The geographic boundaries of the Project (reservoir, Forebay, Dam and Tailrace) are defined in exhibit "K" of the Project's FERC license.

13.23 "RCW" means Revised Code of Washington.

13.24 “Representative Flow Conditions” means that the flow of the Columbia River measured at Grand Coulee Dam during the study is between 205,381 (spring)/164,905 (summer) cubic feet per second and 100,523 (spring)/76,318 (summer) cubic feet per second. These flows bound the ten percent to ninety percent range on the flow duration curve attached as Appendix C “Flow Duration Curve”. Studies conducted when flow is within this ten percent to ninety percent range (values above) are automatically included in the three-year average as long as the study is otherwise valid. However, when studies are conducted when river flow is between 220,597 (spring)/180,607 (summer) cubic feet per second and 90,152 (spring)/63,291 (summer) cubic feet per second, the Coordinating Committee shall decide whether the study is included in the three year average. This decision is not subject to dispute resolution. These flows bound the five percent to 10 percent range and the ninety to ninety-five percent range on the flow duration curve attached as Appendix C “Flow Duration Curve”. The flow duration curve was created by compiling the flows coming out of Grand Coulee Dam. Starting as part of the 2013 comprehensive review, and every ten years thereafter, the Coordinating Committee shall update the flow duration curve and the river flow amounts contained in this definition.

13.25 “Spill” means the passage of water through spill gates.

13.26 “TDG” means total dissolved gas.

13.27 “Tailrace” means the body of water represented in the drawing (which is approximately 1000 feet downstream of the Dam), which is attached hereto as Appendix B “Forebay and Tailrace Diagram” and incorporated herein by this reference.

13.28 “Threshold Population” refers to a naturally reproducing population that contains a five-year average of greater than 500 adults as assessed at Wells Dam and is composed of a population that is reproductively isolated from other populations of the same species”.

13.29 “Tools” means any action, structure, facility or program (on-site only) at the Project, except those prohibited in Section 9.7 “Drawdowns/Dam Removal/Non-Power Operation” that are intended to improve the survival of Plan Species migrating through the Project. Tools do not include fish transportation unless otherwise agreed by the Coordinating Committee. This term is a sub-set of Measures.

13.30 “Unavoidable Project Mortality” refers to the assumed 9% mortality caused by the Project to Plan Species that is compensated through the tributary and hatchery programs

13.31 “Unforeseen Circumstance” is defined by 50 CFR 222.102 (2001), and implemented according to 50 CFR 222.307(g) (2001). If these regulations are modified, the modified regulations will apply only to the extent the modifications were required by subsequent action of Congress or court order, unless the Parties otherwise agree.

IN WITNESS WHEREOF, the Parties hereto execute this Agreement as of the date last signed below.

Dated April 1, 2002

PUBLIC UTILITY DISTRICT NO. 1 OF
CHELAN COUNTY, WASHINGTON

By Charles J. Hosken
(signature)

Charles J. Hosken
(print name)

GENERAL MANAGER
(Title)

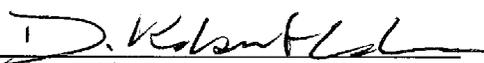
Address for Notice:

Public Utility District No. 1 of
Chelan County, Washington
327 N. Wenatchee Avenue
P.O. Box 1231
Wenatchee, WA 98801

Attn: General Manager

Dated 4/5/02

NATIONAL MARINE FISHERIES SERVICE

By 
(signature)

D. Robert Lohn
(print name)

Regional Administrator
(Title)

Address for Notice:

National Marine Fisheries Service, Regional Office
7600 Sand Point Way NE, Bin C15700, Bldg 1
Seattle WA 98115-0070

Dated 4/10/2002

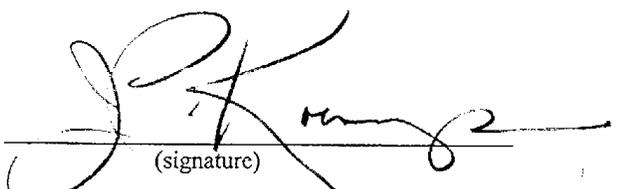
UNITED STATES FISH AND WILDLIFE SERVICE

By *Rowan W Gould*
(signature)
Rowan W Gould
(print name)
Deputy Regional Director
(Title)

Address for Notice:
Project leader
US Fish and Wildlife Service
Eastern Washington Ecological
Services Office
32 C Street NW
P.O. Box 848
Ephrata, WA 98823

Dated 4/2/2002

WASHINGTON DEPARTMENT OF
FISH AND WILDLIFE

By 

(signature)

Dr. Jeffrey P. Koenings

(print name)

Director

(Title)

Address for Notice:

Washington Department of Fish & Wildlife
600 Capitol Way North
Olympia, WA 98501-1091

Dated April 4, 2002

CONFEDERATED TRIBES OF
THE COLVILLE RESERVATION

By Colleen F. Cawston
(signature)

Colleen F. Cawston
(print name)

Chair, Colville Business Council
(Title)

Address for Notice:

P.O. Box 150
Nespelem, WA 99155

Dated _____

CONFEDERATED TRIBES AND BANDS OF
THE YAKAMA INDIAN NATION

By _____
(signature)

(print name)

(Title)

Address for Notice:

Dated _____

CONFEDERATED TRIBES OF THE
UMATILLA INDIAN RESERVATION

By _____
(signature)

(print name)

(Title)

Address for Notice:

Dated _____

AMERICAN RIVERS, INC., a Washington
D.C., nonprofit corporation

By _____
(signature)

(print name)

(Title)

Address for Notice:

Table 1

Summary of Route Specific Passage Studies at Rocky Reach (RRE) Dam Acoustic Tag and Radio Telemetry Information

Tool	Project	Species (rearing)	Year	Spill %	PH	Spillway	Bypass	Total	Proj. FPE	Spill Eff.	Report
Radio telemetry	RRE	Sum/Fall Chin 1 (ROR)	1998	0.156	0.533	0.075	0.392	1.000	0.467	0.481	English et al. (1998) ¹
Radio telemetry	RRE	Sum/Fall Chin 1 (ROR)	1999	0.153	0.579	0.157	0.263	0.999	0.420	1.026	English et al. (1999) ²
Radio telemetry	RRE	Sum/Fall Chin 1 (ROR)	2000	0.193	0.537	0.179	0.284	1.000	0.463	0.927	English et al. (2000) ³
Acoustic tags	RRE	Sum/Fall Chin 1 (ROR)	2000	0.193	0.476	0.140	0.384	1.000	0.524	0.725	Steig et al. (2001) ⁴
Average Project Fish Passage Efficiency for Sum/Fall Chin 1 at RRE =									0.469		

Note:

¹Petersen Index Estimates / 5.5% of fish guided through units 1&2 included in bypass estimate.

²Petersen Index Estimates / 2.9% of fish guided through units 1&2 included in bypass estimate.

³Petersen Index Estimates / 5.3% of fish guided through units 1&2 included in bypass estimate.

⁴HTI monitored Units 1-11, spillway and surface collectors 1 and 2; fish tagged with acoustic tags.

Table 2

HCP Production Commitments for Rocky Reach Project

Species	Initial Production Levels			Calculated 7% Production Levels ³	Rearing Facility
	Original Inundation ¹	Passage Losses ²	Total		
Spring chinook		144,000	144,000	90,000	New program Methow
Steelhead	165,000	35,000	200,000	30,000	EB, TR, CF
Summer/fall chinook ⁴ yearlings		400,000	400,000	200,000	EB, RRA, TR
sub-yearlings	1,620,000		1,620,000		EB, RRA, TR
Sockeye				300,000	New program

EB=Eastbank
 TR=Turtle Rock
 CF=Chelan Falls
 RRA=Rocky Reach Annex

¹ Compensates for original inundation by the Project. These amounts are not subject to recalculation, and are provided in addition to the levels necessary to compensate for Unavoidable Project Mortality.

² Agreed to production levels to compensate for Unavoidable Project Mortality. These hatchery levels are greater than that required to compensate for 7% Unavoidable Project Mortality. These hatchery levels will be produced from the Effective Date of the Agreement through 2013. These amounts are subject to recalculation every 10 years beginning in 2013.

³ These are the hatchery levels that are required to compensate for 7% Unavoidable Project Mortality. Original inundation levels must be produced in addition to the hatchery levels in this column.

⁴ There is potential for program shifts from sub-yearling production to more yearling production.

APPENDIX A Detailed Fishway Operation Plan (DFOP)

ADULT FISH PASSAGE INFORMATION

The location of adult fish passage facilities is shown on Figure 2 “Rocky Reach Dam General Site Plan”. This information may be out of date and will be reviewed and updated as appropriate by the Coordinating Committee.

ADULT PASSAGE FACILITIES

The adult passage facilities at Rocky Reach Dam consist of a fishway on the powerhouse side with right and left powerhouse entrances, a powerhouse collection channel, a spillway transportation channel and a main spillway entrance. The left powerhouse entrance is located at mid-dam between the powerhouse and spillway. The fishway includes a counting station on the right bank. The system includes pumped and gravity auxiliary water supplies.

Construction activities and associated modification in operations have potential for impact on adult passage at Rocky Reach Dam. Construction schedules and activities will be reviewed in advance to limit this potential. Activities which have a high probability of affecting passage will be scheduled during nighttime hours.

ADULT MIGRATION TIMING

For operation and maintenance purposes, the primary fish passage season is considered to be April through November. Primary passage periods by species are:

Spring Chinook	April 18 - June 23
Summer Chinook	June 24 - September 1
Fall Chinook	September 2 - November
Steelhead	April - March
Coho	August - November
Sockeye	Late June - August 15

OPERATING CRITERIA FOR ADULT PASSAGE

SPILL MANAGEMENT FOR ADULT PASSAGE

1. Spill not provided for juvenile passage will be shaped to avoid delay of upstream migrants according to agencies, tribes, and PUD agreement.
2. Spill shaping requests are based on the tribes and agencies objective of achieving 100% passage efficiency without delay.

Spilling Schedule for Rocky Reach Dam, Est. 1984. (Openings in feet)

Gate Number											Total	
1	2	3	4	5	6	7	8	9	10	11	12	
						(2)		2				
					(2)		2					
	(2)		2		2		2					
	(2)		2		2		2					
	2		2	(2)	2	2	2					12
	2	(2)	2	2	2	2	2					
	2	(2)	2	2	2	2	2					
	2	2	2	3	(3)	2	2					
	2	2	3	3	3	(3)	2					
	2	2	3	(4)	3	3	3					20
	2	(3)	3	4	4	3	3					
	2	3	4	(5)	4	3	3					
	2	3	4	5	4	4	(4)					
	2	3	5	5	(5)	4	4					
	2	3	5	(6)	5	5	4					30
	2	3	5	6	(6)	5	5					
	2	4	5	6	(7)	5	5					
	2	4	6	6	7	(6)	5					
	2	4	6	6	(8)	6	6					
	2	4	6	7	8	(7)	6					40
	2	5	(7)	7	8	7	6					
	2	5	7	7	9	(8)	6					
	2	5	(8)	8	9	8	6					
	(3)	5	8	9	9	8	6					
	3	6	8	9	(10)	8	6					50
	3	6	8	10	10	(9)	6					
	3	6	9	10	(11)	9	6					
	3	(7)	9	11	11	9	6					
	3	7	10	11	11	(10)	6					
	3	7	11	(12)	11	10	6					60

Circled values indicate opening one foot less than value. For example:

(2) means 0 or 2 foot opening

(3) means 2 or 3 foot opening

OPERATING STANDARDS FOR ADULT PASSAGE FACILITIES
Reviewed February 1990

Adult Fishway

Water depth over weirs: 1.0 to 1.2 ft.

Transportation Channel (Between Entrances and Ladder)

Transportation velocity: A transportation velocity of 1.5 to 4.0 feet per second (prefer 2.0 fps) shall be maintained in all channels and the lower ends of the fish ladders which are below the tailwater.

Entrances

General: Head 1.0 ft. minimum

Right Powerhouse Entrance: Rotary gate openings at RPE1 and RPE2 shall be fully open.

Left Powerhouse Entrance: LPE1 and LPE3 shall be continuously open.

Submerged weir crest elevation for the following tailwater elevations shall be at or below:

<u>Tailwater El.</u>	<u>Submerged Weir Crest El.</u>
615.0	603.5
620.0	606.5

Orifice Entrances: The following 6 orifice entrances shall be open: CC1, CC2, CC3, CC16, CC18, CC20

Main Spillway Entrance (MSE): Open May 1 - October 31. One gate permanently closed. One gate permanently open.

Submerged weir crest elevations for the following tailwater elevations shall be at or below:

<u>Tailwater El.</u>	<u>Submerged Weir Crest El.</u>
Below 621.5	604.5
625.0	605.3

Turbine No. 11 Operation

Turbine No. 11 loading will be reduced or discontinued completely during daylight hours from May 1 through October 31 of each year, during periods when the powerhouse is not fully loaded. This will improve adult passage at the left powerhouse entrances.

Trashracks

Visible buildups of debris shall be removed immediately from ladder exit and attraction water intake trashracks.

Visible buildups of debris shall be cleaned immediately from picketed leads at the counting window.

Staff Gauges and Water Level Indicators

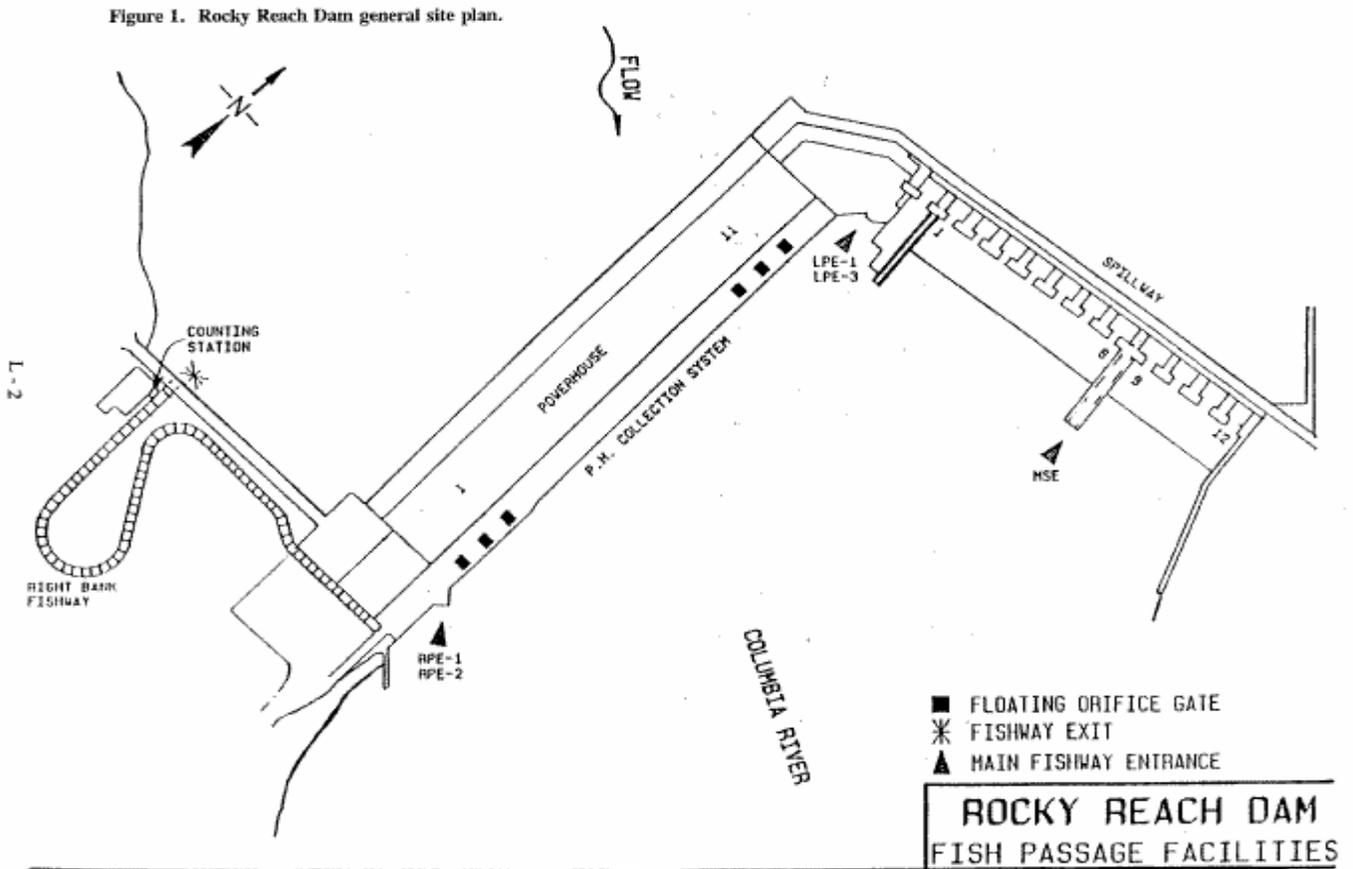
Shall be readable at all water levels encountered during passage periods.

Staff gauges or water level indicators shall be located upstream and downstream from entrances, and at a convenient location for viewing along the ladder.

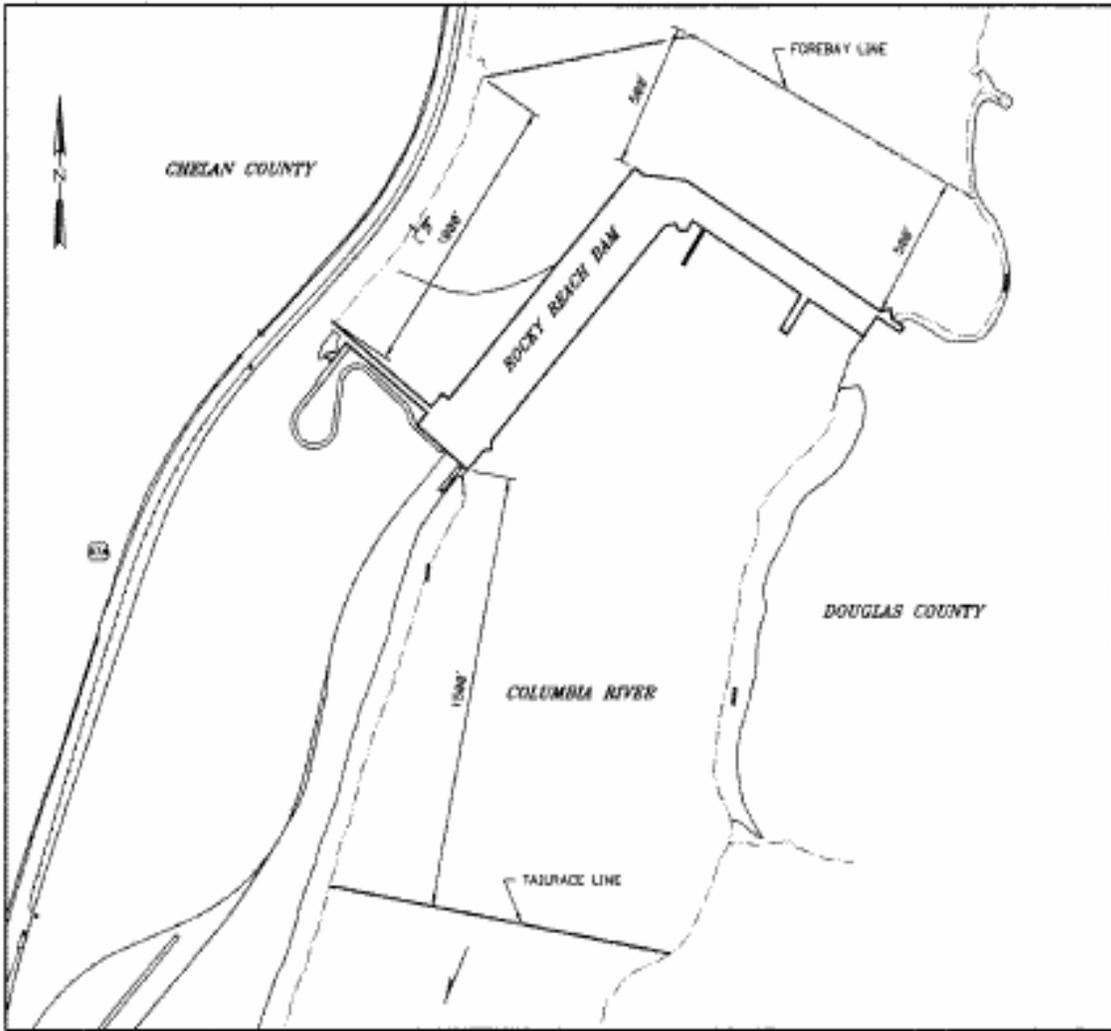
Staff gauges or water level indicators shall be consistent with panel board water surface readings in the fishway room.

Water level indicators shall be maintained such that they are in continuous operation.

Figure 2 "Rocky Reach General Site Plan"



APPENDIX B
Forebay and Tailrace Diagram

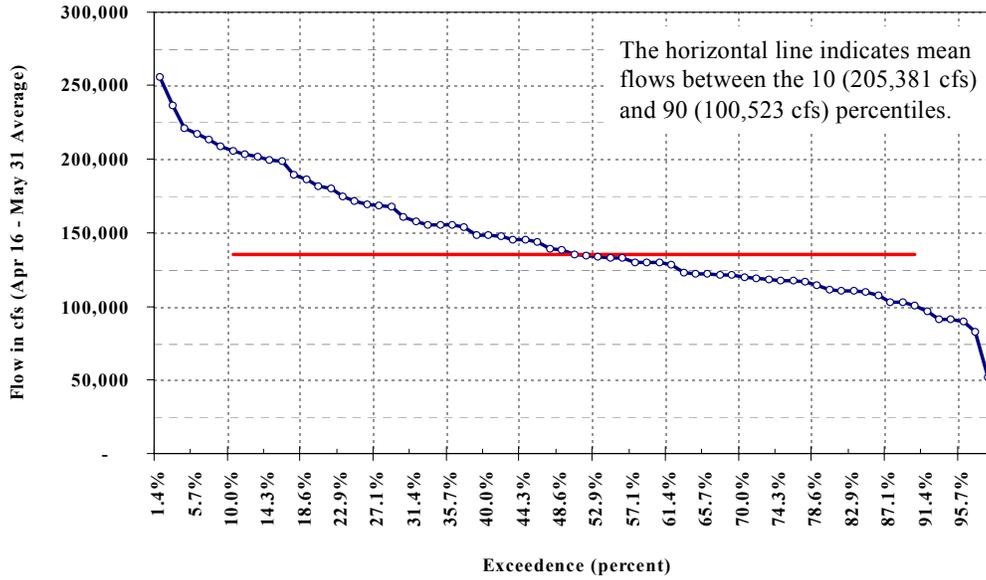


ROCKY REACH TAILRACE AND FOREBAY

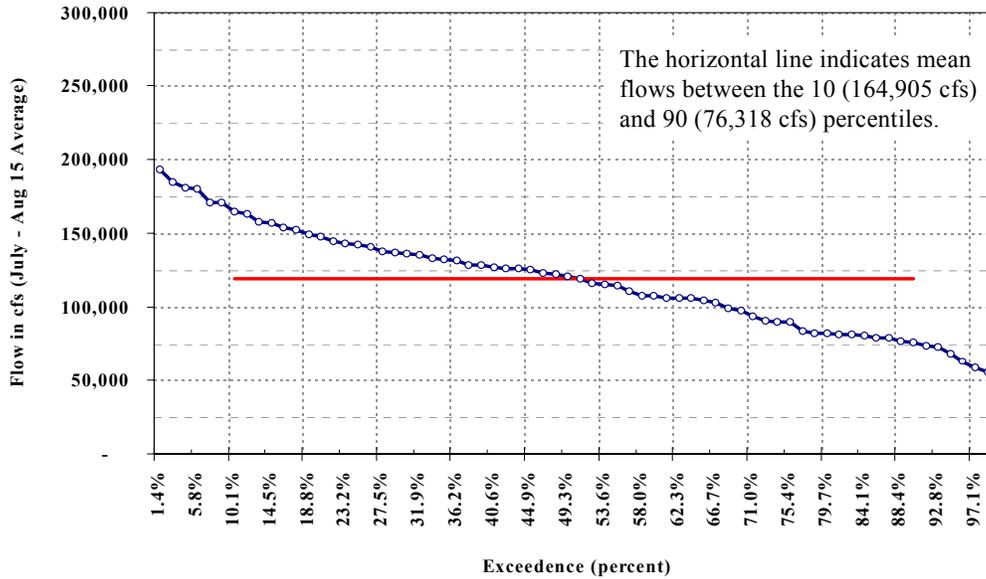
APPENDIX C

Flow Duration Curve

Flow Duration Curve for Average Apr 16 - May 31 Outflows at Grand Coulee Dam (cfs) from 1929-1978 & 1983-2001



Flow Duration Curve for Average July 1 - Aug 15 Outflows at Grand Coulee Dam (cfs) from 1929-1977 & 1983-2001



LIST OF SUPPORTING DOCUMENTS

- Supporting Document A Tributary Plan, Project Selection, Implementation, and Evaluation (1998)
- Supporting Document B Aquatic Species and Habitat Assessment: Wenatchee, Entiat, Methow, and Okanogan Rivers (1998)
- Supporting Document C Biological Assessment and Management Plan (BAMP): Mid-Columbia Hatchery Programs (1998)
- Supporting Document D Briefing Paper Estimating Survival of Anadromous Fish through the Mid-Columiba PUD Hydropower Projects (2002)
- Supporting Document E Rocky Reach Background Biology (1998)

Supporting Documents can be obtained by contacting Public Utility District No. 1 of Chelan County, Washington at 509-663-8121 or the National Marine Fisheries Service web site at <<http://www.nwr.noaa.gov/1hydrop/hydroweb/ferchcps.html>>

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